**15 Annex - Energy**

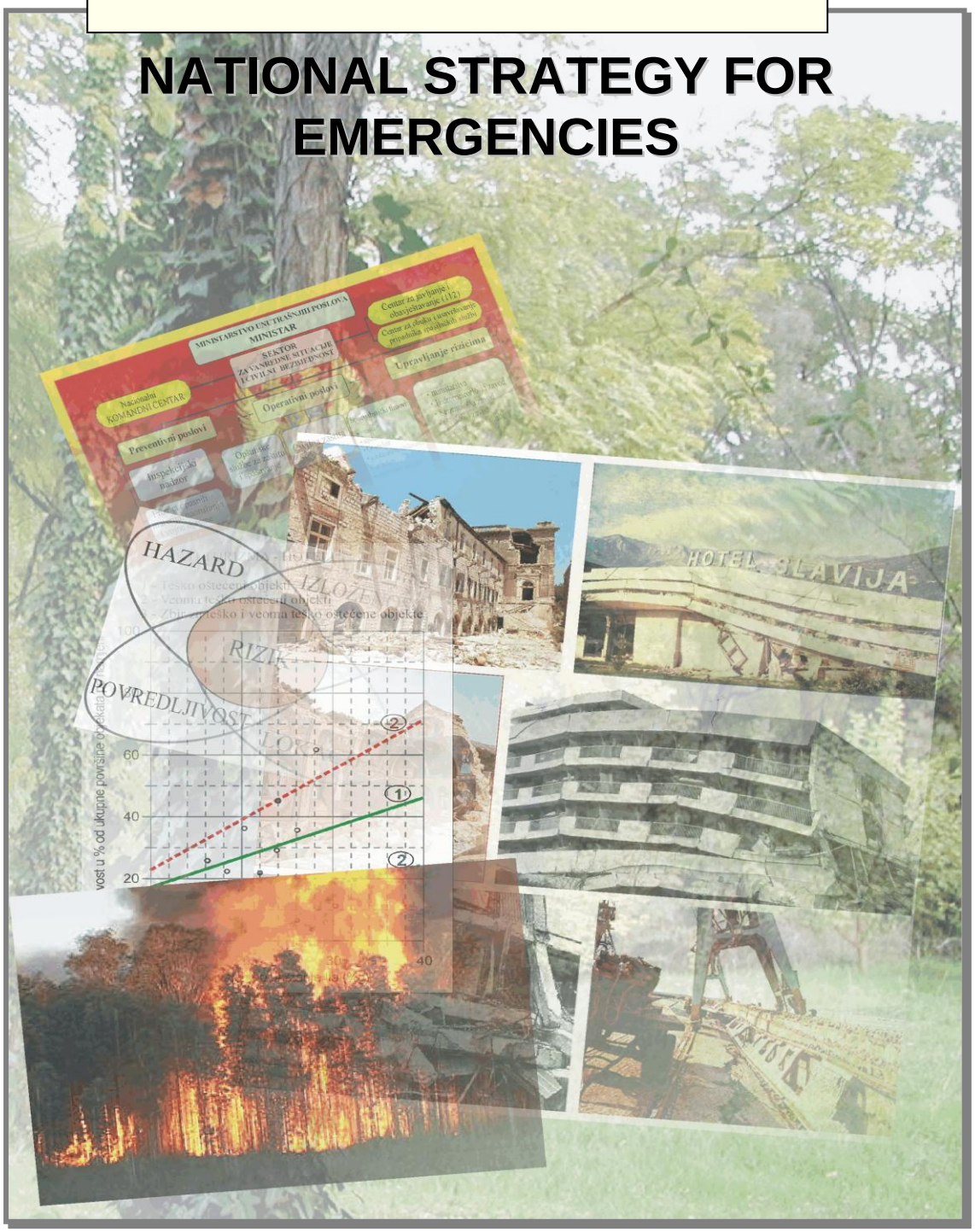
## 94. NATIONAL STRATEGY FOR EMERGENCIES

**GOVERNMENT OF THE REPUBLIC OF MONTENEGRO**

**MINISTRY OF THE INTERIOR**

**EMERGENCY AND CIVIL SECURITY SECTOR**

# NATIONAL STRATEGY FOR EMERGENCIES



*NATIONAL STRATEGY FOR EMERGENCIES has been developed as an expression of growing awareness and need of the citizens of the Republic of Montenegro, and the society as such, for a comprehensive and well-organised response to all types of emergencies within the state. The strategy development initiated pursuant to the Decision of the Government of the Republic of Montenegro adopted at its session held on 21st July 2005 by which the Ministry of Interior was ordered to set on the development of such a strategy in order to establish a comprehensive concept for the creation of a functioning system for prevention of accidents, as well as for protection and rescue in possible natural disasters, technical and technological accidents, biological, chemical, nuclear and radiological accidents, breaking out of epidemics of contagious diseases with a large number of diseased and dead. The document at hand, the Law on Protection and Rescue and the establishment of the Emergencies and Civil Security Sector within the Ministry of Interior make an integral and efficient response of the Republic of Montenegro to emergencies. Thus, Montenegro has set essential directions for proper response to emergencies in terms with global intentions and commitments of the international community to mitigate disasters.*

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TABLE OF CONTENTS

## I. INTRODUCTION

In the event of a realisation of a destructive natural or technological hazard, the National Strategy for Emergencies is one of the strategic national security documents aiming to establish the attitude of the state towards emergencies and an organised action of state and other institutions for efficient response to emergencies caused by all forms of large natural disasters, technical and technological accidents and contagious disease epidemics in order to prevent their occurrence by preventive action or mitigate their consequences as well as to enhance specific institutional capacities and the whole society in case of their occurrence in future.

As used here, an **emergency** means the state created by the action of extraordinary circumstances, suddenly caused by natural causes or human factor, thus posing an imminent danger to life and public health, property of people, or greatly endangering the environment or cultural and historic heritage at a certain area that the affected community is unable to remove using own powers and means, but their restoration calls for the assistance of the whole state, sometimes even the involvement of the international community. The number of people affected, the scope of damages and the need for assistance are the main features of disasters. Disasters abruptly and drastically disturb the social or environmental balance of the affected area, causing significant aggravation of hygienic and epidemiological situation at the affected area.

Emergencies arise as a consequence of uncontrolled action of a large number of natural phenomena. At the geographical area of Montenegro, such phenomena are mostly related to earthquakes, large movements of rocky masses (land and rock slides), floods, long-lasting extreme meteorological phenomena, avalanches, regional fires and other natural disasters. Large technical and technological accidents that may result in disasters and emergencies are related to oil installation accidents, damages caused during transport and storage of chemical and toxic materials, explosive and radioactive substances, large-scale pollution of potable water sources supplying settlements, large-scale traffic accidents, mine accidents, industrial accidents caused by explosions, radiological, biological, epidemiological and other technical and technological accidents. An emergency may occur also as a consequence of large epidemics of contagious diseases (epizootics and epiphytotics – occurrences of mass diseases in people, animals and plants).

Unlike the category of disasters, an **incident** is a sudden and imminent danger to life and public health within a certain area which the affected community is able to remove on its own – using own forces and means.

Permanent existence of a considerable hazard level from several natural and technical factors in Montenegro is arguably indicated by vast centuries-long experience in these areas. Over the past several decades, within the territory of Montenegro and its immediate surroundings, the hazards whose manifestations were particularly destructive were: earthquakes and the accompanying phenomena (land and rock slides), then large-scale floods, fires and environmental pollution. It should be realistically expected that in near future such natural phenomena may occur again, but also the technical hazards, occurring as consequences of inevitable technological and industrial development of the region, including not only Montenegro, but the neighbouring impact areas. Realistic natural hazards and consequential demands and needs for an efficient societal response make an integral part of inevitable coexistence of people and nature, but the behaviour of humans towards these hazards may be changed.

In terms with the messages contained in the ***Yokohama Strategy and Plan of Action for a Safer World***[1], stipulated by the states members of the United Nations – disaster prevention and enhancing the level of preparedness of a society, should make basic integral aspects of development policy and planning at the national, regional and international level. In that sense, as one of the basic aims in the implementation of the Strategy, we need to define a considerable reduction of all types of losses, both in terms of human and economic losses, cultural heritage and environment – in the conditions of possible large-scale disasters and technological accidents in near or far future.

It is a common knowledge that the scope of human and economic losses, arising as consequences of natural disasters, has greatly risen in recent years. As a rule, those mostly affected are the poor and socially disadvantaged groups, predominantly in developing countries, resulting in such groups being least equipped to cope with such challenges. Nevertheless, whereas hazards are inevitable and the elimination of all risks impossible, there is still a number of technical measures, traditional practices and experiences which, if applied, may reduce the economic and social scope of disasters. To that effect, we need to move away from mere response to events – towards increased practice of prevention. Disaster prevention, mitigation, preparedness and effective relief are basic elements contributing to successful implementation of development policies. These elements, along with environmental protection and sustainable development, are closely interrelated.

Disaster prevention, mitigation of their harmful consequences and better preparedness of the society for their occurrence are much more humane and efficient approach than the very response to disaster once it happens. First of all, disaster prevention is a high morale imperative, and the very process of disaster prevention should cover at least three components: ongoing

[1] At the World Conference on Natural Disaster Reduction, held from 23 to 27 May 1994 in Yokohama, Japan within the "International Decade for Natural Disaster Reduction", the states members of the United Nations established the ***Strategy and a Plan of Action for a Safer World***, known as the Yokohama Strategy, defining the general commitments for active combat to reduce harmful effects of natural disasters.

technical monitoring of processes and phenomena that may result in an incident or disaster, simulating disaster scenarios based on realistic indicators and experiences gained and definition of potential sources of disasters and removal of observed weaknesses in the system.

Proper information, knowledge and technology are necessary prerequisites to reduce the effects of natural and other disasters. As declared in the Yokohama Strategy Declaration, each country has the sovereign responsibility to protect its citizens from natural disasters, to develop and strengthen national capacities and relevant national legislation for natural and other disaster prevention and mitigation, to promote and strengthen regional and international cooperation in activities to prevent, reduce and mitigate natural and other disasters, with particular emphasis on human and institutional capacities, technology sharing, the collection, the dissemination and the utilization of information and mobilization of resources.

In order to provide for well argued concept of optimal disaster protection measures and processes, mitigation measures and strengthening the preparedness of the society to future disasters, this Strategy envisages for the territory of Montenegro and its immediate surrounding a consistent structural analysis and quantification of most significant types of natural hazards, such as: devastating earthquakes and accompanying destructive manifestations (land slides and ground liquefaction, rock slides, etc), extreme meteorological phenomena, regional fires, then the technical and technological accidents such as: accidents on oil installations, during transport and explosion, large traffic accidents, accidents at power generation plants and hydrotechnical facilities, chemical and radiological contamination, as well as a wide range of biological hazards.

## II. STRATEGY GOALS

The National Strategy for Emergencies, which occur as a result of some destructive natural or technological hazard, or their combined effect, or some terrorist act with a consequence of a high level of technological, radiological or biological risk, is one of the strategic national security documents. The Emergencies Strategy aims at understanding current and future risks, establishing the concept of organised action of state and other institutions in response to emergencies caused by all forms of large natural disasters and technical and technological incidents in order to mitigate their consequences, prevent their occurrence by preventive actions, as well as to develop preparedness of relevant state capacities and the whole society, in all events of their occurrence in immediate and distant future.

Therefore, the National Emergencies Strategy should incorporate the concept of reducing the disaster risk in highly prone regions and among social groups with inadequate institutional capacities for disaster management. The Emergencies Strategy needs to specify the organisational concept of the sequence of immediate actions undertaken in cases of imminent and serious danger to people and property from all forms of large-scale natural disasters, technical and technological incidents or terrorist acts.

As for Montenegro, its National Emergencies Strategy should establish basic strategic solutions and guidelines for reducing the risk of all forms of natural and technical hazards, primarily by carrying out the following tasks:

- create institutional conditions for the establishment of a well-harmonized network of existing and new institutions for timely, organised and efficient response to emergencies in Montenegro,
- increase public awareness regarding the significance of and the need for a well-organised and efficient response to emergencies, with active and organised participation of citizens in such processes, at the regional and local level,
- initiate societal processes which will lead to long-term development of research activities concerning the phenomenology of natural disasters genesis, their impact on the society, as well as efficient and continuous monitoring of such phenomena in order to provide for timely prediction of their occurrence and to reduce their harmful effects,
- create realistic preconditions for systematic technical and human resources enhancement of the needed operational units in order to observe and prevent the conditions which may

lead to technical and technological accidents with grave consequences for the community, for material goods, cultural heritage and environment,

- determination of the acceptable level of risk that may be generated by natural and technological hazards, as a dynamic parameter in the function of attained level of community development, of the specific area, as well as the type of goods the risk refers to,
- establish a good quality platform for the creation of a specific and efficient plan of action to restore the consequences caused by natural and technological hazards compatible with the needs and capabilities of the whole society.

The Strategy needs also to define the emergency management concept, to set up the framework and the guidelines for the development of operational national action plans for all types of disasters.

As main segments of the relevant framework for activities aimed to mitigate harmful effects of disasters, we should highlight the following: organisational and legislative management frameworks, identification and quantification of hazards and continuous monitoring for the needs of early warning of disasters, then increased knowledge of the phenomenology of genesis and manifestation of natural hazards, reducing appropriate risk factors, as well as the preparation for an efficient response to disaster and relief.

The strategy to protect against disasters and technical accidents has directly or indirectly to include the following specific objectives:

- reduction of the number and consequences of possible incidents and their further consequences by preventive action,
- improved general preparedness of society for natural, technical and technological disasters and terrorist acts, applying the principles of sustainable development,
- upgrading the technical level of continuous monitoring of natural phenomena as potential causes of disasters, as well as technological processes as possible causes of accidents,
- establishment of an efficient system of prompt and reliable information to competent institutions and the National Coordination Disaster Management Centre, towards an efficient assessment of the scope and degree of incident, proper activation of rescue operations and coordination of the rescue process,
- reduction of the response time of relevant services in the event of natural and other disasters,
- improved management of hazardous, toxic and radioactive substances, ecosystems and cultural heritage,
- creation of formal preconditions for interaction with other countries in the region in the event of regional-scale disasters,
- development of new concepts to remediate consequences of disasters based on enhanced responsibility of physical and legal persons in the event of danger to persons and property, as well as on the principle of insurance of property, etc.

## III. AN ANALYSIS OF RISK COMPONENTS OF NATURAL DISASTERS AND TECHNICAL AND TECHNOLOGICAL ACCIDENTS IN MONTENEGRO

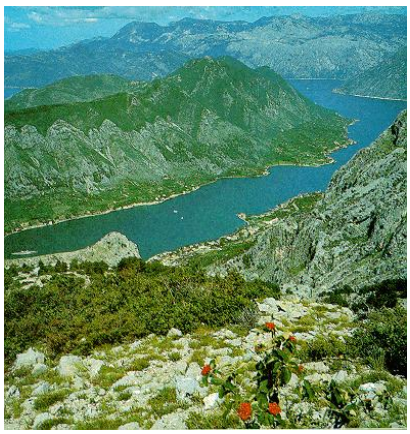
Montenegro is located in Southeast Europe, it has an area of 13,812 km$^2$, with the total of 190,212 households and 620,145 inhabitants, according to the 2003 census [(2)] (based on the so-called new concept of domicile population). The capital city is Podgorica, and the old royal capital Cetinje.

[2] From the Statistical Yearbook of the Montenegro Statistics Institute (Monstat) for 2005.

Land borders of Montenegro are 614 km long, while the sea border is 293 km long, which equals half of its land borders. Montenegro has sovereignty over a part of the Adriatic with the accompanying aquatic area up to 12 nautical miles away from land (22.2 km). The climate shows features of the continental, Mediterranean and mountain climate.

***Population of Montenegro by municipality according to 1991 and 2003 census (Source: Monstat).***

| | Popis<br>*Census* | Učešće poljoprivrednog stanovništva u ukupnom[1], u %<br>*Share of the agricultural population in total pop. [1], in %* | Učešće aktivnog stanovništva u ukupnom, u %<br>*Share of the active population in total pop., in %* | Učešće nepismenog stanovništva u ukupnom, u %<br>*Share of the illiterate population in total pop., in %* | Broj stanovnika u sjedištu opštine<br>*Number of citizens in town* | Gustina naseljenosti<br>*Density* | Broj naselja<br>*Number of settlements* | Broj domaćinstava [2]<br>*Number of households [2]* | Broj lica u domaćinstvu<br>*Number of households members* | Prirodni priraštaj<br>*Population growth* | Vitalni Indeks[3]<br>*Vital Index[3]* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CRNA GORA** | **1991** | **7,0** | **39,0** | **5,9** | **325040** | **45** | **1240** | **163274** | **3,7** | **5636** | **2.4** |
| ***Montenegro*** | **2003** | **5,3** | **42.6** | **2.4** | **347987** | **45** | **1256** | **190212** | **3,5** | **2640** | **1.5** |
| ANDRIJEVICA | 1991 | 13,0 | 36,0 | 8,8 | 939 | 24 | 24 | 1871 | 3,6 | 18 | 1,4 |
| | 2003 | 8,4 | 40.1 | 3.4 | 1073 | 20 | 24 | 2017 | 3,1 | -15 | 0.8 |
| BAR | 1991 | 4,0 | 37,0 | 6,4 | 10971 | 62 | 83 | 10664 | 3,5 | 239 | 1.8 |
| | 2003 | 3,0 | 42.3 | 2.1 | 13719 | 67 | 83 | 13796 | 3,3 | 113 | 1.3 |
| BERANE | 1991 | 10,0 | 35,0 | 5,8 | 12267 | 54 | 66 | 9458 | 4,1 | 432 | 3.1 |
| | 2003 | 6,9 | 38.4 | 2.1 | 11776 | 49 | 66 | 10875 | 3,8 | 219 | 1.7 |
| BIJELO POLJE | 1991 | 14, 0 | 38,0 | 7,0 | 16586 | 60 | 98 | 13233 | 4,2 | 624 | 2.8 |
| | 2003 | 11,6 | 41.0 | 3.1 | 15883 | 54 | 98 | 14129 | 4,0 | 246 | 1.5 |
| BUDVA | 1991 | 1,0 | 44,2 | 2,6 | 7178 | 96 | 33 | 3777 | 3,1 | 102 | 2.2 |
| | 2003 | 0,8 | 46.4 | 1.0 | 10918 | 130 | 33 | 5440 | 3,0 | 104 | 1.9 |
| DANILOVGRAD | 1991 | 4,0 | 37,0 | 7,5 | 4409 | 29 | 80 | 4379 | 3,4 | 121 | 1.9 |
| | 2003 | 4,7 | 41.7 | 1.8 | 5208 | 33 | 80 | 5057 | 3,3 | -23 | 0.9 |
| ŽABLJAK | 1991 | 20,0 | 43,0 | 5,2 | 1853 | 11 | 28 | 1461 | 3,4 | 17 | 1.4 |
| | 2003 | 16,2 | 42.5 | 2.5 | 1937 | 9 | 28 | 1353 | 3,1 | -8 | 0.8 |
| KOLAŠIN | 1991 | 19,0 | 41,0 | 6,9 | 2540 | 12 | 67 | 3283 | 3,4 | 74 | 2.5 |
| | 2003 | 12,7 | 42.8 | 2.6 | 2989 | 11 | 70 | 3230 | 3,1 | -30 | 0.8 |
| KOTOR | 1991 | 1,0 | 41,0 | 3,8 | 5620 | 67 | 46 | 6783 | 3,3 | -6 | 1.0 |
| | 2003 | 0,6 | 42.8 | 1.5 | 1331 | 69 | 56 | 7385 | 3,2 | -3 | 1.0 |
| MOJKOVAC | 1991 | 8,0 | 39,0 | 4,4 | 5859 | 30 | 13 | 2824 | 3,8 | 79 | 2.0 |
| | 2003 | 6,7 | 41.4 | 1.8 | 4120 | 27 | 15 | 2919 | 3,5 | 21 | 1.2 |
| NIKŠIĆ | 1991 | 4,0 | 40,0 | 5,0 | 56141 | 36 | 110 | 19400 | 3,9 | 607 | 2.2 |
| | 2003 | 2,8 | 42.7 | 1.6 | 58212 | 37 | 110 | 21479 | 3,6 | 268 | 1.4 |
| PLAV | 1991 | 15,0 | 25,0 | 9,5 | 4560 | 40 | 23 | 3847 | 5,0 | 188 | 2.9 |
| | 2003 | 15,0 | 33.0 | 5.7 | 3615 | 28 | 23 | 4760 | 4,5 | 84 | 1.6 |
| PLUŽINE | 1991 | 35,0 | 49,0 | 7,2 | 1458 | 6 | 43 | 1530 | 3,4 | -10 | 0.7 |
| | 2003 | 19,6 | 46.0 | 3.5 | 1494 | 5 | 43 | 1352 | 3,2 | -17 | 0.7 |
| PLJEVLJA | 1991 | 17,0 | 44,0 | 9,7 | 20187 | 29 | 158 | 11431 | 3,5 | 268 | 2.0 |
| | 2003 | 12,3 | 46.3 | 4.1 | 21377 | 27 | 159 | 11376 | 3,2 | 1 | 1.0 |
| PODGORICA | 1991 | 3,0 | 40,0 | 5,0 | 117875 | 106 | 143 | 39653 | 3,8 | 1963 | 3.8 |
| | 2003 | 3,1 | 44.7 | 2.2 | 136473 | 117 | 143 | 50382 | 3,6 | 1306 | 1.9 |
| ROŽAJE | 1991 | 9,0 | 31,0 | 7,1 | 9033 | 53 | 26 | 4340 | 5,3 | 467 | 5.8 |
| | 2003 | 9,3 | 35.7 | 3.1 | 9121 | 53 | 26 | 5576 | 4,9 | 353 | 4.5 |
| TIVAT | 1991 | 1,0 | 40,0 | 2,1 | 8230 | 248 | 12 | 3516 | 3,2 | 38 | 1.3 |
| | 2003 | 0,4 | 44.5 | 0.8 | 9467 | 296 | 12 | 4675 | 3,0 | 9 | 1.1 |
| ULCINJ | 1991 | 6,0 | 29,0 | 10,4 | 11144 | 95 | 39 | 5950 | 4,0 | 209 | 2.5 |
| | 2003 | 5,6 | 37.8 | 5.6 | 10828 | 80 | 39 | 6271 | 4,2 | 40 | 1.2 |
| HERCEG NOVI | 1991 | 1,0 | 41,0 | 2,1 | 11429 | 117 | 27 | 8673 | 3,2 | 118 | 1.5 |
| | 2003 | 0,6 | 43.2 | 0.6 | 12739 | 141 | 27 | 11318 | 3,0 | 44 | 1.1 |
| CETINJE | 1991 | 3,0 | 43,0 | 5,2 | 15946 | 22 | 94 | 6139 | 3,3 | 93 | 1.4 |
| | 2003 | 1,9 | 45.9 | 1.7 | 15137 | 20 | 94 | 5899 | 3,2 | -57 | 0.7 |
| ŠAVNIK | 1991 | 38,0 | 51,0 | 9,2 | 821 | 7 | 27 | 1062 | 3,5 | 13 | 1.5 |
| | 2003 | 32,5 | 44.0 | 3.2 | 570 | 5 | 27 | 923 | 3,2 | -15 | 0.6 |



Boka Kotorska Bay (left) and Durmitor in wintertime (right).

The territory of Montenegro is divided into 21 municipalities with 368 local communities and the total of 1,256 settlements, 40 of which urban in character. Within its territory, Montenegro has four large national parks (Durmitor, Lovćen, Biogradska Gora and the Skadar Lake Basin), with the total area of 91,000 ha. The total area of 40 natural lakes in Montenegro is 375 $km^2$.

Undoubtedly, the territory of Montenegro is characterised by an exceptional geographical and biological diversity, always linked with a specific natural phenomenology, creating and enriching the diversity, but sometimes even endangering it. Natural disasters in the area of south Dinarides are predominantly provoked by tectonic activity of the earth's crust and orogenesis, then the extreme hydrological, meteorological and other natural activities which are fortunately not such a frequent occurrence in our areas. Due to the scale of accidents caused by such disasters and the resulting degree of devastation to the society in general, to material resources, cultural and historic heritage and natural resources, in order to protect these resources, each organised community puts in place efficient measures to combat such disasters. In that sense, in order to design a reliable system to protect against disasters, it is necessary to analyse in detail their phenomenology and genesis, then the scope and intensity of their occurrence, as well as spatial distribution of equivalent hazards from their occurrence.

Fast and comprehensive technological progress inevitably brings about corresponding harmful consequences which may sometimes result in serious accidents and incidents and consequential serious disasters. Therefore the following chapters focus considerably on the analysis and quantification of hazards from such phenomena. The technological development, but also modern pace of life and a high level of communications globally, are imposing an increasing need for protection against the biological hazard, or various forms of epidemics in people as well as mass disease of animals and plants.

## III.1. NATURAL DISASTERS

Generally, **natural disaster** most often implies a consequence or an effect of an occurrence of a natural phenomenon, where the number of casualties or material losses depend on the capacity of the population to combat these phenomena and mitigate the impact.

In 2000, the United Nations launched the International Strategy for Disaster Reduction in order to identify the causes of vulnerability of human and economic losses and to design optimal guidelines for building disaster resilient communities as an integral component of sustainable development, with the goal of reducing human, social, economic and environmental losses due to natural hazards.

By the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, with 189 contracting parties to this day, as well as its Kyoto Protocol adopted in 1997 (which entered into force on 15$^{th}$ February 2005) the international community established legal frameworks to deal with the issue of global climate protection.

### III.1.1. EARTHQUAKES

The earthquake risk has for centuries been, and still is, a large natural threat to human lives and material goods in many states around the globe, but also a natural disaster with most severe consequences in all the countries of the northern rim of the Mediterranean, Montenegro included.

Contemporary regional geo-physical research and precise satellite and geodetic surveillance, show with certainty that the area of the Mediterranean has over a long geological period represented a zone of intensive contact of continental masses of Europe and Africa. In its slow translatory motion northwards (with the approximate speed of one centimetre a year) the African tectonic plate is exercising a powerful collision with the southern margin of the European continent, moving south-eastwards (with approximately the same speed).

As a result of the collision of these two segments of lithosphere of huge scale, in the rocks of the contact area, from mid Mesozoic till today, there have occurred very violent and diverse tectonic processes – in the form of folding, thrusting, rising and slipping of rock masses of the area, as well as specific volcanogenic activities, stimulated by created stress field, creating at the same time a complex orogenic and geological complex of the earth crust of the area.

Tangential pressures from the contact zone of these tectonic plates, particularly from the Apenines, are transferred over the Adriatic micro-plate in the area of the Dinarides – in the north-east direction. The concentration of stresses in the lithospheric rocks of Dinarides has been achieved through complex motion (rotational and translatory) in the segments of lithosphere in the area of Adriatic micro-plate in the direction of diving of the Apennines subduction plate – towards the Tyrrhenian Sea (under the sediment complex). This kinematic process includes deeper rocks of the earth's crust, primarily of the acid and base composition, all the way to Mohorovičić border. On the other hand, a powerful side pressure creates a thick sediment complex of the Adriatic (up to the level of Triassic clastites) defying the horizontal deformation in the Adriatic region at the same time generating powerful tectonic effects in the outward and inward Dinarides. As a result of such strains, in the rocks of this part of the terrain, geological forms are created, such as: horst and graben structures, mountain massifs, tectonic trenches, nappes, normal, reverse and transformed faults etc. The systems of normal reverse fault structures are almost always oriented in parallel with the Dinarides. It is often characterised in regional dimensions, with falling angle on land – from 20 to 50 degrees in comparison to the horizontal plane. Transcurrent faults in the Dinarides are mostly created in the direction normal to the previous, characterised by relatively small dimension and very steep inclination of the fault plane.

As a consequence of the above geo-dynamic processes, the greatest part of the south Adriatic and a considerable part of south Dinarides, over the more recent and distant past, were the scene of numerous damaging and disastrous earthquakes. All contemporary research confirm the existence of a high level seismic hazard in the region, and thus also at the greatest part of Montenegrin territory. From the point of view of expected level of seismic hazard the coastal region is particularly prone to earthquakes. In addition to the seismic, there are other hazards of other geological processes present in this region, such as large-scale landslides, rock slides and ground liquefaction in dynamic conditions, to be elaborated in more details in the following section.

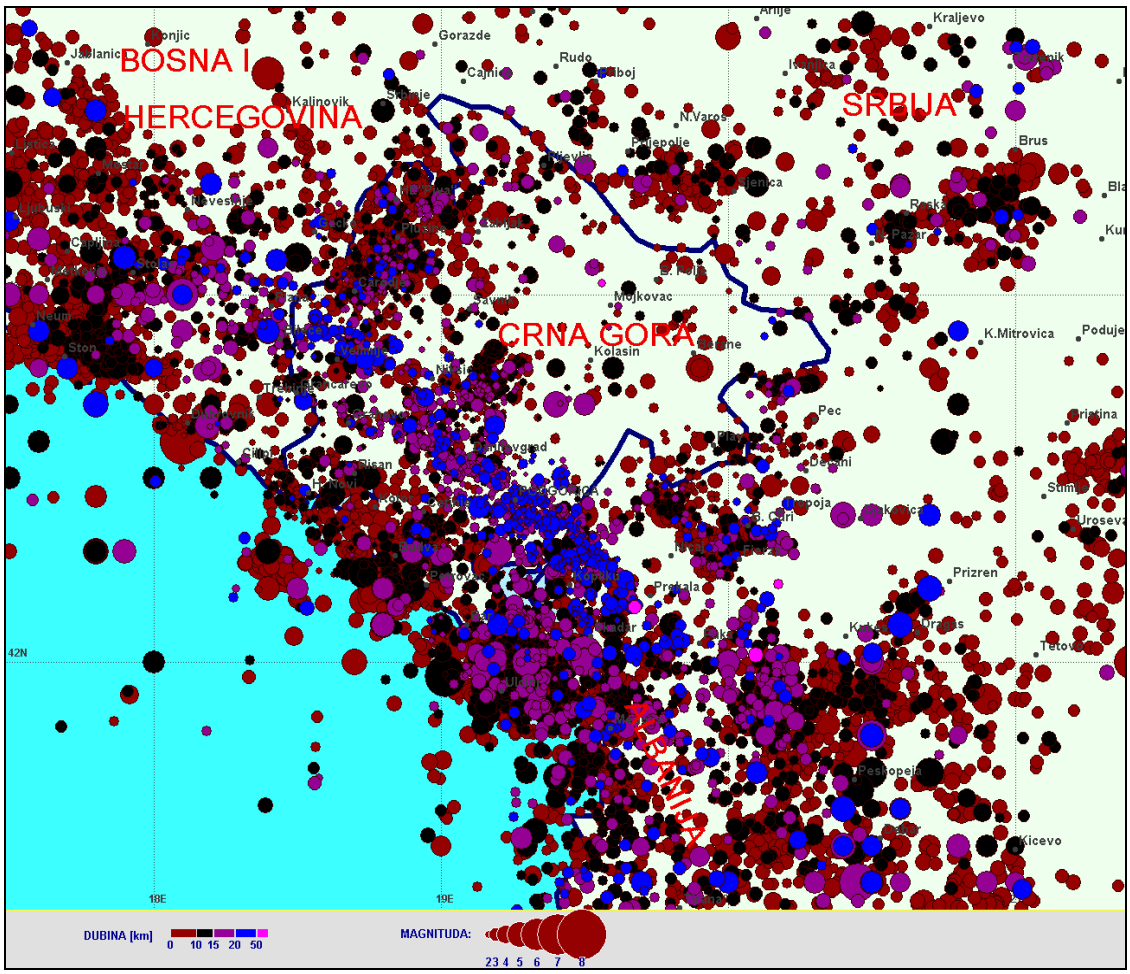



Figure 1. Map of epicentres of all properly documented earthquakes occurring from 15th century to the end of 2005 within the area of Montenegro and its immediate vicinity.

The character and intensity of seismic activity in the area of south Dinarides is illustratively expressed by the map of epicentres of properly documented earthquakes occurring for the past five centuries in the region (Figure 1).This figure clearly shows that earthquakes of great magnitude and devastating power are generated at the greatest part of Montenegrin territory.

Seismic activity in Montenegro is also characterised by numerous autochthonous seismogenic foci, but also a large number of seismogenic zones of the whole Western Balkans, especially the one from southern Croatia, Herzegovina, northern Albania and south and southwest Serbia. The seismic zones near Ulcinj and Bar, Budva and Brajići, as well as Boka Kotorska regions, immediate vicinity to Berane, the whole Skadar Lake region, the mountain massif of Maganik, etc should be highlighted as particularly seismically active areas of Montenegro.

The first documented data of seismic effects in Montenegro and its immediate vicinity date back some 15 centuries in the past, but such documents are very rare. Nevertheless, Dubrovnik and Kotor archives hold numerous documents on frequent and devastating earthquakes that used to happen between 15th and 17th century in the area between Dubrovnik and Boka Kotorksa bay. Over this period only 7 disastrous earthquakes were recorded with their epicentres under the sea, some 15 km away from the entrance to Boka Kotorska (Figure 2)., the 1563 and 1608 earthquakes were described as the ones with gravest consequences; according to the macro-seismic effects recorded in historic documents, they had the damaging intensity of 9 degrees on the MCS scale[3], or their equivalent magnitude amounted to 6,3 units (Richter scale).

[3] MCS: Mercalli-Cancani-Sieberg 12-degree scale, approximately numerically equivalent to the new EMS-98 European macroseismic scale.

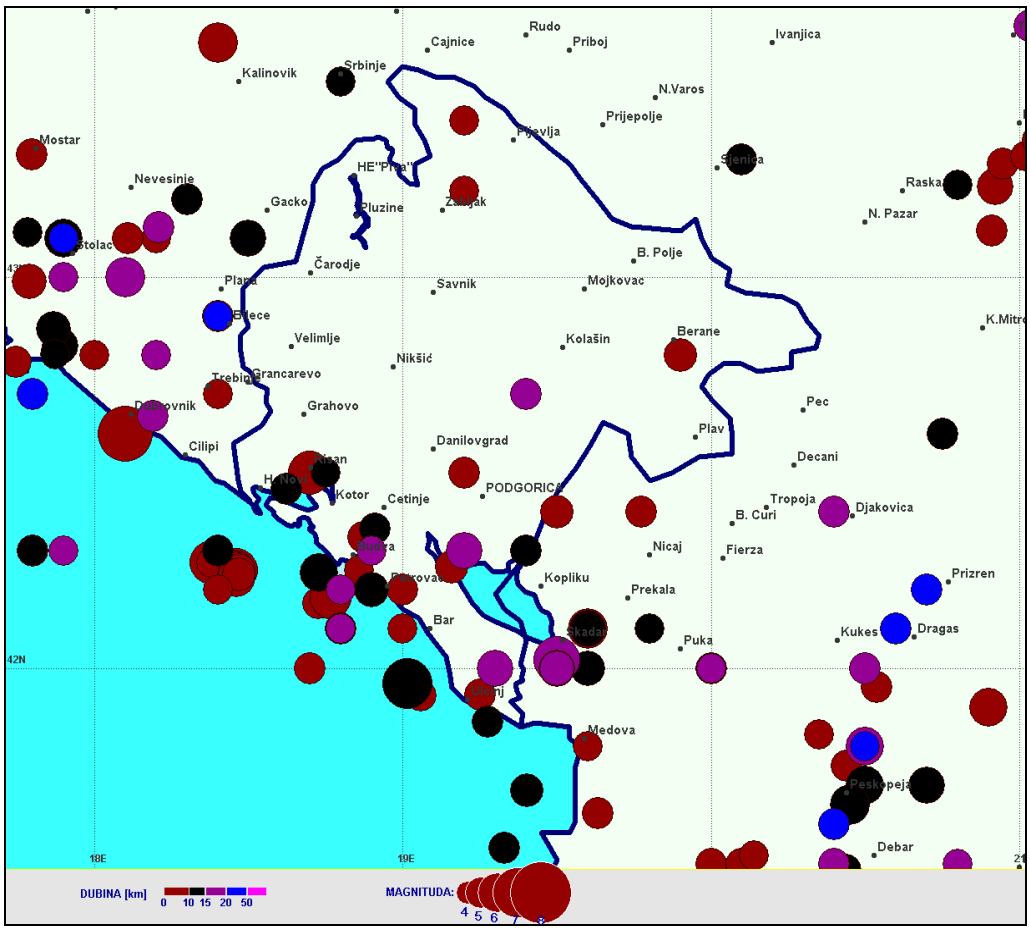



Figure 2. The map of epicentres of damaging and disastrous earthquakes in Montenegro and the surrounding for the past 5 centuries.

The strongest ever studied and documented earthquake in the area of South Adriatic and South Dinarides occurred in 1667 in the immediate vicinity to Dubrovnik (Figure 2) with the intensity of 10 degrees on the MCS scale, or an equivalent magnitude of 7.4 of Richter units. This earthquake almost fully devastated not only the area of Dubrovnik, but the whole of Boka Kotorska region as well. In addition, the 1905 earthquake in Shkodra and the surrounding area caused great destruction the intensity of which was 9 degrees on the MCS scale, whereas in today's Podgorica the recorded destruction was in the range of 8 degrees on the same scale.

As the most powerful earthquake in 19$^{th}$ and 20$^{th}$ century, the disastrous event of the 15$^{th}$ April 1979 (at 07:19:40 local time) with the magnitude of 7.0 and the epicentre intensity of 9 degrees on MCS scale should be noted. Practically the whole coast of Montenegro was affected by the destruction of this intensity, with the total of 136 lives lost (101 in Montenegro and 35 in Albania) and over 4 billion US dollars of direct economic losses in Montenegro.

Figure 3 summarises maximum occurred earthquake intensities, based on overall seismic-related documents, which have affected the territory of Montenegro until this day, expressed in MCS intensity scale.

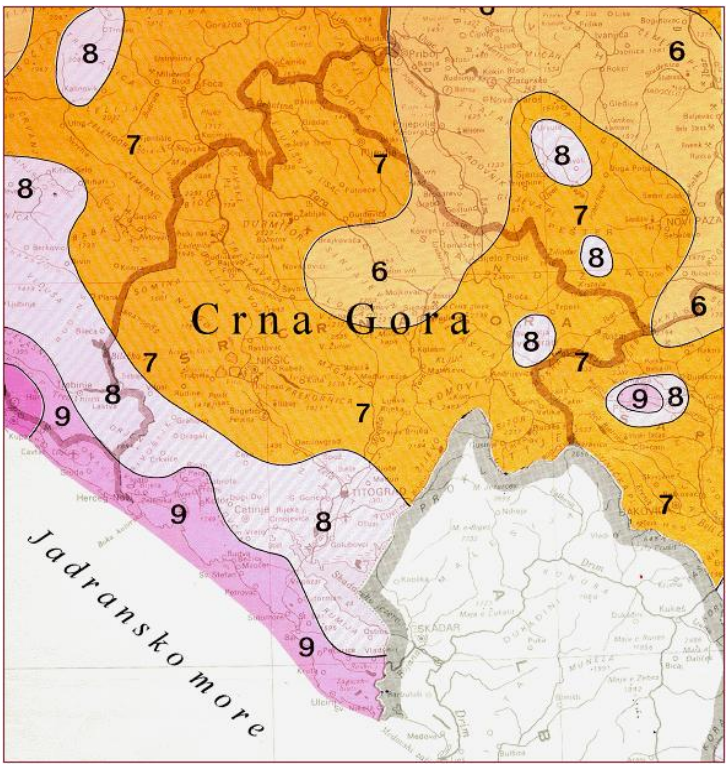



Figure 3. Map of maximum occurred earthquake intensities within the territory of Montenegro.

### *III.1.1.1. QUANTIFICATION OF SEISMIC HAZARD IN MONTENEGRO*

General characteristics of the seismic activity in Montenegro and its immediate surroundings over the past several centuries may be simply expressed by the frequency of occurrence of strong and devastating earthquakes in the area. Over the given period, and for certain even much before that, on average every 3 years there would be one earthquake in the range of 7 degrees on Mercalli's scale, every 15 years one earthquake with the intensity of 8 degrees, and on average every 60 years one damaging or disastrous earthquake with casualties. Having in mind the causes and long-term persistence of geodynamic processes in the Mediterranean region, manifested in this area almost in unchanged form for the past 50 million years, we may with absolute certainty say that such a seizmogenic scenario is to continue – both in near, and in distant future. Thus, seismic hazard is a natural phenomenon with which the communities in this region, as well as in many others worldwide, have to coexist.

Increasingly more dense population and intensive construction of buildings in Montenegro, with the application of different degrees of required seismic reinforcement, in such an environment, particularly in the coastal region, lead to a certain paradox – that seismic hazard may not longer be regarded solely as an element of natural disasters. That is to say, this paradox is caused on one hand, as a consequence of non-conformance of today's respectable knowledge of the characteristics and scope of potential levels of ground motion in future strong earthquakes in the region, as well as enviable achievements in practical seismic planning, design and construction on the other – inadequate scope in the application of such knowledge in design and construction practice.

The level of knowledge on seismogenic characteristics of the northern Mediterranean and the Balkan region, from the time of devastating and disastrous earthquake on 15$^{th}$ April 1979 at the Montenegrin coast, has been greatly improved and today represents a valid basis for reliable determination of expected earthquake activities in the upcoming period, as parameters needed for a successful and reliable urban planning and design in Montenegro.

Seismic hazard expresses the probability for the realisation of a certain parameter of land movement within a specific time period. The seismic hazard for the territory of Montenegro has on

several occasions been defined applying various methodological approaches. We should mention some of the existing seismologic bases in use:

- Seismic zoning map for Montenegro (1982),
- A series of interim seismic maps (1987),
- Seismic hazard within the Spatial Plan of Montenegro (1988),
- Seismic micro-zoning of urban areas within all municipalities in Montenegro (1984-1988) and
- Seismic hazard for the needs of the new Spatial Plan of Montenegro (2005).


Figure 4. Seismic zoning map for the territory of Montenegro.

The first form of the seismic hazard map for Montenegro, at the regional level, was carried out by the National Seismologic Institute of Montenegro (in cooperation with the Institute for Geological Research of Montenegro and the Institute for Earthquake Engineering and Engineering Seismology from Skopje), in the form of a Seismic Zoning Map (Figure 4) for the conditions of the so-called "middle ground"[4], in 1982. This map contains a parameter of basic degree of seismic intensity at the territory of Montenegro, and here several zones of different level of seismic hazard may be discerned:

- southern, coastal region, the zones of Ulcinj and Skadar, Budva and Boka Kotorska Bay, with possible maximum intensity in the conditions of middle ground of nine degrees on the MCS scale,
- Podgorica-Danilovgrad zone with maximum intensity of eight degrees on the MCS scale,
- central part of Montenegro with the northern region, including Nikšić, Kolašin, Žabljak and Pljevlja, characterised by possible maximum intensity of seven degrees on the MSC scale, and

[4] "Middle ground" for the area of Montenegro has been determined by a special, very extensive multiyear seismic refraction research in urban areas of all Montenegrin municipalities and has been defined as follows: from the lithologic point of view, middle ground in Montenegro refers to clay-sand pebble soil, partly related to somewhat looser (lime, dolomites etc.), with the speed of longitudinal seismic waves of 1760 m/s, or transversal waves of 740 m/s, with mean density of 1.9 t/m$^3$ and average depth of underground water of 10 m.

- an isolated seismogenic zone of Berane, which may generate earthquakes of maximum intensity up to eight degrees on the MCS scale.

In 1987 all republic seismologic institutions of then SFRY, organised within the “Community for Seismology of SFRY”, prepared a series of “Interim Seismologic Maps for SFRY” for several recurrent periods of time (Figure 5). The map for a 500 year period makes an integral part of the "*Regulations on Technical Norms for Building Construction in Seismic Areas*" (Official Gazette of SFRY no. 31/81 with amendments no. 49/82, 29/83, 21/88 and 52/90). It is established in article 2 of the amendments to the 1990 Regulations (Official Gazette 52/90) that the 500 year period map (Figure 5) represents a basis for designing buildings categorised as categories 2 and 3. These Regulations are still in force at the territory of Montenegro. All such seismic hazard maps express elements of expected maximum intensity of earthquakes in the conditions of solid ground (main rocks) for a specified period of time.

In parallel with the realisation of seismic hazard maps, in the period between 1984 and1988, a studious preparation of seismic micro-zoning maps for urban areas in all municipalities in Montenegro was done, based on extensive geophysical and geological field research. The institution in charge of this project was the Institute for Geological Research of Montenegro, and the partner institutions practically all geological and seismologic institutes from then SFR of Yugoslavia. These maps are of the 1: 5.000 or 1:10.000 scales and cover a large number of aggregate maps with highly complex contents. One of these maps contains detailed seismic micro-zonings, while the other contains the elements of suitability of the terrain fr building construction.


Figure 5. “Interim Seismologic Map for the Territory of SFRY” (a part thereof concerning Montenegro) with levels of expected maximum intensity of earthquakes for the recurrent 500 year period.

Good technical capacities of telemetric seismologic stations network in Montenegro installed in late 1982, as well as earlier regional networks of stations, enabled the establishment of good quality data based on seismic activity, as well as on structural composition of earth’s crust of the whole region. Using such a base of seismologic data, by applying modern methods of numerical processing, a representative numerical seismogenic model for the territory of Montenegro has been made, necessary for up-to-date calculation of seismic hazard elements. Figure 6a shows the graphic illustration of parameters of expected maximum magnitudes of earthquakes for the coming

100 years at the area of Montenegro and its immediate surrounding, as one component of such numeric seismogenesis model.

The determined model of seismogenesis for the territory of Montenegro has been applied to appropriate up-to-date numeric algorithm in order to calculate the elements of seismic hazard for the components of expected maximum ground acceleration and earthquake intensity (MCS scale) for several recurrent time periods. As a representative and instructional example of such a process and its results, Figure 6b shows the map of expected maximum intensity of earthquakes for the recurrent 200 year period and the realization probability of 70 % for the area of Montenegro and its surrounding. It is evident that the contents of this map significantly in more detail express the aspect of expected seismic activity compared to the map shown in Figure 5 and as such, with other products of seismic hazard may represent a more reliable basis for spatial and town planning in earthquake prone areas of Montenegro, as an important part of seismic risk control.

In addition to seismic hazard, as the second significant component of natural hazards, we need to highlight the geological hazard caused by large movements of rock masses and ground, as well as ground liquefaction. In recent and more distant past, at the area of Montenegro several manifestations of geologic hazards were recorded. Thus, for instance, during the disastrous earthquake of 15$^{th}$ April 1979, at several locations at the coast of Montenegro, as well as in the hinterlands, in particular in Crmnica region, 35 people died of consequences of large-scale land and rock slides (earthquake induced) together with huge economic losses to buildings in the area. In addition, on several locations in the Skadar Lake zone, as well as in the coastal zone, the liquefaction phenomena were registered then (ground melting) followed by eruptions of sand from the soil.

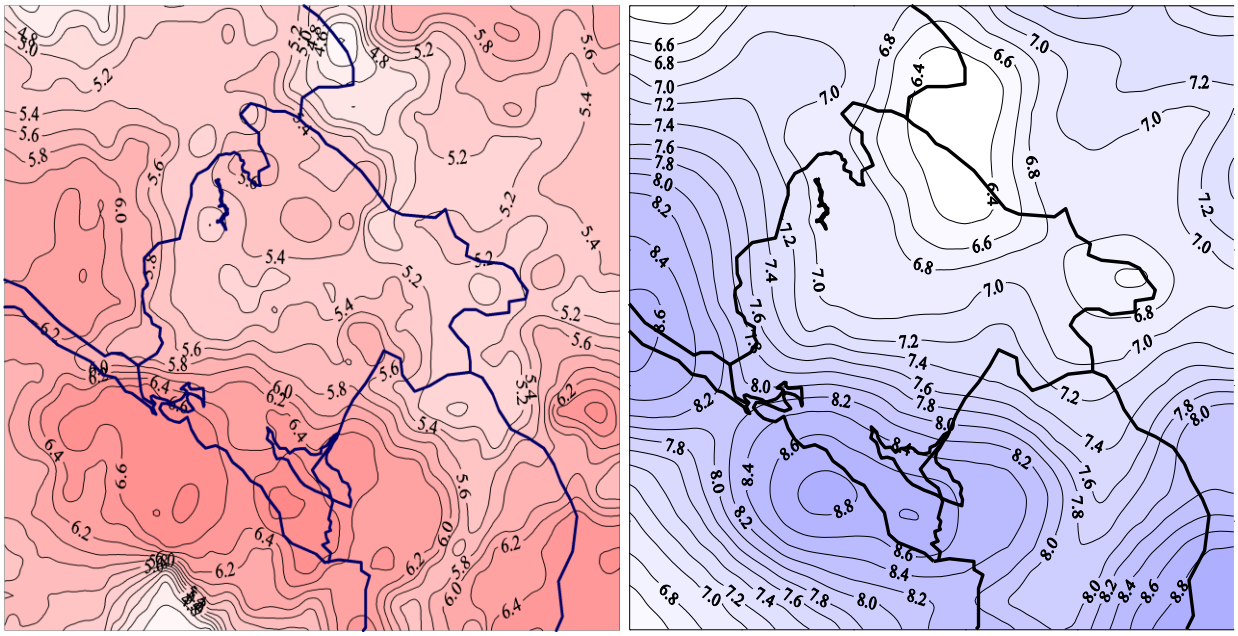


Figure 6. a) A map showing expected maximum earthquake magnitudes (Richter units) as components of a numeric seismogenic model for the territory of Montenegro; b) A seismic hazard map, with the element of expected maximum earthquake intensities (MCS) within a 200 year period, with the occurrence probability of 70 %.

### *III.1.1.2. SEISMIC EFFECTS OF ARTIFICIAL ACCUMULATIONS*

In the region of South Dinarides intensive construction of river dams and creation of accumulation lakes began in mid 1950s. In the period between 1954 and 1991, over 40 such facilities were built. The volume of several created artificial accumulations would exceed one billion cubic metres of water (for example: Grančarevo in Herzegovina, Fierza and Škumbini in Albania). Figure 7 graphically shows the position of all accumulations built over that period, with the symbolic indication of the size of accumulation (by a circle whose radius is proportionate to the square root of the accumulation volume). Distribution of accumulations is shown in a simplified map of

epicentres indicating only stronger earthquakes which occurred in 20th and 21st century (above the magnitude of 3.5).

The construction of hydro-technical facilities with large artificial accumulations inevitably leads to increased hydrostatical pressures and considerable changes in the state of internal pressures in the rocks within the earth's crust in a wider zone of the accumulation. In the conditions of already critical pressures in rocks, created by natural geodynamic effects, this additional pressure may represent stimulation, or a trigger for the release of seismic energy, or the genesis of induced earthquakes. Such a process eventually leads to a change in overall seismic regime of the region, and thus observation and study of such phenomena is extremely significant from the point of view of protection of these hydrotechnical plants and human lives.

Systemic study of the phenomenon of induced seismicity (or seismic activity stimulated by artificial accumulations) started in early 20th century. Studious observation of this phenomenon started in 1960s, in parallel with the establishment of numerous accumulations around the world. There are many examples of such destructive manifestations of induced seismic activity in dams, the most striking examples, judging by the degree of such effects, being the following: Koyna in India, Kremasta in Greece, Vaiont in Italy, Carriba in Zambia, etc.

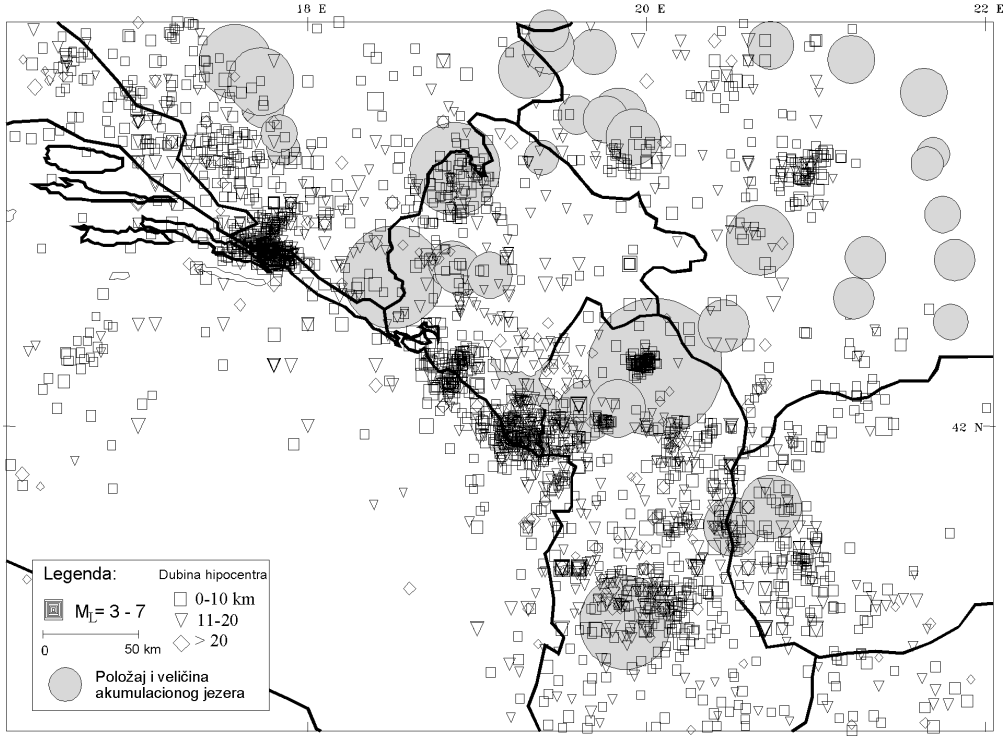



Figure 7. Position and relative size of artificial accumulations at the epicentre map of stronger earthquakes.

Studying well-documented examples with a pronounced phenomenon of induced seismic activity by large accumulations in more than 200 cases, it has been positively established that there is a direct link between the dynamics of filling and emptying accumulations, i.e. the changes in the water masses of the accumulation, on one hand, and realized seismic activity on the other. It has been noted that the phenomenon of induced seismicity almost regularly occurs in large accumulations in tectonically active regions, the activity being caused by one of the following:

- Sagging of the reservoir basin and establishment of the new balance for the rock masses of the basin base, due to filing of the accumulation with water, having as a consequence the geotectonic activity in the accumulation zone;
- Filling of the accumulation may cause re-activation of the existing tectonic faults in the accumulation zone;
- Additional stresses, created by filling the accumulation, may also have the triggering effect in strained existing tectonic faults;

- Increased internal pressure in rocks, caused by filling accumulation, plays a vital role in the creation of conditions for activating already tectonically predisposed seismogenic zones, particularly manifested in the procedure for injecting water under high pressures in exploitation of geothermal energy;
- Presence of non-homogenous, weakened and degraded zones in rock masses in the accumulation zones, may contribute to the creation of tectonic dislocations.

The largest number of accidents which occurred in large accumulations was caused due to improper assessment of the realistic ranges of maximal intensity for natural seismicity.

In addition to direct damaging effects which may be caused by the action of seismic waves of earthquakes with their hypocentre in the very accumulation zone, it is known that hydro-dynamic reaction of water accumulation to the occurrence of large ground oscillations may also contribute to the formation of additional strains in the body of the dam, and even cause its partial damage. Therefore, today great attention is given to the phenomenon of hydrodynamic effect of water masses of large artificial accumulations.

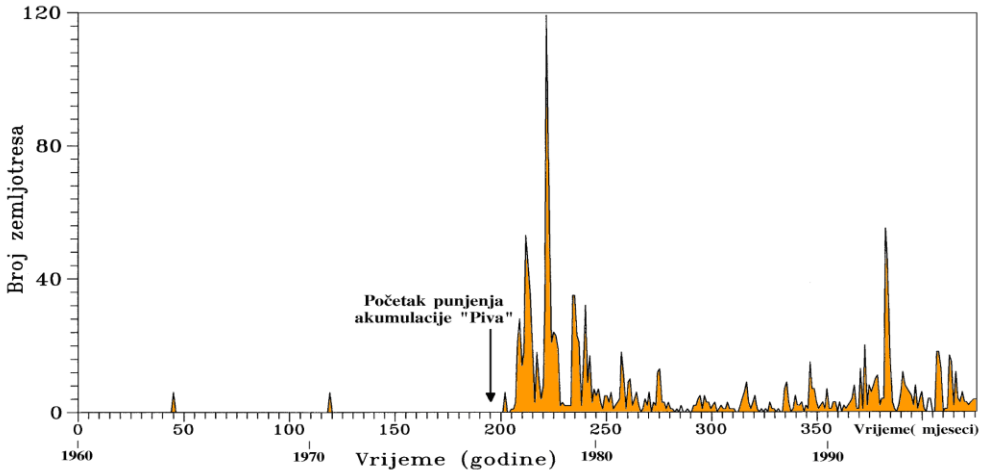



Figure 8. Frequency of occurrence of earthquakes over the period 1960-1997, with the indication of the year of first filling of the “Mratinje” accumulation.

Potential damaging effects which may be caused by sudden slide of a larger quantity of rocks and soil into the accumulation reservoir should also be noted. Pressures and hydrodynamic effects thus formed may be even more significant than the hydrodynamic effects of the water mass of the accumulation, caused by oscillations of the ground incited by earthquake.

The “Mratinje” accumulation at Piva river, to the northwest of Montenegro, is a typical example with pronounced induced seismic activity. The dam of the hydro-technical facility “Mratinje” is in the form of a concrete arc, with the construction height of 220metera, while the length in the crown of the dam is 261 metre. The first filling of the accumulation started in 1976.

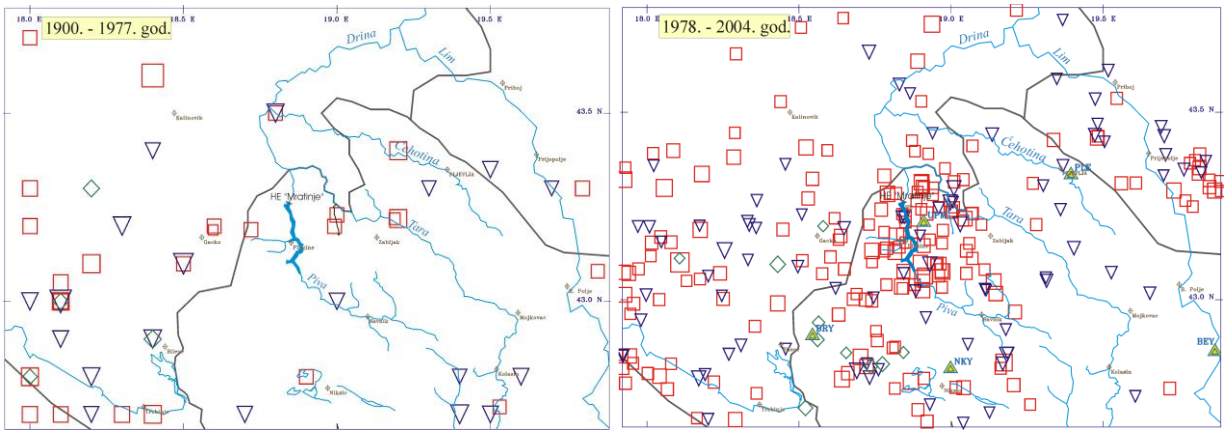



Figure 9. Seismicity in the wider accumulation zone of Mratinje until construction and first filling (left) and after the first filling (right).

Figure 8 shows the development of seismicity over time within the zone of “Mratinje” accumulation, expressed as a number of occurred earthquakes per unit of time (1 month) in the period from 1960 to 1997, indicating the time of the first filling of the accumulation. The diagram features only the earthquakes positively located within the accumulation zone. This diagram markedly indicates the above mentioned process of intensified seismic activity in the region of the accumulation, especially in the first 2 years after its filling (the time actually needed for its full formation). Figure 9 presents the same data in the form of the epicentre map for stronger earthquakes which occurred in the wider zone of the accumulation until its first filling (Figure 9 left) while the epicentre map on the Figure 9 right shows the period of seismic activity from 1978 to the end of 2004. The difference in the contents of these pictures clearly indicates pronounced stimulative seismic effect of the accumulation.

The design and construction of high dams and large accumulations in tectonic areas, such as the whole area of the Dinarides require meticulous assessment of the realistic level of seismic hazard, i.e. “maximal” and “designed” earthquake, considering that the maximum seismic activity level to be induced by the new accumulation with a high degree of probability will be found within thus estimated limits of natural seismicity.

### *III.1.1.3. SEISMIC RISK AS A CONSEQUENCE OF SEISMIC HAZARD REALISATION*

When describing the expected consequences of seismic hazards, i.e. exposure of material and human resources to dangers created in the event of an earthquake, the term seismic risk is used. This type of a risk may be defined as expected level of losses or damages caused due to the effect of earthquakes at a certain place and at a certain time. When assessing the level of seismic risk it is necessary to know all the components of the risk, their place and interrelations (Figure 10). This refers to the knowledge of four basic risk components:

1. seismic hazard,
2. elements exposed to seismic hazard: population, buildings, economic or cultural and historic values, etc.,
3. location of the exposed element compared to the hazard and
4. vulnerability of elements, representing the degree of possible losses or damages of the element, at the given location, in the conditions of the action of a specific hazard. Vulnerability may refer both to physical, but also to social and economic categories.

Depending on the methodology applied, seismic risk may be expressed through: the expected number of casualties, expected economic losses expressed in monetary units, expected level and distribution of damages of a certain type of buildings, infrastructure facilities, etc.

Figure 10: Components in the assessment of the degree of seismic risk.

Risk assessment studies are aimed to determine priorities in risk management, i.e. to define and implement the planning measures and actions to mitigate expected consequences of seismic hazard: through gradual activity on planned and up-to-date design and spatial planning, elimination or strengthening of most vulnerable types of building, redistribution of important activities, insurance policy, as well as a number of other measures, the so-called seismic mitigation or reduction of possible harmful effects of earthquakes.

The factors most frequently leading to increased vulnerability of a community to any hazard, seismic hazard included, are as follows:

- increased number of inhabitants, resulting in increased population density and investments in areas with high seismic hazard. This phenomenon is common in the areas which are being reconstructed after some earthquake as a consequence of large inflow of funds and jobs on their rehabilitation,

- non-sustainable development practices,
- unpreparedness of the society to deal with increased population accompanying this process with adequate social measures – including reduction of seismic risk and crisis management,
- degradation of natural resources,
- increased uncertainty in water supply, food supply and energy sources supply,
- rural-urban migrations and urbanisation pressures to cities which become uncertain,
- poor institutional capacities in facing disasters,
- inadequate risk management measures or forecast techniques,
- inadequate participation of local communities in risk management and in emergencies,
- inadequate level of society preparedness for emergencies,
- inadequate communication and transportation infrastructure,
- lack of strict measures to control natural environment,
- inadequate market mechanisms which are supposed to prevent risk spreading and mitigate the consequences of disasters.

Particularly significant examples of some technological trends aimed to reduce vulnerability of the society following an earthquake are as follows:

- better understanding of seismic hazard as a phenomenon and its more reliable determination,
- enhancement of analytical methodology enabling the use and development of complex models in the assessment of behaviour of buildings and communities in the event of an earthquake,
- enhancement of timely communications enabling the application of new knowledge and advanced engineering practice, using up-to-date knowledge both of engineering construction materials and the very construction, including new approaches in designing seismically resistant buildings.

Many of the above factors affecting increased risk of destructive earthquakes are present considerably at the Montenegrin territory. Level of seismic risk is practically increased proportionally with population increment (Table 1) and density of population, particularly true for regions where estimated seismic hazard is the greatest (Figure 4).

*Table 1: Areas and population in seismic regions*

| Region | Maximum earthquake intensity | area* | | population** | |
|---|---|---|---|---|---|
| | | $km^2$ | % | total | % |
| Coastal region | IX | 1 900 | 13.8 | 151 000 | 24.4 |
| Podgorica-Danilovgrad region | VIII | 3 030 | 21.9 | 205 000 | 33.1 |
| Central region of Montenegro | VII | 7 600 | 55.0 | 229 000 | 36.9 |
| Seizmogenic zone of Berane | VIII | 340 | 2.5 | 20 000 | 3.2 |
| Northern region | VI | 940 | 6.8 | 15 000 | 2.4 |

*, ** Note: *Areas of zones in seismic zoning, as well as the population of certain regions, are estimated based on the 2003 census.*

As a parameter of expected earthquake with maximal effects to buildings and the ground, earthquake intensity was used in seismic zoning of the Montenegrin territory, as illustrated in Figure 4. According to European Macro-seismic Scale (EMS-98) in use in EU member states,

earthquake intensity is defined based on the objective effects of earthquakes on the ground and the structures, as well as subjective feeling of people. According to this scale, structures are also differed according to their material, the structural system, design and performance and classified into the so-called vulnerability classes. The standard grades of damage to structures have been defined (five grades – from negligible damage to destruction), and based on the behaviour of buildings in earthquakes which already occurred the percentage of possible damages in the stock of buildings of a certain class was defined for each of 12 degrees of intensity on this scale quality.

| TYPE OF STRUCTURE | EARTHQUAKE / SITE | GRADE OF DAMAGE | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Simple stone masonry | Montenegro, Yugoslavia 1979 | | | ● | | |

Figure 11. Classification of buildings according to the EMS-98 scale for masonry, with grade 3 of destruction, illustrated by a building damaged in Montenegrin 1979 earthquake.

Table 2 shows expected maximal effects of earthquakes of the intensity 7, 8 and 9 (based on the elements of seismic zoning of Montenegro – Figure 4) and are expressed through the overall percentage of buildings with a certain degree of damages and for this characteristic types of buildings (vulnerability classes). The table gives just the overview of those damages that according to the EMS-98 scale are classified as "s*ubstantial to heavy damage*", "*very heavy damage*" or "*destruction*". The meaning of these terms according to the degree of damage is as follows:

- substantial to heavy damage: buildings with moderate structural damage and heavy non-structural damage,
- very heavy damage: buildings with heavy structural damage and very heavy non-structural damage,
- destruction: buildings with very heavy structural damage.

Table 2 does not show slighter, the so-called non-structural damage which may be very significant, both in scope and danger they pose to human life.

*Table 2: Destructive effects of earthquakes of certain intensity compared to the vulnerability class of buildings (defined by quality, material and structural system of the building) expressed as a percentage of total damaged buildings of the given type.*

| Intensity | well seismically protected buildings (reinforced concrete and steel structures) | contemporarily designed buildings (confined or reinforced masonry, reinforced concrete structures designed according to seismic regulations – moderate reinforcements) | reinforced concrete structures (buildings before the introduction of seismic regulations) | masonry of better quality (massive stone houses, non-reinforced houses made of dressed stone, or with reinforced concrete ceilings) | masonry of poorer quality (rubble stone or earth brick) |
|---|---|---|---|---|---|
| I =7 | | | | 0-15 % buildings with substantial to heavy damage | 15-55 % buildings with substantial to heavy damage |
| | | | | | 0-15 % buildings with very heavy damage |
| I =8 | | | 0-15 % buildings with substantial to heavy damage | 15-55 % buildings with substantial to heavy damage | |
| | | | | 0-15 % buildings with very heavy damage | 15-55 % buildings with very heavy damage |
| | | | | | 0-15 % destroyed buildings |
| I=9 | moderate damage (slight structural damage, moderate non-structural damage) | 0-15 % buildings with substantial to heavy damage | 15-55 % buildings with substantial to heavy damage | | |
| | | | 0-15 % buildings with very heavy damage | 15-55 % buildings with very heavy damage | |
| | | | | 0-15 % destroyed buildings | 15-55 % destroyed buildings |

Different methodologies are applied in the assessment of vulnerability of building structures: empirical, analytical, methodologies based on expert observation, etc. It is usual that vulnerability assessment is done for classes or types of buildings, depending on the structural system, materials, time of the design (current regulations according to which the structure was calculated) etc.

For the needs of the previous Spatial Plan of the Republic of Montenegro, in 1984 a *Study for the Assessment of Expected Vulnerability and Seismic Risk Developed on the Basis of Research of Effects of the Earthquake of 15th April 1979 in the SR of Montenegro (SFR Yugoslavia)* was made. The methodological approach to risk assessment in this Study consisted of:

- identification of risk elements,
- definition of seismic hazard,
- determination of appropriate vulnerability functions concerning the existing elements of risk and showing interdependency of specific loss and seismic hazard,
- assessment of specific risk per elements of risk and participation in the existing stock of material assets and
- assessment of overall seismic risk of the studied region.


Figure 12. An illustration of the degrees and types of damages sustained during the earthquake of 15th April 1979: a detail from the Old Town Budva, "Slavija" hotel - Budva, "Gradište" monastery in Buljarica, "Agava" Hotel in Bar, then a detail of damages to this hotel and quay no 2 in the port of Bar.

For the needs of the above Study, classification of damages (Figure 12) was done for the total of 40,004 surveyed buildings from the area of six coastal municipalities and Cetinje, which were classified according to the purpose, structure type, number of floors, material, as well as the type of foundations and the type of the ground. Based on such data, empiric vulnerability functions were made for the adopted categories: infrastructure facilities, so-called significant facilities, and then buildings: residential buildings, tourist (Figure 13a) and education establishments, per type of structure and structural material. For more recent buildings (designed following modern regulations, for which the dynamic analysis was possible) as well as for restored buildings (Figure 13b) the analytic vulnerability functions for 5 levels of acceleration were made, on the basis of two representative time histories of earthquakes registered on 15th April 1979.

In order to analyze acceptable level of seismic risk[5], some detailed research of the repair and reinforcement costs of 104 public buildings for 6 different purposes and 5 types of structures, as well as 140 private residential buildings was done. Vulnerability functions and repair and reinforcement costs for restored and new buildings were separately analysed.

Combining the determined vulnerability functions with the established level of seismic hazard and spatial distribution of buildings (risk elements) the seismic risk studies were made as follows:

1. Results established by the study of the so-called *observed risk* which was carried out for all mentioned types of buildings, but also for local and regional infrastructure with special emphasis on road and railroad infrastructure, maritime, water supply and sewerage facilities as well as telecommunications facilities corresponded to empirical function.
2. Applying theoretical vulnerability functions, spatial distribution of risk elements as well as expected seismic hazard (calculated for recurrent periods of 50 and 200 years) the so-called *expected seismic risk* was analysed.

Based on all previous analyses of occurred and expected vulnerability of buildings and infrastructure, proper criteria, conditions and measures to reduce expected risk were defined, which were recommended for practical application in the development of the Spatial Plan for Montenegro.

[5] The acceptable level of seismic risk is defined by the competent authority (local/regional, state) as a threshold above which the probability of overcoming harmful consequences of earthquakes is such to indicate investment into protection, or losses reduction.

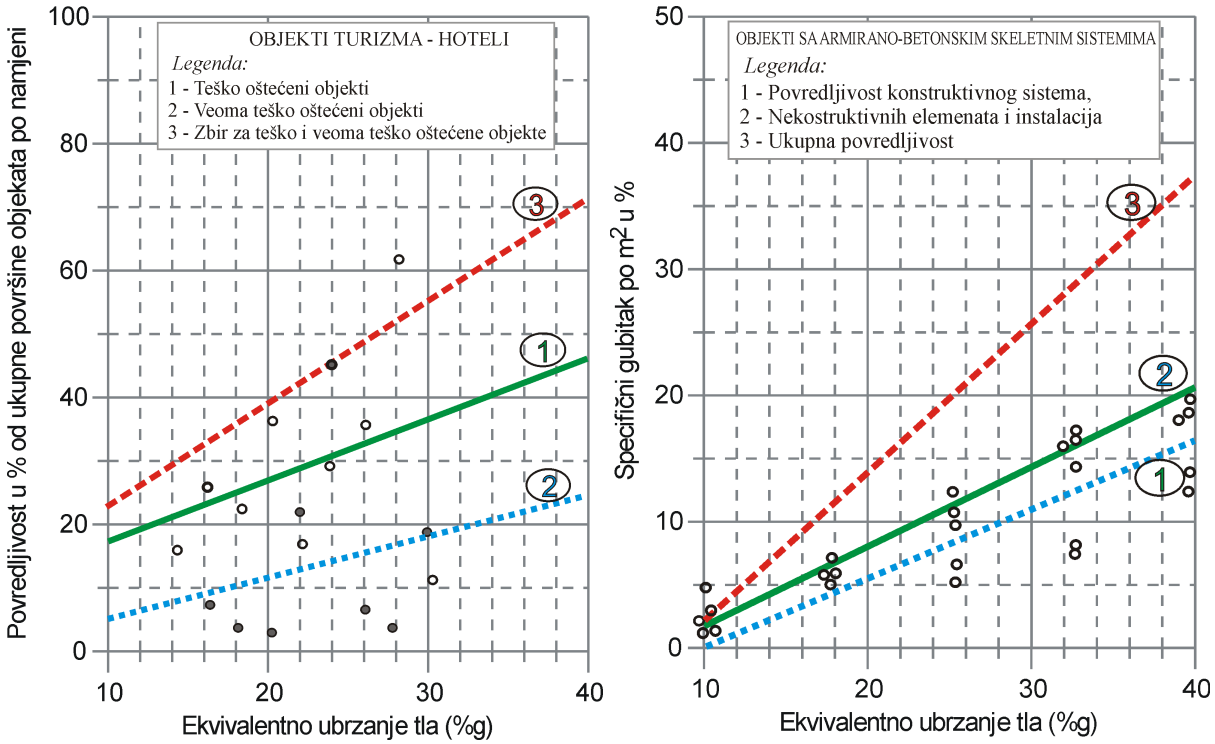



Figure 13. a) Empiric vulnerability functions for tourist establishments; b) theoretical vulnerability functions for restored buildings with reinforced concrete skeleton.

After the development of the above Study, seismic risk (both at the level of specific regions, municipality or the state) has not been defined in any form, nor has the existing Study been updated in any sense. Thus, today there are justified and marked reasons for an updated, contemporary seismic risk assessment, primarily for rapidly developing municipalities, located in highly earthquake prone areas, for instance: Budva, Herceg Novi, Bar, Ulcinj or Podgorica, with not only evident accumulation of economic resources, but also rapidly growing population. We particularly highlight the following reasons for seismic risk re-evaluation:

- present doubts concerning the quality and supervision over the construction of new buildings, as well as a frequent phenomenon of statically and dynamically untested adaptations (so-called reconstructions) of existing housing stock,
- systemic lack of any organised activity to reinforce the existing building stock, notwithstanding the obvious need for doing so,
- introduction of new methodologies in the assessment of structure vulnerability, both empirical, but in particular the analytic ones which became available.

### *III.1.1.4. LEGISLATION CONCERNING SEISMIC HAZARD AND RISK*

#### *Identification of Relevant Legislation*

*The legislation including or relevant for the remediation of consequences of realized seismic hazard, reduction of seismic risk and emergency management may be divided into the following groups:*

- construction and investment,
- spatial planning,
- housing and communal issues and
- protection against natural disasters, fires and explosions.

#### General Legislation

- Law on Spatial and Physical Planning (Official Gazette of the RoM no. 28/05)
- Law on Building Construction (Official Gazette of the RoM no. 55/00)
- Law on Spatial and Town Planning and Development (Official Gazette of the RS no 44/95),
- Law on Protection against Natural Disasters (Official Gazette of the RoM no. 57/92),
- Law on the Army of Yugoslavia (Official Gazette of the FRY nos 43/94, 28/96, 44/99, 74/99),
- Law on Internal Affairs (Official Gazette of the RoM no. G 24/94),
- Defence Law (Official Gazette of the FRY nos 43/94, 44/99)
- Law on Civil Defence (Official Gazette of the RoM no 8/83, 27/87, 33/88, 34/91),
- Spatial Plan of the Republic of Montenegro until 2000 (Official Gazette of the RoM no 16/86, 4/88, 46/90, 17/97),
- Regulations on the Operation of Bodies and Organisations in Charge of Observation and Determination of Certain Phenomena (Official Gazette of the RoM no 27 n9),
- Regulations on the Establishment of Work Units for Protection against Natural Disasters (Official Gazette of the RoM no 11/86),
- Regulations on the Exercise of Certain Public Security Tasks and on the Application of Special Authorities and Duties in their Exercise (Official Gazette of the RoM no 22/84),
- Regulations on the Protection Measures against Natural Disasters (Official Gazette of the RoM no 6/93),
- Decree on the Organisation and Operation of the Observation and Information Service (Official Gazette of the FRY no 54/94),
- Decree on the Organisation and Proficiency of Civil Protection Units and Protection and Rescue Measures for Civil Population and Material Assets (Official Gazette of the FRY no 54/94),
- Decree on the Establishment of the National Notification Centre (Official Gazette of RoM no 3/84),
- Guidelines on Unique Methodology for Assessment of Damages Caused by Natural Disasters (Official Gazette of the SFRY no 27/87),
- Decision on the Establishment of a Commission for Natural and Technical and Technological Disasters (Official Gazette of the FRY no 27/95),
- Decision on the Conditions and Criteria for Extending Assistance to Remove the Consequences of Natural Disasters (Official Gazette of the RoM no 15/93)
- Decision on the Establishment and Composition of the National Civil Protection Headquarters (Official Gazette of the RoM no 37/91).

***Legislation adopted following the 1979 earthquake at the Montenegrin Coast***

- Law on Restoration and Revitalisation of Old Towns Damaged in the Disastrous Earthquake of 15$^{th}$ April 1979 (Official Gazette of RoM no 10/84),
- Law on Banning the Trade of Property Owned at Specific Municipalities (Official Gazette of RoM no 16/79),
- Regulations for Restoration of Buildings Damaged in Earthquake (Official Gazette of RoM no 18/79),
- Decree on Restoration of Buildings Damaged in Earthquake in SRM (Official Gazette of RoM no 15/79),
- Decision to Determine Areas Where Special Procedure for Expropriation of Property Due to Natural Disasters Will be in Place (Official Gazette of RoM no 15/79) and

- Regulations on Technical Norms for Restoration, Reinforcement and Reconstruction of Building Constructions Damaged by Earthquake and for Reconstruction and Revitalisation of Building Constructions (Official Gazette of SFRY no 52/85).

***Technical regulations concerning building design and construction***

- Regulations on Interim Technical Requirements For Construction in Seismic Areas (Official Gazette of SFRY no 39/64), not valid for building construction,
- Regulations on Technical Norms for Building Construction in Seismic Areas (Official Gazette of SFRY nos 31/81, 49/82, 29/83, 21/88, 52/90),
- Regulations on Technical Norms for Restoration, Reinforcement and Reconstruction of building Constructions Damaged by Earthquake and for Reconstruction and Revitalisation of Building Constructions (Official Gazette of SFRY no 52/85),
- Regulations on Technical Norms for Design and Calculation of Engineering Facilities in Seismic Areas (1986 - draft) and
- Regulations on Technical Norms for Seismic Observation of High Dams (Official Gazette of SFRY no 6/88).

**Critical Overview of the Legislation on Construction within Seismic Areas**

This section gives the assessment of current relevant domestic legislation and technical regulations covering construction in seismic areas and their application in Montenegro in order to assess their updatedness and the compliance of new constructions in Montenegro with current technical norms, and the degree of their seismic safety. In doing so, we analysed the following pieces of legislation:

**Law on Spatial and Physical Planning** (Official Gazette of the RoM no. 28/05)

This Law stipulates that spatial and physical planning, inter alia, is based on the principle of aseismic planning and design. Unlike the previous version of the Law, spatial plans of local governments do contain the seismic micro-zoning plans, while general urban plan contains seismic micro-zoning plans. In addition, this law envisages that urban planning requirements (UPR) need to determine “parameters for aseismic design, as well as other requirements to protect against earthquakes”. It should be highlighted that the values of designed seismic parameters for asesimic design, currently included in UPR, are not as a rule calculated on the basis of the study of microseismic hazard of the given site, but by transferring these values from other locations with similar local ground composition. Such a practice is completely wrong, considering that it may lead to the determination of not only the inadequate parameters expressing expected maximal intensity of ground oscillations, but other types of seismic hazards (such as the effects of dislocation of close tectonic faults, rock slides, land slides, ground liquefaction and other geological phenomena in dynamic conditions) are not recognised at all. It is known, however, that damages to buildings due to the occurrence of this type of geological hazards may be highly significant, even exceed the degree of damage caused as a consequence of primary ground oscillations in the event of an earthquake.

**Law on Building Construction** (Official Gazette of the RoM no. 55/00)

As for the Building Construction Law, it stipulates only the general requirement that “the construction and occupation of buildings has to be in all aspects in compliance with current legislation and principles for aseismic design and construction in order to reduce the seismic risk to an acceptable level”. We should point out that such a norm in a situation when the acceptable risk is not properly defined either qualitatively or quantitatively (as is the case in Montenegro) usually turns out to be inapplicable.

***Regulations on Technical Norms for Building Construction in Seismic Areas*** *(Official Gazette of SFRY nos. 31/81, 49/82, 29/83, 21/88, 52/90)* and

***Regulations on Technical Norms for Design and Calculation of Engineering Facilities in Seismic Areas*** *(draft)*

In general, safety of people in the event of an earthquake primarily depends on the quality of regulations which guide the design and performance of buildings people occupy as well as of their proper enforcement. Over the past years the world has seen a huge progress in this sense, both regarding the number of countries who adopted aseismic regulations and their improved quality. Thus, back in 1973 the International Association for Earthquake Engineering (IAEE) out of the total of some 60 countries where seismic activity occurs, identified only 27 countries where these issues were regulated by laws. In 1996, this list was extended to 43 countries with the tendency of increasing this number.

The quality of aseismic regulations has been greatly improved and upgraded recently in a large number of countries. Some analysis showed that back in 1970s all aseismic regulations were inadequate or wrong in at least one of their segments (such as: definition of seismic load, criteria for acceptable seismic behaviour, treatment of structural details, etc). We shall focus on the rationale for some issues which indicate the obsoleteness of our regulations treating the issue of building constructions and engineering facilities in seismic areas. The following shortcomings may be singled out as most significant:

1. Lack of transparency: provisions do not present clearly the basic concept to be followed in the analysis and calculation of structures. The best illustration of this is inadequate definition of design quotient, instead of defined and recognisable physical parameters. Thus, the designer is denied the possibility to understand the impact of certain factor to the magnitude of design seismic forces, turning the calculation into a mere application of rules stipulated by the regulation.
2. Earthquake load is not defined quite explicitly and in quantitative terms. Instead of using physical values as measures of earthquake intensity that may be directly applied in designing (for instance: maximum ground acceleration, spectral acceleration, etc), which has been done in all modern aseismic regulations, our domestic regulations still define the earthquake intensity following the obsolete MSC scale of earthquake intensity. Thus, there is a pronounced need for better definition of seismic load, or the so-called design earthquake.
3. These regulations allow the use of the theory of allowed stresses (elasticity theory) in calculations and setting the dimensions of structural elements which, considering that it is expected for the structure in design earthquake, with the recurrent period of 500 years, deeply to enter a non-linear field of behaviour, highly improper and wrong. In addition, in using the theory of limit load, the proposed safety quotients are inadequate.
4. Recently worldwide great importance is attached to the treatment of structural details, which is to provide proper ductility of the structure – when updating old and adopting new modern aseismic regulations. Past damaging earthquakes showed that a large number of buildings collapsed or was locally damaged due to poor treatment of reinforcement details (in reinforced concrete structures) or details of joints (in steel structures). The most recent experiences with the earthquake in Turkey (Izmir, 1999) showed that the collapse of a large number of reinforced concrete frame structures was caused by inadequate quantity of transverse reinforcement in stanchions and nodes. The same was seen also in 1979 earthquake in Montenegro. Comparing the regulations in question with contemporary solutions worldwide, it may be noted that from the point of view of treatment of structural details of buildings, the use of certain provisions does not provide for required ductility on the locations.

We have mentioned but a few objections, mostly general ones, indicating inadequate treatment of certain issues in the area of aseismic design in domestic regulations, which may lead us to conclude that a designer even if adhering strictly to the provisions from the regulations may still design seismically unsafe structure. This implies the need for prompt enhancement of design and planning legislation. Their alignment with modern European standards treating this field (Eurocode 8, EC8 - European Committee for Standardization (2003), Design of Structures for Earthquake Resistance. Part 1: *General rules, seismic actions and rules for buildings DRAFT No 6., 2003*) together with the development of appropriate national document for their enforcement, may be an optimal way to implement this important task.

***Regulations on Technical Norms for Restoration, Reinforcement and Reconstruction of Building Constructions Damaged by Earthquake and for Reconstruction and Revitalisation of Building Constructions*** *(Official Gazette SFRY no. 52/85)*

It should also be noted that these Regulations are not being properly applied, primarily due to inadequately defined requirements for restoration and reinforcement of seismically unsafe buildings. Although there is no well-established general procedure for the assessment and the degree of seismic resilience of existing buildings worldwide, nor fully adequate technical regulations, still there are today some programmes for reinforcement of existing buildings being applied in several countries (USA, New Zealand, Japan, Italy, Turkey). Considering that the total seismic risk is predominantly affected by older masonry and stone buildings constructed before the adoption of aseismic regulations, there is a need for the issues of assessment of seismic safety of the existing buildings and their reinforcement to be regulated much more precisely for the total seismic risk to be reduced to a socially acceptable level.

### *III.1.2. OTHER GEOLOGIC HAZARDS*

The territory of Montenegro is built of various types of sediment, magmatic and metamorphic rocks which were formed in the past 400 million years. This period in earth's evolution, according to the geologic time scale, belongs to the following periods: Palaeozoic (with geologic periods: Devonian, Carboniferous and Permian), Mesozoic (with geologic periods: Triassic, Jurassic and Cretaceous) and Cainozoic (with geologic periods: Palaeogene, Neogene and Quarternary).

The terrains of Montenegro belong to southeast Dinarides and are known for their highly complex tectonic composition. Many issues linked to the character of main tectonic dislocations are disputed among scientists, but it is beyond dispute that at the land part of Montenegro four or five structural tectonic units may be clearly recognised: Paraautochtonous, Budva-Cukali zone, high Karst and Durmitor tectonic unit (Figure 14).

#### *III.1.2.1. GEOLOGIC FACTORS AS PRECONDITIONS FOR NATURAL HAZARD IN MONTENEGRO*

Geologic condition on any part of the surface of Earth reflects the evolution "moment" in its ongoing development and changes, as a consequence of interaction of endogenous, exogenous and cosmic forces and processes. These dynamic processes belong to most important factors of natural hazard, which is exactly why to know them is a precondition for rational behaviour of a society and undertaking proper long-term protection measures. Among the geologic factors, the following need to be highlighted as the most important ones for the occurrence of natural disasters: structural-tectonic, engineering-geologic, hydro-geologic and geomorphologic factors.

a) STRUCTURAL – TECTONIC FACTOR

To date research and numerous data on the geologic composition and tectonic features of the Montenegro's terrain (and the Dinarides) indicate that the territory of Montenegro consists of five structural tectonic blocks or units, established during Palaeogene and early Neogene. Such structural tectonic relations were created as a consequence of differential movement, collision and separation of certain blocks of earth's crust in the wider Mediterranean region.

Since late Palaeogene, i.e. throughout Neogene until today on the whole territory of Montenegro mostly vertical movements of rock masses of the lithosphere were manifested, i.e. various intensity disruptions of blocks or contact zones. These so-called neotectonic fracture of earth's crust is particularly important as a potential cause for geologic hazard in Montenegro, or as a cause of earthquakes of various intensities.

Main neotectonic fracture zones in Montenegro are in the northwest-southeast direction. With these regional ruptures the area of Montenegro is divided into five blocks, in correlation with the thickness of earth's crust, or the geotectonic blocks. These main geotectonic blocks are designated as: north-eastern Montenegro, Maganik, Skadar-Zeta depression, Orjen and Lovćen and the coastal block.

Geomorphologic and neotectonic analysis of the territory of Montenegro showed that the **Maganik block** has the so-called high positive relief values, indicating blocks of intensive relative elevation of the relief. This block includes the areas of Volujak, Maglić, Njegoš, Golija, Vojnik, Durmitor, Sinjavina, Komovi and Žijovo. In addition, analyses have shown that within the block itself there are differential movements of sub-blocks separated by neotectonic faults in the direction N-W, SW-NE and rarely W-E. Based on the levelling measurements performed over several decades, it was proved that the Maganik block shows most intensive rising with the speeds of 4-6 mm/a year. It is interesting that from the SW border of this block towards NE, the speed of rising increases from 4 mm/year to 6 mm/year in the blocks of Volujak – Durmitor direction. Thus, this block shows a graded structure. Within the Maganik block the sub-block of Nikšić stands out as the one relatively sinking compared to the neighbouring sub-blocks of Njegoš and Maganik.

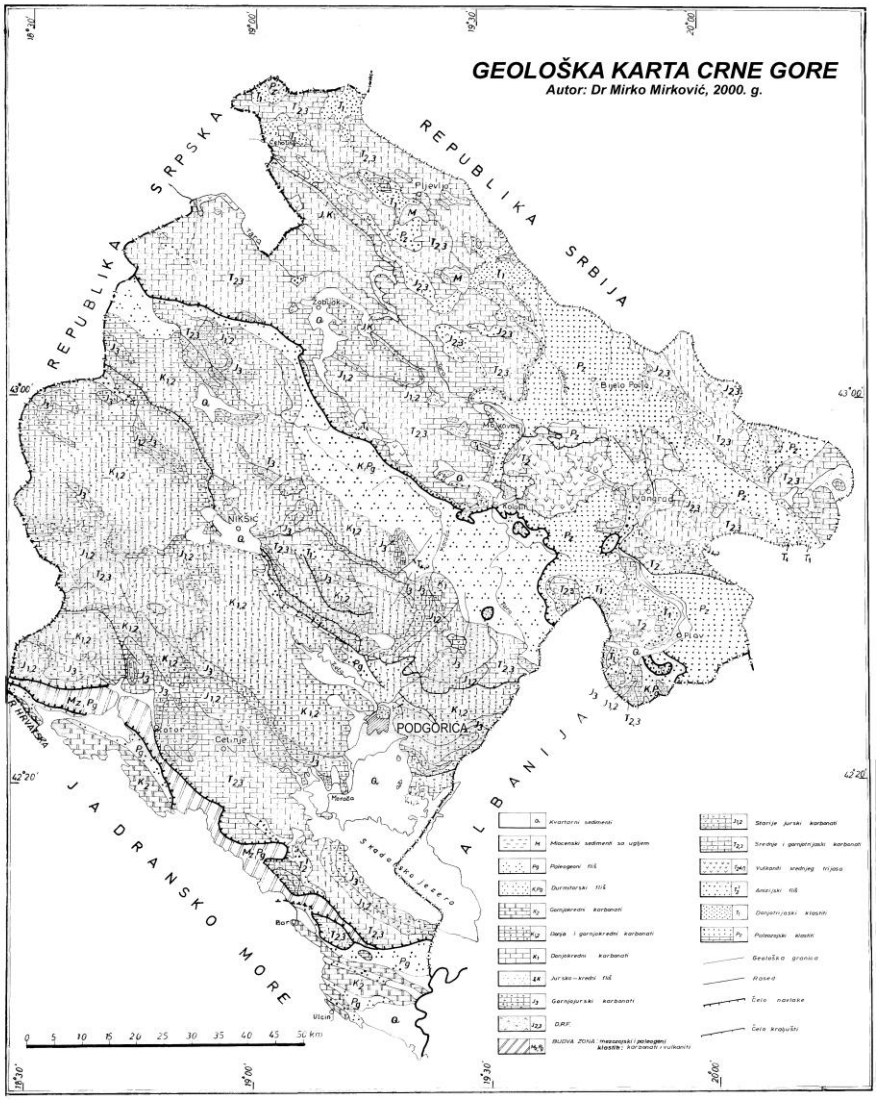



Figure 14. Geologic map of Montenegro (M. Mirković, 2000)

**North-eastern Montenegro block** is as a whole less pronouncedly rising or sinking compared to the Maganik block. Within this block there is also a graded structure with relative sinking (or smaller rising) in the direction SW towards NE. With neotectonic faults, this block is again divided into many sub-blocks, among which the Bjelasica sub-block is particularly characteristic with its relative rising at the speed of 4 mm/year, as well as smaller blocks in the area of Ljubišnje and NW of Rožaje. The sub-blocks of Pljevlja and Berane basins are relatively sinking compared to the surrounding and have elements of netoectonic trench.

**Block of Skadar-Zeta depression** mostly shows relative sinking, with the speed of 2 mm/year registered in the area of Skadar Lake, Ćemovsko Field and Rijeka Crnojevića. This block in essence presents a neotectonic trench structure, which extends via Nikšić and Klanac Duge

towards Gacko in Herzegovina. Constant speed of sinking in the area of Nikšićko field is not more than 1 mm/year.

**Orjen and Lovćen block** includes also the area of Rumija and the whole coast of Montenegro, all the way to Ulcinj and its coastline. To the NE of this block shows maximum rising speed of 4 mm/year in the area of Orjen and Lovćen and 2 mm/year in the area of Rumija Mountain. The narrower coastal area of Montenegro, between the nappe of Veliki krš and the sea has a tendency to sink up to 1 mm/year.

It should also be mentioned that ruptures in the area of Montenegro during Neogene and Quaternary on many occasions changed not only the intensity but also the direction of motion: relative risings were superseded with periods of relative sinking and vice versa.

As a final remark, it may be concluded that the neotectonic activity in the area of Montenegro is pronounced, particularly in the coastal region and in the direction of Skadar-Zeta depression, and thus disastrous earthquakes may be expected in these areas, similar to the 1979 one.

b) ENGINEERING-GEOLOGIC FACTORS

Engineering-geologic characteristics of the terrain represent an extremely important factor for design and construction of all types of infrastructure facilities, development of urban settlements as well as for the conditions to organise work and life in a certain area. These features of the terrain and rocks are particularly pronounced in the times of strong earthquakes, when the instable and relatively stable terrains move and start to be broken off or slide, with possible even disastrous consequences. The stability of rocks and the terrain is also essentially linked with hydrologic and hydrogeologic conditions of a certain geologic environment. Thus, the knowledge of engineering-geologic features of a certain territory is a precondition for proper organisation of living and working conditions in the area.

According to their engineering-geologic features, all rocks may be divided into three groups: incoherent, semi-coherent (nonpetrified) and coherent (or petrified).

**Group of incoherent rocks** consists of classical sediment rocks known under the names: diluvium, alluvium, terrace sediments, moraine and glaviofluvial sediments. Their composition most often includes: dust, sand, pebbles, boulder, debris and blocks. They are characterised by intergranular porosity and different water-bearing. The phenomena of instability are pronounced in dilluvial deposits. This group of rocks is found in canyon beds and slopes and in the valleys of rivers Ibar, Lim, Ćehotina, Tara, Piva and Morača, as well as in flatlands along the sea. The deposits of glacial origin are developed mostly on a wider area of high mountains Maganik, Vojnik, Maglić, Durmitor, Sinjavina, Komovi and Prokletije, as well as along the beds of nearby rivers.

**The group of semi-coherent or non-petrified rocks** includes: lacustrine and limnoglacial sediments, Quaternary clays and sands, Neogene clays and marlstone with coal strata and marine sands and clays. These are mostly non-petrified rocks with plastic matrix and with variable physical and mechanical features and frequent occurrences of instability. These are primarily water impermeable rocks. They are mostly spread in the northern edges of Skadar Lake, in Bjelopavlica valley, Nikšićko field, then in the vicinity of Pljevlja, Maoče, Matarauge, Berane and Polica, while marine sands and clays are found in the vicinity of Ulcinj. In the Neogene basins of Pljevalja and Berane, land sliding is mostly caused by mining activities in coal exploitation.

**The group of coherent rocks** is a complex of petrified rocks of various ages, lithologic composition and origin. Here the following groups are usually discerned: a class of petrified and semi-petrified rocks and a class of well-petrified rocks. Petrified and semi-petrified rocks include clastic, metamorphous and volcanogenic-sediment rocks, while well-petrified rocks include hard, stable and rigid rocks of various lithological composition, formation and age. Greatest part of Montenegrin territory is made of well-petrified rocks, either magmatic or sediment by origin.

**Most important landslides in Montenegro**

At several dozens of locations all over Montenegro there are landslides of larger or smaller scale which disturb the natural environment locally (sometimes regionally), pose a threat to human life and environment.

The southwest slopes of Rumija, Sutorman, Lovćen, Orjen and Vrmac represent geologically and morphologically predisposed terrains for the formation of large-scale landslides. The instability of these terrains is particularly affected by the zones of flysch plastic and impermeable rocks over which there are, most often in tectonic relation, thick masses of rigid, well-petrified rocks, lime mostly. These rigid masses press onto and deform softer flysch formations, whereas on the verges blocks break off and slide. This process is intensified during rain seasons, and in particular with earthquakes. This is how large block slides, such as Vladimir, Ratac, Seoca and Savina occurred, covering a large area, both in surface and in depth and are very difficult for remediation. This natural factor, together with anthropogenic effects, caused the formation of numerous slides at the coastal region known as: Savina 1, Đenovići, Kumbor, Bijela, Radanovići, Babin Do, Sveti Stefan, Šumet, Stanišići, Škaljari, Reževići, Sutomore etc. Some have been remediated, but due to human actions new slides keep appearing.

At Skadar – Bjelopavlićka depression, smaller scale landslides are found Crmnica and the NE verge of Zeta depression, the largest being the side at Povija.

A typical landslide (up) and a rock slide

Quite often landslides of various dimensions appear in the flysch part of the upper and middle flow of Morača river, among which particularly important is the landslide below Crkvine (location Dolovi) not yet fully remediated.

In the Tara river valley, landslides most frequently appear in the flysch areas, and less frequently in the terrains composed of clastic Palaeozoic rocks. These landslides are most often caused by the construction of roads and railroads. The known landslides are: Mojkovac, Gajakovići, Siga, Đurđevića Tara, Rasova etc.

Within the catchment area of Piva river, the Pivsko lake accumulation could represent a great cause of instability of the surrounding terrain, which is accompanied by numerous induced earthquakes of smaller intensity in these areas. Such instabilities have been noted in the vicinity of Plužine and Goransko. The landslides Goransko, Sinjac and Aluge are related to the construction of the road and are typical landslides of anthropogenic origin. Smaller landslides are noted in the catchment area of Piva river in Donja Bukovica and Tušina.

As for Pljevlja area, there are smaller landslides related to road infrastructure in Zabrđe, Mijakovići and Mihajlovići. In the Neogene sediments of Pljevlja coal basin the landslides Ljuće and Tvrdaš are caused by mining activities in the surface pit.

In the catchment area of Lim river, due to very heterogeneous geologic composition of the terrain, landslides appear in various geologic formations: Palaeozoic and Lower Triassic clastic and metamorphous formations, in the terrains made of diabese-cherk and marly clay Neogene deposits. There are some landslides along roadways: Čokrlije, Jabučno, Zaton, Dapsiće etc.

In the catchment area of Ibar river there are some smaller landslides in the terrains made of Paleozoic clastite and sediments of dieabese-cherk formations. One of such landslides is Besnik found on the Berane - Rožaje roadway.

**Land and rock slides on highways and regional roads**

Montenegrin road network (regional roads and highways) consists of 1,796 km of roads, 950 km being regional roads and 846 km of highways. The backbone of the network is the M2 highway (Debeli Brijeg - Podgorica - Berane - Špiljani) with sections M-21. (Ribarevina - Bijelo Polje - Barski most), M-2.1. (Budva - Cetinje - Podgorica), M-2.4. (Petrovac - Bar - Ulcinj - Sukobin) and the highway M-18 (Šćepan Polje - Nikšić - Podgorica - Božaj). Some sections of these roads are not completed in terms with design documents, and their average age is 22 years, with poor maintenance in the past 15 years.

The state of road network in Montenegro is in need of thorough rehabilitation, which requires long-term planning. Systemic change of road maintenance policies in Montenegro is in its final stages, and the new Law on Roads has been adopted. There are also a number of bylaws in effect regulating this field. The state of the road network has been assessed and an invitation for bids announced for road maintenance based on the new concept, and subsequently a contractor is to be selected and maintenance agreement signed. The agreement envisages the maintenance standards to be adhered to and assigns responsibilities, with the aim of turning corrective maintenance into preventive one within 5 years.

The road network in Montenegro is mostly built in terrains with extremely complex topographic and geologic conditions, thus having at a relatively small area sections of roads with numerous and deep landslides, slopes prone to rock falls, ground with poor load bearing capacity, areas prone to flooding, etc.

In general, flat land sections (mostly without slopes) account for some 10% of the total road network, hilly sections for some 68%, and mountainous to some 22% of the total network.

Geologic composition of the base of Montenegrin roads is characterised by the following elements:

- out of the total of 931 registered slopes of categories I, II, III and IV, some 67% (the total of 686) are in lime (405 – massive limes and 216 layered limes). The total of 16 slopes is done in dolomites, and 30 in complexes of limes, marl, and cherk;
- the total 113 slopes are done in sediment flysch complexes;
- a highly complex terrain structure is composed of flysch and Mesozoic limes. In a certain number of cases these areas are the fronts of nappes, where limes are thrust over flysch. The total of 28 slopes is made of terrains of such geologic composition;
- 35 out of the total registered slopes are made in terrains composed of Palaeozoic slates;
- As for other rock masses, 29 slopes are made in vulcanite, 21 in breccia and breccoid limes, 5 in conglomerates;
- in 18 cases the dominant influence on stability is exercised by scree deposits in different bases, and in 15 cases fluvio-glacial deposits.

The stability of slopes and the occurrence of landslides is greatly affected by local hydrogeologic conditions, climate and terrain seismicity. All three factors vary within a great range at the territory of Montenegro, and in each separate case they need to be specifically analysed and respected.

Rock slides, in addition to large slopes and inclinations which cannot be avoided in mountainous areas, are also caused by climatic conditions with great rainfall, sudden temperature changes, etc. Rockslides from the slopes along Montenegrin highways and regional roads are frequently very intensive, and sometimes result in casualties. The existence of so many critical spots along the roadways is a consequence of the previous policy of savings in road design and construction, which frequently led to such a situation that constructed sections of the roads failed to be issued inspection certificates. The main feature of such design and construction is that preventive measures for security of slopes were lacking and would be introduced only after larger rock slides (establishing the network of road surfacemen). Complex morphological features of the terrain caused the construction of a large number of tunnels, bridges and viaducts. Many of the existing tunnels do not even have the primary protection, posing a huge risk for traffic participants.

Due to the lack of financial resources, regular or scheduled maintenance of bridges and viaducts is missing.

Traffic intensity varies from medium to intensive during high summer tourism season, which causes the risk of various traffic accidents to vary accordingly.

c) HYDROGEOLOGIC FACTORS

The knowledge of the hydro-geologic features of an area is important from several points of view, both concerning the determination of regional regularities and rules and the solutions to specific tasks concerning the use and protection of ground water sources. Issues that need an answer refer the ground water supply, the use of mineral and thermal waters, protection against ground waters in construction industry, mining and agriculture, etc. Hydro-geologic characteristics of a certain geologic area affect considerably the stability of certain rocks and rock complexes.

From the point of view of hydrogeology, rocks may be classified into three groups: water permeable rocks or hydro-geologic collectors, water impermeable rocks or hydro-geologic insulators and hydro-geologic complexes.

The group of **water permeable rocks – hydro-geologic collectors** consists of two subgroups: water permeable rocks - hydro-geologic collectors with intergranular porosity and water permeable rocks - hydro-geologic collectors with fracture and cavernous porosity, while the group of **water impermeable rocks – hydro-geologic insulators** covers two subgroups: practically impermeable rocks and mainly water impermeable rocks. **Hydro-geologic complexes** consist of groups of rocks with features of both collectors and insulators, such as: a complex of water permeable and impermeable rocks with alternating hydro-geologic features characterised by intergranular porosity in its permeable part and the complex of water permeable and impermeable rocks with alternating hydro-geologic features characterised by fracture and cavernous porosity in its permeable part.

**Aquifer pollution and protection**

Catchment areas of all major karst springs along the canyons of Piva, Tara, Ćehotina and Morača, at the perimeter of karst fields and in the coastal area are located in the mountainous areas. These catchment areas are made of karst plateaus and mountain massifs, with scattered population without developed infrastructure and industrial plants. The most endangered aquifer waters are the ones within lime paleorelief of Nikšićko and Cetinjsko fields, which are drained via karst springs Glava Zete and Oboštničko Oko, and Crnojevića Rijeka spring. Due to pronounced karst features of the terrain within the zone of Budoški and Cetinjski faults, the pollution by communal and industrial waters is spreading under ground fast via numerous chasms, karst canals and caverns. Urban and industrial development of larger settlements is not accompanied by proper protection measures, and thus industrial facilities and town centres, with their communal and industrial waste waters pollute aquifers and surface waters.

In order to protect aquifers, measures to define the narrower and wider zones of major sources need to be undertaken as well as monitoring of aquifer water quality. It is particularly important to install water treatment facilities before their discharge into the recipient, planning and construction of landfills for proper solid waste disposal, construction of the sewage systems and other activities to prevent non-controlled discharges of waste materials into the ground.

The possibility to protect ground waters and sources depends on specific geologic, hydro-geologic and morphological features of a certain area. As for the terrains made of water impermeable rocks, where single and mostly separated sources of various output occur, their pollution may be only at the area of the spring and may not have graver damages. Since two thirds of the Montenegrin territory is made of carbonate rocks, this makes the issue of protection of ground waters a much more difficult and complex task. Carbonate rocks are greatly fractured and karstified up to great depths, as well illustrated by the sources and submerged springs on the shore or under the sea level, then at the edges of Skadar Lake, in deep canyons of Tara and Piva etc. At the same time, these karst areas deep down represent hydro-geologic reservoirs or collectors of ground aquifers of the rupture-cavernous type from which the known sources and submerged spring of good-quality potable water flow. Since the catchment area of ground aquifers and their sources may be approximately identified, thus the protection of such areas should be given special attention in order for one of the greatest natural resources Montenegro has not to be devastated (intentionally

or unintentionally). Large aquifers of potable water in coherent and incoherent rocks of glacio-fluvial deposits of the Ćemovsko Field and the northern edge of Skadar Lake, as well as the Nikšičko Field, are put in jeopardy by urbanisation, industrial development and mass contamination with organic, chemical and toxic substances. Within the area of Podgorica and Zeta, as well as Nikšić, in the past 60 years or so large natural ground water collectors have been greatly polluted.

d) GEO-MORPHOLOGICAL FACTORS

The analysis of geo-morphological factors in order to define their potential for the generation of natural disasters makes sense if it seen as a part of overall geologic factors. The action of endogenous forces, be it magmatic activity, orogenous or epirogenous movements, forms the uneven surface, or very dispersed relief. Contrary to these, exogenous forces by the destruction of protruding parts on the Earth's crust and by taking away the broken off material to lower areas where these are accumulated, tend to level the terrain. The result of constant action of endogenous and exogenous forces are constant changes in the appearance of the surface, or the relief.

Within geo-morphological studies in the area of Montenegro by morphostructural analysis the following elements have been singled out: negative structures, positive structures, regional nappes, depth of earth's crust and deep regional faults.

Geomorphologic characteristics of the relief in Montenegro in essence represent a precondition for the occurrence of smaller or larger scale natural hazards, even disasters. The occurrence of landslides, rock slides, snow slides, etc are directly related to steep or canyon-like parts of the relief. On the other hand, flat lands, such as Zeta Valley, Nikšić Field, etc are prone to floods with grave consequences. The canyons and gorges in Montenegro also pose a potential threat of large rock slides even larger-scale landslips (due to earthquakes) blocking river flows, which would cause great damages. It should not be overlooked that all geologic factors as causes of natural hazard are interrelated and may always be seen in their interaction, or as causes and consequences.

### *III.1.2.2. TYPES OF GEOLOGIC HAZARD AND THEIR ENVIRONMENTAL IMPACT*

Among different types of natural hazard, the geologic hazards belongs to most significant causes of disastrous occurrences and accidents, whose consequences may be occur in a part of the territory of the state, on its whole territory or the territory of several states.

a) GEOLOGIC HAZARD CAUSED BY TECTONIC ACTIVITIES

As was already elaborated, the territory of Montenegro is located in an area of frequent genesis of small to medium intensity earthquakes, but occasionally even the damaging and disastrous earthquakes, as was the one on 15. April 1979.

In addition to already described consequences of such earthquakes, the following harmful effects are particularly characteristic for geologic factors:

- formation of landslips in the areas composed of: tectonized rocks, of incoherent rocks of the diluvium or colluvium type, then coherent semi-petrified and petrified rocks including all types of flysch in Montenegro and clastic lower Triassic and Palaeozoic sediments. While the seismisicity of the terrain in Montenegro is predominant at the coast and in Skadar-Zeta depression, the area of upper and middle catchment area of the Morača river and steep slopes of coastal mountains Rumija, Sutorman, Lovćen and Orjen are particularly prone to large landslides, while the SW slopes of Pipersko-Bjelopavlićka Valley, towards Zeta river, are less prone to it. In the worst scenario case, apart from destruction of neighbourhoods and infrastructure facilities in the affected areas, such landslides may also block river flows causing great overall damages and consequences.
- changing the course of ground waters and location of water sources due to tectonic fractures, subsidence and other types of disturbances in terrains (rocks) which are hydro-geologic collectors. It is highly possible for sources or springs used for water supply to dry

out. This is particularly true for karst terrains at the Coast and in the vicinity of Podgorica and Nikšić.

- rising or falling of the sea level due to significant tectonic disturbances under the sea and in the coastal part of the Mediterranean Sea or its parts such as the Adriatic, etc. Floods in coastal flatlands along the whole of Montenegrin coast would have particularly tragic consequences.
- rock slides of various intensity, particularly pronounced in high mountains and on steep grounds, as well as steep and canyon-like valleys of rivers Morača, Piva, Tara, partly also a Lim and Ibar. Such types of natural accidents mostly have just local consequences and may not lead to disasters.

b) GEOLOGIC HAZARD CAUSED BY CLIMATE FACTORS

Climate factors may occasionally cause various types of accidents, such as landslides, rock slides, floods, ground aquifer pollution, etc. Such disturbances on and in the ground most frequently occur following heavy long-lasting rains when intensively waterlogged grounds, with unfavourable physical and mechanical characteristics of the rocks they are composed of, break off and begin to slide, possibly threatening and damaging infrastructure facilities and neighbourhoods or some their parts. In Montenegro such disturbance are particularly prominent along highways and regional roads in northeast Montenegro, and to a lesser degree at the coast.

### *III. 1.3. EXTREME METEOROLOGICAL PHENOMENA*

According to the data for a thirty-year period, 1963-1992, the contributing factors to total damages on planet Earth: tropical storms accounted for 30%, droughts 22%, floods caused by heavy rains 32%, earthquakes 10% and other natural disasters 6% (hail, electric charges, heat waves, dense fog, icy rain, etc.). Thus, worldwide, according to the damages they cause, the predominant natural disasters are weather-related ones. According to the estimates of the World Meteorological Organisation, over a ten-year period 1992–2001, some 90% of all natural disasters were hydro-meteorological in origin. Nevertheless, the structure of great damages caused by natural factors in Montenegro is much different.

Today there is an increasing awareness of susceptibility of economy to the weather, climate and water and practically there is no human activity which is not, to a greater or lesser degree, susceptible to the weather conditions. Unfortunately, the effects of adverse weather conditions mostly affect developing countries, whose national meteorological services are generally not capable of timely warning of danger and whose systems are still underdeveloped.

Worldwide there is no doubt that the weather and climate represent an economic resource that needs to be better understood as well as their changes in order to increase the economics of production and reduce possible damages. Up-to-date observation systems supported by powerful computers and telecommunication devices enabled the development of numerical weather forecast that has greatly upgraded the usability of meteorological information in all fields. Montenegrin Hydro-meteorological Institute has such a forecast system in place which mostly aims to improve quantitative precipitation forecasts aiming to greatly contribute to more efficient planning of water use and timely warning of floods.

Therefore, the hydro-meteorological service of the state of Montenegro should be one of the key elements in preventing and reducing damages of weather-related incidents through enhanced forecasts and early warnings, in order to respond to the challenges related to sustainable development in areas such as: disaster mitigation, food production, water management, transport, tourism and pollution control.

Any systematic analysis of weather-related incidents needs to take into account that some of them:

- *may only be monitored and early warnings issued* – then passive protection measures are undertaken or
- *may be monitored and certain actions taken* aiming to reduce their harmful effect – then active protection measures are undertaken.

Dangerous meteorological occurrences become disasters when they hit densely populated areas, in urban areas. Their duration varies significantly. Thus, for instance, thunder strike occurs practically instantly, while ice age (as the most disastrous meteorological occurrence) is measured in units of geologic time (thousands and tens of thousands of years).

Rapid population growth leads to increasing number of casualties due to weather-related disasters. Migrations to urban areas mostly result in additional number of casualties. The migrations to urban areas reduce the threat of certain weather-related incidents, for instance thunder strike. Economic losses increase with the development of urban infrastructure.

### III.1.3.1. OBJECTIVES OF STUDYING WEATHER RELATED DISASTERS

Weather-related disasters, or extreme meteorological occurrences, are tremendously important, both from the meteorological and social viewpoint, considering that extreme meteorological situations cause huge human and economic losses.

Over the past years we have witnessed huge losses in Montenegro caused by extreme weather and climate factors, but systematic and thorough study needs to give an insight in the historic development of damages over a longer period of time.

Quantitative determination of the impact of meteorological extremes to a society is a highly complex and challenging task for meteorologists. First the damages occurring under the influence of most significant meteorological extreme phenomena need to be defined. These include: **heavy rains leading to floods, winter storms, extreme cold and heat, drought, dense fog, phenomena related to storm clouds** (hail, thunder strikes, heavy rain or snow, gale, pressure fall), **freezing** (on the ground and in the air).

Knowing the trends in damages sustained in a certain area does not necessarily mean to know the trends of meteorological extremes. The frequency and intensity of extreme meteorological occurrences does not have to follow the trend in damages. It is caused by a multitude of meteorological and other factors. For instance, damages caused by floods de to heavy rain are not related only to extreme rainfall during one single day. They are also caused by the amount of rainfall over the previous period. Certainly, they are also caused by the ground conditions, contents of water in ground, frozen ground surface, etc.

The relation between meteorological extremes and damages is highly complex and depends on several factors. For instance, damages in agriculture greatly depend of the period of time when the extremes occur. Thus, extremely high temperatures will have greater negative impact on yield if occurring for two to four weeks during the time of pollination than at any other stage. These periods within which greatest damages would be sustained vary each year and such periods of vulnerability do exist for many crops, fruits, wine, etc.

The Hydro-meteorological Institute launched a highly significant research project entitled ***"Weather-Related Disasters"*** aiming to:

1. determine criteria for the definition of weather related disasters in Montenegro and map the areas where certain types of disasters occur in order to determine the vulnerability level and assess possible damages of such disasters,
2. provide reliable forecasting and warnings of dangerous meteorological situations and timely inform the relevant parties,
3. reduce damages of extreme meteorological occurrences, both locally and regionally, according to the character of the disaster is done in two directions: by monitoring occurrences and warning of them, or by observing and undertaking certain procedures aimed to mitigate their harmful effects.

Upon the completion of the project, the competent institutions could implement the project outputs in the adoption of relevant legislation to guide these matters under the competences of the state. Successful project execution would greatly enhance our knowledge of weather-related disasters and enable minimisation of huge economic losses the state would otherwise suffer.

### III.1.3.2. CRITERIA TO DEFINE WEATHER-RELATED DISASTERS AND THEIR CLASSIFICATION

It may be said that ***each meteorological situation which causes considerable damage is a weather-related disaster.*** An aggregate of such conditions under which damages are sustained may be determined from historic data, and then based on these values, using statistical procedures, minimum thresholds may be calculated. Here one needs to discern:

1. ***thresholds*** of meteorological values ***defined on the basis of damages***, considering that we are interested in situations in which damages occur, and not meteorological situations reaching extreme values of specific meteorological parameters. This does not exclude the possibility that greatest damages may occur in the event of extreme magnitudes of meteorological values, but by such stipulation of thresholds we exclude situations of reaching extremes without damages being caused;
2. ***thresholds*** defined based on the magnitude of the given meteorological value, ***regardless whether damages were caused or not.*** A threshold so defined implies reference values for the given meteorological value by which these magnitudes are classified as great, major and the greatest.

It would be wrong to designate thresholds values stipulated in the above manner as extraordinary, dangerous or disastrous. Only if proven that these values are followed by damages corresponding to such terminology being used, it would be justified to designate them as such.

Weather-related disasters are characterised by meteorological elements and occurrences diverse by their nature. Thus, they are characterised by ***continuant*** meteorological values, such as atmospheric pressure, temperature, etc. The term “continuant” values is used to indicate that at any point of the observed area and at any point in time there is a certain magnitude of these meteorological values. The occurrences like fog, icy rain, hail, electric discharges, etc are different from the above and to a greater or lesser degree harmful by their very occurrence.

According to the values of realistic thresholds for meteorological values (those thresholds determined by damages for the given month or selected area), weather-related incidents may be divided into: extraordinary, dangerous and disastrous. For which meteorological values the thresholds will be observed, it depends on the type of damages being sustained.

If such a classification is not possible, then the classification of weather-related incidents may be done solely via magnitudes of meteorological values. In that case, an *extraordinary* meteorological incident should imply those meteorological situations characterised with: maximal and minimal air temperature as well as their inter-day changes considerably above or below the normal values; maximal and minimal atmospheric pressure as well as their inter-day changes considerably above or below the normal values.

*Dangerous* meteorological incidents are characterised by at least one of the following: daily amount of rainfall or depth of snow considerably above the normal, exceeded air pollution limits above the normal, storm wind, hail, electric discharges, avalanches, snowstorms, landslides and icy rain with freezing.

*Disastrous* meteorological incidents are those expressed by one or more of the meteorological parameters which characterise dangerous meteorological incidents, provided that the meteorological characteristics exceed substantially the normal values and cover wider areas.

The analysis of extreme values of certain meteorological elements held by the Institute is not usable in treating weather related incidents since usually greater damages are caused by the combination of several factors. The daily rainfall above 200 litres per square metre in the southern areas of Montenegro is an extreme occurrence but in these areas it mostly causes no damages, whereas the same amount of rainfall up north may cause damages. Such an occurrence again may not be observed in isolation, since large rainfall in combination with heavy melting of snow may cause floods.

**Types of extreme meteorological phenomena in Montenegro**

**1. Strong winds**

This meteorological occurrence my lead to:

- "environmental erosion" (winds above 10 m/s cause erosion )
- damages to overhead power lines;
- damages to building constructions and structures;
- spreading of forest fires;
- high waves in the sea and interruption of maritime transport, damages to ships, to the shore and shore facilities;
- agricultural damages: lodging of crops and falling of fruits, breaking of stalks, breaking of flowers, exposure to the so-called black frost, disruption of agricultural works, especially when protecting crops from plant diseases and pests;
- freezing of plants due to low temperatures, due to the effect of the wind to additional chilling.

These occur at the Montenegrin territory:

- strong winds with gale to hurricane speeds, from the southern and northern quadrant – which causes the passing of cyclones and the synoptic situation causing 'bura'. Montenegro is located in the zone of strong 'bura'.
- Strom winds – related to adverse weather caused by very strong local instability followed by strong convection.

The former occur in wintertime **(gusts of southern wind** on the Adriatic with the absolute maximum of 32 m/s – Bar andUlcinj; **gusts of northern wind** with the absolute speed of 40 m/s - Podgorica). For instance: on 19.11.2004 the gusts of northern wind of 33 m/s in Kolašin tore down a pine tree in the vicinity of the meteorological station, then several poplar trees and caused damages around the town. Strong to storm NNE and N wind characterised the second and the third decade of January and the first decade of February 2006, with the speeds exceeding 20 m/s. For instance, in Podgorica, in particular between 23 – 24.01.2006 the speeds of the north-eastern wind reached even 25 m/s.

The second type of strong winds occurs in summertime when cumulonimbus develops. These clouds reach the altitude of 8 to 15 km and in them there are strong vertical circulations with the speeds in the range of 20 to 30 m/s and even more. These very strong vertical air currents cause a very strong wind close to the surface, whose whirling character additionally increases its destructive power and causes great material damages. These cumulonimbus incidents, in addition to the very strong wind, are also followed by hail, thunder strikes, very heavy showers, and low pressure. Statistics indicate that in summertime these phenomena are most frequent in mountainous areas at the north of Montenegro.

The wind regime of a locality and a wider physical and geographical area means the basic causes for winds, the frequency of occurrence of various speed intervals and direction and separation of maximal values in order to calculate the probabilities of maximum speeds and additional strain due to the action of wind and for various durations envisaged by the building usage period.

**2. Extreme rainfall and snowfall**

In addition to other factors (current hydrological situation, stores of water in the ground, melting of snow and physical characteristics of the terrain), extreme rainfall is the single most important factor causing floods. Heavy rains leading to floods most often affect the area of Tara and Lim in colder season (October – March). At that period, in the coastal region of Montenegro there is a pronounced air depression persevering for longer periods of time causing maximal rainfall in this region. Due to the features of the ground in the southern part of Montenegro (karst area),

notwithstanding the fact that this area shows the European maximum in rainfall, floods are not a frequent occurrence. The only exceptions are the karst fields in which periodically, in spring, after prolonged precipitation and snow melting there occurs the saturation of ground flows leading to floods. Such floods occurred several times in Cetinjsko field and caused great damages to buildings.

The lack of systematized data on damages makes the quantification of flood risks difficult. Judging by the available data on damages caused by floods in Montenegro, over a 19-year period (1979 - 1997) floods occurred only 5 times. In November 2004 flooding of Tara river was recorded (e.g. in Kolašin it caused damages in the vicinity of the sport hall). The year 2005 brought much rain to the wider area of Bijelo Polje, with the total annual rainfall being 134% of the average. The same year was extremely rainy even in the area Nikšić – Cetinje – Podgorica, Pljevlja – Kolašin – Rožaje. On 17.11.2005, Nikšić and Kolašin had 209 mm and 195 mm of rainfall, respectively, these being the second largest maximum daily rainfall values since the beginning of instrumental measurements in these areas.

It is not only the rainfall which causes extraordinary situations, but also extreme snowfall, both high up in the mountains and at lower altitudes. Apart from the snow depth, for road traffic it is important to know the duration of snow cover as well. For instance, in winter 2004/2005 the snow cover lasted long in northern region of Montenegro, with small interruptions from mid November to late March. The record-breaking 230 cm of snow in Žabljak was measured on 28$^{th}$ February, this being the new absolute daily maximum of the total snow depth in Montenegro. To illustrate how extreme this occurrence was, be it noted that the previous record was registered back in 1967 (209 cm) and that it was only on one other occasion, in 1981, that the snow depth at Žabljak exceeded 2 m. The absolute maximum of 155 cm from 1954 was also exceeded in Kolašin, where on 7$^{th}$ March 156 cm was measured. To illustrate how extreme this value was, be it noted that since 1949 the maximum snow depth measured at this station exceeded 1m only on 4 occasions.

Extreme snow depths and frequent occurrence of its rapid formation in the northern region and at higher altitudes in the southern parts of Montenegro lead to prolonged traffic disruptions on many public roads and total interruption of communication with many villages and towns, like Šavnik and Žabljak. Combined with strong winds and snow storms, huge snow drifts are formed, difficult to be removed and roads made serviceable.

Extreme rain and snow fall, which may occur over a brief period of time, are related to storms, accompanied, in addition to intensive rainfall, also to extremely strong wind, hail, thunder strikes and pressure fall. Statistics show that in summertime there is the greatest frequency of such occurrences with showers in mountainous region of the northern Montenegro. In the area of Rožaje in 2005 one such storm was followed by huge rainfall over a very brief period of time causing floods on a narrow area which led to great material damages. Torrents caused by these heavy rains in such a small area incited several landslides which destroyed several houses and caused considerable damages to many others. Storms during the warmer part of the year are quite often accompanied by hail which may cause huge damages to crops. Large hail can also cause damages to building constructions.

**3. Extreme air temperatures**

- *Have a strong impact on public health;*
- Affect the overall productivity during working hours. People use own capabilities optimally at the temperature around 16.0 C$^{o}$, while temperatures lower or higher for some 15.0 $^{o}$C reduce performance for more than 50%;
- Cause great material damages: e.g. in agriculture low temperatures in spring may greatly reduce the yields of fruits, vegetables and crops; high temperatures in summer, frequently followed by lack of precipitation disturb the water balance between plants and the soil, increase transpiration and make water supply to the plants more difficult;
- Affect overhead power supply lines;
- Indirectly, by drying out of litter and other forest fuels, contribute to the occurrence to forest fires;

- Particularly their variations in brief periods of time, cause damages to buildings. This impact can only be pre-empted by taking into account the probability for the occurrence of extreme temperatures on a certain location when designing and constructing buildings, since wrongly taken temperatures cause damages and accelerate wear and tear of the concrete and other elements of buildings due to sudden expansion and deterioration caused by unforeseen temperature variations, etc.

We should also stress here the impact of heat waves which are also classified as extreme occurrences and constitute a secondary danger. Namely Montenegro, in particular its southern parts are exposed to the impact of heat waves. Brief heat waves are characterised by a sudden rise of temperatures for some 7 $^0$C – 15 $^0$C above the seasonal average lasting for 3 – 6 days. Longer waves are characterised by a gradual increase in temperature for 5 $^0$C to 7 $^0$C lasting over 10 days. For instance, a heat wave affecting Europe in summer 2003 caused 35,000 accidents and large scale damages. At the time, the maximum recorded temperature in Podgorica was 42.2 $^0$C, which is an absolute daily maximum within our state. The absence of data on damages and the impact to health of heat waves in Montenegro makes risk assessment for this emergency difficult. Timely warning of the possibility of heat waves may help in undertaking protection measures and planning activities, thus mitigating its harmful effects.

4. **Freezing**

Freezing, either near the ground or in the air, cause damages to:

- transport
- air carriage
- electric power supply
- forestry
- agriculture
- telecommunications

Studying the conditions under which freezing occurs is highly complex, due to the diversity of processes causing this phenomenon. Freezing may occur in the case of advection of warm air above the cold base and due to freezing of rain drops. In the case of freezing drops of rain, the power supply lines, tree tops, roads, etc may freeze. However, freezing of the roads may occur even without precipitation. It also happens in the case of warm advection. Due to atypical conditions in which it occurs, such a phenomenon is more difficult for observation and forecasts, and thus consequences for road traffic and crops are even more disastrous.

**5. Fog**

Dense fogs are also considered as weather-related incidents. All types of traffic (air, road, rail, sea) suffer great damages. Since it may be localized, of uncertain duration, to protect against it active measures are undertaken. In Montenegro fog occurs frequently in basins and along water courses in the northern region. This phenomenon combined with pollutant emissions in certain troughs, such as the one in Pljevlja, lead to high levels of air pollution which, in the event of long lasting stable anti-cyclone situations, considerably endangers public health and has a negative impact to wildlife. Fog is also a phenomenon occurring in the open sea and less frequently in the coastal zones which greatly affects the safety of maritime traffic and other maritime activities.

**6. Drought**

There are three definitions of drought:

1. meteorological;

2. hydrological and

3. agricultural.

Droughts:

- cause damages to electric power supply, water management and agriculture;

- contribute to breaking out of severe forest fires;
- may exist even without meteorological drought and vice versa.

However, there is no unique definition of drought considering that it is a slow developing phenomenon and has unclear beginning and ending. It is obvious that any form of drought is a consequence of the lack of rain due to general disturbances in atmosphere circulations.

### III.1.3.3. CLIMATE CHANGES

This strategy should take into account the impact of global climate changes to extreme meteorological and hydrological phenomena. This impact is difficult to be quantified and basically there are no solid elements on which to base valid conclusions. World Meteorological Organisation intends to establish regional centres for modelling climate change which are supposed to provide assistance to member states in the assessment of climate changes at the local level and assessment of harmful effects of these changes.

**The Earth's climate has been changing from one regime to the other, both globally and regionally. Before the industrial era, the changes were the consequence of natural factors and it took thousands of years to change from one to the other. But since the industrial revolution, changes accelerated as a result of human factor.**

Since the climate system in itself is highly complex, it is not an easy task to make scientific climate forecasts. The description of future climate is based on the presumption that the impacts, globally speaking, will continue with their action by inertia. Each additional action, such as uninterrupted emission of greenhouse gases will contribute to further deterioration. Therefore the assessments of the degree of warming are rather unreliable; the projected increase of global mean surface temperature ranges between 1.4 – $5.8^0$ C in late $21^{st}$ century.

Detecting climate changes as opposed to its variability is the main problem in climate research. Detecting climate change should rely both on global and regional reactions to external initiators of changes, primarily those which are the result of anthropogenic factor. It is needed to establish long-term monitoring of key climate values of atmosphere, oceans, ground surface and the ice cap for the whole globe. It should be supported by a wide range of historic data, the preservation of existing, the control of their quality and homogenisation. For the needs of the assessment, the indices characterising and having the role of indicators of changes are the main tools for the given research.

Thus there are still no reliable assessments of global climate changes pursuant to which future projections for climate at the territory of Montenegro could be made. It is particularly difficult to assess the changes in extreme meteorological occurrences in future. Here we will state just a few indications on global changes based on research so far, noting lack of reliability of these projections. Some of the important factors which may be forecasted by models are presented here, and which may be appropriate to characterise the climate in future.

- global mean surface temperature – projected increase ranges 1.4 – $5.8^0$ C in late $21^{st}$ century;
- a larger number of warm days and heat waves is probable almost in all continental areas. The rise in heat index (a combination of temperature and humidity) is expected. Frequency of frosts and cold waves at higher latitudes will probably decrease;
- according to the projected values for maximum rain and snowfall, these are to increase above average, as well as their intensity globally;
- loss of habitats for some of cold water fish species, and an increased number for those living in warmer waters. According to scientific forecasts, total global production from phytoplankton in the seas is to reduce some 15% in late $21^{st}$ century. The cause for this is the slowing down of ocean circulation as a result of global warming and the changes in atmospheric circulation.

Over the past years we have witnessed great economic losses in Montenegro caused by extreme weather and climate factors. Quantitative determination of the impact of meteorological extremes to a society is a highly complex and significant task of meteorological services. Primarily, the damages sustained under the influence of most significant meteorological extreme phenomena need to be defined. For this country they include: heavy rains leading to floods, winter storms, extreme cold and heat, drought, dense fogs, phenomena related to stormy clouds (hail, thunder strikes, showers, gale, low pressure) and freezing (on the ground and in the air).

### III. 1.3.4. Hazards to Waters and during the Influence of Waters

The fundamental characteristic of Montenegrin hydrography is existence of two catchment areas: the Black Sea and the Adriatic Sea. The total surface of the Black Sea catchment area is 7.545 $km^2$ or around 55% of the territory of Montenegro, whereas the remaining catchment area belongs to the Adriatic Sea. Generally speaking both catchment areas are rich in water. The considerable part of Montenegro is composed of continental dinaric stone, without constant runoff and with many crevices. That is a reason why karst terrains lack surface waters and are abundant in ground waters. Large quantities of ground waters from karst areas flow into the Adriatic Sea. In terms of average runoff, abundance varies greatly from one catchment to another. The Morača river has the most abundant basin with a specific runoff amounting to 60-70 l/s in $km^2$, 40-70 l/s in $km^{2,}$ for the Tara river and 40 l/s in $km^2$ for the Piva river.

The majority of surface flows in Montenegro are torrents. According to the specific geographic terms they are grouped into the following torrent systems: the Coastal, Skadar, the Boka Bay, Nikšić, Cetinje, Podgorica, Piva, Lim and others. Natural lakes are also numerous. The Skadar Lake, which was formed on an expansive depression is the largest lake in the Balkans, whereas the Šasko lake ranks second in terms of size. Both these lakes are significant nature reserves primarily for the presence of migratory birds and numerous species of fish, which in addition to the other lake and coastal flora and fauna makes this area highly valuable. Numerous glacial lakes, the biggest of which are the Crno lake, Biogradsko and Plavsko lake also represent a significant natural resource of Montenegro. The hydrography of Montenegro is also specific for its artificial lakes on the Piva, Ćehotina, Zeta and Grahovska rivers which were formed with the construction of dams.

The Adriatic Sea makes the greatest water resource of Montenegro. Our coast is around 300 kilometers long. Around 80% of coast is made of stone, with deep water nearby coast, while the rest of the coast is shallow and highly suitable for tourism, recreation, rehabilitation purposes etc.

#### I. Floods

Large volume of precipitation during the year, their arrangement and high amplitude of variation of abundance in karst springs, along with the position of karst springs and larger depressions with a limited capacity of crevice zones result in periodical flooding of some areas in Montenegro. This particularly occurs in spring and autumn months and causes severe damage often followed by epidemic outbreaks.

Karst spring waters moisten slopes made out of deluvial deposits that are laid over the sediments of flysch, which together with antropogenous influences significantly contributes to the initiation of gliding process. This phenomenon is particulary manifested during earthquakes and intensive precipitation. Drainage channels for reception of karst spring waters before their inflitration into deluvial deposits are one of the fundamental preventive and salvage measures which may contribute to the stabilization of terrain. Floods in karst fields (Cetinjsko, Nikšićko, Njeguško) have certain common characteristics in terms of the way they are formed, time of their occurence and duration.

Disastrous floods in Cetinje on February in 1986 were caused by intensive precipitation (from 16 to 18 February in the volume of 670 mm), sudden melting of snow and outflow of occasional karst springs.

Over 50 $m^3/s$ flew out of the Cetinje cave which is hydrollogically active once in more than one hundred years, while total inflow into the field amounted to more than 60 $m^3/s$. Similar problems arise in Nikšićka plain where damage is caused due to occasional outflows of water course of the Zeta and Morača rivers and where atmposperic sewage system of the city was installed.

As regards the Skadar Lake basin, apart from Nikšićko and Cetinjsko field, floods often occur in Bjelopavlićka plain, in Lugovi (to the west from Podgorica) and Donja Zeta.

In the Montenegrin coast catchment area, floods occur in Ulcinjsko and Anomalsko field, during the high water level of the Bojana river, with confluents Miđanska, Rastiška i Međurečka river, as well as in the old town of Kotor. Frequent floods in the Kotor area have been reduced after the installation of injection curtains in immediate hinterland (between Škurda and Tabačina) in order to prevent saltening of the karst spring waters from the Tabačina spring. Occasional floods occur in the Northern and North-Eastern parts of Montenegro, particularily along the water courses of the Lim, Ibar, Ćehotina and Tara rivers and upstream of Crnih poda, Bukovica and Tušinja, upstream of Šavnik. It is important to emphasize that floods caused severe damage to the roads on several occasions along the Lim, Bjelopoljska Bistrica and Morača rivers and other water courses.

Sudden breakthroughs of karst spring waters hindered and interrupted traffic in the Morača kanyon and in Sozina, Budoš and Vrmac tunnels. Exploitation in coal mines in Pljevlja and Berane basins and in bauxite mine in Nikšić was occasionally interrupted due to a high inflow on karst waters into excavations.

Bearing in mind geomorphologic characteristics of Montenegro, it may be concluded that floods may jeopardize settlements, farmlands and roads built in river valleys. The considerable number of cities and settlements in Montenegro are built on banks of major rivers (Podgorica, Kolašin, Mojkovac, Pljevlja, Plav, Berane, Bijelo Polje, Rožaje) and majority of them are potentially jeopardized by outflow of large waters from river beds. In addition, there is another threat of flooding in the areas of the Skadar Lake and Cetinje. Occasional rise in the water level of the Skadar Lake endangers expansive farmland around the lake, while flooding of Cetinjsko field with internal waters might jeopardize a large urban zone of Cetinje municipality. Damages caused by floods are also evident in the Nikšić field.

Protection against floods in Montenegro must be based on the following principles:

- Protection against floods must be carried out by employment of all available mechanisms, such as passive protection, usage of accumulation as a measure of active protection, strict definition and compliance with regulations for the protection against floods;
- A Forecast Hydrologic Service needs to be established within the framework of Hydrometeorological Institute. This service would warn about the danger from floods and predict the movements and duration of the flood wave at least a few days in advance. This forecast activity would ensure timely preparation and implementation of protective measures;
- Regular maintenance, upgrading and reconstruction of facilities constructed to fight floods is an an important condition for their efficient performance
- In order to reduce direct and indirect threats from floods, non-investment-preventive measures should be applied in areas threatened with floods, primarily by means of discouraging larger investments in jeopardized or insufficiently protected zones. To that end, it is necessary to label endangered areas in appropriate maps and plans and define elements of defence against floods in physical plans and
- Another condition for ensuring efficiency of the system for protection against floods and arrangement of water courses are activities related to protection against erosion and torrents in the upper parts of basin. Exploitation of materials from water beds must be systematic, in accordance with the charateristics of water courses so as to avoid harmful influences on water course and built facilities.

Despite disastrous consequences, insufficient attention has so far been given to the protection against floods in Montenegro. Resolution of this issue would significantly contribute to the stabilization of terrain, safety of roads and expansion of farmland.

**Torrents and erosions** are processes that may jeopardize lives of people, their property and natural resources. General exposure of terrains in Montenegro to these processes and specific vertical dissection of vegetation with markedly steep and very steep slopes, habitat with 1,000 to 5,000 mm of water sediments a year, low-resistance soil created by wasteful and inadequate use of natural resources in these areas result in erosions in forests and farmland. Virtually all rivers in Montenegro are torrents either in their upper flows or in entirety. This means that there are major

differences between the flow of larger and smaller waters and regular occurence of torrent waves with considerable level of sediments. Each of these torrent flows jeopardizes settlements and roads, as well as farmland, forests and other soils.

The minimum value of a specific production of drifts is limited to relatively small areas in Montenegro, mainly to the zone of mountain tops and snow border where soil is constantly covered with snow and frozen. The maximum values of specific production of drifts are present in the coastal area in Montenegro where average temperatures and average volume of precipitation are high.

*Specific Production of Drifts*

| EROSION CATEGORY | | | Specific Production of Drifts ($m^3/km^2$ per year) | |
|---|---|---|---|---|
| Label | Coefficient of Erosion | Category | Minimum | Maximum |
| I | 1,25 | Excessive | 3.000 | 18.000 |
| II | 0,85 | Strong | 1.700 | 10.000 |
| III | 0,55 | Medium | 900 | 5.000 |
| IV | 0,30 | Weak | 350 | 2.000 |
| V | 0,10 | Quite weak | 70 | 400 |

According to the official indicators, considerable part of Montenegro is affected by various types of erosion. Total production of drift, calculated on the basis of available indicators, amounts to 3,799.352 $m^3$ per year, while specific production of erosional drifts amounts to 291 $m^2/km^2$ per year. If this amount of drifts is converted into equivalent hectares with the layer thickness of 20 cm then around 1000 hectares of land is lost per year. Visible consequences are manifested through:

- Around 300 of registered torrent basins and areas
- Around 460.000 hectares affected by various types of erosions between I and V degree of destructiveness, without taking into account the areas made of bare stone
- Around 4,982.000 $m^3$ of erosive sediments on the following profiles: Andrijevo (Morača), Žuti Krš, Bakovića Klisura, Bijeli Brijeg (the Tara river), Andrijevica, Zaton and Gostun (the Lim river) and Šavnik, Lonca and Mratinje (the Piva river)
- Reduced production capacity of land due to erosion caused by wind and water (particulary present in mountain and south arid parts of Montenegro due to the loss of land and floods)

Integral approach to the arrangement of torrents and protection against erosion in Montenegro entails coordination and synchronization of all activities and measures, whereby particular importance needs to be attached to the concept of development of entire teritory. Within that framework, the modifications in functions of certain parts of territory must be included. Conversion of low-productivity and degraded areas into forest complexes is also very important. Afforestation of these areas and melioration of degraded forests would produce significant antierosive effects. The most efficient and effective solutions for antierosive arrangements of an area include optimal combination of biological, geological and pedeological conditions of a terrain, condition of vegetation, as well as meteorological and hydrological factors.

Addressing the issue of protection against torrents depends on water level. In cases of larger torrent flows, protection against waters is carried out by means of ordinary measures of watercourse arrangement and protection against floods. In cases of smaller torrent flows, measures of arrangement are based on a complex antierosive arrengement of basin.

**Avalanches are** phenomena that may endanger people` s lives, settlements, road infrastructure, forests and forest lands. Montenegro is largely a mountainous country, with extremely steep mountain terrains and mountain notches and intensive snowfalls which is why these areas are often subject to avalanches. The effects producing avalanches are quite strong which depends on the type of avalanches, the quantity and density of snow, slope and speed of avalanche moving. It is a well known fact that avalanches made out of moist snow are moving more slowly than those made out of dry snow. The majority of avalanches occurs on slopes with and angle of 30 - 50 degrees. Avalanches create bare and even land particularly if they are moist or wet. The role of forests is quite important as they prevent avalanches either physically or by formation of a microclimate which does not allow avalanches to appear.

Avalanches in our country often result in loss of human lives. The victims are usually residents of villages, hunters, mountaineers and skiers. Roads and railways are threatened with avalanches in Montenegro particularly due to the fact that the most important corridors run through steep mountainous terrains.

**Storms and Hurricanes** may also inflict considerable damage to forest resources. The consequences of the influence of edaphic factors on forests are manifested through windthrows and windswept areas. Severity of damages depends on the type of winds and speed of their movement, direction of wind in relation to the forest, composition of the stands etc. Storms and hurricanes have not caused severe damages to forests in Montenegro so far. The reasons for that are the existing edaphic factors in this area and relatively high stability of forest ecosystems since they are mainly composed of natural stands.

### *II. 1.3.5. Legislation in the Field of Protection of Atmosphere and Waters*

The current legislation is not adequate since the Law on Hydrometeorological Institute in Montenegro has not yet been defined.

At this point the majority of affairs concerning weather are performed by the Hydrometeorological Institute which is regulated by the Decree on Organization and Way of Work in Public Administration (Official Gazette of the Republic of Montenegro, number 54/04). In addition to the Decree, the following Montenegrin laws are also applied:

- The Environment law (Official Gazette of the Republic of Montenegro, number 12/96)
- The Law on Waters of the Republic of Montenegro (Official Gazette of the Republic of Montenegro, number 16/95)
- The Law on Protection against Natural Disasters (Official Gazette of the Republic of Montenegro, number 57/92)
- The Law on Protection of Air against Pollution (Official Gazette of the Republic of Montenegro, number 14/80 and 16/80)

Provisions of the following laws are also still being applied:
The Law on Hydrometeorological Affairs of Interest to the Entire Country (Official Gazette of Socialist Federal Republic of Yugoslavia, number 18/88 and 63/90)

- Defense Law of Federal Republic of Yugoslavia (Official Gazette of the FRY, number 18/88 and 63/90)
- The Law on Air Traffic (Official Gazette of the FRY, number 12/98)
- The Law on Waters Regime (Official Gazette of the FRY, number 59/98)
- The Law on the System of Statistical Surveys (Official Gazette of the FRY, number 80/94 and 28/96)

Upon formation of state union between Serbia and Montenegro, i.e. upon adoption of the Law on Implementation of the Constitutional Charter, both Republics agreed to assume obligation to adopt separate Republic laws for those affairs which had been regulated by laws of the former Federal State (FRY). It should be emphasized that Federal Law on Hydrometeorological Affairs of the

Interest to the Entire Country defined affairs to be performed by the Republic Hydrometeorological Institute, Federal Hydrometeorological Institute, Federal Administration for Flight Control, and a number of commercial organizations that had certain responsibilities in the area. At this point all affairs performed by the Federal Hydrometeorological Institute were delegated to the Republic Hydrometeorological Institutes, but the lack of proper regulations adversely affects their performance.

Particular problem arises in international cooperation in this area as there are several important international conventions that were ratified and whose implementation requires quality state-level legal regulations. The most important international act in the field of hydrometeorological affairs is Convention on the World Meteorological Organisation. (Official Gazette of the Federal National Republic of Yugoslavia, number 80/48). The World Meteorological Organization is a specialized agency of the United Nations, while the Convention on WMO was ratified by Yugoslavia in 1948 and is of the same type like the Convention on OUN. Regulatory documents which are adopted on the basis of resolutions issued by the World Meteorological Congress as the highest constitutional body of the Organization and resolutions of the General Assembly OUN are binding for member states. Activities are performed by the state meteorological, that is hydrometeorological institutes which constitute integral parts of global technical and technological systems established by OUN. Therefore, public hydrometeorological institutes are harmonized with regulatory documents of the WMO in organizational, functional, technical, procedural and personnel terms in all member states, including the states with complex structure.

In accordance with the Convention on WMO, the states shall:

- establish the networks of stations for meteorological, hydrological or other geophysical observations and ensure their operational functioning within the world and regional observance systems
- establish meteorological telecommunication systems on their territory and integrate it in international meteorological and hydrological telecommunication systems
- ensure implementation of standards in meteorological, hydrological and other geophysical observations, processing, filing, international exchange and publishing of data and information
- provide development of meteorological and hydrological activities, research in meteorology and hydrology and implementation in aviation, maritime affairs, agriculture and other economic and social activities
- provide education and training of personnel
- strengthen bilateral and multilateral cooperation in these areas and transfer know-how and technology
- provide institutional, personnel, and other conditions for the development and functioning of the National Hydrometeorological Institute

In addition, certain obligations in meteorology and hydrology arise from the Convention on International Civil Aviation, Convention for the Safety of Life at Sea (SOLAS), the Convention on Climate, the Convention on the Establishment of the European Centre for Medium Term Weather Forecasts, the Convention on Cross Border Long-Distance Air Pollution, the Vienna Convention for the Protection of Ozone Layer and others.

Article 29 of the Decree on Organization and Way of Work of Public Administration enumerates affairs that were transferred to the competence of the Republic Hydrometeorological Institute which is also an administrative body. Many of these affairs could not be operationally performed due to a range of reasons (lack of funds, professional personnel, equipment, difficult international communication and lack of mechanisms and standards in certain areas of use of meteorological and hydrological information). In the meantime, there emerged new affairs whose performance required additional normative mechanisms.

**Legal regulations related to waters** treat waters as a natural resource in general use which is used under terms and conditions which ensure their effective use, protection and other general

interests defined by law. In line with this law, waters shall be used in a manner which does not jeopardize natural qualities of water, does not threaten lives and health condition of people or flora and fauna, or ambient and environmental values. For the purpose of this law, water management includes management of waters, arrangement of waters and water courses, protection against harmful effects of waters, protection of waters against pollution, provision and use of waters, along with a long-term protection of the quality of waters and springs.

The main objectives of the Law on Waters are: prevention of further deterioration and protection and improvement of the status of water ecosystems, including land and marshy ecosystem which are directly dependant upon water ecosystem; management of waters and water assets in order to provide a good status of waters; protection and improvement of ecosystems, sustainable use of waters based on a long-term protection of available water resources; progressive reduction of pollution of ground waters, prevention of their further pollution and mitigation of the consequences arising from floods and droughts. For the purpose of this law, protection of waters is a set of measures and procedures aimed at safeguarding the water quality, i.e. raising it to a required level of use for different purposes. Protection of waters against pollution is carried out for the purpose of ensuring harmless and unhindered use of waters, protecting people` s health and protecting flora, fauna and environment. It is effected by imposing prohibition, restriction and prevention of importation of dangerous and harmful substances in waters and by controlling and prohibiting operating of dams and drainage sluices on those rivers which disrupt main qualities of water courses in certain period in a year. Protection of waters against pollution includes the following: *organizational measures*, which include surveillance of the condition of water quality and sources of pollution, prohibition and restriction of importation of dangerous and harmful substances in water, prohibition of distribution of substances which are dangerous for waters and which may be substituted by more environmentally friendly products; *economic measures*, which include payment of water pollution fee, which is higher than the costs of the water treatment; *technical and technological measures,* which include waste water treatments on the place where they appear and introduction of advanced technology in production and *water measures*, which means improvement in regime and quality of small waters by targeted discharging of clean accumulation waters which is particularly important during mitigation of pollution caused by major breakdowns.

Protection against harmful effects of waters includes activities related to the protection against floods, against erosions caused by rivers, water in general, wind and torrent, drainage and mitigation of consequences of such water effects. Protection activities include construction and maintenance of protective water facilities (partitions, drainage sluices, biotechnical facilities and the like) and performance of protective activities (forestation, grassing, terracing, cleaning of water beds etc.) Anti-erosive activities and measures are performed before or at the time of construction of accumulations, melioration systems, roads, industrial and other significant facilities, as well as during water course arrangement if erosive processes progress in gravitating basins. The following activities are prohibited on erosive area: devastation, clearing and cutting forests, deforestation of areas, uncontrolled digging and plowing of meadows, growing one year field crops in pastures and uncultivated areas, covering springs and uncontrolled collection and disposal of water, storage of timber and other materials, construction of facilities without appropriate planning and design documents, exploitation of river sediment from the bottom or slopes, except for the needs of permeability capacity of the torrent bed, construction of investment and other facilities that might jeopardize stability of land (watermills, dams, channels, ponds and the like) and initiation of other activities which encourage erosions and create torrents.

### III,2. TECHNICAL AND TECHNOLOGICAL ACCIDENTS

This group of accidents includes analyzed and quantified forms of accidents that may result in substantial losses of human lives, destruction of goods and environment such as: major accidents on oil installations and petroleum products, breakdowns during transportation, storage or use of chemical, toxic, explosive and radioactive substances, explosion, pollution of drinking water springs, chemical and toxic accidents, radiological accidents, combined effects of terrorism and large-scale toxic radiological and biological effects, major traffic accidents, outages in large power plants and hydro technical plants, chemical and radiological contamination and accidents with dangerous chemical substances.

## III. 2.1. REGIONAL FIRES

Natural disasters, such as large-scale fires have always posed a serious threat to people and goods. Their destructive potential constalntly provokes fear and unease in people. If consequences of majors breakdowns caused by fires are analyzed, it may be concluded that they sometimes approach and at times surpass definition of a natural disaster.

General technology progress, introduction of new processes related to the use of flammable and explosive materials, the use of new materials in construction of facilities, new types of fuels, concentration of goods in small areas and a range of other factors inevitably carry an increased danger of a fire outbreak.

In addition to the other natural disasters that must be given attention in national strategy and research, there are also fires that may break out during:

- mine disasters (fires, explosions and floods in mines and the like)
- technical and technological disasters: fires in warehouses storing oil, installations of hazardous substances and gases, fires during the transport of materials through tunnels and in open roads with a particular aspect in urban areas, plane crashes, railway accidents and the like
- other fies (in residential ares – fires in blocks of flats, in industry and in forest complexes).

Discharge of toxic gases, explosions and fires in tanks carrying various flammable liquids may result in disastrous environmental consequences. The most impressive examlples of such disasters are Flixborough – England, Bopal – India, Osaka – Japan etc. However, regardless of all that, analyses reveal that 65.4% of fires were caused by negligence – disregard, which means that human factor is still most often the cause of fires or explosions.

Fires are often consequence of natural disasters and breakdowns, but it may also happen the other way around. On the other hand, forest fires caused by either human negligence or spontaneously may endanger entire regions. There are numerous examples of such type of fires, such as great forest fires that ravaged along our coast a couple of years ago.

### III. 2.1.1. ANALYSIS AND QUANTIFICATION OF THE ACTUAL FIRE THREAT

A degree of mitigation of consequences resulting from large-scale fires primarily depends on how fast help arrives and how fast the the intervention of saving begins, as well as on adequacy of the help provided. Fires breaking out in residential facilities as a rule are followed by a great number of victims. Analysis of the factors causing this situation reveals that considerably greater number of people gets killed more by the smoke in conditions of reduced visibility than by a fire itself. Modern construction materials used in interiors of facilities carry fire during burning very quckly thus producing enormous quantity of smoke that fills in evacuation spaces in a short period of time (2-5 minutes). This makes rescue operations and efficient intervention of fire brigade more difficult. Therefore it in necessary to be familiar with methods for the protection against smoke in order to reduce the number of victims in cases of a fire breaking out in facilities where a considerable number of people gets together, stays, works or lives.

Experience reveals that large-scale fires are most often caused by wars and earthquakes, but individual fires in residential and public facilities and forest fires may cause numerous victims and property damage as well. Disastrous fires have been recorded throughout history when entire cities were burning thus causing tens and hundreds of thousands of people to die. This primarily refers to fires in: Rome, 64 AD, London in 1666, Moscow in 1812, Chicago in 1871, San Francisco in 1906, Tokyo in 1923, Hamburg in 1943 etc. Nowadays, all around the world large complexes of fires ravage followed by great explosions producing disastrous consequences.

Considering constant mobility of fire brigades, they are nowadays engaged for the first intervention on almost all types of natural disasters, most often in cases of floods, earthquakes, explosions, traffic accidents, various demolishions, pollution and naturally all types of fires.

Territorial or industrial, professional or voluntary associations of fire brigades independently extinguish small and medium fires breaking out on a daily basis depending on the location of a fire in a specific area. Their equipment and professional expertise makes them ready to successfully intervene and provide help.

- Fire brigades (teams that were specially trained for this type of intervention) are engaged in the event of major accidents and disasters in order to primarily extinguish fires, participate in rescue operations, and mitigate the consequences caused by these circumstances.
- Headquarters for emergencies should coordinate rescue operations during extinction of complex and disastrous fires. If necessary, the headquarters engages units of the Ministry of Interior, military and citizens. A professional task force for protection against fire is established with the aim of extinguishing fires more efficiently.
- In order to employ the best extinction tactics in cases of complex fires, it is necessary to conduct a detailed evaluation of the situation beforehand and adopt the extinction plan accordingly.
- Decisive determination of a course of action aims at rescuing persons threatened with fire. If there are no persons threatened, the course of action will be directed towards the most efficient rescue of material goods and the fastest possible extinction of fire.
- Establishment of task forces made of highly specialized experts for major disasters within the firefighting units in Republic centers and their actions in disastrous fires would considerably reduce death toll in fires.

Numerous examples in history show that natural disasters themselves may cause fires and explosions. For example, earthquakes may cause damage to the gas and other installations, fuel tanks and poisonous gases may cause explosions and fires in both, facilities and atmosphere.

Burning of easily flammable gas mixture may occur at a speed faster than the speed of sound (detonation burning) or at a lower speed, which is equivalent to explosions.

Major accidents throughout history, such as explosions in Flixborough (England), Beek (Holland) etc. show that explosions of the clouds made out of flammable vapor and gasses may have disastrous environmental consequences. A good example is the Flixborough explosion where a large vapor cloud made out of cyclohexane was formed after which a pressure wave of explosion and a fire destroyed much of the plant. The area caught with fire extended to 12.8 km which destroyed 2,488 homes, shops and factories.

It is possible to establish a set of recommendations for safety of facilities in gas supply which depends on a number of factors, such as:

- Design and selection of a solution, site, minimum safety distance and other prescribed conditions
- Selection of materials, construction, surveillance and receipt of a built facility
- Periodical examinations, surveillance and control over operating facilities
- Repair, overhaul and substitution of parts, sections and entire plants by new ones, as well as provision of spare plants
- Security and safety systems in facilities in both, ordinary and extraordinary circumstances

Many of these factors are integral part of technical rules and terms in legal and technical regulations which ensures technical and technological unity, unique training of expert staff and identical procedures in emergencies. All this may provide new quality and increased safety in gas distribution primarily in cities which is a major goal of all tendencies and efforts.

Municipal firefighting units have been established in all Montenegrin cities except in Plužine, Šavnik, Mojkovac, Andrijevica and Žabljak. Voluntary firefighting services exist in some municipalities (Kolašin, Bar, Bijelo Polje, Ulcinj, Berane – Haremi and Petnjica, Cetinje, Danilovgrad, Podgorica, Tivat – Radovići, Kotor – Perast and Nikšič – Župa, Grahovo and Vilusi). Operating firefighting units have been established in: the Bijela Shipyard, airports in Tivat and

Podgorica, the Port of Bar, the Aluminum Plant (KAP) in Podgorica, the Steel Factory in Nikšić and the Thermal Power Plant in Pljevlja. Municipal associations of firefighters have been set up in Danilovgrad, Podgorica, Bar, Berane and Nikšić. These associations form one of the constitutional parts of the Association of Firefighters of Montenegro.

Association of Firefighters of Montenegro and its members are still not able to adequately address accidents – fires and explosions, which are natural disasters because of its size, functionality, activities, technical equipment and staff capacity.

In terms of the age structure of the employed firefighters, the condition in Montenegro is not entirely satisfactory as a considerable number of firefighters is older than 35. Worryingly, in addition to the unfavorable age structure, health condition is unsatisfactory which reduces capacity of firefighting service to successfully execute its tasks during peacetime and in emergencies.

Due to the frequent fires in a fire season (summer months) a particular attention must be attached to the activities which prevent fire outbreaks in open zones – green areas and forest complexes in the Republic of Montenegro, and southern and central regions that pose high fire risk. The importance of these activities will additionally increase as this region, apart from green areas and forest complexes, is also home to industrial, traffic, hotel and tourism facilities which due to their installations fall under the category of facilities highly threatened with fire. This refers to the facilities and installations in the Port of Bar (*Jugopetrol* Kotor – storage capacities of liquid loads amount to cca 120.000 $m^3$), Grain Silo, Storage of acetic acid, cement silo, timber terminal, storage of B substance), *Tehnogas* in Petrovac, more than 100 of gas stations (technical oil gas) located mainly in tourist facilities-hotels: two large storages of *Energogas,* a gas distributor, the Bijela Shipyard, airports, Aluminum Plant (KAP) in Podgorica, the *Steel Factory Nikšić*, numerous hotels and other facilities.

Detailed analyses were conducted in each municipality in southern and central region in presence of mayors, heads of firefighting units and representatives of the Ministry of Interior (Inspectorate for Protection against Fires, Explosions, Breakdowns and Technical Protection of Facilities) when the following locations were identified as potential locations carrying high fire risk:

| *Municipality* | *Locations of Forests* |
|---|---|
| **PODGORICA** | *Gorica, Ljubović, Dajbabska Gora, Srpska, Malo Brdo, Zlatičko polje, Ćemovsko polje, Tološka šuma* |
| **NIKŠIĆ** | *Latično, Duga-Crnovrh i Golija, Javorak – Vojnik, Krnovo – Vučje, Župa – Štitovo, Ponikvice, Somina, Kapavica – Bratogošt, Njegoš – Zla Gora, Jelovica, Bijela gora, Grahovska prla, Trebjesa i Studeničke Glavice* |
| **CETINJE** | *Vrtijeljka, Han Mašanovića, Jankovića krš, Nacionalni park Lovćen,Njeguši, Gornja i Donja Markovina, Katunska nahija* |
| **DANILOV-GRAD** | *Studeno, Borov Do, Topolovo, Jablan, Vukotica, Komunica, Grbe, Daljam, Mareza, Novo Selo, Bandiće, Jabuke, Plana, Mala Zagreda, Velja Vagreda, Velje Brdo, Begovine, Jastreb, Pitoma Loza, Lazine* |
| **ULCINJ** | *Mendra, Bazbuljuk, Valdanos, Mavrijan, Bijela gora, Pinješ, Možura, Briska gora, Donja klezna, Kaliman, Krute, Bojke,Vladimirsko područje, Brijeg mora, Kolomoza* |
| **BAR** | *Ratac, Zeleni pojas, Pobrđe, Golo brdo, Sutorman, Volujica, Kufin, Mala Volujica, Pečurice, Stari Bar* |
| **BUDVA** | *Spas, Dubovica, Košljun, Gospodština, Zavala, Paštrovska gora, Malo Brdo, Zakolač, ostrvo "Sveti Nikola"* |
| **KOTOR** | *Čeline, Brezovačka planina, Reovačka planina, Štrakonoca, Jasenov Do, Grkavac, Ledenica, Korita, Velje Selo, Lokvice, Gornji Grbalj (Gorovići, Bratešići, Nalježići, Čavori, Poda, Mezalin, Šišići), Gornji Morinj, Donji,Grbalj (Jaz, glavatske kuće, Pobrđe, Lješevići, Bigovo, Trašte, Glavatičići, Krimovice, Višnjevo), Cerovik, Morinj, Orahovac, Ljuta - Dobrota, Vrmac, Lovćenske strane, Krimalj, Duplja, Goražda, Peraško brdo, Lukavac, Dragalj, Strp, Stoliv, Kavač, Bujkovići* |
| **TIVAT** | *Krtoli, Krašići, Đuraševići, Topliš, Oblatno, ostrvo ",Sv.Marko", Popova Glava, Trojica - Sv.Ilija, Sv. Šimun, Velji Grm, Knježinje, Peani, Kukuljina, Pečkovica, Vijeće brdo, Lukatovo, Orašje, Gornja Lastva, Tomičići, Pasiglav* |
| **HERCEG NOVI** | *Zaleđe grada od Zelenike do Kamenara, Orijenski masiv, Debeli Brijeg - Rt Oštro-Kobila, Kompleks Kameno - Borići, Savinska Dubava, Luštica peninsula* |
| **BIJELO POLJE** | *Bjelasica, Rudo Polje, Kovren, Mejdenica, Koritski omar, Vukovina - Kisjele vode, Džafića brdo-Ribnik* |
| **BERANE** | *Šekularske šume, Turjak, Kaludarsko-dapsićke šume, Crni vrh-Ruišta, Mrtvica, Dašča rijeka, Jelovica, Gornji Ibar-Županica* |
| **PLJEVLJA** | *Tarski omar-Glibaći, Boišta-Kosanica, Crni Vrh-Kosanica, Mosur-Kosanica, Kanjon Drače-Bobovo, Strmećica-Mataruge, Bujiška Breza-Vrulja, Podborovo-Vrulja, Mijakovići-Odžak, Vilići-Odžak, Kozlinovača-Kosanica, Kovač-Boljanići, Nange-Šula, Čemerno* |
| **KOLAŠIN** | *Bašanje brdo, Vinića brdo(Barutana),brdo Dulovine, Šumski kompleks oko nacionalnog parka »Biogradska gora«* |
| **PLAV** | *Reon Skića, Bjeluhe, Šipovice, Nećinat, Murinska rijeka, Zelatin, Visitor, Bogićevića, Hrid, Treskavac, Trokuza, Košutica, Zabelj, Grebaje, Vezirova Brada, Trojan, Vusanjske planine, Bor Radončića, Lipovica, šume Lijevog Grnčara* |
| **ROŽAJE** | *Kula, Balotiće, Carine, Paučina, Kanjon rijeke »Ibar«, Šušteri, Bogaje* |

An assessment of necessary forces and means for efficient intervention is conducted in the abovestated locations by taking into consideration all required parameters and high quality intervention (distance from the location, type of forest trees, weather conditions, access roads,

locations for water filling, preparedness of terrain for intervention), industrial and other facilities as well as installations in these municipalities including prior experience in interventions.

The current condition of equipment and level of training of fire brigades reveal:

- That fire brigades are not equipped with sufficuient number of firefighting vehicles, accompanying vehicles, means of telecommunication, pumps for water absorption, personal protection equipment, fire pumps for fire extinction in open zones etc.
- That the existing equipment is in a very bad condition, outdated, poorly maintained (due to the lack of funds), technollogically outdated which particularly refers to the firefighting vehicles
- That the number of firefighters in fire brigades is not harmonized with actual needs in respect to great differences

In order to increase efficiency of all shareholders in municipalities who participate in forest fire extinctions and rescue operations of people and goods, it is necessary to do the following before each fire season:

- Each municipality should adopt an Order on Undertaking Preventive Protection Measures against Fires in their jurisdictions respectively
- Before the beginning of the season, each municipality should establish municipal headquarters for managing emergencies which will include all important shareholders and provide successful implementation of activities concerning fire extinction
- Heads of OVJ and Ministry of Interior need to release information that they need policemen who will be engaged in compliance with the operational plan of fire extinction in their municipality.

It is necessary to consider parameters that define fire load of green areas, forest complexes and all other types of facilities and installations in order to realistically analyze equipment, mobility and intervention capacity of fire brigades.

Lack of professional staff and insufficient number of professional workers for the protection against fire hinders intensive efforts invested into organizational and technical strengthening of fire brigades. Adequate professional preparedness of firefighting staff would enable selection of the most effective extinction tactics, proper use of firefighting techniques and advanced extinction means. Education and training of staff in this are has still not been regulated properly so far.

Starting with the current experiences and achievements in the area of fire protection, it is necessary to consider the following in order to improve organization of voluntary firefighting services and professional firefighting units and their preparedness for more efficient activities:

1. Assessment of the level of threat and fire load
2. Categorization of settlements, organizations and enterprises
3. Minimum preparedness achieved
4. Minimum number of professional firefighters provided
5. Firefighting facilities located
6. Other elements significant for successful operations in cases of a fire, breakdowns or disaster

Advanced and efficient protection against fire requires adequate use of advanced technical and technological processes and equipment. This means that protection against fire needs to be systematic and based on professional and scientific assessment of danger and threat. However, Montenegro has still not defined a scientifically based policy on protection against fire which should be an integral part of social self-protection, nor has it clearly defined the development strategy.

Nowadays it is easy to discern a gap between a contribution of science and technology to the development of protection against fire and actual social needs. General social treatment of science and technology in this field is dissatisfactory, integration of scientific and technological potentials is

insufficient, irrationality is also present, as well as repetition of research, use of scientific results in production and social practice is insufficient, contribution of science to programming of development of protection against fire is insufficient, staff and technical preparedness of institutions for performance of official tasks and regional projects concerning protection against fire is inadequate.

Like in any other field of life and activities related to the protection against fire and explosions, one of the most important factors is complete and timely informing during the preparation and implementation of anti-fire and anti-explosion measures on all levels of activities against fire which are an integral part of social self-protection.

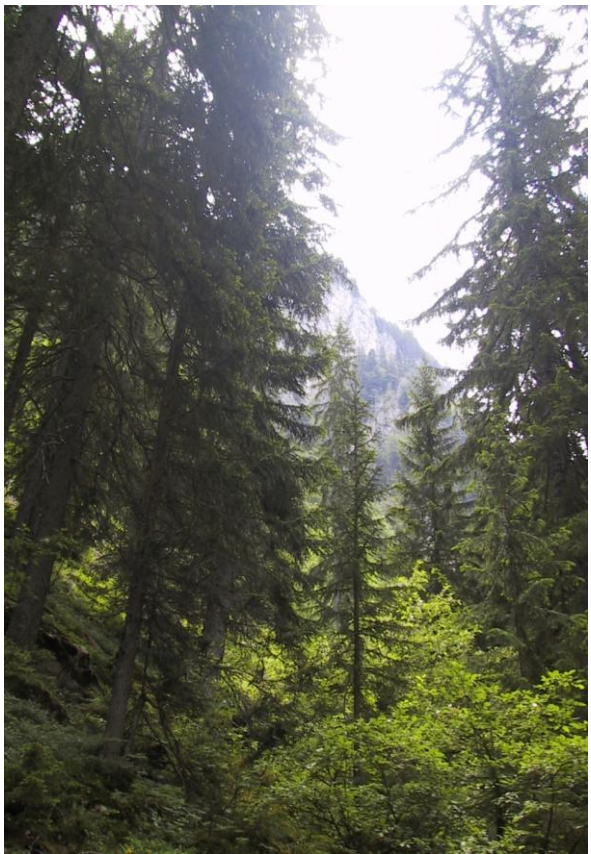
Organization of training in this area is particularly important for further development and improvement in protection against fires and explosions. Regular and continuous training and increase in level of security and anti-fire behavior of labor and citizens is quite necessary as it is a well known fact that what most often causes fire is the subjective factor, i.e. failures related to the capacity and adjustment of people to perform certain tasks and activities in a safe and secure manner. Bearing in mind the current level of development of our society, there is a need for an overall action particularly in the area of informative, propaganda, training and education activities in order to face increased threat of fire ravages. Each citizen and worker should participate accordingly. Therefore, protection against fire needs to be attached greater attention and importance, particularly in legislation.

In order to reduce fire threat and vulnerability of physical structures of urban agglomerations it is necessary to use urban norms in definition and restriction of the percentage of construction and coefficient of land usage (i.e. height of facilities) in urban zones.

### 2.1.2. Hazards to Forest Resources in Montenegro

Forest ecosystems are key components of natural systems which are considerably important for prevention of certain circumstances which represent natural hazard. Bearing in mind the fact that Montenegro has become ecological state 13 years ago, the issues of conservation of forest ecosystems as its most important ecological resource and sustainable forest management have grown in importance.

Relevant facts indicate a quite stable level of forest coverage in Montenegro during a long period of time. In distant past, forests were mainly used to address the needs of local population, while they were threatened with cutting down for the purpose of forming farmland and feeding cattle which endangered their natural regeneration. At the beginning of the last century Montenegro was faced with industrial exploitation of forests which expanded after the Second World War in the course of rapid industrialization of the SFRY.



Recently, this natural resource has become less threatened due to the decline in industrial production, migrations of country population to the cities and reduced cattle fund. Process of natural forestation in areas which had been earlier used for agriculture created new surfaces under forests. Statistical indicators reveal that forests and forest land occupy 743.609 hectares or 54% of Montenegro` s surface area. Forests cover 620.872 hectares while the area of uncovered forest land amounts to 122.737 hectares. The majority of forests and forest land is state owned. Forests which are mainly commercial cover 347.581 hectares or 81.43%, protective forests cover the area of 66,283 hectares or 15.53%, while national parks cover 12.975 hectares or 3.04%.

Dendoflora variety of Montenegro is estimated at several hundreds of species of forest trees. The most represented species is beech, followed by spruce, pine, fir, other hardwoods etc. Our forests mainly have natural structure and are largely mixed with autochthonous species of trees.

Forest is one of the most complex, dynamic natural systems which is composed of integrated parts that influence on each other thus forming biotic community called biogeocenosis or ecosystem. From economic and biological aspect a tree may be considered as a forest` s backbone as it is an organic product of forest which gives 25.000 products. The trees in the forests play the role of an ediphicator, creator of specific conditions in it, permanent guard and stabilizer of atmosphere, hydrosphere and pedosphere (water, air and soil).

Importance of forest ecosystems is manifested through their most important functions: plants produce oxygen without which a life on earth would be impossible, while the key role in this process is played by forest trees; the photosynthesis is the process in which plants absorb carbon dioxide thus regulating its quantity on Earth; forests are the most important reservoirs of water which play a key role in the hydrologic cycle; timber products are individually the most represented social products which may not be substitued by other products in the majority of cases; energy gained from trees is the cleanest from environmental aspect; forests are considerably important for both, microclimate and macroclimate etc.

Generally speaking, forests are mainly threatened by various natural adverse factors, primarily climate and edaphic ones. High and low temperatures, heat waves, strong winds and storms and heavy snowfalls have harmful consequences on the forest. Generally, Montenegro falls in the category of regions where climatic factors exert far more harmful influences than edaphic factors whose effects are not weak either. The variability of climate in our region indicates that we can face more frequent and extreme climatic phenomena: droughts, intensive heat waves, quite intensive short-time precipitations etc. Therefore, identification of their influences (including definition of actions for their reduction) on forest ecosystems, water resources and soil degradation processes must have multidisciplinary character.

Anthropogenic influences pose another threat to forest resources. Human factor in general is a relevant risk factor for natural resources. Nowadays risk is a constitutional part of modern society. Industrial and air pollution, various types of waste, greater needs of society for energy and raw materials have increasingly severe consequences on instability and reduction of capacities of natural resources. The major losses of forests are caused by human actions in timber industry, illegal cutting of trees and conversions of forests into farmlands. Over 90% of forests fires are caused by humans, humans are the biggest air and soil polluters, human activities cause saltening of soil and high presence of hard metals in it etc.

Other factors inluencing negatively on forests are air pollutions, pathogenous microflora and harmful insects. The issue of forest drying is a problem found in out country and around the globe.

As regards the risk of natural hazards, the highest vulnerability is shown by forests set up on habitats which are not favorable to their growth, then overly used forest stands, monocultures of hardwoods created artificially, forests in poor rocky areas and forests in very steep terrains.

**FOREST FIRES** represent constant, latent threat for the loss of forests and forest land. Society is concerned over more frequent forest fires, particlulary in coastal and seaside region, which being often so heavy threaten forests, agricultural products, settlements and human lives. Therefore, forests in coastal and central parts of Montenegro are threatened the most as bioclimatic conditions (high air temperatures in summer and characteristics of vegetation) are favourable to the fire outbreak. July and August are the most critical months for fire outbreaks in our conditions due to the low intensity of precipitation, which also applies to February and March - periods of dry and warm winters.

Fires usually occur in dayllight, between 10 and 18 hours.

It may be concluded that daily rhytm of forest fires corresponds to daily activities of humans. Village residents used to set fires purposely in order to get new meadows, pastures and farmland. With exception of fires caused by thunder, all fires are nowadays grouped into biotic, that is antropogenous, environmental factors because they include various influences of humans on biotic community (biocenose, ecosystems). Antopogenous factors mean various activities of humans and individuals that increase or reduce fire threat in forests and vegetation either directly or indirectly. Around 95% of fires in our country are casued by humans.

The following is a list of firest fires made according to the classifications used in our country:

- Ground fires (soil fires) usually sweep through humus and peat layers of soil which are placed under forest floor and insoluble part of surface layer of forest soil. Exceptionally, ground fire may cause more severe damage by destroying the roots of trees. If this type of fire occurs in rocky areas, scarce soil between stones is damaged and ground is dried which leads to disappearance of vegetation in such terrains.
- Surface (low) fires burn the upper layer of organic forest floor, brushwood and saplings. This fire occurs most often. They are the most dangerous in young stands, particularly in conifer forest.
- High (crown) fires mainly break out in conifer forests. They may also be caused by ground fires when combustible material grows in intensity. High fires always cause damage because they devastate the stands they sweep through.

Consequences of forest fires depend on the type of fire, type of forest, time of fire occurrence, duration of fire, size of the area burned, and condition of forest ecosystem. High fires consume trees from roots to the crown thus causing the most extensive damage. Such burned stands need to be cut and regenerated. Not only do the fires cause damage in the form of loss of timber mass, but they also entirely destroy environmental, social and economic functions of forests. These damages are interrelated with soil erosions which create waste lands by drainage which does not give vegetation opportunity to grow again. Eolic and water erosions often appear after fiords. The post-fire period is characterized by the growth of pioneering, less valuable species of trees in burned area which is exposed to various types of degradation.

The percentage of the area burned in Mediterranean countries (including Montenegro) is between 1 and 1.5% of the total surface area which is within normal limits.

| Percentage of area burned | |
|---|---|
| In respect to the total forest surface | Interpretation |
| 1-1.5% | Damages are within normal limits |
| 1.6-3% | Severe consequences |
| 3.1-5% | Highly severe consequences |
| More than 5% | Disastrous consequences |

Environmental, ambiental, social, cultural, health and other functions of forests are very important for stability and future development of our country since Montenegro is recognized as a country of magnificent natural beauty which is strategically oriented to tourism and organic agriculture development. The mere fact that 1500 large-scale forest fires have been recorded for the last 15 years, whereby the area burned amounted to over 15.000 hectares and around 1.300.000 $m^3$ of timber mass was destroyed points at the actual risk of disappearance of large forest areas and forest land (only in 2003, more than 350 fires broke out resulting in almost 2.500 hectares of area burned, around 200.000 $m^3$ of timber mass was destroyed causing directly a damage worth 1 million Euros, if calculation is made according to the sale price per log). Between 1955 and 1985, 1.730 forest fires were recorded in Montenegro, whereby the area burned was estimated at 15.500 hectares. According to the available data, the number of fires has grown for over the past three decades.

According to the scientific findings, entire Earth is currently threatened with global warming which is why the fire phenomenon needs to be approached with particular attention and seriousness in order to prevent the natural disasters that may destabilize lives of all beings on Earth. This particularly applies to Montenegro, mainly due to the fact that Montenegro is one of the threatened areas with different scenarios of climate (global, regional) and a considerable number of drought years recorded over the last two decades. Consequences of these processes are manifested in changes such as increased air temperature, reduced precipitations, appearance of extreme precipitations, deterioration in physical features of soil, increased soil erosion, reduced protective role of vegetation and difficult conditions for natural and artificial reforestation of forest vegetation.

Analysis of forest fires must certainly consider the condition of national parks in Montenegro: Durmitor National Park, Biogradska gora National Park, Lovćen National Park, the Skadar Lake National Park, as well as conifer forest complexes in the area of Berane, Rožaje, Plav, Herceg-Novi, and olive plantations grown along entire coast. Without timely and efficient intervention, each fire in these complexes would result in natural disaster.

High temperatures affecting certain parts of Montenegro (southern and central region) during summer months followed by small volume of precipitation and insufficient protection of forests against fires facilitate outbreak of fires in open zones – green areas and forest complexes. On the basis of these parameters, the area of Montenegro may be classified into:

1. *The area of high fire risk – southern and central region (*municipalities: Ulcinj, Bar, Budva, Kotor, Herceg-Novi, Cetinje, Danilovgrad, Nikšić and Podgorica)
2. *The area of increased fire risk – south-western and western region - conifer trees* (municipalities: Pljevlja, Žabljak, Mojkovac, Andrijevica, Rožaje, Berane, Bijelo Polje, Plav, Kolašin, Šavnik and Plužine)
3. *The area of mild fire risk – oak, hornbeam and other deciduous tree (*mountain area in municipalities Šavnik, Bijelo Polje, Berane and Kolašin)

**HARMFUL INSECTS AND PHTYTOPATOGENS** are another factor of risk to the natural resources. It is well known that forest is a natural or artificial ecosystem composed of inanimate habitat (soil and climate) and living beings (plants and animals) dominated by forest trees, whose balanced interactions ensures continuous, long-term production and steady consumption of organic substances. Therefore, in order for a forest system to properly function it needs to consist of three groups of organisms: producers (green plants in this case), consumers (animals) and mineralizers or reducents (microorganisms). Each disruption of that system may give rise to certain risks thus causing instability of forest systems.

Harmful forest insects are organisms that may not jeopardize forest trees if they are not largely present. Therefore, harmful forest organisms are those that appear continuously or occasionally in large numbers which may cause evident negative changes in forest trees, jeopardize their productivity and cause drying. Multiplication may occur after certain primary harmful influences (drought, forest fires, poor or inappropriate habitat etc.) and invasion of insects and fungi. Insects and fungi act together quite often. Trees weakened by fungi invasion often become prey to bark beetles. Certain species of insects and phytopatogenous fungi are the most important species that appear in forests in multiplication. Both groups have the capacity to react quickly to negative changes in forest ecosystem and a large reproduction capacity. Harmful forest insects that are present in Montenegro are: Gypsy Moth (Lymantria dispar) that may cause extensive defoliations, while consecutive years of defoliation may cause forest dieback especially if it forms chain with other secondary pests. Its gradations appear very often in deciduous

forests in coastal and inland regions of Montenegro, whereas the last gradation occurred in 2004 when strong intensity of invasion on 12,000 hectares of forests was recorded. Oak leafroller moth (Torticidae and Lepidoptera) is major pest in oak forests as it also causes defoliations and may cause trees dieback.

Montenegro has not recorded any serious consequences caused by this pest so far; bark beetles (Scolytidae family) are insects living beneath the tree bark or more or less deeply in the tree itself.

Their gradations may cause large trees diebacks. The majority of species appear in conifer trees which is why they are considered to be major enemies of conifer forests. They fall under the category of secondary pests, but in cases of larger multiplications they invade healthy trees as well. Strong intensity gradations have been recorded in our country during the thirties of the last century and immediately after the Second World War; then, caterpillar moth (Thaumetopoea pityocampa). Other important phytopathogenic fungi are: rot fungi, out of which the most represented and harmful are honey mushroom (Armilaria Melea) and fungi Heterobazidion Annosus which causes root rot in conifer trees. Over 10% of spruce trees in Europe are considered to be infected by Heterobastidion fungus. The consequences of invasion of this type of fungus are manifested in loss of technical tree, increased danger in wind swept areas to invasion trees, and physiological weakening and extinction of trees. Phytopathogens fungi cause disease of seeds and shoots (Fusariuj genus, Pythium genus, Phitophthora genus). Fungi also cause tree bark diseases (Nectria genus, Endothia parasitica) while some fungi may cause disease of leaves and fir needles. (Microspherea alphitoides, Lopohodermium pinastri, Lopodhdermiunm seditiosum, Dothistroma pini)

**Avalanches** may jeopardize human lives, settlements, road infrastructure, forests and forest land. Montenegro is largely a mountainous country, with extremely step mountain terrains and notches and heavy snowfalls which is why there is a high risk of avalanches in this area. Consequences caused by avalanches depend on the type of avalanche, quantity and density of snow, slopes and the speed of avalanche movement. It is a well known fact that avalanches made out of wet snow move more slowly than those made out of dry snow. Avalanches mainly occur on slopes between 30 and 50 degrees. Avalanches leave behind bare and smooth ground, especially if they are wet or moist. Forests extensively prevent occurrence of avalanches, both physically and by producing microclimate which is not favorable to the formation of avalanches.

Avalanches in our country often cause casualties. Residents of mountain villages, hunters, mountaineers and skiers are most often the victims. Montenegro is characterized by the threat of avalanches to the roads and railways as the most important corridors run through mountain terrains.

**Storms and hurricanes** may also inflict severe damage to forest resources. Consequences resulting from the influence of edaphic factors on the forests are manifested through windthrows and windswept areas. Degree of damage depends on the type and speed of winds, direction of winds in respect to the forest, composition of the stand etc. Montenegro has not recorded severe damages caused by storms and hurricanes. The reasons are the existing edaphic factors in this area and relatively high stability of forest ecosystems with the presence of mainly natural stands.

**Drying of forests** has still not been thoroughly examined. Air pollution and so-called acid rains are believed to be the main sources of this phenomenon. On the basis of the researches conducted so far it may be concluded that the majority of acid precipitations are amassed in air masses coming to our country from the North-West after collecting pollutions from Europe. These phenomena are manifested through physiological weakening and drying of individual trees and groups of trees. In relation to that, the project of monitoring of this phenomenon has been launched on an international level whereby the health of forests on bioindicational points is constantly being monitored.

### III.2.1.3. ANALYSIS OF LEGAL REGULATIONS, INTERNATIONAL TREATIES AND BINDING CONVENTIONS IN THE FIELD OF PROTECTION OF FOREST FROM THE ASPECT OF THE STRATEGY FOR EMERGENCIES

Current legal regulations in the field of forestry are based on the principles that forests should be regenerated, preserved and used under terms and in a manner which ensures their permanent conservation and increase in their natural values and environmental functions, protection against harmful consequences which threaten these values and cultivation which ensures continued increase in accrual and yield. According to their function, forests are classified into: commercial forests, protective forests and forests of other purposes. Protective forests primarily serve to protect commercial and other facilities, land, settlements, springs, water courses etc. Protection of forests is defined as taking measures and actions in order to: conserve natural and work-created values of forests, prevent and remove harmful consequences of all biotic and abiotic factors which threaten the values and improve the current condition.

As it is aimed at protecting forests, the law prohibits: burning open fire in a forest or at a distance less than 100 meters from the forest outskirts, except in certain places and places anticipated for such activities in accordance with the regulations on fire protection; leaving and keeping objects in the forest that might cause forest fire or jeopardize environment; operation and construction of plants for mechanical processing of timber in the forest or at a distance less than 200 meters from the forest outskirts; devastation and clean cut of forests which are not anticipated in planning documentation as a regular type of forest regeneration; cutting and distribution of conifer trees during New Year, religious and other holidays; removal, relocation or damaging of signs signaling forests which reflect physical division of forests, as well as other signs pf information and prohibitions; use of seeds and plant material  without certificate of origin and health condition; pasturage, browse and pruning of twigs which is inconsistent with planning documents.

Law also prescribes that forests shall be protected against fire in compliance with annual Protection Plans adopted by the state administration body competent for forest management. Special measures for the prevention of fires such as construction of walls, provision on necessary quantities of water, construction of protection zones alongside roads, pruning of branches of coniferous trees which are close to the ground and other measures are anticipated for those forests that are extensively exposed to the fire threat. Obligation of establishment and continued maintenance of forest order has been imposed in order to prevent outbreaks and spread of fires and other natural disasters, harmful insects and plant diseases as well as to provide saplings in forests, protect soil against erosion and threatening of water springs.

If damage is caused to the forests by either physical or legal entities, the reparation of damages by a perpetrator is prescribed.

**List of current laws in the field of forestry and hunting important from the aspect of the strategy:**

**Forests Law** (Official Gazette of the Republic of Montenegro, number 55/00)

**Hunting Law (**Official Gazette of the Republic of Montenegro, number 47/99)

**Law on Protection of Plants against Disease and Pests** (Official Gazette of the Republic of Montenegro, numbers 4/92, 59/92, 17/92, 27/94)

Law on

**Law on Seeds and Plant Material** (Official Gazette of the Republic of Montenegro, number 39/42 and 59/92)

**Law on Protection of Species of Agricultural and Forest Plants** (Official Gazette of the FRY, number 28/2000)

**Law on Acknowledgement of Agricultural and Forest Plants** (Official Gazette of the Republic of Montenegro, number 12/98 and 37/02)

From the aspect of this strategy, in addition to national there are also international regulations governing forestry sector whose implementation contributes to the reduction of risk of natural disasters. They include:

- Agenda 21 (1992)
- The UN Framework Convention on Climate Changes (UNFCCC) (1992)

- Convention on Biodiversity (2001)
- Convention on Long-Term Air Pollution (1979)
- Resolution of the Ministerial conference of protection of forests (2003)
- Council Directive 43/92 on Conservation of Natural Habitats and Wild Fauna and Flora (1992)
- Council Directive 409/79 on the Conservation of Wild Birds (1979)
- Council Directive 2158/92 on the protection of the Community's forests against fire (1992)
- Council Directive 3528/86 on the protection of the Community's forests against atmospheric pollution (1986)

## PROTECTION MEASURES

**Protection measures** are preventive and direct measures aimed at preventing severe consequences or mitigation and recovery of damages inflicted to forest resources. Legal regulations in the field of forestry define protection measures and bearers of responsibility.

The Forest Protection Service operates throughout Montenegro within the framework of forestry institutions (the Ministry of Agriculture, Forestry and Water Management, Forests Administration, Biotechnical Institute). All social entities, legal and physical persons engaged in forest land activities are bound to implement and abide by prescribed measures.

Institutionalized capacity refers to the existence of protection services and monitoring and control services with permanent staff, technical strengthening and improvement.

Surveillance of border crossings is quite important as it prevents importation of contagious diseases and organisms that inflict harm to forest vegetation. The use of forest reproductive materials of domestic origin forms a solid ground for provision of healthy and resistant material needed for regeneration and growth of new forests.

Preventive measures and organizational, staff, technical and technological competency are very important for minimization of disaster risk.

Preventive measures for protection of forests include a broad range of activities such as provision of conditions for recognizing forest resources risks, establishment of the best protection mechanisms and implementation of anticipated activities.

Constant and correct implementation of preventive measures strengthens capacities of forest ecosystems, their health condition and natural resistance to certain risks.

Direct measures are aimed at mitigating consequences of hazards. They are usually more costly and complex than preventive measures.

## CONCLUSIONS AND RECOMMENDATIONS

- It is necessary to define national forestry policy and development strategy, while the existing legal regulations need to be harmonized with international regulations in this field which will ensure fulfillment of European standards of conservation of natural resources and principles of sustainable development.
- Advanced information systems (GIS) need to be integrally developed while advanced programs of monitoring over health conditions of forests need to be part of that system. The IDP service of forest protection (reporting, diagnoses, weather forecasts).
- Adequate plans for forest protection against all major hazards to forest resources need to be drafted in order to implement measures and activities aimed at preventing and mitigating harmful consequences.

- Consistent implementation of legal regulations and plans of forest management needs to be encouraged so as to reduce illegal acts in forests, usurpation of forest land, waste disposal etc.
- Program for education of expert staff needs to be implemented on order to apply the latest scientific and professional knowledge. Increased scientific and research activities in the field of forestry is also necessary. Employees in forestry need to be trained so as to be able to achieve high quality performance.
- Various campaigns need to be conducted particularly during increased fire risk with the aim of informing the public about the importance of forest resources and damages caused by negligent acts.

### III.2.2. BREAKDOWNS IN OIL AND OIL DERIVATIVES INSTALLATIONS DURING TRANSPORT, EXPLOSIONS, RADIOLOGICAL AND OTHER ACCIDENTS

#### III.2.2.1. MAJOR ACCIDENTS IN OIL AND OIL DERIVATIVES INSTALLATIONS

The following capacities are installed in the Port of Bar:

- 23 tanks for storing oil derivatives, with the capacity of 128.000 $m^3$
- 1 tank for storing natriumhydroxid with the capacity of 5.000 t and 1 tank for caustic soda, with the capacity of 5.000 $m^3$. Both tanks are stored to serve the Aluminum Plant` s needs
- 3 silos for cement, with the capacity of around 2.000 t for the use of *Dalmacija Cement*
- Alumina tank, with the capacity of 6.000 $m^3$

These data about installed capacities say enough about the size of potential catastrophes in cases of breakdowns caused by natural disasters, negligent acts or terrorist activities. Considering the fact that oil derivatives are easily flammable there is a high explosion risk in cases of oil plants breakdowns, as well the breakdown of surrounding tanks containing oil derivatives and chemical substances.

Explosion and inflammation of just one tank would make atmosphere in Bar and surrounding areas toxic to people and flora and fauna (CO, CO2, NOx, CHx, PAHs etc.) Accidents caused by potential successive breakdowns of other tanks would be extremely serious. Oil derivatives spills in the sea would leave disastrous consequences on an entire Montenegrin coast and cause air pollution because the sea currents progress from our coast to Croatia at the speed of few meters per second. One liter of oil of fuel may pollute (cover the surface of) 1 $km^2$.

Storage of these substances may cause disastrous consequences to population, flora and fauna.

Significant storage capacities are located in the Port of Bar (1 tank for natriumdioxide with the capacity of 5000 t, 1 tank for caustic soda with the capacity of 5000 $m^3$, 3 tanks for concentrated acetic acid with the capacity of around 2,500 $m^3$). Small storage capacities are situated in other commercial organizations.

Damage of reservoirs storing natriumhydroxide or caustic soda may have disastrous consequences for population, biotic community and sea aquarium as contact of NaOH with water creates explosive exoteric reaction, but if mixed with acids the reaction is even more explosive and followed by release of alkaline vapor capable of causing immediate death of those inhaling it, inflicting severe burns, blindness and other severe consequences to population` s health.

A good example is a breakdown that occurred in Bar in 1998 after empty tank for NaOH stored a so-called *white oil* (mineral coal used for manufacturing motor oils and other products). Due to negligence a small amount of hydroxide remained in the tank, which was enough to completely melt ceiling of the tank during decanting of oil and disperse the contents around the surroundings. This occurrence was driven by heat. If the entire contents had leaked from the tank the population in Bar would have suffered tremendous consequences.

The breakdown of tanks storing acetic acid (even though this acid is the weakest of all) would result in quick evaporation of acid and toxic gasses that might cause death or severe impairment of lungs of the nearest workers and destroy life in land and sea.

The aquarium would suffer consequences from the breakdown of tanks storing basic oil.

Apart from installed storage capacities, transshipment and decanting of other dangerous substances such as various acids and chlorine compounds may cause disastrous health and environmental consequences in cases of accidents.

In addition to the danger from installed capacities, heavy pollutions through sea aquarium may be caused by tank breakdowns in Montenegro waters. Oil and crude oil may cause severe consequences biotic community and water ecosystem especially if they are retained in water ecosystem for a couple of years thus resulting in pollution and disfunction of beaches.

**In Lipci (the Boka Bay):**

- 8 tanks for oil derivatives with the capacity of 22.000 $m^3$ have been installed. Breakdowns of these tanks would possibly result in human casualties and severely devastate water ecosystem of the Boka Bay (the largest fjord in Europe, placed under UNESCO protection). As it is a closed system, the overall effects would cause serious environmental consequences.

**In Bijelo Polje:**

- 8 tanks for oil derivatives with capacity of 28.000 t have been installed
- Military installations contain 6-8 tanks with around 22.000 $m^3$ of oil derivatives stored

Potential explosion of any of these tanks would possibly cause successive reaction of other installations, initiate severe fires and emission of toxic gasses that may have lethal effect on people and biotic community in Bijelo Polje and surroundings, pollute the Lim River, destroy railway and jeopardize Belgrade-Bar highway.

Potential disasters caused by oil derivatives may be expected in possible crash of tank trucks in Sozina, Budoš or Lokve (nearby Berane) tunnels because inflammation of fuel or oil would release extremely high heat with enormous amount of toxic gasses that could virtually immediately kill or severely poison thousands of people who would be in their cars in the tunnel at that moment. During last summer, approximately 12,000 vehicles per day drove through the Sozina tunnel.

There is a great likelihood of disasters caused by oil derivatives in both Montenegrin airports (Podgorica and Tivat) as they are in possession of the kerosene tanks, transportation service and installations. An example of a fortunately escaped disaster is related to the Tivat airport ten years ago when the kerosene tank leaked thus extensively moistening the surrounding soil, nearby water channel which polluted part of the sea. Fortunately, accident was discovered on time which prevented inflammation that would have disastrousconsequences on the airport area.

Large-scale oil derivatives disasters may occur in city centers during transportation of fuel or crashes of cargo trains. These accidents happen very quickly so in most of the cases there is no much space for undertaking preventive measures to avoid disastrous consequences, especially if disaster is caused by fuel or light oil derivatives.

### III.2.2.2. BREAKDOWNS DURING TRANSPORTATION, STORAGE OR USE OF CHEMICAL, TOXIC, EXPLOSIVE OR RADIOACTIVE SUBSTANCES

The previous chapter described the example of possible effects of breakdowns during transportation of oil derivatives in our tunnels, rail and roads. The same may happen on critical points during transportation of poisonous and hazardous substances such as: ammonia, various hydroxides, phosphorous or sulfur acid, chlorine and chlorine derivatives, perchlorates, ethylene, propane butane gas, various benzene derivatives, cyanide compounds, pesticides, and many other chemical substances-poisons that are used as a raw material in basic industry or represent a finished product intended for export via port of Bar and Zelenika.

Emergency might have been caused by a train accident on 22 February 2005, nearby train station Lutovo, when cargo train encountered large amounts of avalanche which caused tumbling of a locomotive into a precipice just 400-500 meters away form the Morača river. Namely, transformer contained 3.720 kg of transformer oil whose pouring out would extensively pollute the Morača river and Zagorič water zone. As the terrain was difficult to access, the Railway Company of Montenegro engaged the Gorska Rescue Service from Nikšić in order to pull out transformer oil from the locomotive.

It is generally quite difficult to exactly define the course of potential effects as each dangerous substance has its own, particular features which determine level of danger and manner of prevention of disastrous consequences. It is clear that consequences of these accidents would certainly be rather severe, followed by considerable number of casualties.

Significant preventive measure for prevention and mitigation of such breakdowns is a strict surveillance over transportation of dangerous chemical substances in Montenegro, correct labeling of cargo, provision of escort to hazardous cargo, adjustment of transportation speed and loading and reloading of cargo when there is a high likelihood that accidents may happen. Due to all this, it is necessary to accelerate adoption of the Law on Chemicals, including the POP chemicals in compliance with the Rotterdam Convention.

Particular surveillance and control should be exercised on critical points in transportation, such as tunnels, urban areas and protected areas.

### *III.2.2.3. EXPLOSIONS*

- In addition to already mentioned causes of great explosions in facilities for storage of oil derivatives, there are other potential causes of great explosions in Montenegro as well, such as: the factory for production of anti-armor missiles *19 Decembar,* warehouses of commercial explosives of the Bauxite Mine in Nikšić, company *Booster* from Nikšić for punch riveting metals by means of explosives, warehouses of commercial explosives in companies engaged in blasting activities in mines and quarries, factory that manufactures perchlorates (former Mont-Heming), and military warehouses storing explosives. There is also possibility of explosion in military factory *Arsenal* in Tivat due to activities concerning examination of explosives and filling of torpedo. In this case it is necessary to establish the quantity of dynamite and other explosions and explosive compounds stored.
- Tanks containing propane butane gas may cause explosions during transportation. Critical points in handling them are decanting in the port of Bar or transportation with wagon tank trucks from Serbia as well as large tank located nearby Aluminum Plant.
- In addition to the abovementioned potential causes of large scale explosions, explosions may occur in the Steel Factory in Nikšić if explosives, old weapon or large amount of water are placed into the electric arc furnace either by negligence or intentionally. These breakdowns have already happened before; they took away human lives and caused immense property and commercial damage. Preventive measure should be rigorous control of the import of old iron used for filling the Iron Factory stove and control of each batch of stove filling.

### III. 2.2.4. POLLUTION OF DRINKING WATER SOURCES

Terrains in Montenegro are dominantly made of karst which is extremely sensitive to pollution of ground waters or water sources, with the possibility of permanent pollution in one of the following ways:

- Pollution may be a consequence of intensive use of pesticides in agriculture in zones of water sources or areas of sanitary protection of sources. Preventive measures may include monitoring of environmental quality and all activities in zones of water sources and protective zones. If water source is polluted, citizens' health would suffer major

consequences, while protection measures would call for extensive funds for the construction of water treatment plant or discovery of new source of water supply.

- Pollution of water sources may be caused by unintentional accident in water source zone or zones of protection such as tumbling down of a train or truck transporting dangerous chemical substances, oil derivatives or other chemical substances that will directly pollute water source. Preventive measure is relocation of roads from water source and sanitary zones for water supply. Two years ago a composition of the wagon carrying anthracite bitumen used for manufacturing anodes plunged into nearby Zagorič water source, but quick intevention and remouval of a damaged layer of soil prevented pollution of ground water. Solid substances that hardly dissolve were dispersed in this accident, but in cases of pouring out of some toxic liquid substances water source and water supply in Podgorica would suffer tremendous consequences.
- The third type of pollution is penetration of waste waters from sewage into the pipes for drinking water which may cause excessive poisoning and epidemics. This may be a consequence of pipe breakages following tectonic movements or accidental breakdowns.
- Purposeful, terrorist poisoning of water sources with some highly toxic or biologically dangerous substance is not be disregarded as it is one of the most dangerous possibilities while population may suffer disastrous consequences in this case.

Preventive measures in these cases are: armed guard services should provide security of water sources and protection zones 24 hours a day, competent water management services should be immediately informed of breakdowns and terrorist acts. In addition, a well organized service for taking measures of cleaning polluted soil should be established, along with a laboratory for fast and reliable identification of toxic substances. Therefore, construction of a pool with biologic indicators – fish (salmonides) and sensor monitoring of their perishing might be one of precaution measures. Notification of possible fish perishing may be received by Water Supply Company, emergency service for alarming or notification and/or other authorized services which may immediately shut down water supply to citizens until discovering the reason for fish (bio-indicators) perishing. Such biotest is at this point possessed only by the Water Company in Herceg-Novi.

Another measure for prevention of mass poisoning with drinking water is existence of alternative water source with the possibility of quick transfer from one source to another. The third measure is sense monitoring of the basic indicators of water quality (Ph, permeability, redox potential, UV extinction on 254 nm, temperature and oxygen) in Water Company, emergency service for notification and alarm, and in some other authorized points. Each change in quality should activate alarm for shutting down water.

Systematic examination of quantity and quality of surface and ground waters is conducted on the basis a program drafted by the Ministry of Agriculture, Forestry and Water Management and implemented by the Hydrometeorological Institute (Article 30, the Waters Law). Program contains a network of stations which encompasses 13 water courses with 13 profiles, 3 lakes with 11 profiles, coastal sea with 19 locations and ground waters in the Zeta plain in 5 villages.

As additional funding has not been received for the implementation of this program, the Hydrometeorological Institute implemented part of the program within its capacities which covered all measuring stations, but with a reduced number of parameters. To be more precise, 18 parameters were monitored instead of 41 which results in incomplete, but still useful picture about the condition of waters in Montenegro. Overview of pollution level of surface water courses and natural accumulations – lakes, coastal sea and ground waters is announced on the basis of reports released by the Hydrometeorological Institute

### III.2.2.5. CHEMICAL AND TOXIC ACCIDENTS

Potential harmful chemical effects depend on the type of a chemical substance, its physiochemical and toxicological attributes and reaction in a given environment. Therefore, it is necessary to compile a data base of chemical and dangerous substances in Montenegro, a record of locations and quantity of the substances. Such data bases should contain information about toxicity of

chemical substances and emergency measures for reanimation, detoxification and recovery of the area. However, until now there has been no such information in Montenegro.

The number and use of chemical substances for various purposes in modern life has considerably increased in recent years. Around ten millions of chemical compounds have been recorded throughout world until now and a certain number of them may result in increase in health, environmental and working surroundings hazards. Poisonous and dangerous chemical substances forming part of these compounds are distributed and regularly used in majority of world countries, including ours.

Recently the World has recognized the threat of use of biological and chemical weapons for mass destruction in terrorist acts. Current estimates reveal that Montenegro is less jeopardized that more developed countries in world.

Individual incidents caused by dangerous chemical substances are possible in Montenegro. The Health Institute has no knowledge of whether the control, supply, transportation, storage and distribution systems and their precursors have been established and whether data base exists.

In addition to traditional chemical substances used as poison gases, as shown in the table below, a multitude of new chemical substances may be used as poison gas for mass destruction of people and permanent environmental pollution, such as: PCDDs, PCDFs, microtoxins, and other natural and synthetic toxins. Apart from the threat posed by the use of poison gases which is unlikely during peacetime, another threat is posed by accidents in chemical industry (Bopal, Sevesso and others) or breakdowns during transportation of dangerous substances, particularly poisons of I and II groups or group of cancerogenous substances. In the event of chemical accidents, the most important is to quickly identify a chemical substance and to be familiar with its toxicological attributes and emergency measures to be taken in order to prevent and mitigate consequences. Such procedure calls for highly specialized staff - toxicological chemistry specialist and clinical toxicologist for undertaking measures of treatment of the poisoned as well as adequate equipment for quick identification of chemical substance.

Unfortunately, there is no a single doctor-clinical toxicologist in Montenegro at this point. Until now the data base of toxic substances was located in National Toxicology Center in VMA[6] in Belgrade. Such base needs to be compiled in Montenegro, along with the establishment of appropriate organization in cases of chemical accidents.

Dangerous chemical substances and their precursors that may be used as chemical weapons are classified in three lists as follows:

| **List 1** | **List 2** | **List 3** |
|---|---|---|
| 1. O-Alkyl phosphonofluoridates | 1. Amiton | 1. Phosgene |
| 2. 0-Alkil phosphoramidocyanidates | 2. PFIB | 2. Cyanogen chloride |
| 3. 0-Alkil phosphonothiolates | | 3. Hydrogen cyanide |
| 4. Sulfur mustards | | 4. Chloropicrin |
| 5. Lewisites | | |
| 6. Nitrogen mustards | | |
| 7. Saxitoxin | | |
| 8. Ricin | | |

[6] VMA – Vojno Medicinski Centar – Military Medical Center

The most common chemical agents used as chemical weapons may be classified according to their purpose:

1. Nerve agents (Sarin, Tabun, Soman, VX9)
2. Blister agents (sulfur and nitrogen mustards)
3. Choking agents (Phosgene)
4. Blood agents (Hydrogen cyanide)
5. Tear gases
6. Vomiting agents
7. Some herbicides, particularly those containing Arsenic

Special services and units should be established as part of military or police (as it was done in the majority of countries) with adequate staff, space and equipment in order to prevent and control these threats.

### *III. 2.2.6. RADIOLOGICAL ACCIDENTS*

The level of radioactive contamination of environment is determined in compliance with the *Decision on Systematic Testing of the Radionuclide Contents in Environment which* was published in the Official Gazette of the FRY, number 45/97 based on Law on Protection against Ionizing Radiation, Official Gazette of the FRY, number 46/96. Testing the level of external radiation and radionuclide contents in environment is carried out by measuring specific activities of radionuclide in samples taken from the environment. These types of testing in Montenegro were carried out by the Health Protection Institute (now Public Health Institute) until 2003 when testing ceased probably due to the lack of funds. The systematic testings of this kind need to be carried out, but it still remains unclear whether someone actually does that.

Hazard of radioactive contamination is quite realistic which is why it must be under constant control. In the near past we were witnesses to radioactive contamination of environment in majority of European countries after explosion of nuclear reactor in Chernobyl which had and still has enormous impact. The likelihood of new breakdowns in nuclear plants (NP) is relatively high as the number of nuclear plants has increased in Europe and worldwide over the last couple years. As for our direct vicinity, there are 2 NPs in Bulgaria, 1 NP in Romania and Slovenia, 5 NPs in France, 9 NPs in Germany, 1 NP in Slovakia, 2 NPs in the Czech Republic, 2 (according to some sources 3) NPs in Italy etc. It should be mentioned that 66 NPs operate in the USA. Potential technological breakdowns in reactors and other capacities or potential terrorist attacks to nuclear plants also pose a threat. Each breakdown of this kind results in large-scale disasters since air, water, biological substances and soil are polluted by either short-living (iodine and other) or long-living radionuclide (caesium, strontium, plutonium) that build into biological cycle – a food chain thus permanently endangering human lives. Continued monitoring of absorbed dose of gamma radiation aims at timely establishing whether there has been an increase in the dose of gamma radiation in air and warning citizens (by informing and alarming them) about the need to evacuate from open zones.

Potential wars or technological accidents caused by nuclear weapon or on nuclear weapon pose another threat of radioactive contamination. We are witnesses to the breakdown of the Russian nuclear submarine a few years ago which after all did not result in environmental consequences. Breakdowns of this kind might jeopardize and contaminate vast water expanse and have disastrous consequences to the sea biotic community. Unfortunately, such breakdown may occur in ports too which would jeopardize population.

We must not forget the use of nuclear weapon in wars when consequences of nuclear attack would be similar or even worse than those in Hiroshima and Nagasaki. In that case humans and other living beings would die of radioactive strike, while environment would suffer secondary contamination.

Permanent disposals of used nuclear fuels and other highly active nuclear waste pose another threat of possible radioactive contamination. The source of contamination in this case may be terrorist attacks, earthquake or some other natural disaster or technological accident.

Another threat is posed by *orphan* (forgotten or not recorded) sources which may radiate people or environment because they are not officially recorded. Therefore, a cadastre with all types of sources of radiations must be established and placed under constant control.

Another source of radioactive contamination might be *dirty bombs* which are not explosive but are made from radioactive material capable of polluting large areas. Therefore it is necessary to set up the safety control of dose measuring in all border crossings which would monitor citizens, vehicles and imported goods.

Cosmic activities (eruptions on the Sun) or fall of radioactive meteorites may increase radioactive radiation.

Radioactive material may be alpha, beta or gamma emitter or radiate combined elements. Protection systems for these radiations are not the same which is why quick identification of the type of radiation, that is radionuclide is extremely important. It is also necessary to provide means for decontamination, disposals for contaminated material and adequate shelters in case of nuclear attack.

Since 1998 the Center for Environmental and Toxic Examinations of Montenegro has been conducting systematic examination of the contents of radionuclide in Montenegro in line with the Program drafted by the Ministry of Environmental Protection and Physical Planning. The results are reported to competent institutions.

### III. 2.2.7. COMBINED EFFECTS: TERRORISM AND LARGE-SCALE TOXIC, RADIOLOGICAL AND BIOLOGICAL EFFECTS

Potential biological and radiological diversions, the first being far more dangerous than the latter, pose major threat due to insufficient development of virus diagnostics in Montenegro. In addition, the methodology of determining microbiological contamination takes a lot of time which is why the possibility of transmission of contamination is quite high. Preventive measure is establishment of Virusology Service with the most advanced, fast tests for early diagnosis of biological contamination.

### *III. 2.2.8. OTHER TYPES OF TECHNICAL AND TECHNIOLOGICAL BREAKDOWNS*

#### Breakdowns in industrial facilities

Breakdowns in industrial facilities are treated from the aspect of malfunction or accident occurring in power energy system and power generation technological complexes as well as the aspect of breakdowns in power pipelines in major manufacturing energy facilities which may threaten the safety of people and cause enormous property damage due to the breakdown itself and interruption of production process.

Major industrial facilities in Montenegro to be analyzed from the aspect of the possibility of occurrence of technical and technological accidents are: Steel Factory Nikšić, pipelines in hydro power plant Perućica Nikšić, the Aluminum Plant Podgorica, the Port of Bar, the Bijela Shipyard, Technical Overhaul Facility in Tivat, Bokeljka (Kotor), Rivijera (Kotor), Ulcinj Salt Pans, Crops silos (Bar, Spuž, Nikšić, Obod Cetinje), Radoje Dakić (Podgorica), 4. Novembar (Mojkovac), Vunko (Bijelo Polje), Imako, Beranka, Polimka I Polieks (Berane).

#### Mine Accidents

The following accidents threaten to occur in the existing mines: explosions in warehouses storing explosives and explosive devices for blasting operations, tumbling down of operating and finished slopes in surface exploitation, explosions of methane and coal dust in ground coal mines, water outbursts in mine openings, floods in open pits, fires in coal mines of ground exploitations,

outbursts of poisonous and suffocating gasses in mine openings, breakdowns in ventilation systems, uncontrolled fluid eruptions during borehole drilling etc.

There are two mines with surface and ground exploitation in Montenegro:

- The Pljevlja Coal Mine, with surface exploitation and
- The Nikšić Bauxite Mine, with surface and ground exploitation, as well as Leaf and Zink Mines *Šuplja Stijena, Pljevlja, Brskovo* Mojkovac which are not operational at this moment.

These accidents are possible and they may threaten human lives and cause major property damage.

### *III. ASSESSMENT OF THE ACCIDENTS IMPACT ON ENVIRONMENT*

Assessment of the incident, accident or crash risk and danger of pollution of environment includes identification of potential threats, determination of the mechanisms of their occurrence and development and analysis of their potential consequences. Preparedness for potential incident, accident or crash include employment of protection measures in physical planning, design, construction, work process, waste disposal and conservation, control of use and maintenance, as well as other measures undertaken in the course of performance of dangerous activities which prevent or reduce the likelihood of accidental situations and their potential consequences.

Mitigation of accidental consequences includes a set of measures and procedures for monitoring of the post-accident condition, regeneration of degraded environment and removal of threat of another similar situation.

After considering all technological processes in the **Steel Factory Nikšić** from the aspect of breakdowns, i.e. threats to human lives and major environmental breakdowns, it may be concluded that there exists a set of dangerous facilities and plants that may give rise to excessive circumstances.

Bearing in mind the fact that a set of facilities is susceptible to excessive technological situations, breakdowns, diversions and natural disasters, they may be classified as follows:

1. Breakdown in tank space with storage capacity of 4.500 tons; breakdown in the tank area may pollute entire factory and river bed of Bistrica river downstream of the Steel Factory, as well as river beds of Zeta and Morača rivers, extending to the Skadar Lake.
2. Excessive situations or explosions in the warehouse storing liquid oil gas (PB gas) with the capacity of 240 tons, which may cause devastation of facilities within the Steel Factory, the main power transformer station of 110 kV, Nikšić and part of residential area Humci and Rudo Polje.
3. Breakdowns in warehouse tanks containing acids and bases with storage capacity of 20 and 15 tons of hydrochloric acid and natriumhydroxide, caused by penetration of these chemical substances into the soil around Energana Steel Factory, Nikšić.
4. Potential explosions in power arc facilities in Steel Factory, which might cause dozens of casualties due to spilling of liquid metal.
5. Possibility of explosion and large-scale fires in distribution networks of explosive gases in the Steel Factory such as propane butane and acetylene.

The plant generates all kinds of waste, including PCB condesators, explosives and car batteries and stores them all in its area. Coal ash (10.000-12.000 tons per year), slag, old iron, sludge from the waste water treatment facilities, dust from baggy filters and sand for molding (some 9.100 tons per year) are disposed in the waste area located 3 kilometers from the Steel Factory. Waste area which has been used for 50 years covers 12 hectares and is 30 meters. On the basis of a lease agreement, the Austrian company Frany Loshing implements a pilot project of waste recycling.

**The Aluminum Plant – Podgorica** uses heavy and light fuels and caustic soda as main raw material in its manufacturing process. Heavy and light fuels are transported by tank cars from the Port of Bar. Fuel is transferred to the storage tanks through the set of ground pipelines. Two tanks for storage of hard fuels with the volume of 2000 $m^3$ and 1000 $m^3$ are located there. Caustic soda is also delivered by tank cars to the zone designated for delivery of caustic soda through a range of ground pipelines. There are two tanks of 1.300 $m^3$ ad 170 $m^3$ volume. Caustic soda is brought by ships and further pumped into two tanks of 3.260 $m^3$ (5,000 tons) capacity through the system of pipes.

Unloading facilities, storage tanks and decanting pumps are equipped with usual additional equipment including secondary sandy covering in tanks. These zones are inadequately maintained which is why they may exert negative influence on soil and ground waters. Montenegro does not have legal regulations related to the storage of fuel and caustic soda.

Power failures in the Aluminum Plant (power outage for longer period of time) denies opportunity to control leakage of manufacturing solutions and suspensions (soda solutions, masut) from the plant into the sewage system (the system is open – use of industrial and drinking water) and further into the waste waters channels of Aluminum Plant into the Morača river and Skadar Lake.

On 16 June 2004, conditions that might have resulted in emergency were created in Aluminum Plant due to the breakdown in autoclave number 15 (pressure vessel) followed by leakage of dilute solution into the industrial waters channel (open system of cooling with water) through the system of cooling heat exchangers.

Other dangerous substances in Aluminum Plant are polychlorinated biphenyls (PCB). Transformer oils containing PCB were earlier used in Aluminum Plant. There is a specially designated area for disposal of waste containing PCB (extracted from transformers). That area (which is a temporary waste area) at this point contains 50 $m^3$ of waste transformer oil with PCB. There is a number of operational transformers using oil with PCB in Aluminum Plant. Incidents occurred in the Plant as transformer exploded causing discharge of oil into the soil.

The main waste of Aluminum Plant is red sludge which is discharged in the amount of 350.000-420.000 tons per year (7.6% is dry sediment) and which is considered dangerous waste due to the increased pH level; worn out cathode cover with around 7.000 tons per year, PCB and other industrial waste such as sludge from primary production, fire-proof brick and materials, clinker, coal froth, worn out cathode covering, PCB, anode residues, diatomic and active soil, paints waste etc.

**Red sludge** is disposed in two basins. The Basin A covers the area of 170.000 $m^2$ (the height of deposited sludge is estimated at 20 meters) was constructed on the basis of wet disposal of red sludge technology. Red sludge with low presence of solid particles was disposed in this basin. There existed no possibility of infiltration of alkaline waters as the basin is inlaid with impermeable material. Basin A with storage capacity of 3.5 millions tons is not operational any longer.

Basin B, covering 220.000 $m^2$, was constructed for disposal of dry sludge without inlaying basin with impermeable material. Technological problems forced the Plant to reuse wet disposal of red sludge technology which resulted in an increase of pH level in red sludge. Around 4 million of red sludge is placed in this, now operating basin.

Solid waste dumping site which does not meet the standards is located next to Basin B. Worn out cathode covering, coal froth, active soil, fire proof materials, foundry and clinker*, salt cake* and other waste are disposed in it. This dumpsite poses a threat of pollution of ground waters due to the effect of atmospherilia.

The Aluminum Plant built four bunkers for storage of hazardous waste from technological process. However, drainage channel for atmospheric waters and treatment plants have not been constructed which is why ground waters suffer pollution.

**Thermal Power Plant Pljevlja** may be considered from the aspect of incidental situations which may have negative environmental impact:

- Breakdown overflowing of waste waters in a dredge station are possible, which might cause outpouring of waters into the Vežišnica river

- Rupture of pipelines containing recurring waters in recirculation from the dumpsite
- Outpouring of acids from the facility *Chemical Processing of Water* because of their high alkaline attributes, that is high pH level of waste waters
- Damage, that is incidental situation on electric filtering facility results in excessive emission of particles in the form of flue gases whose intensity varies with the degree of reduction of dust removal coefficient. Consequences in these circumstances depend on the length of damage duration and meteorological conditions at that time.
- Leakage of masut during tank and installations breakdowns
- Self-combustion of coal in dumpsites

The Thermal Power Plant Pljevlja annually deposits around 280.000 tons of ash and clinker (which are not classified as dangerous waste according to the European list) in Maljevac dumpsite. Still, this type of waste requires particular management.

**Coal Mine Pljevlja AD** uses dangerous substances in its operations (substances which have toxic, oxidations, explosive, environmentally toxic, combustible, self- combustible and other effects threatening environment and life and health condition of humans) in quantities far less than those listed in the List of Dangerous Substances which requires obligatory assessment of crash threat, out of which the following is used:

- Explosives (explosive devices for blasting operations)
- Combustible liquids (motor fuel, lubricants)
- Combustible and compressed gases (acethylene etc)
- Small quantities of toxic, oxidizing, self-combustible and other substances used in operations

Potential accidents and facilities that may be involved in accidents in Coal Mine Pljevlja are:

- Fires of all categories
- Storage, transportation and handling of explosive devices
- Storage, transportation and handling of diesel fuels and lubricants (5 tanks with 50 $m^3$capacity)
- Mining and shaking of soil caused by blasting operations
- Landslides on open pits and disposal sites (interior disposal sites of surface mine Potrlica)
- Water penetration from the Ćehotina river into the surface mine Potrlica and floods and torrents caused by heavy rains
- Alarming circumstances during air pollution during stable atmosphere in winter conditions
- Sabotages and diversions

The Coal mine Pljevlja uses external dumping site Jagnjilo (which covers 150 hectares) for disposal of coal overburden layers of which there is 7.5 million per year.

**Small and Middle Industry Waste**

The Bijela Shipyard annually produces around 1.000 t of dangerous waste as a result of ship sand blasting. The waste is disposed in the area of the company. Significant amount of this type of waste is generated in the Overhaul Facility in Tivat (*Arsenal)* which consigned a part of its capacities to a private company engaged in the same business activities (ships overhaul). The waste is disposed within the company's area.

The Electrode Factory in Plužine generates 25-27 tons of hazardous waste per year which is disposed within the plant's area. Significant amount of waste used to be disposed in communal dumpsite.

Flotation waste rock dump site of former *Brskovo Mine* in Mojkovac is located directly alongside the right bank of the Tara river in the zone encompassed by DUP[7] and GUP[8] of Mojkovac. This facility made one technological unit with flotation capacities and waste water treatment plant. It was designed and developed in three phases: the first one extending to the elevation of 801 mnm, the second one to 805 mnm, and the third one (final) to 807,5 mnm. It covers the area of 18 hectares with total volume of 2 millions $m^3$.

Lead and Zink Mine has not operated since 1991. The deposited arid land, that is arid land in its entirety, threatens environment which is why the Ministry of Environmental Protection and Physical Planning has agreed on preparation of documentation for recovery and recultivation together with the University of Montenegro (the Faculty of Civil Engineering), in accordance with prescribed procedure. At the end of 2004, the Faculty of Civil Engineering submitted the Main Project *Improvement and Recultivation of waste rock dumpsite of Lead and Zink Mine in Mojkovac,* whose technical control was finalized in April 2005.

This created conditions for implementation of the first phase of works on recovery and recultivation of waste rock dumpsites for the first time in order to solve this issue in Mojkovac and Montenegro as a whole adequately and professionally. Since funds necessary for the implementation of the project exceed financial capacities of Montenegro, the Ministry has undertaken specific activities aimed at obtaining donor funding.

### *III. 2.2.10. LEGAL REGULATIONS*

***Field: Thermal Power Plants and Pressure Vessels***

- Rulebook on Protection at Work and Technical Measures for Developers of Acetylene and Acetylene Stations (Official Gazette of the SFRY, numbers 6/67, 27/67 and 29/67)
- Rulebook on Construction of Plant for Combustible Liquids and Storage and Decanting of Combustible Liquids (Official Gazette of the SFRY, numbers 20/71 and 23/71)
- Rulebook on Pipeline Transportation of Gas and Liquid Hydrocarbon (Official Gazette of the FRY, number 29/27)
- Law on Explosive Materials, Combustible Liquids and Gases (Official Gazette of the Montenegro, numbers 44/76, 49/76, 34/86, 11/88)
- Rulebook on Technical Norms for Pumps and Compressors (Official Gazette of the SFRY, number 32/74)
- Law on Basic Safety of Transport through Oil Lines and Gas Lines (Official Gazette of the SFRY, numbers 64/73)
- Rulebook on Construction of Facilities for Liquid Oil Gas and Storage and Decanting of Liquid Oil Gas (Official Gazette of the SFRY, number 24/71)
- Rulebook on Construction of Stations for Motor Fuel Supply and Storage and Decanting of Motor Fuel (Official Gazette of the SFRY, number 27/91)
- Rulebook on Technical Regulations for Fire and Explosion Protection during Cleaning of Vessels for Combustible Liquids (Official Gazette of the SFRY, numbers 44/83 and 60/86)
- Rulebook on Technical Regulations for Design, Construction, Operation and Maintenance of Gas Boilers (Official Gazette of the SFRY, numbers 10/90 and 52/90)
- Rulebook on Technical Regulations for Installation of Stable Pressure Vessels for Liquid Atmospheric Gases (Official Gazette of the SFRY, number 39/88)
- Rulebook on Technical Norms for Stable Pressure Vessels for Liquid Atmospheric Gases (Official Gazette of the SFRY, number 9/86)

[7] DUP – Detailed Urban Plan
[8] GUP – General Plan

- Rulebook on Technical Norms for Installation of Stable Pressure Vessels for Liquid Carbon Dioxide (Official Gazette of the SFRY, number 39/90)
- Rulebook on Technical Regulations for Testing and Examination of Stable Pressure Vessels for Liquid Carbon Dioxide (Official Gazette of the SFRY, number 76/90)
- Rulebook on Technical Norms for Mobile Closed Vessels for Compressed, Liquid and Pressured Gases (Official Gazette of the SFRY, numbers 25/80, 9/86 and Official Gazette of the FRY numbers 21/94, 56/95 and 1/03)
- Rulebook on Technical Norms for Stable Pressure Vessels
- Rulebook on Technical Norms for Pipelines for Gas Oxygen (Official Gazette of the SFRY, number 52/90)
- Rulebook on Technical Regulations for Cleaning and Grease Removing in Oxygen Equipment (Official Gazette of the SFRY, number 74/90)
- Standards: JUS.M.E., JUS.M.Z., JUS.C.T. and JUS.B.H.

**Mining Industry:**

- The Mining Law (Official Gazette of the SFRY, number 28/93)
- Rulebook on Technical Regulations for Ground Coal Exploitation
- Rulebook for Power Facilities, Devices and Installations in Blasting Operations in Ground Exploitation
- Rulebook on Handling Explosive Devices in Blasting Operations
- Rulebook on Construction of Storages of Explosive Substances in Mine Openings of Ground Exploitation of Minerals

**Other Areas:**

- Law on Health Safety of Food and Objects of General Use (Official Gazette of the SFRY, number 53/91)
- Law on Sampling Methods (Official Gazette of the SFRY, number 29/83)
- Rulebook on Conditions concerning Health Safety of General Use Objects which may be Distributed (Official Gazette of the SFRY, number 26/83, 61/84, 56/86, 50/89)
- Rulebook on the Amount of Pesticides, Metals and Metalloids and other Poisonous Substances which may be found in Food (Official Gazette of the FRY, numbers 5/92, 11/92, 32/2002)
- Rulebook on Conditions concerning Health Safety of Diet Food that may be Distributed (Official Gazette of the SFRY, number 4/85, 70/86 and 69/91)
- Rulebook on Quality of Mineral Water (Official Gazette of the FRY, number 45/93)
- Rulebook on the Amount of Harmful Substances and Ingredients in Animal Feed (Official Gazette of the SFRY, number 2/90)
- Rulebook on Quality and other Requirements for Animal Feed (Official Gazette of the FRY, number 20/2000)
- Rulebook on Quality and Conditions for the Use of Additives in Food and other Requirements concerning Additives and their Mixtures (Official Gazette of the FRY, number 56/2003)
- Rulebook on Hygienic Quality of Drinking Water (Official Gazette of the FRY, number 42/98)
- Rulebook on Requirements to be Met by Legal Persons Conducting Certain Type of Quality of Water Testing (Official Gazette of the FRY, number 10/97)

- Rulebook on Quality of Waste Waters and Manner of their Discharge into Public Sewage and Natural Recipient (Official Gazette of the FRY, number 10/97)
- Decree on Classification and Categorization of Waters (Official Gazette of the Republic of Montenegro, number 14/96)
- Rulebook on Allowed Quantities of Hazardous and Harmful Substances in Soil and their Testing Methods (Official Gazette of the Republic of Montenegro, number 18/97)
- Rulebook on Conditions concerning Professional Staff, Premises and Equipment to be Met by Health and other Organizations that Conduct Analysis and Superanalysis of Food and Objects of General Use (Official Gazette of the FRY, number 4/92)
- Rulebook on Methods for Pesticide Testing (Official Gazette of the FRY, number 63/2001)
- Pesticides in Agriculture and Forestry in Serbia and Montenegro, 15 revised and amended edition, Society for Plants Protection of Serbia, January 2004
- Rulebook on Documents to be submitted along with the Application for Issuance of Permits for Import, Export and Transit of Waste (Official Gazette of the FRY, number 69/99)
- Law on Protection of Air against Pollution (Official Gazette of the SFRY, number 14/80)
- Rulebook on Allowed Concentration of Harmful Substances in Air (Official Gazette of the Republic of Montenegro, number 4/82)
- Rulebook on Methodology of Testing, Deadlines and Manner of Releasing Results of Monitoring of Harmful Substances in Air (Official Gazette of the Republic of Montenegro, number 4/82)
- Rulebook on Deadlines and Methods of Measuring Quality and Quantity of Discharged Harmful Substances into Air in Sources of Pollution (Official Gazette of the Republic of Montenegro, number 4/82)
- Rulebook on Emission of Pollution Substances into Air (Official Gazette of the Republic of Montenegro, number 25/2001)
- Rulebook on Limited Values of emission, Manner and Deadlines for Measuring and Recording Data (Official Gazette of the Republic of Serbia, July 1997)
- Maximum Allowed Presence of Harmful Gases, Vapor and Aerosols in the Atmosphere of Working Premises and Sites (JUS, Z.BO.001, 1991)
- Law on Protection against Ionic Radiation (Official Gazette of the FRY, number 46/96)
- Decision on Systematic Testing of the Contents of Radionuclide in Environment, Official Gazette number 4597
- Rulebook on MDK of Radionuclide in Environment and Manner of Contaminating
- Law on Production and Distribution of Poisonous Substances, with accompanying rulebooks (Official Gazette of the Republic FRY, number 15/95)

The majority of these laws were adopted in the FRY, but they remain in use until adoption of new laws and by-laws.

In addition to legal regulations, Center for Ecotoxicological Research of Montenegro (CETI) possesses all standard methods for analyses of toxic substances such as EPA method, ASTM, NIOSCH, all ISO standards applied to the methods, standard methods for analysis of air samples and hazardous waste and radiation. CETI has a list of all conventions and protocols in its area and all EC Directives such as: Water Framework Directive, Air Framework Directive, the Stockholm Convention, the Basel Convention, the Rotterdam Convention, the Barcelona Convention and others.

### *III. 2.3. MAJOR TRAFFIC ACCIDENTS*

### III. 2.3.1. ACCIDENTS IN AIR TRAFFIC

Geographic position of Montenegro and intensity of flights create conditions for accident threats. A considerable number of air flights and frequency of traffic, particularly in summer months, bind Montenegro to act preventively. It is well known that plane accidents may result in loss of many human lives and cause major property damage. In order to have intensive air traffic without consequences Montenegro needs to organize Flight Control and equip airports in accordance with world standards. Search and Rescue Service also needs to be established as an integrated service which would be ready for onshore and offshore interventions.

The following potential accidents may pose a hazard and therefore must be considered in the National Strategy for Air Traffic:

- Aircraft collision in air
- Bomb attack in the airplane
- Defect of technical devices in airplane and on ground
- Hijacking of airplanes
- Takeoff and landing phases
- Error committed by a pilot or flight controller

These accidents may cause major property damage and loss of human lives, particularly if they occur above residential areas, factories, dams etc. Likelihood that these accidents will occur is small, but still a well organized Search and Rescue Service (equipped with planes, helicopters, vehicles and patrol boats) must work with the Ministry of Interior, Firefighting Service and ambulance as a well trained team that is capable of quick intervention and disaster mitigation in cases of accidents.

Flight Control Service and airport services have a well developed network of reaction to accidents in the airport, but there emerges a need for establishment of connections with all Search and Rescue Services.

Air traffic is the safest method of passenger transportation, with a growth trend of 7% on an annual level. Safe traffic requires continued improvements in standards and implementation of recommendations given by international organizations.

### *III. MARITIME ACCIDENTS RISK*

**The Risk of Collision, Stranding or Sinking of Ships**

Maritime accidents risk is continuously present due to an increased presence of vessels, particularly yachts and sport and leisure boats. Montenegro has become increasingly interesting nautical tourism destination. Merchant marine ships which sail into and from Montenegrin ports on a daily basis represent a particular segment. The fact that annually over 1000 ships of merchant marine sail into and from Montenegrin ports and that the number tends to grow means that we need to pay attention (and we are paying it) to the safety and security issue at sea. Over 500 foreign yachts a year sail into and from Montenegrin marinas.

The first notions of the institute of search and rescue at sea is found in the collection of maritime and legal regulations of the Rhodos Island *Nomos Rodion Nauticus* which reflects human solidarity and readiness to rush to help. Rescue, as one of very old institutes of maritime law, has not lost its significance even today. On the contrary, search and rescue nowadays constitute one of the elements of navigation safety. In relation to that, the SOLAS (Safety of Life at Sea) dedicated its chapter V to the issue of search and rescue services.

Maritime Search and Rescue Department operates within UPS in order to mitigate consequences of maritime accidents which may be caused by collision, stranding or sinking of ships.

Search and rescue involves obligation to provide all types of assistance and rescue of people whose life is in danger, ships and facilities in internal sea waters and territorial sea, in accordance with the International Convention on Maritime Search and Rescue (the SAR Convention of 1979).

Our country, being signatory to the SAR Convention, had prepared National Plan of Maritime Search and Rescue which was adopted by the Government of Montenegro and which governs operations of Maritime Search and Rescue Department. Draft proposal of Official Rulebook on implementation of National Search and Rescue Plan has been finished. It defines activities of employees in the Service and still waits to be adopted.

Finally, the risk and mitigation of consequences of maritime accidents is regulated by the National Maritime Search and Rescue Plan that should find its place in Action Emergency Plans in Montenegro which will arise from this National Strategy for Emergencies.

**The Risk of Sea Pollution Caused by Oil Spills and/or Discharge of Ballast Waters**

Numerous pollutions are caused by ships and maritime activities in general. Oil pollutions have particularly serious impact on coastal activities and those activities that use the sea or benefit from it.

In addition to the basic activities concerning security and safety at sea, the Maritime Safety Department in Bar is tasked to:

1. prevent sea pollution caused by ships
2. monitor ships carrying hazardous cargo which may threaten sea environment
3. carry out inspections of ships in compliance with the MARPOL 73/78 Convention and Technical regulations for Prevention of Pollution from Ships
4. on behalf of Montenegro, issue certificates on prevention of pollution caused by oil, bilge waters and faecal discharges

During 2004, the Maritime Security Department proposed and prepared the Proposal of national plan for prevention, readiness and actions in cases of sudden sea pollution, whose main goal is to establish adequate measures to be undertaken in the event of pollution caused by oil accidents, hazardous and harmful substances and natural disasters.

National Plan needs to be adopted as soon as possible in order to ensure efficient reaction and entirely eliminate pollution. It should be emphasized that regional strategy for protection against pollution has not been prepared on a national level.

Potential risks of maritime pollution particularly concern the Port of Bar which manipulates all kinds of liquid fuels and chemical substances. There are permanent risks of collision, stranding, explosion and fire during arrival of oil carriers, reloading and unloading cargo in the Port itself and departure of carriers from the Port. Such risks are increased during bad weather, while several cases of pollutions in the Bar Bay have been recorded over the last several years. Other potential risks are posed by the Bijela Shipyard where oily ship sludge is disposed within the shipyard itself. The issue of disposal and destroying thereof is not entirely resolved. Minor pollutions often occur but there is always a risk of occurrence of major pollution, particularly during heavy precipitations since rains carry and swill sludge into the sea.

Due to the threat posed to the maritime environment by sinking or burning of waste and disposal of other hazardous substances from ships, as well as disposal of other waste collected in the course of ordinary ship operations and increased number of sport and leisure boats, draft Law on Protection of Sea against Pollution has been prepared in order to prevent and eliminate sea pollution. It is also obligation to be fulfilled by our country as it is signatory to the Barcelona Convention.

## III. 2.4. BREAKDOWNS IN MAJOR POWER SYSTEMS AND HYDROPOWER FACILITIES

Breakdowns of major facilities in power systems are treated from the aspect of malfunction in facilities of major producers (electric power plants), malfunctions in facilities of major customers, malfunctions in power lines of 110 kV, 220 kV and 400 kV, as well as breakdowns in facilities and

high power transformers which result in: collapse of entire power systems of Montenegro and absolute cut of power delivery; partial collapse of system which causes cuts in power delivery for certain sections; delivery power cuts for regions where a large number of consumers of all categories is left without power and power delivery cuts to major consumers where technological procedure requires continuity in delivery.

According to the organizational units of the Electric Company, the facilities of power systems may be classified as follows: hydro power plant Perućica, hydro power plant Piva, thermal power plant Pljevlja, small hydro power plants (7 plants); transmission plants; power lines of 400 kV, 220 kV and 110 kV and transformer stations and distribution facilities of the same voltage level (400, 220 and 110 Kv) and distribution plants which include facilities with 35 kV, 10 kV and 0.4 kV voltage level.

Image 15 illustrates arrangement of facilities, where certain areas receive power supply from the 110 Kv transmission line which are under 35 kV voltage, instead of 110 kV transmission line.

Power facilities are used for delivery of electric power in Montenegro and exchange of power with neighboring countries which is why interconnection were established with them as illustrated on the map. A good example is an overview of power exchange in 2003 (image 16) which gives an insight into the complexity of connections and enormous interdependence of power systems of the countries in the region and possibility of disfunction of systems with serious consequences for Montenegro system.

Power system of Montenegro established parallel operations with Western European power interconnection (UCPTE), while it is connected with the power systems of neighboring countries through the following transmission lines:

Power system of Serbia and further:

- DV 400 kV RP Ribarevina – *Kosovo* thermal power plant
- DV 220 Kv TS Pljevlja 2– *Bajina bašta* hydro power plant
- DV 220 Kv TS Pljevlja 2 - *TS* Požega
- DV 110 Kv TS Pljevlja 1 – *Potpeć* hydro power plant

Power system of Bosnia and Herzegovina and further:

- DV 400 kV TS Podgorica 2 - TS Trebinje,
- DV 220 kV HE Perućica - TS Trebinje,
- DV 220 kV HE Piva - TS Sarajevo,
- DV 110 kV TS Pljevlja 1 - TS Goražde,
- DV 110 kV TS Herceg Novi - TS Trebinje i
- DV 110 kV TS Nikšić - TS Bileća.

Power system of Albania and further (Serbia and Greece):

DV 220 kV TS Podgorica 1 - Vau Dejes (Skadar)

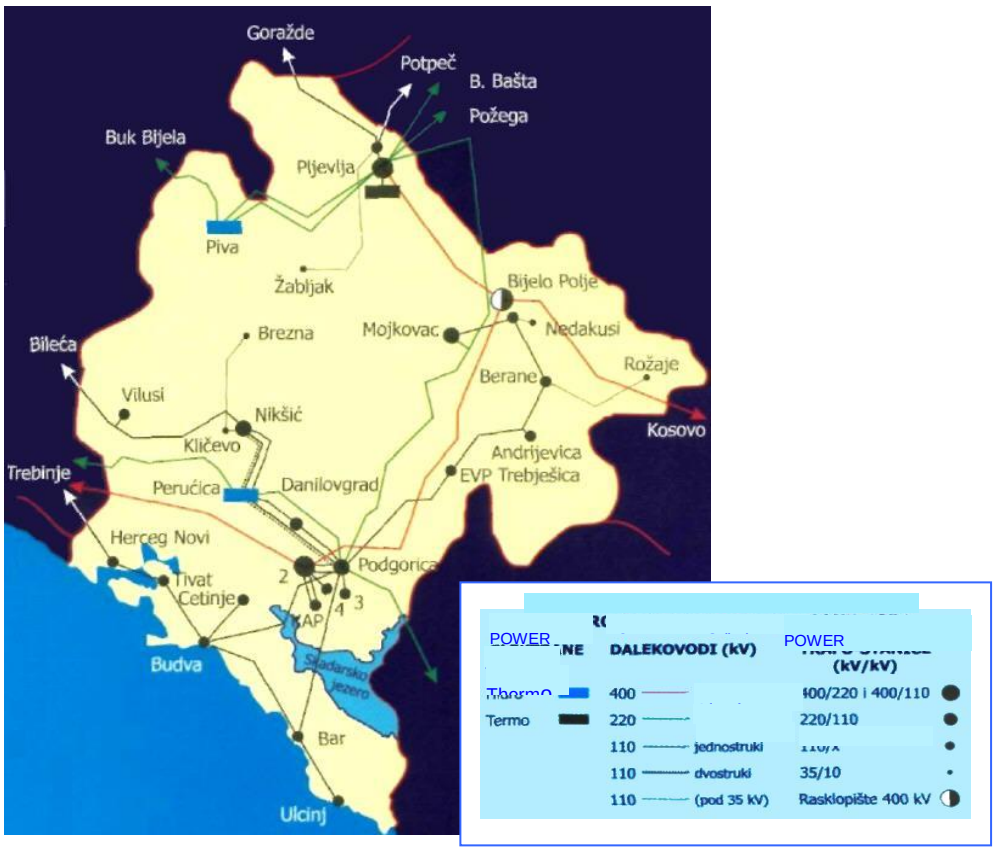



Image 15. Power System of Montenegro

Interconnections of 400 kV and 220 kV network through two transformers in TS Pljevlja 2 and 1 tranformer in nearby Trebinje, then 400 kV and 110 kV network in TS Podgorica with two transformers, with adequate number of interconections of 220 kV and 110 kV network within the Power System of Montenegro and with a relatively well developped network of tranmission lines of 220 kV and 110 Kv ensure highly reliable operations of the power system and steady supply of consumers in Montenegro with electric power.

There is a high possibility of breakdowns, that is malfunction of some of the elements of the system that would result in collapse of power system of Montenegro. If the interconnections are correct, the collapse of the system does not happen that frequently.

This refers to the prescribed procedure in the Code of Network and Distribution Code in terms of the obligation to react to accidental situations. Namely, the term *significant unwanted events* refers to the events that may result in: outage of some parts of the system, the change in the management of plants, facilities or devices, voltage exceeding (ordinary) plant limits; change in frequency of power system exceeding allowed (plant) limits; instability od electric system; surcharge of generators or components of transmission systems.

Information about these events are immedialtely forwarded to the system operators who undertake the measures to restore the system or its components back to the ordinary operations regime, in line with prescribed procedures, rulebooks on reactions during breakdowns and precise instructions for manipulation in such circumstances.

Consequences of system failires are various depending on what component of the system is disrupted or collapsed, how much time it lasts and what group of consumers face power cut.


Image 16. Scheme of structure and power exchange volume in Montengro with neighbouring countries in 2003

Quantification of the level of danger may not be precisely determined due to the specificities of the breakdown conditions. Major property damage and disurbance of commercial and social environment are consequences of such breakdowns. Power cut may cause cessation or collapse of commercial and social activities. This occurence may be accompanied by explosions and fires, along with their consequences. However, these accompanying accidents are limited to the locations with power facilities and plants.

In a period between 1990 and 2000 (for the 400 kV network until 2004) power system was shut down from interconnection (partially or entirely) which caused frequent disturbances in system operations, collapses of the system and long lasting power cuts to all areas in Montenegro. Breakdowns of facilities and transmission lines in particular cause power supply cut in all areas in Montenegro which mainly affects Durmitor municipalities (Žabljak, Šavnik, Plužine), then Plav, Andrijevica, Rožaje as well as coastal municipalites and other areas depending on circumstances. In 1994 there was a major breakdown in Pljevlja thermal power plant which came back online after only 18 months, but with enormous damage caused by the breakdown and interruption of manufacturing process. Breakdown in two transmission lines of 220 kV (Piva – Pljevlja) interrupted the production process in Piva Power Plant for a ten day period back in 2005. Power cuts in all areas lasting even a couple of days are caused by major breakdowns (broken towers of transmission lines).

### III.2.4.1. DAM BREAKDOWNS

The occurence of dams related emergencies is possible in the event of a sudden collapse (rupture) or overflowing of dams. On the basis of the following data for these facilities:

- The type of dam
- Basic characteristics of dam
- Hydraulic conditions in accumulation and valley downstream of dam
- Type and duration of rupture
- Hydraulic conditions on downstream boundary profile

it is necessary to possess information about hydraulic characteristics of flood waves that may emerge in the course of dam overflowing or collapse, as well as analysis of potential consequences carried out on the basis of wave height, increase in the water level, the time of appearance of the frontal wave, labelling terrains on the points of reaching of the maximum flood

wave caused by dam collapse and define procedures about informing and alarming of population in the area threatened by potential dam collapse.

Several high dams were constructed in Montenegro to create accumulation for the needs of electric power production, provide technical water for major techical plants while some serve as disposals for ash, clinker, waste rock etc. These dams are also used for irrigation. The following is a list of sites where dams are located, with referral to documentation which contains the assessment of potential breakdown risks:

Dam in hydro power plant *Piva*, dams in hydro power plant *Perućica: Vrtac, Krupac, Slano, Liverovići,* then Otilovići dam in thermal power plant *Pljevlja*, the *Maljevac* dam in Pljevlja serving as disposal for ash and clinker, the Grahovo dam used for irrigation of the Grahovo polje, dams in Mojkovac and Šuplja Stijena (near Pljevlja) serving as disposal of waste rock from mines, and waste rock disposal *Jagnjilo* nearby Pljevlja.

As regards dams with accumulation lakes, complete documentation was prepared in the mid-eighties of the last century (on the basis of regulations applying at that time) when the risks of dam breakdowns where defined and quantified, including degree of coverage and threat to population and area.

Theoretically, major earthquakes may cause damage or breakdowns of dams. The Mratinje dam, with hydroaccumulation of the Piva Lake, is located in the region of Montenegro that is seismitically active area with medium to strong earthquakes which could not provoke major damage of dam. In the event of substantial damage or collapse of the dam, the settlements and infrastructure in upper and middle Drina watershed would suffer tremendous consequences. It is for this reason that preventive maintenance of this system requires continuous monitoring of dam behaviour in dynamic conditions of earthquakes in accordance with the Technical Regulations for High Dams Monitoring. However, these regulations are not being applied nowadays (not even in exceptionally high Mratinje dam on the Piva river) which needs to be changed.

Major accidents may be caused by breakdowns of transmission, high voltage power network which may cause forest fires and take away lives of those people who would happen to be in the place of cords disconnection.

Potential breakdowns of any of the power transformer stations would produce the following multiple negative effects since the transformers contain polychlorinated biphenyls – PCB (Piralen oil): burning of PCB creates dioxin and furan (cancerogenous substances) which directly accumulate in human body and adipose tissues of other living beings and also build into the food chain. The PCB, dioxin and furan are characterized by their persistence in ecosystem and retention in soil for a period of more than 30 years which threatens the production of food, drinking and ground water. The recovery of the areas polluted in this manner requires enormous funds (that is, if the recovery is possible at all). For example, the bombing in Serbia caused burning of several power transformer stations containing pyralene which polluted many areas in Serbia. Funds received from UNCOPS for partial recovery of endangered areas amounted to 27 million dollars, but the pollution problem still has not been resolved.

Another example is pollution caused by Aluminum Plant fifteen years ago. The effect of this pollution was construction of new water supply facility for Zeta because the ground water may not be consumed. This virtually means that each power transformer station of the Electric Company of Montenegro and major industrial entities such as Aluminum Plant, the Steel Factory Nikšić, thermal power plant Pljevlja etc. are potential causes of large-scale, long-lasting pollutions.

One of efficient prevention measures is organized replacement of piralen in power transformer stations by silicone oil (in accordance with the Stockholm Convention, our country is also a signatory to it). The entire amount of collected piralen should be delivered and burnt in some of the incinerators of hazardous waste in Europe. Funds for export of piralen should be provided for this activity.

Dams with accumulated waste substances such as basins for red sludge produced by the Aluminum Plant, dam on the waste rock dumpsite in Mojkovac, dam on the waste rock dumpsite Šuplja Stijena and dam for ash disposal of the thermal power plant in Maljevac also fall within the group of hydro system hazards. Humans and environment might suffer tremendous consequences

from potential breakdowns of the abovementioned facilities. For instance, red sludge in Aluminum Plant basin is still in liquid condition, which is why there exists a real threat that potential bursting of dam results in spilling of liquid alkaline and toxic substances into the surrounding areas which would cause casualties and permanent pollution of the Zeta valley and its ground waters. However, hardly will the rupture of dams occur spontaneously. That may often happen as a consequence of large-scale earthquakes, extremely heavy intensive and long-lasting precipitation and diversions or accidents (potential air crash due to the proximity of airport).

The consequences of potential rupture of dam on the waste rock dumpsite in Mojkovac may aslo have negative impact on the Tara river ecosystem, but fortunately that impact is far weaker than that of 10 years ago when the contents of cyanide, phenol and other soluble toxic substances was significantly higher. This conclusion was confirmed by testing of coal waste behavior in water (in pH7, pH 2.0 and pH 12) when it was revelaed that hard metals firmly adhere to water without soluting in it. The project concerning permanent recovery and recultivation of this dumpsite will soon be brought to completion.

The same refers to the coal waste dumpsite in Šuplja Stijena, whereas the consequences of the rupture of dams for ash in Maljevac are far more serious as it contains alkaline water and sludge while entire terrain is a landslide that might threaten the settlements in base of the dam, including the Vežišnica river, the Ćehotina river, and downstream from it- even the Drina river.

In addition to the mentioned possibilites of major explosions in the Steel Factory *Nikšić* and Aluminum Plant, rupture of industrial dams and breakdowns may occur in other facilities in Montenegro, but with far less severe consequences.

### III. 2.4.2. LEGAL REGULATIONS

**The Energy Field:**

- Energy Law (Official Gazette of the Republic of Montenegro, 29/03)
- Rules for Electric Power Supply (Official Gazette of the Republic of Montenegro, 13/05)
- Temporary Network Code (Official Gazette of the Republic of Montenegro, 13/05)
- Temporary Distribution Code (Official Gazette of the Republic of Montenegro, 13/05)
- Standarization Law
- Law on Construction of Facilities (Official Gazette of the Republic of Montenegro, 55/00)
- Rulebook with Tecnical Regulations for Electric Low Voltage Installations
- Rulebook for Construction of Surface Power Lanlines of 1kV-4kV
- Rulebook for Construction of Low Voltage Landlines
- Rulebook for Protection of Electric Plants and Installations against Fire
- Rulebook for Operations and Maintenance of Power Systems and Lines
- Rulebook for Construction, Operations and Maintenance of Power Generators and Hydrogen Cooled Synchronic Compensators
- Rulebook for Protection of Power Systems against Overvoltage
- Rulebook for Protection against Static Electricity
- Rulebook on Terms and Conditions for Design and Operations of Electric Facilities in Premises with Explosive Manipulations
- Rulebook for Power Plants with over 1000 V Voltage
- Rulebook for Grounding of Power Facilities with over 1000 V Voltage
- Rulebook for the Protection against Low Voltage Networks and Accompanying Power Transformer Stations

- Rulebook for Power Facilities with 10 kV Voltage for operations under 20 kV

## III. BIOLOGICAL HAZARDS

### III.3.1. PREVENTIVE MEDICAL PROTECTION IN EMERGENCIES

### III. 3.1.1. POST- EARTHQUAKE PERIODS

As it has already been pointed out, Montenegro and its surrondings are located on a seismically active area where earthquakes are registered relatively often. Sometimes they are destructive which is why they represent a real, latent danger.

Each disastrous earthquake causes drastic changes in the way of life. Particular importance in such circumstances is attached to disrupted water supply, congestion in temporary accommodation facilities, interruption of regular and planned activities related to monitoring and prevention of infectious diseases. Epidemiologic condition and efficiency of preventive medical care may significantly be determined by numerous factors such as epidemiologic situation before the disaster, severity and level of destruction, health behavior and awareness of population, readiness and capacity of health service to operate in disaster circumstances, season and climate conditions.

**Table. 1. CHARACTERISTICS OF SOME MAJOR ACCIDENTS AND DISASTERS**

| Type of Major Accident – Disaster | | | |
|---|---|---|---|
| Subject of | Impact of Nature | | Human Impact |
| | Natural Disasters (epidemic OOZ* | Natural Disasters (large-scale | War (armed conflict with use of biological weapon) |
| Population Losses | - No killed people (rarely are<br>- No injured.<br>- Mass disease.<br>- Increased dying | - There are killed people.<br>- There are injured<br>- There ar e psychotraumatized | -Many people are killed.<br>-There are many injured<br>-Many psychotraumatized people<br>-Many persons with mixed injuries<br>-Numerous ill and dead |
| Duration of Immediate Threat | Short (weeks to months) | Short (days) | Usually long (months, years) even though it may be short (intervention from |
| Affected Teritory | Limited (in cases of pandemic, entire teritory is affected) | Limited | Entire country |
| Means and Equipment | - Sufficient<br>- Standard | -As a rule, at the beginning in deficit, but later in suficit<br>-Standard and supplementary | -Scarce<br>-Formation and improvized |
| Number of Staff | By rule, sufficient | As a rule, at the beginning they are in | Lacking (as a rule) |
| Work of Health | - Unhindered<br>- Stable institutions | - Favorized<br>- By rule, institutions are stable (damages may result in work in | - Somewhat difficult<br>- Mobile institutions |
| Safety of Staff | Safe (floods) or threatened (epidemic OOZ*) | Safe, by rule | Threatened |

| | | | |
|---|---|---|---|
| Who provides care | Prevention service plus clinical service (infection, pediatric and other wards) | Primarily surgery ward, aided by prevention service | Surgery ward plus preventive service |
| Vertical links of phases | Normal | Emphasized | Threatened |

*OOZ – Extremely infectious diseases, which spread fast and have high lethal effects

All the abovementioned contributes to a significant rise in number of people with infectious diseases, particularly those belonging to a group of acute bowel (enterocolitis and alimentary toxic infection, various etiologies, hepatitis A virus etc.) and acute respiratory diseases (streptococcal infections, meningitis, flu, bronchopneumonia caused by microplasms and Chlamydia, cold illness etc.) The most important preventive measures aimed at prevention of infectious diseases are provision of hygienically acceptable food and water, adequate accommodation and sanitary conditions for personal and general hygiene (particularly for persons whose homes have been devastated and who are placed in temporary individual or collective accommodation facilities). timely provision of adequate health and preventive information to the jeopardized population (advice to boil water or use additionally chlorinated water that is delivered by tank cars from adequately controlled water sources), daily performance of tighter epidemiologic surveillance in order to realize potential rise in the number of infected people on time and undertaking adequate measures of prevention and control thereof. If there emerges a need, DDD affairs are conducted (particularly in preparation and maintenance of temporary collective accommodation facilities),

One of important tasks falling within the group of specific prevention measures against infections is program for systematic immunization of children in order to keep under control numerous vaccine-preventable diseases with high epidemic potential (difficulties arise due to power shortages as it is very difficult to conserve adequate temperature conditions for keeping vaccines – *cold chain)*. It is for this purpose that all health institutions need to have power generators operating with liquid fuels).

In order to perform epidemiologic surveillance (fast and precise diagnosis) and carry out the most important health and preventive measures it is necessary to have well organized and trained terrain teams for medical prevention. Preventive medical teams need to have equipment and means for their operation, transportation, accommodation, food and water supply. Number of teams, their structure and equipment should be rational. The structure of teams needs to include specialists of preventive medicine (epidemiology and hygiene), sanitary engineer and sanitary chemist, as well as laboratory and sanitary technicians. Experts with experience and capacity to work independently should be selected to be pat of these teams. Experiences reveal that teams should not have more than 10 to 15 persons. The team of this structure may organize and control preventive medical care in urban areas with around 50.000 residents. In addition to terrain vehicles (maximum two to three vehicles per team depending on whether microbiologic laboratory is included), the team must also have equipment and means for disinfection of drinking water and control of residual chlorine (provision of aid to public utilities services of infected municipalities), telecommunication devices, tools for sampling for laboratory testing etc. The team must all have their own accommodation provided (tents) as it may be impossible to provide accommodation in facilities with solid construction in infected territory. It is later determined whether laboratories should be sent to the disaster zone (microbiological, toxic).

It is clear that the team structure may and should be changed and supplemented with necessary experts of other profiles if a need for such action emerges. Local crews of civil territorial protection and Red Cross, as well as public utilities teams, should be included. Great help in undertaking of hygiene preventive measures may be provided by organized groups of citizens in residential areas and local communities.

Preventive medical care most often can not be provided only by local health service which is why teams and experts from other parts of a country not familiar with local circumstances are engaged. That is why it is necessary for the team members to immediately upon their arrival gain an insight into the post-earthquake conditions as well as hygiene and epidemiologic conditions before the

earthquake occurred. One should bear in mind that work of preventive medical teams, unlike other teams engaged on immediate repair of damage and mitigation of disaster, continues later. Implementation of long-term measures may take several weeks.

### III. 3.1.2. EPIDEMIC CAUSED BY FLOODS

The current experiences in Montenegro reveal that parts of Zeta around Skadar lake, the Bjelopavlićka Valley, the valley of Lim river (area around the Plavsko Lake) and possibly certain areas in Nikšić, Pljevlja, Ulcinj and Cetinje are exposed to the risk of large scale floods.

Large scale floods resilt in the epidemic threat of acute bowel infections disease due to potential pollution of water sources (particularly of wells in rural areas – the most dangerous in phases of water receding when popoulation returns home). Epidemic of acute bowel and respiration infections are also possiblei n centers/facilities of tempoprary collective accommodations of persons whose homes have been flooded (if these persons are not accommodated in the houses of tehir family and friends).

In addition to provision of health and instruction information to the population (advice to boil water and process food thermically) and increased epidemologic surveillance over infectious diseases (in temporary collective accommodation facilities during floods, and in flooded area-after water receding and return of population to their homes), the most important tasks include cleaning and disinfection of individual water sources where population is adviced by preventive medical teams. Public utilities teams are responsible for maintenance of the centralized water supply system – water supply network).

Considering the proximity of micro bilogical, sanitary and chemical laboratories and assessment that they are located in safe areas, preventive medical teams should comprise specialists in the field of epidemology and hygiene, as well as sanitary engineers and sanitary technicians equipped with terrain vehicles, equipment for water sampling and measurement of residual chlorine and equipment and means for disinfection of drinking water and environment.

As with earthquakes, one should bear in mind that the work of prevetive medical teams, unlike other teams engaged in immediate repair of damage and disaster mitigation, continues after disaster. Implementation of long-term measures may take several weeks (epidemological surveillance and control of hygiene quality of drinking water).

### *III. EPIDEMICS OF INFECTIOUS DISEASES*

Epidemologic conditions related to infectious diseases in Montenegro are relatively stable. Obligatory systematic vaccination is a measure undertaken for fighting vaccine-preventable diseases (tubercolosis, diphteria, tetanus, whooping cough, child paralisis, chicken pox, mumps, rubeola, hepatitis B) which are mainly kept under control, i.e. epidemologic forms of these diseases have not been recorded over the last couple of years (notably, the majority of these diseases have intensive epidemologic potential). Other diseases are more or less kept under control even though epidemics of certain infections diseases must be borne in mind as they are still present in endemic and epidemic form throughout Montenegro (varicela, hepatitis virus A, enterocolites of various etiologies, hemorrhagic fever with kidney sindrome, enterovirus meningitis, meningococcal meningitis etc.). Current epidemiologic evaluation reveals that health care services of Montenegro are able to control these diseases within an adequate time period in cases of their occurrence.

In addition to diseases registered in Montenegro each year, there is a possibility of importation of certain diseases from abroad. This primarily refers to extremely dangerous infectious diseases (those with high lethality spreading fast or slowly) such as quarantine diseases (plague, hemorrhagic fevers) and other dangerous diseases such as cholera, SARS, West Nile encephalitis, bird flu, human pandemic flu etc.).

*Operating Plan for Implementation of Measures concerning Recognition, Prevention of Importing and Spreading of Severe Acute Respiratory Syndrome (SARS)* was adopted in 2003 to cope with potential SARS outbreak. At this point, the condition concerning SARS is epidemiologically calm around the globe as the last cases were registered in laboratory employees in China in 2004. However, the possibility of its new outbreak is not to be disregarded. In addition, there are no specific prophylactic and therapeutic means for treatment of this disease which is why classic anti-epidemic measures are employed in prevention of it. (isolation, quarantine etc.)

The Government of Montenegro adopted National Plan for Protection against Avian Influenza and Pandemic Influenza in October 2005. The Plan which was prepared by a task force in the Ministry of Health of the Republic of Montenegro explicitly lists the needs of Montenegro to adequately address potential outbreak of avian influenza in humans and pandemic influenza. In addition, the Government adopted the Guidelines for Implementation of Measures to Prevent and Control Avian Influenza which was prepared by the Veterinary Department of the Ministry of Agriculture Forestry and Water Management. The threat of avian influenza still persists which is why epidemiological situation around the globe is under constant monitoring, whereby the public is accordingly informed and certain measures undertaken.

According to the current estimates, in the event of avian influenza outbreak not many people are expected to get infected (due to still limited capacities of causal agents for interhuman transmission) but the measures to be undertaken by the veterinary and health care services in that case are quite extensive and exhausting. Certain genetic changes in causal agents, (causal agents are often subject to genetic changes) which would ensure sustainable transmission between human being, would result in pandemic with enormous number of diseased people around the globe. Experts of the World Health Organization believe that around 25-40% of total population might get infected in one out of three waves of disease outbreak. The same figure applies to all states respectively. Rise in the number of diseased at the outset of pandemic is expected due to the fact that a specific vaccine for pandemic set still has not been developed (at this point, technology used in production of vaccines against flu cannot create new vaccine until it has been revealed how pandemic set looks like, even though new technologies for development of vaccines are rapidly progressing giving encouraging results) while adequate quantities of antiviral medicines (primarily Oseltamivir – Tamiflu) are still not available in desired amounts due to limited manufacturing capacities. Due to the expected rise in the number of atypical cases of pandemic forms of flu, usual anti-epidemiologic measures have limited effect and may only slow down transmission of infection without keeping it entirely under control.

In accordance with the Law on Infectious Diseases it is necessary to determine which facilities will serve as quarantine in order to treat quarantine diseases (plague, hemorrhagic fevers and other particularly dangerous diseases such as cholera, West Nile, encephalitis etc.). There is also a need to create conditions for isolation of those persons who are proved or doubted to be infected (at this point, Department for Infectious Diseases of the Clinical Centre of Montenegro fails to meet required conditions for proper isolation and treatment of such persons which is why in this case everything would be done in improvised circumstances that do not provide sufficient security). In addition, epidemiological teams are not equipped with special protection suits and masks with special filters for work with agents of diseases, while microbiological laboratories do not meet either technical or diagnostic conditions for safe handling of agents of infectious diseases. Furthermore, samples of infected persons (infectious material) may not be sent to referent/specialized laboratories anywhere in the world for the purpose of diagnosis of certain agents of infections diseases as there are no specialized agencies in Montenegro for transportation of such packages at this point. Therefore, should such diseases outbreak Montenegro will be forced to seek aid from the World Health Organization and specialized departments of that organization – collaboration centers such as Euro- CDC, CDC-USA etc.

### *III.3.2.1. PLANT DISEASES AND PESTS*

Health protection was a multidisciplinary and complex area. Activities within this area affect various aspects of commercial and everyday life. The area of health protection of plants is considerably important for our country in international trade, for health of the nation and should be one of strategic interest of Montenegro.

Health condition of agricultural plants is threatened by causal agents of plant diseases, pests and weeds as well as physical an chemical abiogenic factors which pose natural threats, cause natural disasters and downgrade economic development of a country.

External factors such as high temperatures, enormous water shortages– droughts, surplus of water - floods or early spring frosts additionally jeopardize agricultural plants. Damages caused by these agents are large and reflected in a drop in yield per unit of land and low product quality.

The issue of health protection of plants is quite complex, particularly if observed from the aspect of plant diseases and pests (around 10,000 species of insects, around 1,500 species of parasite (pathogen fungi), around 1,500 species of nematodes, mites, around 200 species of parasite (phytopathogenic) bacteria, viruses and viroids, microplasms, plant parasites, weed plants and few dozens of harmful rodents.

Permanent presence of a number of plant diseases and pests has been recorded in Montenegro. Harmful organisms are classified according to the level of risk they pose to the health of plants and plant products as well as survival of certain plant species and risk of large scale economic damages they might provoke. Plants and plant products are under constant surveillance and phytosanitary measures are applied for the purpose of preventing importation and spreading of harmful organisms.

Particular importance needs to be attached to the production and conservation of food as it is a strategic product and significant condition for preservation and reproduction of human beings.

In addition to the protection of plants against plant diseases and pests, another important issue is protection of plants against radiation, chemical and biological contamination and all other types of pollution.

Agricultural plants and plant products which are stored in warehouses until the moment of their consumption are continuously threatened with the attack of causal agents of diseases and pests. Damages caused by these factors often account for 30% of food, but sometimes damage caused by plant diseases and pests are even bigger.

Certain plant diseases and pests (plum pox virus, Californian aphid, olive fly etc.) inflict great economic damage and pose constant threat to the cultivation of certain plants in Montenegro.

Failure to undertake adequate and timely phytosanitary measures results in spreading of plant diseases and pests. Montenegro as a state and manufacturers are responsible for the health protection of plants.

**Harmful organisms which are present and spread in agricultural plants**

Meteorological factors are quite important for growth, development and dissemination of causal agents of diseases and pests.

This refers to the temperature and amount of precipitation in the most critical months of vegetation period. For instance, high air temperatures during vegetation may impede normal growth and development of plants (particularly in summer months), but at the same time they may be favourable to the growth of pests and unfavorable for development of plant diseases. This means that agricultural crops are threatened with unfavorable environmental conditions, in addition to plant diseases and pests. That is a reason why many crops and quality of their products may fail to produce expected results. With the presence of pests and diseases, the health of agricultural plants may be severely threatened if appropriate agrotechnical preventive measures are not undertaken and protective means for direct protection of plants used.

**Measures undertaken to prevent threats and mitigate consequences caused by of plant diseases and pests**

Bearing in mind the threats and consequences of plant diseases and pests, measures intended to control them are continuously undertaken. Control of plant diseases and pest in exercised in an organized manner. The control is exercised by legal persons engaged in production and processing of plants and plant products, while in private sector (individual farmers) these activities are not sufficiently organized.

Insufficient control over use of substances for plant protection as well as other chemical and biological substances employed in agriculture poses another problem (with individual farmers).

Substances for plant protection are not manufactured in Montenegro which is why they are imported. Insecticides, fungicides, herbicides, substances against germination and for regulation of plant growth are imported on the basis of an approuval issued by the Ministry of Agriculture, Forestry and Water Management.

Worryingly, incompetence of individual manufacturers in their selection and use of substances, nonobservance of toxicological withholding period and use of substances whose consumption date has expired poses threat as these substances may have harmful effect on humans and cause air, water and soil pollution.

Individual farmers need to receive constant education in this field which should be arranged by technical services that are in contact with farmers on a daily basis. Specialized education is also necessary for employees in agricultural drugstores who sell substances for plant protection.

According to the regulations, substances for plant protection may only be sold by specialized stores – agricultural drugstores. However, pesticides are often sold on the markets or supermarkets together with other products.

**Bodies Exercising Control of Plants and Plant Protection**

Health care protection activities are performed by:

- Competent bodies in local government
- Scientific and research institutions with a license which are authorized to do so by an administration body competent for affairs of health protection of plants
- Companies and entrepreneurs which meet the necessary requirements and are registered for performance of professional and technical affairs in implementation of phytosanitary measures and authorized for activities thereof by a body competent for affairs concerning health protection of plants
- Growers of plants

Special units of civil protection may be established to protect plants and plant products. These units are established depending on needs which should arise from adequate assessments of threats in certain areas.

**Measures and Activities Undertaken to Improve Conditions**

In order to have a clear picture about the condition of health protection of plants in Montenegro, the Ministry of Agriculture, Forestry and Water Management financially supports the protection of plants against plant diseases and pests. The main objective is to establish the presence of causal agents of plant diseases and pests, their transmission and damages they inflict to crops.

The current condition of protection of plants and plant products in Montenegro is characterized by inequality in certain areas, which mainly depends on the nature of agricultural production. In areas with predominantly intensive agricultural production the issue of plant protection is addressed in a more organized manner. However, areas with extensive agricultural production face numerous difficulties and problems, such as lack of organized activities, staff and material issues etc.

Professional training of individual farmers for execution of tasks concerning health protection of plants and plant products is just partly organized and does not meet actual needs.

Continued surveillance and control over importation of harmful organisms in Montenegro is of particular importance.

Phytosanitary department and phytosanitary inspection must be established in order to employ all necessary instruments in phytosanitary area and fulfill the obligations assumed by ratification of international treaties in the field of protection of plants health. This would protect the health of humans and ensure food safety.

**Harmful insects and phytopatogenous organisms** also pose risk to natural resources. It is well known that forest is a natural or artificial ecosystem composed of inanimate habitat (soil and climate) and living organisms (plants and animals) which is dominated by forest trees whose balanced interactions and effects provide continued, long lasting production and permanent consumption of organic substances. Therefore, forest system needs to comprise three groups of organisms in order for it to function properly: producers (green plants in this case), consumers (animals) and mineralizers or reducents (microorganisms). Each disturbance of the system might result in certain differences and cause instability of forest ecosystems.

Small number of **harmful forest organisms** cannot threaten forest. Therefore, harmful forests organisms are considered to be those that appear in large number either continuously or occasionally thus causing visible changes in forest trees, threatening their productivity or provoking timber drying. Multiplication may occur due to some primarily harmful influences (drought, forest fire, poor or inadequate habitat etc.), while the attacks of insects and fungi may also be primary. Insects and fungi very often interact together. Trees weakened by fungi attack become pray to bark beetles. Certain species of insects and phytopatogenous fungi very often appear in multiplications in forests. Insects are causal agents of mechanical damage of trees whereas fungi represent causal agents of diseases. Both groups, with high capacity for reproduction, also have the capacity to react quickly to negative changes in forest ecosystem. Harmful forest insects permanently present in Montenegro are: the gypsy moth (Lymantria dispar) that may cause defoliation on large surfaces, but if it appears for several consecutive years, either alone or in chain with secondary pests, it may cause drying. Its gradations are frequent in deciduous forest in coastal and central regions of Montenegro. The last gradation occurred in 2004 when a strong intensity of attack to around 12,000 ha of forests was recorded.

Oak leaf rollers (Tortrinidae and Lepidoptera family) are major pests in oak forests which may cause defoliations or drying of tree trunks.

However, major consequences arising from this pest have not been recorded in our countries; the bark beetles (Scolytidae family) live beneath the tree bark and more or less deeply in the tree itself. Their gradation may cause drying of a large number of trees. The majority of species of bark beetles appear on coniferous trunks which is why they are considered to be major enemies of coniferous trees. They fall under the category of secondary pests, but in the event of large multiplications they attack even healthy trees. High intensity gradations were recorded in our country in thirties of the last century and immediately after the Second World War, then pine caterpillars (thaumatopoea pityocampa) etc. The most significant phytopatogenous fungi are: root rot fungi, the most dangerous of which being honey fungus (Armilaria Melea) and fungus Heterobazidion Annosus causing rot of conifers. It is believed that over 10% of spruce in Europe is infected with Heterobazidion fungus. Consequences of invasion of these fungi are reflected in loss in technical tree, increased threat from windswept areas and physiological weakening and dying of trees. Phytopatogenous fungi may cause disease of seeds and shoots (Fusarium genzs, Pythium genus, Phitophtora genus); fungi causing disease in the bark of trees (Nectra genus, Endothia Paractica); and fungi causing disease of leaves and fir needles (Microsphaera alphitoides, Laohodermium pinastri, Lophodermium seditiosum, Dothistroma pini).

### *III.3.2.2. EPIZOOTICS – ANIMALS' CONTAGIOUS DISEASES*

Epizootics i.e. epidemy of contagious disease are numerous cases of contagious disease, which from the point of frequency of cases, time, place and infected animal species, have exceeded the expected number of cases.

Except for economic diseases, occurrence of contagious diseases at animals may cause danger for the health of people in the case of zoonozes appearance such as brucellosis, tuberculosis, anthrax etc.

***Basic types of danger***

a) The appearance of contagious diseases, which are subjected to the obligation of registering in accordance with the O.I.E. codex - of the International Office for Epizootics in Paris (OIE), especially the appearance of the animal contagious disease from the former list A according to the O.I.E. codex.

b) The appearance of contagious diseases from the former list B and appearance of other diseases according to the O.I.E. codex.

c) Bringing in of the harmful agents along with the food of animal origin which may cause mass diseases with people:

- living agents: micro-organisms, parasites, mould,
- heavy metals (mercury, lead, cadmium etc.),
- carbon chlorine pesticides and other chemicals,
- residues of antibiotics, hormones, anabolics etc,
- residues of radio nuclides.

d) Feeding of animals with the food containing damaging agents.

**Epizootiologic situation in Montenegro**

Epizotiological area of Montenegro covers the area of 13.812 km². It is characterized with the mountanious-hilly northern part with the steep mountains, cut off with the deep and narrow valleys, deep gorges and narrow plateaus. Central part of the area is partially flat and partially rocky and uninhabited. Major part of Montenegrin livestock is located in these areas. The length of the coast amounts to 293 km while land borderlines amount to 614 km which practically means that almost each municipality in Montenegro is at the same time borderland municipality. This makes the activities on following up epizootiologic situation and prevention of bringing in of animal contagious diseases additionally more complex.

Table 1: Numerical situation of Montenegrin livestock

| Species | Number |
|---|---|
| Horses | 9.028 |
| Cows and oxes | 174.954 |
| Sheep | 252.007 |
| Swines | 23.879 |
| Poultry | 890.045 |
| Honey bee colonies | 41.175 |

*Data from Annual Statistics*

There are approximately 75.000 households in Montenegro. Majority of farms are small ones with the mixed composition of animal species, breeding of which represents an additional activity of their owners and is aimed at supplementing the household budget. There are about 2.200 herds with 5 and more dairy heads of cattle, only about twenty herds with 20 or more heads but the average size of the dairy cattle herds is small and amounts to approximately 2,3. Horses and swines are mainly kept for personal needs while the part of the poultry and beef products (eggs, meat and milk) are sold on the local market. Commercial poultry farms mainly have 3.000 to 8.000 units out of which more than 50% are laying hens. Very small number of farms has more than 10.000 laying hens. Swines breeding is done in a small scope. There is only one farm of swines

which is engaged in intensive higher scale breeding. Last years pigs for battening were mainly brought from Serbia and kept in small number of households in order to satisfy their own needs. Sheep population is mainly present in the northern parts of Montenegro.

In last ten years within the Montenegrin territory, on the basis of laboratory tests of diagnostic material or clinical testing of domestic and wild animals, the following diseases were identified: classic swine plague, aujeszky disease (swines), rabies which was identified in a number of domestic and wild animals species (cows and oxes, sheep, dogs, foxes, wolves), cow and ox tuberculosis, enzootical leucosis of cows and oxes, the „blue tongue" disease, trichinosis with the domestic and wild swines. Gumboro – the poultry disease, American plague of the bee brood, varoosis, cattle brucelosis and 1996 – anthrax in the municipality of Andrijevica.

Compared to the List of the International Organization for the Animal Health (OIE), from the list of diseases for which the obligation of registering is mandatory, out of 16 diseases which are common for a number of animal species, three diseases have been diagnosed: aujeszky disease (swines), trichinosis (wild boars) and rabies (foxes and dogs). Out of 17 cows and oxes diseases from the OIE list, three diseases have been identified: brucellosis, tuberculosis and enzootic leucosis. One case of the very classic swine plague has been diagnosed in 9 swine diseases from the OIE list. Out of 5 bee diseases from the OIE list, two are diagnosed: American plague of the bee broods and varoosis while the miccoplasmosyi (*M.gallisepticum/synoviae)* is the only one poultry disease diagnosed in Montenegro out of 15 diseases from the OIE list that is mandatory for registering. Out of the diseases from the OIE list which has been mentioned for the horses, rabbits, sheep and goats, fish and shells, in the year 2005 no disease was diagnosed.

**Contagious and parasitic diseases diagnosed during the year 2005 in Montenegro**

| **Type of animal** | **Name of disease** | **No. of contaminated** | | | |
|---|---|---|---|---|---|
| | | **municipalities** | **Settlements** | **courtyards** | **animals** |
| **COWS &OXES** | Brucellosis | 1 | 1 | 1 | 1 |
| | Tuberculosis | 1 | 2 | 2 | 2 |
| | Leucosis | 6 | 23 | | 110 |
| **SWINE** | KKS | 12 | 103 | 138 | 142 |
| | aujeszky | 1 | 1 | 1 | 1 |
| **DOG** | Rabies | 1 | 1 | 1 | 1 |
| **WILD BOAR** | Trichinosis | 6 | ---- | ---- | 6 |
| **FOX** | Rabies | 3 | 7 | ---- | 7 |
| **BEES** | Am. Plague | 5 | 7 | 11 | 34 |
| | Varoosis | 2 | 3 | 4 | 5 |

**The most frequent causes and risks of bringing in, occurrence and spreading of the animal contagious diseases**

- The risk of bringing in the causative agent of disease by importing of the alive animals, commodities, raw materials, products as well as food for animals;
- The risk of bringing in the causative agent of disease by the wild birds migration or by other wild animals or insects (aviary influenza, rabies, trichinosis etc);
- The risk of bringing in the causative agent of disease into the estates and farms by direct or indirect contact with the carriers – reservoirs of the causative agent of the disease (for instance, the blue tongue disease);
- The risk of conveying disease to other estates and areas;

- Poor financial situation and disrespect for basic bio-safety and hygienic measures during animals breeding, transport of animals, products of animal origin and food for animals;
- Lack of highly educated veterinary staff and especially insufficient number of the employees in the inspection services which may weaken control and consequently lead to spreading of contagious diseases;
- Insufficient equipment and qualification of veterinary services at all levels in respect of fast recognition of clinical signs of dangerous contagious diseases;
- Lack of the system of gathering and safe destroying of animal corpses and slaughterhouses' waste represents a great risk for the health of people and animals. This risk could significantly increase in the situation of outbreak of contagious disease (this would demand applying of *"stamping out"* method) or in the cases of natural and other diseases and catastrophes, which would result with big increase of the number of corpses, which could be safely moved away.
- Deliberate bringing in the causative agent of disease or other agents which could endanger the health of animals and/or people;
- People's awareness, especially in the rural areas where people do not have enough information and knowledge about possible consequences of contagious disease.

National legislation in the veterinary area is under way to be adjusted with the EU legislation. The Law on Veterinary, which entered into force on 29th February 2004 (Official Gazette of the RCG No.11/04) provides general basis for harmonizing with the EU legislation. Website address is: http://europa.eu.int/eur-lex.

It is necessary to continue with further adopting as problems are created by insufficient and in some cases, obsolete bylaw regulations, whicha are not harmonized with EU standards.

Drafting of special national plans for dangerous contagious disease from the ex OIE list has begun, all in accordance with EU requirements.

Lack of the system for identification, registration and control over animals movement has additionally aggravated problem of follow up animal movement, which is especially important with the occurence of contagious disease. The project of identification and registration of cows and oxes has been initiated in the whole territory of Montenegro. Full support is given to establishing of the system for registration of the sheep and goats.

Apart from this, limited financial resources for financing of the mandatory protection of the animal health protection, lack of the registration system and incomplete system of following the movement of animal transportation vehicles, trading with cows and oxes in Montenegro in the official and inofficial livestock market, where zoohygienic standards as well as the standards of animals welfare, existing structures and equipment, are far below the minimum required standards. Also, the illegal import and other problems have aggravated or made almost impossible following up the disease movement for epizoothiologic purposes.

Apart from the diseases which are in bigger or smaller scale registered with domestic and wild animals, there is a possibility of importing specific contagious diseases from abroad, especially from the surrounding countries as well as from the territory of Serbia.

There is especially great danger for every country regarding the occurence of contagious diseases which are on the former list „A" of the International Organization for the Protection of the Health of Animals (OIE). List „A" especially encompasses dangerous contagious diseases, which have a possibility of very abrupt and fast spreading inspite of the state borders. The diseases from this list cause big negative socio-economical consequences to the country and/or endanger survival of the specific animal species and international trading with animals.

In last years occurence of the disease of classis swine plague was recorded in Montenegro. In more than 97% there were swines originating from the territory of Serbia. Classic swine plague is a dangerous contagious disease caused by the virus, the suppressing of which has been envisaged by the Law on Veterinary and by the Rule Book on measures for suppressing and eradicating of this disease.

This is a disease with the virus origin, very contagious one. Virus is excreted by the sick animals and in the outside environment virus stays infectuous for a long time. Trading of swines also contributes to spreading and conveying of the disease at the big distances. Percentage of morbidity and lethality is very high ranging from 90 to 100%. There is no adequate medication. Disease brings big economic damages to the animals owners. For the purpose of eradication, a stamping out method is applied (killing of all swines within the structure in which the contamination has been identified) and other veterinary – sanitary measures. Animals owner is entitled to compensation for the killed animals. With the operational programme on health protection of animals, which is adopted by the Ministry of Agriculture, Forestry and Water Management, a mandatory imunoprofilax is carried out among the swines older than three months, and that service is free of charge for the animal owners.

In the year 2005, classical swine plague was registered in 11 municipalities, in 103 settlements within 138 courtyards within Montenegrin territory. A total of 436 swines perished and were destroyed. In all cases of diagnosing this disease, all prescribed veterinary-sanitary measures were undertaken.

Due to spreading of the disease: **aviary flu – bird flu** from the Far East and occurence of the disease at birds in Romania, Turkey and spreading on the area of the surrounding countries, there is a real danger of occurence of this disease within Montenegrin territory.

Aviary flu is the acute contagious disease of birds, and domestic poultry is especially susceptible of this disease. The causative agent of the disease is a virus of the flu – type A. There are 2 types of this virus: low pathogenic virus and highly pathogenic virus (HPAI). Highly pathogenic viruses, which appear by mutation of the low pathogenic viruses are especially dangerous and in the contaminated birds flocks the percentage of dying reaches even 90% (from 50 to 100%).

Apart from great number of the birds species, also the mammals (swine, horse, cat and other animals) may get this disease in certain circumstances. This disease is zoonosis. There is no adequate medication for it and the most successful way of suppression is early revealing of the disease and safe removing of all contagious and directly endangered poultry.

Mass poultry diseases in many parts of the world, tendency of further spreading, numerous ways of secretion and transmissibility of the causative agent of disease, possibility that they survive among animals (natural reservoires) as well as knowledge about the fact that new flu viruses are responsible for the disease and death of the big number of people, possibility of re-combination of virus, very rigorous measures in case of occurence of this disease through radical eradication measures – „stamping out“ and safe removal of all contaminated animals and animals that are suspected to be contaminated with the obligation to compensate damage to the owners, blockade of estates, limitation of animals' and people's movement and other measures have highly ranked this disease – on the first place among contaminations which are not reflected only on jeopardizing the livestock in one country, but also have a wider socio – economical character – undermining normal economic operations, aggravating or breaking business, trade, economic and international cooperation.

In October 2005 Government of the Republic of Montenegro adopted National Plan for the Protection from Bird Flu and Pandemian Flu, which had been drafted by the task force of the Ministry of Health and Ministry of Agriculture, Forestry and Water Management. Programme for Prevention, Suppression and Eradication of the High Pathogenic Bird Flu was also adopted. It had been drafted by the Veterinary Administration and Ministry of Agriculture, Forestry and Water Management. This Programme was harmonized with the Directive 92/40 EC and Decision 2005/464/EC.

Montenegro belongs to the group of countries with the high risk of occurence of this disease also because epizootiologic and epidemiological situation in the world especially in the surroundings is permanently monitored and all veterinary – sanitary measures are undertaken in accordance with it. Ministry of Agriculture, Forestry and Water Management adopted a range of orders for prevention its bringing in, occurence and spreading of the bird flu within the territory of Montenegro.

Apart from this, there is a danger of occurence of some other contagious diseases within the territory of Montenegro – foot and mouth disease, Newcastle poultry disease etc, but with some

exceptions (classic swine plague and aviary flu are already present), risk from occurence of dangerous contageous diseases of animals from the former List of OIE is very low in Montenegro.

Relatively small animal population density and rare movement of animals among the farms within Montengro implies that it is expected that, in the case of occurence of this disease, spreading of it should be slow and efficient veterinary service should quickly intervene and eradicate problem that occured.

**Protection measures**

Veterinary service is organized within the whole territory of Montenegro and it carries out veterinary operations including protection of animals' health, revealing and diagnozing of the animal disease, especially contagious disease and zoonoses, veterinary public health protection, environmental protection from the pollution with the causative agents of contagious disease, operations of desinfection, desinsection, derratization etc.

Veterinary administration has been carrying out administration tasks, which are related to: follow up and preventing of occurence, revealing, suppression and eradication of specific contagious animals' diseases; carrying out of veterinary prevention among animals, animal origin products, raw materials, remnants, commodities of animal origin, food for animals, seeds for artificial insemination, and impregnated ova in the internal turnover and Montenegrin cross-border trading; conducting of mandatory scope of the animals' health protection; organization of carrying out tasks of public interest; determining whether veterinary – sanitary requirements for carrying out veterinary operations are met, as well as issuing of permits for carrying out these activities; conducting of the inspection supervision in veterinary area, making of analyses, programmes and information, which serve as a professional basis for determining and carrying out politics in veterinary; preparing of the annual monitoring programmes and prevention of specific contagious animals' diseases and zoonozes within the Montenegrin territory (brucelosis, enzootic cows and oxes leucosis, tuberculosis, mastitis, antrax, poultry plague etc); follow up and implementation of the prevention programme; maintaining of the unified register of structures which are subjected to the veterinary – sanitary control; cooperation and coordination with the international veterinary organizations (OIE etc), institutions, economic subjects and other institutions in the area of veterinary services; other tasks which are the part of its competence.

Ministry of Agriculture, Forestry and Water Management performs supervision over the legality and suitability of the work of the Veterinary administration.

Protection measures are preventive and they are direct messures aimed at prevention or reduction the consequences on the animals or the animal origin commodities.

Preventive measures – general and special measures are prescribed by the Law on Veterinary and are mandatory for the owners or animal holders, legal entities from the area of veterinary, veterinary inspection services, government administration bodies and local self-government bodies, other legal entities as well as any other parties who may get doubts that animal is infected by any contagious disease prescribed by the Law on Veterinary.

Veterinary control encompasses: animals; raw material; animal food; products and commodities under manufacturing and trading; water for feeding the animals; waste waters and remnants; structures, means, accessories and equipment for their breeding, gathering, production, processing, additional processing, transport and warehousing as well as transporters and merchants. Veterinary control also encompasses animals at fairs, markets, shops and other sale and collection places, at expositions, sport competitions, voliers and gaters for wild animals, animals transportation to markets and other public places where the animals are collected.

**Safety measures in extraordinary situations**

Montenegrin territory, including its surroundings, is located in the area which is very inclined to earthquakes, frequently registering earthquakes of the small or big intensity which represent a real, latent danger.

Previous experience has also proved that, in some territories of Montenegro – parts of Zeta plain around the Skadar Lake, Bjelopavlići plain, valley of the Lim river and some areas in the

municipalities of Nikšić, Ulcinj and Cetinje, big scale floods were registered and there is a real danger from even bigger scale floods.

Epizootiologic situation and efficient and timely reaction of veterinary services in extraordinary situations depend on a number of factors: number and type of animal population on the affected territory, epizootiologic situation before occurrence of the extraordinary situation, general health situation of the animal population, gravity and scope of devastation, population awareness, readiness and qualification of veterinary services (the field veterinary service, laboratories etc), seasonal and climate conditions.

There is a special danger that specific contagious diseases may occur in extraordinary situations: disarrangements in water supply, decreased quality of hygienic and sanitary conditions, lack or inadequate structures for accommodation of animals, aggravated or broken communication and possibility of providing and preserving necessary means for medical treatment, nourishment, preventive animal immunization, faster diagnosing in the field as well as the means for DDD tasks.

Such disturbed conditions emerging in extraordinary situations may lead to the significant increase of occurrence of contagious diseases and alimentary intoxication among animals.

Safety veterinary measures imply broad actions in providing conditions for diagnosing, preventing the occurrence and spreading of the specific contagious disease, providing conditions for carrying out quarantine and isolation of the sick animals and the ones suspected to be sick, medical treatment, immuno-profilax with animals, providing sufficient quantities of the hygienically correct drinking water and animal food, providing of possible animal evacuation, providing and maintaining of the adequate accommodation and hygienic conditions in the structures for accommodation of animals, performing of DDD tasks, safe removal of persihed or killed animals, permanent, everyday conducting of epizootic supervision and adequate provision of necessary information to the jeopardized human population and the public.

Specific measures from the veterinary service domain must also be continued in the future period, after rehabilitating of damages which appeared in the time when natural and other disasters happened. It is necessary to establish system for epizootiologic supervision and control over the carried out veterinary – sanitary measures on long term basis.

For the purpose of preventing occurrence and spreading of animal contagious diseases it is necessary to prepare organized, equipped and trained veterinary workers' teams in advance. In relation to the intensity and the size of the affected territory with the specific natural or other kind of disaster, it is necessary to engage veterinary teams and specialists from other parts of the country, who would, together with the teams from the affected area, be engaged in carrying out of the tasks from the area of veterinary service.

It is necessary to provide these teams with sufficient number of protective clothing, masques, disinfection means and other necessary means for the personal protection during the work with the potentially contagious material.

It is necessary to equip additionally Specialized veterinary laboratory, which conducts diagnosing of contagious animal diseases, as for the equipment as for fulfilling all other conditions – diagnostic ones, bio – safety conditions, for safe work with the causative agents of dangerous contagious diseases. For the purpose of confirming specific contagious diseases it is necessary to send samples to the relevant world laboratories (a list of referent laboratories for diagnosing specific contagious animal diseases can be found on the OIE (International Organization for the Animals Health) website. In Montenegro there are no specialized services for transportation of such kind of postal items.

For medical treatment of animals and the immune – prophylactic purposes, it's necessary to provide sufficient quantities of antibiotics and other kinds of drugs and vaccines.

For the needs of performing DDD tasks it is necessary to have sufficient quantities of appropriate reserve DDD means as well as the equipment for their use.

### *III.3.2.4. LEGAL REGULATIONS*

List of regulations from the **area of agriculture**, which are relevant for the strategy:

**PHITOSANITARY SECTOR (set of new laws)**

- The Law on Sanitary Protection of the Plants (Draft Law is to be submitted to the Parliament in the form of proposal)

- The Law on Planting Material (Draft Law is to be submitted to the Parliament in the form of proposal)

- The Law on Agricultural Plants Seed Material (Draft Law is to be submitted to the Parliament in the form of proposal)

- The Law on the Means for Nourishment of the Plants (the law is in drafting stage; the first draft version has been completed)

- The Law on the Means for the Protection of the Plants (commission has been established)

- The Law on Protection of Vegetable Sorts (drafting shall go on in parallel with drafting in Serbia due to the specific requirements of UPOV)

**The following laws are currently effective in this sector:**

- The Law on Plants Protection (Official Gazette of FRY No. 24/98) encompasses three areas: health of plants, fertilizers and pesticides

- The Law on Plants Protection from the Diseases and Pests (Official Gazette of RCG No. 4/92 i 59/92, 17/92 and 27/94)

- The Law on Seeds and Planting Material (Official Gazette of RCG No.39/92 and 59/92)

- The Law on Protection of the Sorts of Agricultural and Forest Plants (Official Gazette of FRY No. 28/2000)

- The Law on Recognition of Agricultural and Forest Plants (Official Gazette of FRY No. 12/98 and 37/02)

- The Law on Fertilizers (Official Gazette of RCG No. 40/75, 45/75 , 29/89, 39/89, 48/91,17/92 and 27/94)

- The Law on Poisons (Official Gazette of FRY No.15/95)

**AGRICULTURAL LAWS**

**-** The Law on Agricultural Land (Official Gazette of RCG No.15/92 and 59/92)

- The Law on Organic Agriculture (Official Gazette of RCG No. 49/2004)

- The Law on Measures for Encouraging the Cattle Breeding (Official Gazette of RCG No. 4/92 and 59/92 and 17/92 and 27/94)

- The Law on Sea Fishing (Official Gazette of RCG No. 55/03 and 40/04)

- The Law on Fresh Water Fishing (Official Gazette of RCG No. 39/76 i 51/76 and 34/88 and 4/92 and 27/94)

- The Law on Tobacco (Official Gazette of RCG No.

- The Law on Wine and Products of Grapes and Wine (Official Gazette of RCG No. 9/83 and 15/83 and 29/89 and 36/89 and 39/89 and 48/91 and 27/94)

- The Law on Olive Growing (Official Gazette of RCG No. 355/0.

**The Law on Veterinary** which entered into force on 29th February 2004 (Official Gazette of RCG, No. 11/04) – provisions from the article 17 prescribed the following:

When occurrence of some contagious disease is identified by the Ministry and during the period of its danger, it shall, in accordance with the nature of the contagious disease and level of danger, decree one or more measures for the jeopardized area, as follows:

1. Separating healthy animals from sick ones;
2. Closing of the sick animals and closing of the infected courtyards in which the contagious disease was identified
3. Prohibition or restricting of movement for animals, vehicles and people;
4. Prohibition to take out products, raw material and remnants (as well as other objects which could transfer the causative agents of contagious disease) from the infected courtyards and facilities with infected animals;
5. Sanitary slaughtering i.e. killing of the infected animals or animals that are suspected to be infected by the contagious disease provided that animal must previously be stunned in a human and professional way;
6. Removal of corpses of the killed or slaughtered animals, infected material and their safe destroying;
7. Prohibition of organizing fairs, markets, exhibitions, cattle transportation to the market, places of purchase and other exibitions of animals;
8. Prohibition of slaughtering the infected animals or animals which are suspected to be infected;
9. Registering and marking of animals;
10. Prohibition or restricting of animals mating as well as of getting, processing, storing and using the seed for artificial insemination, ova and impregnated ova;
11. Vaccination, diagnostic research and medical treatment of animals;
12. Restriction of movement for the persons who come into touch with the infected animals i.e. with the animals that are suspected to be infected, with the products, raw material and the infected animals refuses;
13. Closing and blocking of the infected settlements and areas;
14. Castration of the infected animals;
15. Disinfection, desinsection and deratization of stalls, enclosures, courtyards, pastures, watering places and other places where sick animals or animals suspected to be infected are placed, as well as of objects which made contact with the infected animal or with the animal suspected to be infected;
16. Safe removal and destroying of animal food, floor coverings, excretions and other material from the facilities which cannot be made safe by cleaning and disinfection;
17. Closing of dogs and cats and destroying of stray dogs and cats in human way.

In the case of occurence of the disease from the list A, during carrying out of measures from item 1 of this Article, administrative body may ask for assistance from the state administration body in charge of police affairs and from the bodies in charge of defence affairs.

Relevant healthcare service shall be informed about the measures carried out during the limitation of people's movement and during conducting of people's desinfection.

Pursuant to the Article 18 of this Law, in the case that there is a danger from bringing in the contagious disease to Montenegrin territory, the Ministry may order prohibition, restriction or conditioned import of animals, products, raw material and refuses in the jeopardized area. The Article 28 prescribes that if the contagious disease from the List A occurs when there is an immediate danger for the health of people and animals, the Ministry shall order restriction or prohibition of trading with animals, commodities, raw material, products, refuses, animal food, veterinary medicines and medical equipment.

In the case of occurence of the disease from the List A, the Ministry shall fix the borderline of the infected and jeopardized area and administration body shall establish teams of veterinary workers, who shall be sent to the infected or jeopardized area, if there is an insufficient number of veterinary workers there, or when there is a need for engaging more veterinary workers.

If there is a danger of bringing in the contagious disease into the territory of Montenegro, the Ministry may order the following actions to be performed in the jeopardized area:

1) At certain places (traffic roads, bridges, ferries etc.), there shall be performed control over trading of animals, products, raw material and refuses;

2) Transportation of animals, products, raw material and refuses shall be restricted or allowed under certain conditions in the specific territory;

3) Disinfection of individuals and transporting vehicles shall be carried out.

Item 3 of the Article 19 of this Law prescribes that in the case of **extraordinary or war conditions, in natural and other disasters, which cause disease of a bigger number of animals or in the case of occurrence of epizooty**, the Ministry may order to the legal entities and veterinarians an urgent conducting of special expert measures and tasks.

The Article 20 stipulates the following:

In the cases from the Article 19 item 3 of this Law (war, epizooty, natural disasters which cause disease of big number of animals), the Ministry shall propose to the Government of Montenegro to adopt the following measures:

1) Mobilization of veterinarians and citizens for carrying out the prescribed measures of the animals' health protection;

2) Mobilization of the equipment, medicines and transportation means in accordance with special regulations and temporary use of the land and buildings for the purpose of implementing the prescribed measures of the animals health protection;

3) Land and facilities use for the purpose of safe removing of corpses of the killed or perished animals, food, floor coverings, remnants and other contagious material, by burying them, burning or in some other way;

4) special tasks to all veterinary organizations and, if necessary, also to other legal entities and state bodies for the purpose of implementing prescribed measures of the health protection of animals.

There is a range of bylaws covering specific diseases or measures which ought to be undertaken (disinfection, disinfection, treating of animal corpses, safe removing etc).

Montenegro is a member of a number of international organizations: International Organization for the Health of Animals – OIE, address: http://www.oie.int/, UN Organization for the Food and Agriculture, address: http://www.fao.org/ and other organizations, the standards and principles of which are applied in the veterinary service work, also studiously work on introducing of the EU Veterinary Acquis in its national legislation: EU Veterinary Acquis, address: http://europa.eu.int/eur-lex/.

**Conclusions and recommendations**

1) It is necessary to work studiously on adopting of new legal regulation in accordance with EU standards and principles.

2) Although the risk of bringing in some of causative agents of especially dangerous diseases from the ex A List of OIE into Montenegro seems to be low, this situation could be changed. Therefore, there is an urgent need for preparing the detailed extraordinary national plans for all these diseases and, as soon as possible, for the Veterinary administration, field service and Laboratory, starting from the diseases of highest priority like foot-and-mouth disease. It is also very important to organize exercises and simulate occurence of contagious diseases within

regular intervals in order to ensure that the extraordinary national plans should be applicable and efficient and that staff at all levels and in all services that ought to be involved (veterinary and police service and army) should be fully aware of their roles and responsibilities.

3) Sample taking methods must have a reliable statistic foundation for implementation of programmes of follow up and monitoring of the animal health, monitoring of animals, raw material, commodities and animal food all in order to find out contents of damaging material (bioresidues), refuse and forbidden materials. This means that the programmes concept and analysis of the results of the conducted programmes must be carried out in accordance with the reliable statistic methods. Otherwise there is a big probability that all obtained results would be of little value and that resources and efforts shall be spent in vain.

4) Extending, strengthening and modernization of the animal health protection in accordance with the EU requirements.

System of identification, registration and control over movement of all kinds of domestic animals ought to be urgently introduced.

Having in mind that Montenegro borders with several states and has a relatively long borderline, due to the reduction of the risk of bringing in disease, it is necessary to keep efficient control over the border crossing points, main roads, ports and airports.

There should be enhanced standards of the structures and equipment at the cattle markets, for manufacturing and sale of animals, raw materials, products and commodities of animal origin, animal food as well as their functioning, by which the risk for the healh of people and animals would decrease.

- It is necessary to establish veterinary hygienic service (VHS) in accordance with the Veterinary Law and to recruit staff, provide vehicles, structures and equipment necessary for its functioning. The structures include collection centres and burning rooms for the secure, harmless and environmentally safe removing of animal corpses and slaughtering waste.

Education programmes for farmers and competent persons in the area of cattle breeding about the importance of the dangerous contagious diseases should be strengthened.

- Permanent education of veterinary staff for functioning in the extraordinary situations should be carried out at all levels.
- It is necessary to have reserves of appropriate equipment, means, medicines, vaccines, means for DDD and other necessary means for functioning in extraordinary situations.

### III.3.2.2. BIOLOGIC WAR (BIO - TERRORISM)

During the last several years there is a real danger in the world in relation to the biologic weapon use, more rarely in the case of wars and more frequently because of the so-called bio – terrorism (according to the current epidemiologic assessment, Montenegro is significantly less jeopardized by bio – terrorism than developed countries – USA, Western Europe countries, Russia etc, but this assessment is subjected to the changes, which might be significant by time passing).

Most frequent micro – organiss used as biological weapon are:

- Bacteria: causative agents of anthrax, plague, tularemia, Q – fever, brucellosis, psithacosis-ornithosis;
- Bacterial toxines: toxine of botulism;
- Viruses: smallpox, virus hemorragic fivers (Ebola, Marburg, Lasa,

  Machupo, Kongo – Crimean hemorragic fivers etc.), flu, hepathitis A virus, horse encephalitis viruses, tick meningoencephalitis, West Nile

  encephalitis etc.)

- Fungi : coccidioides immitis, histoplasma capsulatum etc.

For the needs of fast diagnosing and fast and effective suppression of the above mentioned diseases, it is necessary to have special services and units, which in the biggest number of states belong to the armies (specialized military-medical institutes) and if possible - highly specialized civil healthcare institutions. Such institutes have their special protective equipment and special – high biosafety conditions for diagnosing of the highly dangerous causative agents («biosafety level 4», more rarely 3) and isolation and medical treatment of the persons infected with such causative agents. In Montenegro there are no units and institutions of such type (preventive – medical, diagnostic and therapeutic).

## III.4. THE ROLE AND CAPACITIES OF THE EXISTING INSTITUTIONS IN RELATION TO THE IDENTIFIED HAZARDS

### *III.4.1. MINISTRY OF INTERNAL AFFAIRS*

In the former SFRY (before its splitting) great attention was paid to the civil defense as a component of the country defense system. The law provisions were consistently implemented and significant financial funds were alloted to the equipping and training of units. However, even such concept has never had an integral system for managing catastrophes/extraordinary situations. It had only one segment and it lacked basic mechanisms for managing extraordinary situations.

By adopting the new Law on Local Self-Government, the place and the role of fire brigades and other civil defense and rescue services on the local self governance level, was properly defined. Namely, the law envisaged establishing Civil Defense and Rescue Services on the local self governanment level. Its implementation started after the first local elections.

Changes which occured after that, especially economic crisis and later on disturbed relations between the republics, contributed that, such organized civil defense lost the role it used to have. Many activities from the Republic level up to the local self government level were neglected. Among them, there was also organization of the civil defense structures in extraordinary situations. Only public services (first aid, fire brigades, healthcare institutions, communal services etc.) maintained necessary activity level concerning protection in the extraordinary situations. Basis for their operation was contained in the laws that regulate their work under regular circumstances. Their resources were envisaged on the basis of performing regular taks, and not on the basis of eventual extraordinary events. By tradition, in situations which include floods, earthquakes, demolishing of structures etc. it is usually counted on assistance of the Police and the Army due to organization of their units, as they are equipped with appropriate technique (vehicles, boats, construction machines etc). At the same time the question is made starting from the point who ought to ask and who ought to engange these units, where the units that are capable to provide assistance are located, who covers costs of engagement etc. These units certainly represent power which can be engaged in extraordinary situations which need numerous executives, provided that adequate financial support is given.

In majority of cases, the solutions for specific situations are searched only when they become critical i.e. when there is a big danger for the people and property. In that case, professional fire brigades, first aid services, communal companies, medical institutions etc. carry the biggest burden. In the extraordinary situations local self governnment leaders (municipal mayors) are most frequently engaged. Extraordinary situation represents surprise for everyone and becomes finished by visiting endangered places by the representatives of Government or local self- government or by providing available financial support to the endangered persons. In such circumstances it is difficult to make question about the responsibility for actions and undertaken measures.

Planned approach in extraordinary situations operation is necessary, if good results concerning the protection of citizens and their property are wanted. Planned approach also represents a basis for organizing of services and their technical support, recruiting personnel and it represents a precondition for efficient acting in extraordinary situations.

<table>
<tr><td colspan="4">MINISTRY OF INTERNAL AFFAIRS<br><br>MINISTER</td></tr>
<tr><td>National COMMAND CENTER</td><td colspan="2">SECTOR FOR EXTRAORDINARY SITUATIONS AND CIVIL DEFENSE</td><td>Center for calling and informing (112)<br>Center for training and specialization of rescue services memebers</td></tr>
<tr><td>Preventive affairs</td><td colspan="2">Operational affairs</td><td>Risk management</td></tr>
<tr><td>- Inspection supervision<br>- Transportation of hazardous materials,<br>armament and military equipment<br>- Technical protection of space, people<br>and buildings</td><td>Municipal services for protection and rescue</td><td>Civil defense</td><td>Specialized teams:<br>- divers<br>- alpinist<br>- Red Cross<br>- Mountin rescue service<br>- Cavers<br>- Health institutions<br>- Maritime safety</td><td>- ministries<br>- State weather bureau<br>- Institute for geological exploration<br>- Universities and faculties<br>- Medical institutions<br>- Scientific institutions<br>- Other entities</td></tr>
</table>

Structure of management organization in extraordinary situations

Basic idea in the document: Vision for Future which has been prepared by the Ministry of Interior with the assistance of the Danish Institute for Human Rights, is to make an integral Civil Defense and Rescue strategy in extraordinary situations in Montenegro. Professional rescuing units will be organized on the basis of assessing the jeopardy level. They will be able to reach the place where an event occured as soon as possible and to undertake appropriate measures. In specific cases (earthquakes, land slides, avalanches etc.) rescuers' actions during the first hours after the disaster give the best results in people rescuing. Besides, the organization encompassing all participants of rescuing activities and taking care about equipping, training and excercising of rescuers, would be established. Except for the rescuing activities, these units would be trained to provide aid in rebuilding/relieving of the consequences and paramedicinal aid. For efficient action it is necessary to have appropriate equipment, transport vehicles and well trained executives.

After implemented procedure, on the basis of the Article 94, Item 6 of the Constitution of the Republic of Montenegro and in relation to the Article 24 of the Law on State Administration (Official Gazette of the RCG No. 38/03), on its session held on 9th December 2004, Government of Montenegro adopted the REGULATION ON CHANGES AND AMMENDMENTS ON ORGANIZATION OF WORK OF THE STATE ADMINISTRATION. This Regulation, which was published in the Official Gazette of the RCG No. 78/2004 prescribed that Ministry of Interior of the Republic of Montenegro shall be in charge, among other things, for:

- Managing risks,
- Managing civil defense and rescuing in extraordinary situations,
- Managing relieving of consequences in the extraordinary situations (earthquakes, fires and other natural and technical/technological catastrophes).

In that sense DEPARTMENT FOR EXTRAORDINARY SITUATIONS AND CIVIL DEFENSE was organized in the Ministry of Interior.The Department shall enable:

- Integral managing activities aimed at protection and rescuing in the case of occurence of natural and technical/technological catastrophes as well as disasters which appeared due to chemical, biological, radiological and nuclear contaminations – extraordinary situations and managing the work of corresponding bodies within the period of occurence, duration and relieving consequences of extraordinary situations;
- Work coordination of all institutions from the state down to the local level and individuals in the case of occurence extraordinary situations and clearing away their consequences;
- Implementing measures aimed at relieving consequences of extraordinary situations;
- Preparing and informing citizens for acting in the extraordinary situations;
- Equipping of units which are operating in the extraordinary situations; vocational training of the members of units; supervision over functioning and equipping of units belonging to the local self-government, in order to preserve integrity of the civil defense system;
- Safety tasks;
- Undertaking of measures aimed at preventing and extinguishing fire in the green surfaces, forest complexes, as well as fire in industrial, housing and other structures and also activities in rescuing persons and property jeopardized by the fire;
- Undertaking activities on rescuing and relieving of consequences occured due to the earthquakes, floods, land slides, draught, avalanche, ice on the rivers and other natural catastrophes;
- Undertaking activities aimed at rescuing and relieving consequences which occured due to the technical/technological catastrophes (explosions, breakdowns, traffic accidents, accidents in the mines and tunnels, damages at the oil and gas installations etc.) as well as prevention aimed at preventing jeopardizing the citizens' health and environment due to the radiological, chemical, nuclear and biological contamination;
- Supervision in manufacturing and selling of dangerous material, armament and military equipment;
- Establishing of international cooperation and exchange of information and data with the similar services all over the world.

THE DEPARTMENT FOR EXTRAORDINARY SITUATIONS AND CIVIL DEFENSE performs the tasks which are related to: preparing of strategies, projects, programmes and their implementation follow-up; follow-up of harmonization of the legal system with the legal system of European Union and determining and implementing of the programme of cooperation with international and regional organizations, institutions and other subjects as well as participation in international and regional forums, bodies and other types of work; follow-up and enforcing of laws and other regulations in the area of civil defense and rescue, determining of risks and taking care about citizens; drafting texts of the proposals of laws and bylaws, which are, in this area, determined by the Government of the Republic of Montenegro and Ministry of Interior and in relation to this, organizing of public professional debates; providing of explanations, issuing of professional manuals, work instructions and preparing opinions for draft laws and proposals of the laws and other regulations in these area; protection of the citizens' life, health and property and preserving of the conditions necessary for life and work as well as undertaking measures for the purpose of overcoming extraordinary situations – earthquakes, fires, floods, land sliding, draughts, avalanches, snowdrifts, ice on the rivers and other natural disasters, technical/technological disasters, explosions, damages, traffic accidents, accidents in mines and tunnels, damages in the oil and gas premises as well as other unwanted effects of dangerous materials (toxic, poisonous, radio-active, contagious etc); preparation, planning and managing operational task forces and coordinating with all participants in the civil defense and rescue through integral managing activities regarding protection and rescuing in case of occurence of extraordinary situations and coordinating the work of bodies during occurence, duration and clearing away consequences of the extraordinary situations (from the state level up to the local level) in prevention of occurence extraordinary situations and clearing away their consequences; conducting measures on clearing away consequences of extraordinary

situations; preparing and informing citizens how to act in extraordinary situations; equipping of units operating in extraordinary situation and their training; control and supervision of functioning and equipping of units which belong to the local self-government in order to preserve integral civil defense system; collecting, transfering, archiving and processing of data on the basis of modern technologies; establishing international cooperation and exchange of information and data with organizations which are engaged in civil defense in extraordinary situations in other countries, assistance to these states on the basis of the previously signed inter-governmental document on mutual assistance in the case of extraordinary situations; undertaking of preventive measures for the purpose of preventing occurence of extraordinary situations – natural disasters (earthquakes, fires, land slides, draughts, avalanches, snowdrifts, ice on rivers, floods etc), technical/technological catastrophes (explosions, breakdowns, traffic accidents, accidents in mines and tunnels, damages at oil and gas installations etc) as well as prevention in order to prevent endangering the health of citizens and environment caused by the effect of poison, radiological, chemical and biological contamination, rescue activities at the occurence of extraordinary situations, supervision in manufacturing, turnover and transportation of hazardous materials, armament and military equipment and implementing measures to protect people's lives, property and environment from the consequences which appeared due to the incorrect handling these materials and other tasks in accordance with regulations.

These activities are implemented in the Department for Extraordinary Situations and Civil Defense through the following work lines:

a) DEPARTMENT FOR OPERATIONAL AFFAIRS

Department for Operational Affairs performs the tasks in relation to:

Coordination of municipal services for civil defense and rescue; equipping of units that are operating in the extraordinary situations; vocational training of members of rescue units; control and supervision over the units which belong to the local self-government units in order to preserve integral civil defense system; managing and equipping the civil defense units which operate in extraordinary situations and their vocational training; equipping and professional training of the civil defense and rescue units' members in the case of occurence of technical/ technological catastrophes; equipping and vocational training of the civil defense and rescue units' members in case of occurence of chemical, biological, radiological and nuclear contamination; creating of conditios for the efficient evacuation and giving shelter; managing task forces for patrolling and for the defense from fire and air rescue; coordinating of specialist teams for civil defense and rescue; coordination of all institutions, companies and institutions from the state down to the local self-government level in the case of occurence of catastrophes; and other similar tasks.

b) DEPARTMENT FOR CIVIL DEFENSE, PLANNING AND LOGISTICS

Department for Civil Defense, Planning and Logistics performs tasks concerning: preparation of strategies, projects, programmes and follow-up of their implementation; follow-up and implementation of the laws and other regulations in the area of civil defense and rescue, determining of risk and taking care about the citizens; preparing of drafts and proposals of laws and bylaws; preparation of standard operational procedures of protection and rescuing, assessment of danger and civil defense and rescue plans; preparing of the opinion for the drafts and proposals of the laws and other regulations in this field; follow-up the situation and occurences in the area of civil defense; determining the situation and methods of using the shelters and conditions for implementing efficient evacuation and clearing; proposing and organizing of measures for preparing and training of citizens; planning and organizing the civil defense units; proposes type of equipment and means for civil defense units depending on the expressed risks; prepares and makes operational plans for activities of the rescue units on the municipal level, wider region and the state level and other corresponding tasks.

c) DEPARTMENT FOR THE RISKS MANAGEMENT

Department for the risks management performs tasks, which are related to: preparing of strategies, projects, programmes and follow-up of their implementation; follow-up and enforcing of the laws and other regulations in the area of civil defense and rescue, determining the risk and taking care about citizens; preparation the texts of the drafts and proposals of the laws and bylaws; preparing

of the development and strategic documents, national strategies for extraordinary situations and strategic plans for operations of the civil defense and rescue units in the case of big scale extraordinary situations; preparation of the opinion for drafts and proposals of the laws and other regulations in this field; identifying the risk from extraordinary situations, starting with the companies and industrial structures, municipalities, regions up to the state level. This is carried out in cooperation with scientific institutions, other government bodies, organizations, laboratories and individuals; creating database for the high quality risk management, by using modern technology; preparing of action plans for civil defense/rescue operational units at the state level, on the basis of identified risks; follow-up and analysing of modern technical-technological achievements for the purpose of civil defense and rescue in accordance with the expressed risks; other tasks of the kind.

DEPARTMENT 112 – CENTRE FOR CALLING AND INFORMING

The Department 112 – Centre for Calling and Informing is in charge of the tasks which are related to the following: preparing of strategies, projects, programmes and follow-up of their implementation; follow-up and enforcing of the laws and other regulations in the area of civil defense and rescue, identifying the risks and taking care of citizens; preparing of the drafts and proposals of the laws and bylaws; raising of operational readiness, mobility and capacities of the centres 112; collecting and processing of information, notifications and data; informing (notifying) and, if necesary, alarming the citizens, legal entities, government bodies, rescue services and other competent bodies and subjects for civil defense and rescue; preparing of the opinion for the drafts and proposals of the laws and other regulations in this area; keeping records about the situation and events, dangers, disasters and catastrophes, preparing of the public alarm units; coordination of transfering decisions and orders; planning, proposing and coordinating of implementation of modern technologies in the Centre 112 and brahches and sections within the scope of Centre 112 activities; providing of tecnological basis for development of communicational and IT – computer technology necessary for the work and efficient perfoming of the tasks that are envisaged for the government bodies and local selfgovernment units, creating of the conditions for including into the integral European System 112 for the purpose of the high quality international communication with the services for extraordinary situations and civil safety and other tasks of the kind.

d) DEPARTMENT FOR PREVENTION AND INSPECTION SUPERVISION

Department for Prevention and Inspection Supervision performs inspection within the competence and authorizations prescribed by the law in the area of protection from fire, explosions, breakdowns, technical protection of structures and other extraordinary situations; review of the investment-technical documents and it is at the same time when inspection starts, reviewing and follow-up of particular risks and supervision during the construction of structures; supervision of structures where dangerous materials are stored or used in technological process for the purpose of determining the zones of danger; supervision of the technical protection system which directly has an impact on the increase of safety and decrease of the risk of appearance of various accidents – fire, breakdowns, incidents on chemical installations; supervision over the equipment and installations in order to ensure switching off the equipment and installations before appearing of accident; managing of turnover of dangerous material, procurement, use, warehousing and transport; managing of turnover of armament and military equipment; and other tasks of the kind.

### *III.4.2. MINISTRY OF ENVIRONMENT AND SPATIAL DEVELOPMENT*

In the area of environment, this Ministry has been enforcing:

**The Law on Environment** ( "Official Gazette No. 12/ 96),

Regulation on Environmental Impact Assessment ("Official Gazette No. 14/97)

Regulation on the Amount of Allowances and Method of Calculation and

Payment on the basis of Environmental Pollution (" Official Gazette RCG" No. 26/97, 9/00 and 52/00),

The Rule Book on Criteria for Selection of Locations, Method and Procedure

of Waste Material Disposal (" Official Gazette RCG“ No. 56/00),

Regulation on the Protection from Noise ("Official Gazette RCG", No. 24/95 , 42/00 and 25/03),

**The Law on Air Protection from the Pollution** (" Official Gazette RCG“ No. 14/80 , 16/80 and 27/94),

The Rule Book on the Allowed Damaging Material Concentration in the Air

('Official Gazette RCG", No. 4/80, 8/82),

The Rule Book on Methodology of Research, Terms and Method of Informing

about the Results of Follow up and Determining Damaging Material in the Air and on the Resources of Pollution ("Official Gazette RCG", No. 4/82),

The Ruling on Determining of Measuring Posts for Measuring, Specialistic

Testing and Determining the Air Pollution in RCG ("Official Gazette RCG", No. 6/86),

The Rule Book on the Polluting Material Emission into Air ("Official Gazette RCG", No. 25/01),

**The Law on Protection of Nature** ("Official Gazette RCG", No. 36/77 and 27/94),

**The Law on National Parks** ("Official Gazette RCG", No. 47/91) and

**The Law on Foreign Trade** ("Official Gazette RCG", No. 28/04).

During the process of harmonizing legislation from environmental area with the EU legislation, This Ministry adopted **The Law on Environmental Impact Assessment, the Law on Environmental Impact Strategic Assessment and The Law on Integral Preventing and Control of Environmental Pollution.** These laws have been completely harmonized with the international conventions and EU directives and shall be applied as of January 2008.

By signing of the Constitutional Charter i.e. by adopting the Law on Enforcing of the Constitutional Chart of the State Union of Montenegro and Serbia, all tasks concerning the environmental protection have been taken over by the member states, so that this Ministry enforces:

**The Law on the Environmental Protection Foundations** ("Official Gazette RCG", No. 24/98),

The Rule Book on documents to be submitted along with the request

for issing of permits for import, export and transit of waste ("Official Gazette RCG", No. 69/99),

**The Law on the Protection from the Ionization Radiation** ("Official Gazette RCG", No. 46/96),

**The Law on Transport of Hazardous Material** ("Official Gazette RCG", No. 27/90 , 45/90 , 24/94 and 68/02) and

**The Law on the Protection of the Nuclear Power Plants Construction in FRY** ("Official Gazette FRY", No. 12/95)

With the new state organization, this Ministry has also provided enforcing of international conventions and their harmonization with the EU directives as follows:

- Convention on the Birds Protection ("Official Gazette SFRY", No. 6/73),
- Convention on the Swamps of International Importance especially in the

  swamp birds habitats ("Official Gazette SFRY", No. 9/77),
- Convention on Cross Border Air Pollution at Big Distances ("Official Gazette

  SFRY", No. 11/86),
- Protocol on the Long Term Financing of the Cooperation Programme for

the Follow up and Assessment of the Cross Border Transport of the Polluting Material in the Air at a Big Distances in Europe (''Official Gazette SFRY'', No. 2/87),

- Vienna Convention on the Ozone Cover Protection (''Official Gazette SFRY'', No. 1/90)
- Montreal Protocol on Substances Damaging Ozone Cover (''Official Gazette SFRY'', No. 16/90),
- Convention on Biological Variety (''Official Gazette FRY'', No. 11/01),
- Convention on International Trading with the Jeopardized Flora and Fauna Species (CITAS) (''Official Gazette FRY'', No. 11/01),
- Framework UN Conventions about the Climate Change (''Official Gazette FRY'', No. 2/91) and
- Convention on the Control over the Cross Border Movement and Dangerous Waste Disposal (Bazel) (''Official Gazette FRY'', No. 2/99).

Conventions which are signed, but still not ratified:

- Stockholm Convention on the Long Term Organic Polluters (POP- s),
- Convention on the Protection and Utilization of Carpates,
- Protocol on the Environmental Impact Strategic Assessment and
- Protocol on the Register of Emission and Cross Border Transport of the Polluting Material (PRTR).

**1. The Air Quality Control Programme**

Permanent follow up of the air quality in Montenegro has been performed at the certain stations network set up with the Programme. Basic purpose of the air quality control is:

- Determining of the air pollution in the ground atmosphere layer,
- Assessment of the polluted air Impact on the health of people, environment and climate;
- Follow up of the pollution situation change in correlation with the local resources of emission;
- Undertaking of necessary measures for the air protection from the pollution;
- Informing of the public;
- Follow up of the air pollution trends;
- Identifying the Air Pollution resources.

This is the reason why the air control programme scheme has been adjusted to the needs of national and international programme.

**2. Programme of Systematic Research of the Radio-Nuclides Contents**

For the purpose of revealing, determining of danger, informing and undertaking protection measures from the ionization radiation, following tests are carried out: the outside radiation level, radio-nuclides contents in the air, solid and liquid precipitations in lakes, sea, river water, soil, drinking water, human and cattle food, residing premises and construction material. Programme of early announcing of accidents within the Global Atmospheric Programme Monitoring, is implemented by follow up of the absorbed Gamma radiation level in the air four times a day, and as for precipitation it is measured two times a day. In extraordinary situations measurement is carried out every hour.

**The Arza Cape Decontamination Programme** from the consequences of air shelling with the impoverished uranium missiles, has been evaluated by the UNEP scientific mission as successful and efficient.

**3. Programme of Testing of the Hazardous and Dangerous Materials Contained in the Ground**

Programme of testing of materials in ground encompasses ground analyzing by municipalities, on the locations which are the most exposed to the pollution as follows:

- Locations in the vicinity of the waste damps;
- Locations in the vicinity of the roads with the heaviest traffic;
- Sub-stations locations.

**4. Monitoring of the Environmental Situation**

Pursuant to the provisions of the Article 21 of the Law on Environment, Government of the Republic of Montenegro each year adopts Programme on Environmental Situation Monitoring. On the basis of the results obtained by the implementation of this Programme, each year Ministry prapares an Information on the Environmental Situation in Montenegro, which is adopted by the Government and afterwards it is submitted to the municipalities. Since 2002 the information has been published in internet presentation of the Ministry of Environment and Spatial Development.

Monitoring of the basic environmental segments, which is conducted by the Ministry of Environment and Spatial Development, in relation to the air, surface and subterranean waters, soil, biological diversity as well as a radioactivity level in the environment, provides an image about the environmental quality but does not enable establishing the links between the causes, pressures, situation, consequences and measures (DPSIR), which is the requirement of the European Agency for Environment (EEA).

**Competence of the Ministry of Environment and Spatial Development in the Area of the Environmental Protection**

Operational activities in relation to the environmental protection are performed in the **Sector for the Environmental Protection:**

- Monitoring of the environmental situation as a whole and by segments: air, surface waters, land, biodiversity, hazardous waste, ionizating and non-ionizating radiation etc.
- Proposing of measures for rehabilitation, protection and improving the environmental quality.
- Preparation of information, analyses and opinions from the area of the environmental protection, setting up of standards and environmental quality norms;
- Issuing of environmental approval after the carried out procedure of the environmental impact assessment i.e. after preparing of the assessment elaborate.
- Issuing of opinions on the spatial/planning documents as well as about the implementation of the water management and geological research projects.
- Performing of the control tasks, carrying out of the direct supervision over the enforcement of law and other regulations as well as undertaking measures for removing of the identified irregularities. These activities are carried out by ecological inspection.
- Preparing of laws and other regulations covering environmental protection area.
- Proposing and creating of the basis for setting up the environmental protection policy, monitoring of implementation of the set up policy and programme for its carrying out.
- Performing of tasks which are related to the economic policy of the environmental protection, economics of natural resources and economic instruments set up by regulations.
- Creating of the programme for using the means for environmental protection in Montenegro and for the conditions of financing, data collecting and preparing information about implementation of these funds, proposing of the instruments for funding of the environmental protection.

- Establishing and managing environmental protection IT system, designing and creating of applicative software for the Ministry, eco-management affairs and utilization of eco-management instruments.
- Programming and coordinating of international cooperation, follow-up of international contracts and conventions and implementation of the international cooperation due to providing of financial resources.
- Preparing of the drafts and proposals of the laws and other regulations from the area of environment for the purpose of carrying out the set up policy in the area of the environmental protection.
- Cooperation with NGOs from the area of ecology and civil society in the implementation of ecological policy of Montenegro, creating of programmes which are directed towards rising awareness and citizens' education in the area of protection and enhancement of environment.
- Control of the legality of the acts and implementing of supervision over the legality of both acts and working performance of the subjects of public competence in the area of environmental protection.

### *III.4.3. HEALTHCARE INSTITUTIONS AND PERSONNEL*

By the end of 2005 there were 7.510 employees who worked in the public healthcare institutions of Montenegro, as follows:

- There were 3.730 employees i.e. 2.921 medical workers and associates and 809 non-medical workers in out-of-the-hospital services (Healthcare Centres, Institute for Public Health and Pharmacy institutions);
- In the In-Patient Clinics (general hospitals, special hospitals and Clinical Centre of Montenegro) there were 3.780 employees i.e. 2.734 medical workers and associates and 1.046 non-medical workers and
- There were 583 doctors (105 general practitioners, 82 under specialization and 396 specialists), 242 dentists, 95 pharmacists and 39 healthcare associates with the University degree in the non-hospital services.

In In-Patient Clinics there are 620 doctors (3 general practitioners, 165 under specialization and 452 specialists), 29 dentists, 9 chemists and 26 healthcare associates with University degree working now.

**Personnel in the Public Healthcare Institutions in Montenegro**

| Personnel profile | Out-of-the-hospital services | | Hospital services | | Total Healthcare Institutions | | AU Montefarm | | Institute for medical rehabilitation in Igalo | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Medical staff & collaborators | 2.696 | 79,1 | 2.734 | 72,3 | 5.430 | 75,5 | 225 | 70,1 | 342 | 44,0 | 5.997 | 72,4 |
| Non-medical staff | 713 | 20,9 | 1.046 | 27,7 | 1.759 | 24,5 | 96 | 29,9 | 435 | 56,0 | 2.290 | 27,6 |
| TOTAL | 3.409 | 100,0 | 3.780 | 100,0 | 7.189 | 100,0 | 321 | 100,0 | 777 | 100,0 | 8.287 | 100,0 |

***Out-of-the-Hospital Healthcare Protection***

Out-of-the-hospital healthcare protection of the population in Montenegro shall be provided on the territorial units' level (municipalities) and is carried out by the healthcare centres. There are 18 healthcare centres while there are healthcare stations in three municipalities.

Healthcare stations in the municipalities of Plužine and Šavnik are territorially connected to the Healthcare Centre in Nikšić, while the Healthcare Station in the Žabljak municipality is territorially connected with the Healthcare Centre in Pljevlja.

Public healthcare institutions, Institute for Public Health and Pharmacy Institution „Montefarm" encompassing 40 pharmacies (Podgorica 9, Plav 3, Bar, Berane, Budva, Danilovgrad, Kolašin, Kotor, Nikšić, Ulcinj and Herceg Novi 2 each and ih other 10 municipalities 1 in each of them) have special importance for out-of-the-hospital healthcare protection.

There are 165 private healthcare institutions – ambulances, without pharmacies, which have the important role in the primary healthcare protection of the population of Montenegro. The above mentioned institutions are located in several municipalities, where the services are performed for 34 various medical activities. Majority of them is located in Podgorica (44,24%) then in Bar (12,72%), Budva (10,09%), Herceg Novi (8,48%), Nikšić (6,66%) etc. There are 77 (46,66%) dentists' institutions, 14 (8,48%) gynecologic institutions, 10 (6,06%) institutions of internal medicine, 11 (6,66%) institutions for ocular diseases, 7 (4,24%) pediatric institutions, 5 (3,03%) ultrasound diagnostic institutions, 3 (1,181%) general practitioners' institutions etc.

**Hospital Healthcare Protection**

Hospital healthcare protection in Montenegro is provided through:

- ***Seven general hospitals:***
  - Bar (for municipalities: Bar and Ulcinj);
  - Bijelo Polje (for municipalities: Bijelo Polje and Mojkovac);
  - Berane (for municipalities: Berane, Andrijevica, Plav and Rožaje);
  - Kotor (for municipalities: Kotor, Tivat and Herceg Novi);
  - Nikšić (for municipalities: Nikšić, Plužine and Šavnik);
  - Pljevlja (for municipalities: Pljevlja and Žabljak) and
  - Cetinje (for municipalities: Cetinje and Budva).

• ***Five In-Patient Clinics healthcare centres and healthcare stations*** which are located in municipalities: Mojkovac, Plav, Plužine, Rožaje and Šavnik. According to the provisions of the Law on Healthcare Protection, healthcare centres are not allowed to have In-Patient Clinic in their structures. Bylaws for the secondary and tertiary level of healthcare protection haven't been made so that on the basis of the existing ones (until creating of new normative acts) for the hospital healthcare service as well as the Healthcare Institutions Network in the year 2005 there were 85 beds, as follows: Healthcare Centre (HC) in Mojkovac 15, HC Rožaje 30, HC Plav 15, HC Ulcinj 8 and healthcare stations: Plužine 7 and Šavnik 10 (5 beds of the In-Patient Clinic in HC Kolašin is not in use anymore).

• ***Clinical Centre of Montenegro***, which, apart from general hospital activities for the municipalities of Podgorica, Danilovgrad and Kolašin also provides territorial healthcare protection of all levels for the state.

- ***Three special hospitals:***

1. Special psychiatric hospital - Dobrota in Kotor;

2. Special hospital for orthopedic casualty, neurology and neurosurgery: „Vaso Ćuković" Risan;

3. Special hospital for the lung diseases and tuberculosis „Dr Jovan Bulajić" Brezovik in Nikšić.

• ***Institute for Physical Medicine, Rehabilitation and Rheumatology „Dr Simo Milošević" AD Igalo*** in the municipality of Herceg Novi.

Hospitals are territorially located so that, with their personnel, treatment and equipment, provide total in-patient healthcare of the population at the municipality level, inter-municipal level of two or more municipalities and the whole state.

In accordance with the social needs and capacities for the hospital health protection, legal act covered the network, titles and other requirements for carrying out hospital activities.

Hospital bed capacities in the year 2005 were envisaged on the basis of the Bed Stock Normatives in Montenegro, at rate of 4 beds per 1.000 inhabitants (623.684 of domicile inhabitants and 26.331 displaced persons and refugees) or a total of 2.600 beds which are arranged in following way:

- In general hospital capacities there are envisaged total of 1.495 beds, which means 2,3 beds per 1.000 inhabitants,
- In specialist hospital capacities a total of 975 beds was envisaged, which means 1,5 beds per 1.000 inhabitants and
- In Clinical Centre of Montenegro subspecialistic hospital capacities were envisaged with the total of 130 beds i.e. 0,2 beds per 1.000 inhabitants.

***Personnel and beds in the hospital healthcare protection***

| PUBLIC HEALTHCARE INSTITUTION | No. of beds | No. of doctors | No. of nurses | % of capacity utilization | No. of free beds |
|---|---|---|---|---|---|
| **HC In-patient Clinics** | **85** | **11** | **46** | **44,69** | **47** |
| **General hospitals** | **1159** | **218** | **617** | **65,37** | **401** |
| Bar | 153 | 32 | 78 | **71,62** | **43** |
| Berane | 207 | 33 | 117 | **61,04** | **80** |
| Bijelo Polje | 147 | 33 | 96 | **61,51** | **56** |
| Kotor | 152 | 32 | 70 | **56,87** | **65** |
| Nikšić | 286 | 43 | 123 | **65,09** | **99** |
| Pljevlja | 93 | 21 | 65 | **83,05** | **15** |
| Cetinje | 121 | 24 | 68 | **67,33** | **39** |
| **Special hospitals** | **622** | **55** | **206** | **75,43** | **152** |
| Spec.hospitals for lung diseases and tubercullosis: Brezovik – Nikšić | 141 | 15 | 57 | **104,59** | **0** |
| Spec.psychiatric hospital: Dobrota – Kotor | 303 | 13 | 72 | **75,68** | **73** |
| Spec. Hospital for ortop. neuroh. and neurology in Risan | 178 | 27 | 77 | **51,90** | **85** |
| **Clinical Centre of Montenegro** | 715 | 229 | 496 | **71,86** | **201** |

| | | | | | |
|---|---|---|---|---|---|
| **TOTAL** | **2.581** | **513** | **1.365** | **68,91** | **802** |

Compared to the situation from the year 1992, number of hospital institutions and beds is almost the same. With the re-organization of the healthcare service in Montenegro during the nineties and in accordance with the Healthcare Protection Programme in Montenegro for the year 2005, 57,5% beds have been planned for the purposes of general hospitals and In-patient Clinics in the healthcare centres, and 42.5% for special and subspecial purposes.

Out of 2.581 beds which was their number in all healthcare institutions of Montenegro, during the year 2005 there were **802 free beds** or 31% of the total number of beds. In general hospitals during the year there were 401 free beds, 201 beds in the Clinical Centre of Montenegro, 153 beds in special hospitals and 47 beds in the HC In-patient Clinics. Permanent follow-up and information on number of the free hospital beds in the Republic is of a great importance in relation to the extraordinary situations, because in the case of catastrophy, capacities for urgent accomodation of the injured and/or diseased persons for the purpose of medical treatment can be always envisaged.

In accordance with the Report on Working Performance of Hospital-In-Patient Clinic Institutions, there was total of 2.581 beds In Montenegro on 31st December 2005, out of which:

- 1.159 beds which were intended for general hospital capacities and 85 beds located in the HC In-Patient Clinics,
- 622 beds for the special purposes and
- 715 standard beds in the Clinical Centre of Montenegro (in the report from the field services, beds of General Hospital Nikšić and General Hospital Cetinje are still registered and kept in the above mentioned hospitals and not in Clinical Centre of Montenegro).

***INSTITUTE FOR THE PUBLIC HEALTH***

In The Institute for Public Health there are three organizational units that can operate in extraordinary situations: Centre for the Control and Prevention of Disease, Centre for Healthcare Ecology and Centre for Medical Microbiology.

**CENTRE FOR THE CONTROL AND PREVENTION OF DISEASE**

Basic activity and contents of the work of this centre include follow up, research and analyses of the contagious diseases, epidemiological situation and proposing of the prevention/control programme for them as well as elimination and eradication of some contagious diseases.

Centre prepares a unique national immunization programme for preventing contagious diseases, follows up their implementation in all healthcare centres and carries out evaluation, makes plans and proposes programmes/plans for extraordinary situations and prepares reports on possible consequences in accordance with the SZO reports. Centre follows up, makes research and analyses epidemiological situation of the mass non-contagious diseases of a significant social and medical importance and proposes programme for their control and prevention, creates epidemiological studies for the assessment of the contagious diseases and main mass non-contagious diseases.

The activities of this Centre have been implemented within the three departments:

**Department for the contagious diseases epidemiology** performs the following activities and tasks:

- Follows up, makes research work and analyzes situtation with contagious diseases and proposes programmes for their prevention and control as well as elimination and eradication of some contagious diseases;
- Creates professional/methodological instructions for the prevention and control of acute contagious diseases and carrying out of the Mandatory immunization programme and immunization by epidemiologic indications. It carries out professional/methodological coordination and directs professional work of the healthcare institutions which perform epidemiological activity and carry out mandatory immunization programmes;

- Implements epidemiological studies for the assessment of contagious diseases;
- Determines methodologies for considering of the population healthcare situation in the area of the contagious disease epidemiology;
- Keeps healthcare records from its area in accordance with law and makes exchange of epidemiological data with the epidemiological services of the surrounding states as well as with the World Healthcare Organization and other international organizations and agencies which are engaged in problems from the domain of epidemiology of the acute contagious diseases;
- Plans, proposes and carries out measures for preserving and enhancing of the population health from its domain through the health-educational activities and media;

**Department for epidemiology of the mass chronical diseases and injuries** performs the following activities:

> Follows up, makes research work and analyses situation with the mass non-contageous diseases of a significant social/medical importance, researches risk factors which influenced their occurence and proposes programmes for the control and prevention of the diseases;

> Prepares epidemiological studies for the assessment of the main mass non-contagious diseases;

> Determines methodologies for understanging of the population healthcare situation from the area od non-contagious diseases;

> Keeps healthcare records that are significant for the state, within its area of competence in accordance with the law and exchanges epidemiological data with epidemiological services of the surrounding states as well as with the World Healthcare Organization and other international organizations and agencies which are engaged in the problems from the domain of the mas non-contageous diseases epidemiology;

> Makes plans, proposes and carries out measures within its competence, aimed at preserving and enhancing of the population health, through health/educational activities and media;

**Department for DDD and protective medical protection in the extraordinary conditions**

This Department performs the following activities:

> Carries out supervision and control over damaging biological agents and applies measures of desinfection, desinsection and deratization; and

> Determines and carries out necessary healthcare measures under extraordinary conditions (epidemics, natural disasters and catastrophes, war etc).

**HEALTHCARE ECOLOGY CENTRE**

Healthcare Ecology Centre with the Institute for Public Healths performs its activities through:

> Monitoring of the environmental resources: water, land, sediment and mud;

> Follow up, research or control over the healthcare situation, quality of commodities and objects of general use;

> Follow up of the communal noise level;

> Testing of industrial and sanitary waste waters;

> Characterisation and categorisation of waste material;

> On the basis of the performed laboratory test, issuing of the professional opinion about the risks factors present in the environment;

> Analysis of the influence of objects i.g. works upon the environment and risk analysis and chemical accidents risk assessment;

- Assessment of the exposure scale with the identified ecological factors and risks for the health;
- Recording the situation, cooperation with the sanitary inspection, preparing of the environmental protection elaborate, research work in the area of environment;
- Providing of expert opinions.

**Department for sanitary chemistry** has the following laboratories:

*Laboratory for AAS* – which determines contents of heavy and toxic metals in samples of water, air, land, commodities, sediments as well as biological material and waste water through the Atomic Apsoption Spectro-photometry (AAS) with the instrument: Perking Elmwe model 300 equipped with HGA-800 (graphic civette) and FIAS 100 (hybrid system). Laboratory is also capable of determining contents of mercury with the cold steam method through the instrument PYE UNICAM, series 1900. Instrument has all necessary HCL lamps for determining of mineral components, microelements and detrimental/hazardous metals.

*Laboratory for the Gas Chromatography* has the capacity to perform identifying of the contents of easily evaporating and persistent organic polluters. Laboratory owns an instrument for the gas chromatology HP 8590 series II with FID detectors (fiery ionization detector) and ECD (electronig catch detector). The instrument is equipped with all necessary collons for identifying of the specific toxic materials like: pesticides, PCBs, dioxines etc.

*Laboratory for spectrommetry* with UV-VIS spectro-photometers which can test solid, liquid and gas samples.

*Laboratory for TOC* which has the capacity to identify contents of the total organic carbon in the liquid and solid samples.

*Laboratory for the thin-layers chromatography* which can perform high quality testing of the majority of detrimental/toxic substances.

*Laboratory for testing of commodities and general use objects* which performs quality analyses and controls (organoleptic analysis, fat and carbon hydrates, vitamins, methanol, furfurol, additives etc) and sanitary quality of commodities (of vegetable and animal origin) on the contents of the toxic substances residues (heavy metals, pesticides, PCBs, dioxines, hystamine, mycotoxines, anabolics etc) and general use objects (means for maintaining of personal hygiene, tobacco and tobacco products, dishes and accessories for commodities, raw material, etheric oils etc).

*Laboratory for testing of water and ground* which performs testing of the hygienic and sanitary quality of drinking water, surface and subterranean water. There are the following parameters which are identified during the analyses: psychic, psychical/chemical (anions, cations, organic notrogen and phosphore, detergents, fenoli, TOC, mineral oils, specific organic substances like PCBs, dioxines, pesticides, insecticides). Control over the composition and control over the land quality are carried out through determining a range of parameters like: basic contents of mineral components (silicium, aluminium, iron etc), micro-elements (mangane, zync, copper etc), hazardous and detrimental substances (heavy metal, insecticides, PCBs, dioxines etc).

*Laboratory for waste material* where characterisation and categorisation of waste material (waste waters, solid and hazardous waste material) are carried out. This laboratory performs waste waters analysis as influent and effluent in relation to the content of specific parameters (pH, suspended materials, chlorides, sulphates, heavy metals, bio-degradable detergents, insecticides, organic pollutants etc), prepares reports on the waste water environmental impact and makes assessment of efficiency of the instruments which are used for waste water treatment, identifies method of disposal and treating of the solid and hazardous waste material, carries out characterisation of the hazardous waste material, identification and quantification through identifying of contents of eco-toxic and toxic substances, hazardous substances (group I to IV), oxidants and organic peroxides.

- **Department for nourishment and human ecology** performs the following tasks:
  - Makes assessment of the environmental and work environment on the health of population;
  - Follows up hygienic conditions within the mass nourishment structures;
  - Follows up sanitary/hygienic conditions in public structures;
  - Follows up sanitary situation in the structures for manufacturing and trading with commodities;
  - Follows and studies sanitary/hygienic conditions in the water supplying structures and gives a proposal of the necessary measures;
  - Identifies risks factors for the population which may lead to non-contagious diseases and undertakes measures for decreasing or removing of these risks;
  - Participates in the protective supervision over designing and building of the construction structures and in drafting of spatial and urban plans from the point of the protection and enhancement of environmental and working environment and population health;
  - Performs field patrolling and studying of individual/collective nutrition and population nutrition and
  - Performs field patrolling, measuring and taking of the samples from the work domain of Centre.

  The tasks of this Department are performed by the following departments:

  a) Department for nutrition

  b) Communal hygiene and human ecology department.

**CENTRE FOR MEDICAL MICROBIOLOGY**

**Centre for medical microbiology** performs the following activities and tasks:

- Performs functions of the referent microbiological laboratory in the area of operations and procedures for which it is accredited;
- Through the checked and standardized work methods reveals causative agents of the contagious and other diseases that are caused by the bacteria, rickettsias, viruses, fungi, protozoa, helmits and insects;
- For the purpose of preventing and stamping out of the contagious and other diseases, performs research work and identifying of the carriers of microbes and parasites;
- For the purpose of environmental protection, through sanitary microbiological methods performs inspection of the commodities, water, air and general use objects;
- Performs microbiological control of medicines, intravenuous solutions and other material for the human use;
- Performs bacteriological and parasitological check-ups of the persons who are, pursuant to the legal regulation, subjected to the healthcare supervision and issues necessary documents to them on the performed check-ups.
- Through serologic reactions participates and helps in diagnozing of the contagious and other diseases;
- Carries out tasks of cleaning and washing of the laboratory instruments, their sterilization as well as destroying of other bio-hazardous material originating from laboratory;
- In cooperation with other services of the Institute, researches and develops activities in the public health area, healthcare policy and develops public health programmes.

- **Department for bacteriology** also performs the following activities and tasks:
  - > Participates in stamping out and preventing of the contagious and other diseases of the bacteriological etiology (of the sporadical and epidemiological character) by insulation and identification of the insulated causitive agents at patients and the microbe carriers;
  - > For the purpose of controlling efficiency of chemio-terapheutics and antibiotics i.g. their correct appliance, performs testing of the sensibility of insulated bacteria to them, insulates, prepares and keeps bacteria species as well as diagnostic antiserums;
  - > Creates technical means, reagents, bacteriologic colours and other ingridients for its needs;
  - > According to the needs, provides professional-methodological assistance to other microbiological laboratories and healthcare institutions;
  - > Follows up development of the microbiological laboratory technique and diagnostics and proposes introducing of new and contemporary work methods and implements them.
- ***Department for sanitary microbiology*** *also performs the following activities and tasks:*
  - > Sanitary microbiology method takes samples and performs bacteriological inspection of commodities, water, air, general use objects and other materials for human use;
  - > According to the needs it provides professional/methodologic assistance to other microbiological laboratories;
  - > Follows up development of the microbiological laboratory technique and diagnostics and proposes introducing of new and contemporary work methods and implements them.
- **Department for virusology and serology** performs the following activities and tasks:
  - > Carries out insulation and identification of viruses;
  - > Carries out serologic diagnosis of various viruses and other diseases caused by the microorganisms;
  - > Participates in preventing and stamping out of different diseases caused by viruses;
  - > Prepares antigenes, serums and other ingrediencies for diagnosing of virus and other diseases;
  - > Provides professional/methodological assistance from the area of virusology and serology to other microbiological laboratories and healthcare institutions.
- **Department for parasitology and mycology** performs the folllowing activities and tasks:
  - Through the checked and standardized methods (microscopic, cultural and serologic) it performs research of biology, ecology and pathogenic role of the human parasites and fungi;
  - Studies the diseases caused by human parasites (protozoae, helmint) and performs their diagnostics;
  - Makes a diagnosis for the diseases caused by the fungi (micoses) and proposes measures and participates in their preventing and stamping out;
  - Studies level of the outspread of species and studies biology, vectors and molestants;
  - For the purpose of prevention of parasitary diseases it performs check up of the personnel employed in manufacturing and trading of commodities and fresh water supply against the presence of intestine protozoe, helminati and fungi;

  Provides professional and methodological assistance from the area of parasitology and mycology to other laboratories and healthcare institutions.

## PROTECTIVE HEALTH CARE PROTECTION

**Situation with the protection/medical teams in Montenegro**

Looking generally, healthcare system of Montenegro doesn't have enough proctection/medical teams; the existing personnel hasn't been sufficiently equipped and trained for work with the causative agents of especially dangerous contagious diseases (lack of adequate field vehicles and personal protection equipment for the team members; lack of diagnosing capacities for one kind of causitive agents, especially for the particularly dangerous contageous diseases – there are no adequate equipment and biosafety conditions for the safe sampling, transport, stocking and diagnosing of such diseases. Apart from that, it is not possible to send samples of the sick persons (infective material) to the relevant/specialized world laboratories for the purpose of diagnosing of the contagious diseases causitive agents. Namely, there are not specialized agency in Montenegro which could dispatch such special shipments. Clinic for contageous diseases at Clinical Centre of Montenegro doesn't have conditions for adequate insulation of the sick persons and equipment for appropriate curing of the sick persons from the particularly dangerous contageous diseases.

Due to the above mentioned it is necessary to prepare adequate plans of needs and carry out appropriate education of necessary personnel, as urgent as possible. For such activities, it is necessary to engage personnel with the specific and special experience i.e. experts from the highly specialized institutions from abroad. Chances for training of such profile of personnel in specialized institutions ought to be considered.

Also in case that the above mentioned diseases occur it must be expected that Montenegro should have to ask assistance from the World Healthcare Organization and from specialized teams of the collaboration centres of that organization such as Euro-CDC, CDC-USA and others.

I. I. Preventive/medical means in reserve

For the needs of medical treatment and postexposition prophylaxis of hemorrhagic fevers there aren't specific vaccines except for the vaccine for the yellow fever while, for medication and postexposition prophylaxis of plague it is necessary to have the following antibiotics in reserve: doxicycline, cyprofloxacine, chloramphenicol, gentamycine and streptomycine. For the needs of chemio-prophylaxis and medical treatment of the sick persons from the bird flue and pandemian flu, plans have been made for the necessary quantities of oseltamivira and other medicines which are necessary for medical treatment as well as mono-valent vaccines for pandemian race (in case that it is available).

For the needs of DDD tasks it is necessary to have reserves of the appropriate DDD means (chlorine preparations and ordinary preparations for desinsection and deratization) and equipment for their application as well as appropriate quantities of the personal protection equipment (special clothings and masques with the highly-filtrating respirators).

Apart from the vaccines for carrying out of regular immunization programmes it is necessary to provide reserves of vaccines against tetanus, meningkoka, hepatitis A and certain quantity of antibiotics necessary for chemio-prophylaxis (doxicycline, cyprofloxsacine, amoxiciline – clavulonat etc).

For the needs of carrying out of DDD tasks it is necessary to provide a reserve of the adequate quantity of chemical preparations (for instance: chlorine preparations for desinfection of water and environment and customary preparations used for desinsection and deratization) and equipment to use them.

For the needs of medical treatment and post-exposition prophylaxis of the mentioned most frequent causitive agents of bacteriological origin, reserves of various antibiotics: doxiciline, cyprofloxsacine, chloramphenicol, gentamycine, streptomicine, penicillin, various serums (anitibotulite etc) are necessary.

For the virus etiology diseases there are no specific immuno-prophylaxis (vaccines) for the major part of diseases except for the yellow fever, human subtypes of flu viruses, smallpox,

hepatitis A virus and they are available in a very restricted quantities. Practically there aren't possibilities for the specific therapy against the diseases caused by viruses.

For medical treatment of the above mentioned fungous infection diseases it is necessary to have reserves of fluconasol, itraconazol, amphotericine B. There is no specific prophylaxis for mentioned diseases.

For the needs of DDD tasks, it is necessary to have reserves of appropriate DDD means (chlorine preparations and customary preparations for desinsection adn deratization) and equipment to apply them.

Also, it is necessary to have reserves of appropriate quantities of personal protection equipment (special clothings and masques with the highly filtrating respirators), special vehicles in which it is possible to perform showering and decontamination after the field work.

Apart from the Institute for Public Health which provides services within the whole territory of Montenegro and functions partly as municipal institution (Podgorica, Danilovgrad and Cetinje), hygienic-epidemiologic services (HES) from the healthcare centres which are regionally oriented also participate in the preventive healthcare protection. The following healthcare centres (HC) have HES: HC Bar, HC Budva, HC Herceg Novi, HC Nikšić, HC Pljevlja, HC Bijelo Polje and HC Berane.

All healthcare institutions have great importance concerning extraordinary situations. Healthcare centres have emergency aid units which participate in healthcare treatment of all sick or injured persons within the place where the extraordinary situation occured, transport them to the healthcare institution where necessary medical treatment will be provided to them or take sick and injured persons into their premises and provide them with first aid and in a case of need also transport them to the first hospital where medical treatment is continued.

Emergency units are partially equipped and their equipment must be enhanced in all segments: spatial, personnel and especially equipment segment as in the first part there is the biggest deficit.

Institute for Public Health in cooperation with HES at the healthcare institutions, carries out preventive activities and participates in preventing of extraordinary situations from the domain of its activity and participates in rehabilitation of the hygienic/epidemiological situation during extraordinary situation and after its ceasing. Centres for microbiology and healthcare ecology at the Institute have adequate microbiological and chemical laboratories in which it is possible to make necessary analysis of biological material, food, water, ground and air.

Within the hospitals and Clinical Centre of Montenegro, there are urgent units for the urgent medical treatment of patients which can be treated at the healthcare centre. There are also accomodation capacities for treatment of those who need hospital treatment. According to the current capacities in the Republic of Montenegro, there are enough extraordinary accomodation capacities so that in case of extraordinary situation and need between 500 and 700 patients can be received for the hospital treatment.

The biggest problem can be seen in the lack of adequate space for insulation and quarantine as well as in the space and equipment for treatment of the patients that got a disease from the highly infective microorganisms. Also, there is a big lack of the specialized laboratory within the healthcare institutions where presence of hazardous chemical substances and poisons in the biological material could be identified.

In Montenegrin healthcare institutions there is relatively good situation with personnel. There is a lack in the area of epidemiology and medical toxicology which is of a great importance for the extraordinary situations.

### *III.4.4. CENTRE FOR ECO-TOXICOLOGICAL RESEARCH OF MONTENEGRO*

Centre for Eco-toxicological Research of Montenegro (CERM) was established by the Government of Montenegro in the year 1997 for the needs of implementation of monitoring of all environmental segments against the contents of toxic and hazardous materials as well as for performing of analyses from the area of eco-toxicology and radiology of environment, food, drinking water,

biological and human material during the peace time and during the situations of accidents. CERM is equipped with all necessary instrumental equipment as well as with the educated and trained staff for implementation of necessary tasks.

In **The Department for Eco-Toxicology and Monitoring** CERM has the following laboratories:

- Laboratory for identification of all evaporating organic compounds with the possibility of identification of unknown materials. This laboratory has three gas chromatographs with different detecting systems for analyzing of gases, halogen, sulphuric, nitrate and phosphoric compounds, Head Space analyzer for the easily evaporable compounds and gas-mass spectrometry for the analysis and determination of the unknown toxic material as well as specific toxic materials like PCB-s, PAHs, dioxines, myco-toxines etc;
- Laboratory for analysis of heavy metals and other elements by using of the fiery Atomic absorption, track analysis with the graphic civet and hydride technique, track analyzer for the mercury tracks with 27 HCL lamps and ICPS instrument which is capable of simultaneously determining 42 elements from one sample;
- Laboratory for spectrometry with: UV-VIS spectrometre, FTIR spectrometre with the possibility of analyzing liquid, solid and gas samples and determining of the molecular structure of the unknown substances and as a spectro-fluorimetre for analyzing of fluorescent and phosphorescent substances;
- Laboratory for the screening tests with the thin layer chromatography.
- Laboratory for HPLC – liquid chromatography under high pressure, HPLC-MS liquid chromatography under high pressure with the mass detection for the analysis of organic substances (hidro-soluble) like antibiotics, hormones, anabolic myco-toxines, histamines, amino-compounds and many other. New HPLC-MS gives possibility of identification of the unknown substances. In this laboratory there is also an instrument with FIA and IC analyzers for the fast identification of anions, phenols and cyanides in waters.
- Apart from that, CERM also has laboratories for preparation and purification of samples for the above mentioned analytical techniques. CERM has also all necessary equipment for sampling of water, inflammable and toxic materials, automatic samplers for waters, ground, sediments and air samplers in situations of accidents, smoke gases analyzers, pumps for sampling of big air volumes, personal air samples for absorption with indicator tubes as well as current scheme of permanent stations for continual research of the quality of air and precipitations in 17 Montenegrin settlements where the following substances are monitored: SO2, NOx, HsS, formaldehyde, ammoniac, fluorides, phenols, suspended particles, smoke, cinder, sediment metals and organic toxic materials like PAH, PCBs, dioxins etc.

**Department for radio-ecology and monitoring** has the following laboratories:

- Laboratory for gamma-spectrometry with two gamma-spectrometers of the high efficiency and sensibility, PCRM analyzer for the continual measuring of expositional dozes of gamma radiation along with automatic computer data processing and alpha-beta counter.
- Laboratory for testing of radon with several different instruments with the capacity of testing of radon “in situ” in waters and ground which is one of the supporting methods to test possible seismic activities.
- Laboratory for dissymmetric testing with the great number of various dosiometric devices for testing of alpha, beta and gamma radiation.
- Laboratory for TLD (thermo – luminescent dosiometry) for reading of the received radioactive radiation dozes.
- Laboratory for testing of the working environment conditions: noise and microclimatic parameters.

Centre has permanent mobile teams for potential interventions and sampling, sets for the water/ground field analyses as well as mobile monitor station for testing of air quality and

meteorological data. Deficiency of the Centre is that it has only one field vehicle of the Land Rover type for the inaccessible terrains.

So far efficiency of organization in urgent interventions was tested during the NATO strikes in 1999 when our teams where at the places of attack immediately after shelling, together with the intervening unit of the Ministry of Interior. Locations were dosiommetrically tested and samples were taken for the analysis of chemical means and military poisons which were analyzed in a very short period. It is also important to point out decontamination of the Arza cape from the impoverished uranium pollution which was implemented by the CERM employees which makes the first undertaking of the kind successfully carried out in the world. A disaster caused by pouring of oil in the Port of Bar, pouring of oil in Bijela, poisoning of the Ministry of Interior employees in Mojkovac, train accident caused with the anode resin in Zagorič, poisoning of the workers in the Steel Factory Works in Nikšić, pollution from Aluminum Company and other pollutions are worth mentioning, where the capacities of the CERM workers were demonstrated.

From the above mentioned it could be seen that CERM is capable of quickly and efficiently analysing all kinds of chemical substances in waters, air, ground and biological material and of instantaneous detecting of possible increase of the air radio-activitiy in Podgorica and of dosiommetric, α, β i γ α, β and γ-spectrommetry research of radioactivity in the field.

In 2004 CERM obtained quality certificate ISO 9001:2000 from TUV Bayern, Germany and accreditation by ISO 17025 standard for the area of analyzing of waters, ground, radio-activity and fish analysis including the analysis of all toxic materials in them.

### *III.4.5. HIDRO-METEOROLOGICAL INSTITUTE*

1 OPERATIONAL TASKS AND OPERATIONS

Hydro-meteorological institute performs the following tasks and operations:

- Establishing, building and maintaining of the network of hydrologic and meteorological stations that are significant for the state of Montenegro;
- Meteorological observations and measuring for the needs of weather forecasting, climatology, agro-meteorology and special meteorological observations in the meteorological stations network and basic processing of the observed data.
- Hydrological observations and measuring of the surface and underground waters, river sediments and special hydrological observations and measuring in the network of hydrological stations and basic processing of the observed data;
- Observations and measuring quality of air and precipitations including radioactivity of air and precipitations within the meteorological stations network, basic processing of the observed data and follow up of the polluted substances movements through atmosphere;
- Observation and measuring of characteristics of the surface waters, underground waters also including water radioactivity in the hydrological stations network and basic processing of the observed data;
- Establishing, building and maintaining of the hydro-meteorological computer and IT system, setting up and maintaining of the measured equipment.
- Establishing, building and functioning of the hydro-meteorological telecommunication system for gathering, exchange and distribution of the observed data and processed information;
- Establishing and functioning of the analytical/prognostic system for weather forecasting and follow up and warning about development of detrimental and dangerous meteorological phenomena;
- Establishing and functioning of the analytical-prognostic system for water forecasting and monitoring/warning of the development of detrimental and hazardous phenomena;
- Establishing and functioning of the analytical-prognostic system for forecasting of the air/waters quality and for the monitoring/warning about their abrupt pollution;

2. THE ATMOSPHERE AND WATER RESOURCES RESEARCH

- Researching and follow up of atmospheric processes and development of the weather forecasting methods;
- Researching and follow up of hydrological processes and development of the water forecasting methods;
- Researching and follow up of the characteristics of the quality of air, precipitations, surface waters, underground waters including radio-activity of air, precipitations and waters, transfer of the polluting materials through them and researching of the pollution influence on the water resources, climate and vegetation and development of methods for the forecasting of the air/water pollution;
- Researching of the climate physical foundations, follow up of their changes/fluctuations and the development of the climate forecasting methods;
- Researching of the processes and phenomena in atmosphere that are important for the protection from natural disasters;
- Research and follow up of energy potential of the Sun/wind radiation and other energy resources and meteorological/hydrological research for rational using of energy potentials;
- Researching and follow up of weather/climate influence on the agricultural and forestry production also including the ground climate and researching/development of the agro-meteorological forecasting methods;
- Researching of microclimatic characteristics for the purpose of space valorization as a natural resource;
- Hydrological and meteorological researching for reaching of the water balance and utilization of water potentials;
- Follow up and applying of the professional and scientific achievements from the area and scope of work of the Hydro-Meteorological Institution of Montenegro;
- Development of instruments, devices and methods for hydrological and meteorological observations and measuring;

NOTE: During the previous 10 years, due to permanent restriction of financial resources, major part of functions from the area 2 couldn’t be performed.

3. APPLIANCE OF THE METEOROLOGY/HYDROLOGY ACTIVITIES

- These are the tasks related to creating of agro-meteorological analysis and forecasts and tasks from the area of medicine i.e. bio-meteorology;
- Hydrological and meteorological tasks for the needs of water management;
- Hydrological and meteorological tasks for the needs of ecology;
- Applying of knowledge about the climate and water resources for the needs of economic and other activities; analysis of the spatial and weather characteristics of meteorological elements and creating of climatic foundations for spatial/urban planning and designing as well as for building of big investment structures;
- Analyzing of spatial and weather quality/quantity features of the surface water resources and underground water resources in order to create hydrological foundations for spatial and urban planning/designing and building of structures;
- Observing and measuring of meteorological and hydrological elements and phenomena exceeding the framework of tasks which are significant for the state of Montenegro but are specific by its character and are performed upon the request and on behalf of some economic, scientific or other organization or for private individuals;

- Processing of meteorological and hydrological data which are not the part of standard types of processing;
- Meteorological and hydrological analyses and forecasts which are created for special purposes;
- Meteorological insuring of the sea navigation and other maritime activities.
- Hydrological and meteorological activities for ecological purposes.

## 4. TASKS WHICH ARE PERFORMED IN COOPERATION WITH THE HYDROMETEOROLOGY INSTITUTE OF SERBIA

- The tasks of the Hydro-meteorological IT system, Telecommunication system and work on ensuring that Serbia and Montenegro are included into the international hydrological and meteorological telecommunication networks.
- Performing of meteorological tasks for the air navigation i.e. *indirect providing of air navigation (preparing of meteorological products and foundations for the direct ensuring of air navigation);*
- Implementation and preserving of the meteorological/hydrological instruments etalon and calibrating of instruments on meteorological and hydrological stations;
- Adopting and publishing of regulations for implementing of meteorological and hydrological tasks;
- Implementing of international obligations of Serbia and Montenegro in the area of meteorology, hydrology and air/waters quality control.

***Hydro – meteorological Institute capacities in relation to the identified hazards***

Having in mind that Hydro-meteorological institute is a small institution with a great scope of competences, inadequate personnel structure and very low budget, its development strategy has been based on three fundamental prerequisites. To perform only the tasks which are of the biggest importance for the state and citizens with the maximum possible quality which mustn't lag behind the world standards. To finance development of cheap technologies which may be provided from the available Budget. Missing knowledge and technology ought to be provided through intensive international cooperation within WMO, European Union, other hydro-meteorological services from the surrounding countries and the developed western countries as well as through cooperation with scientific institutions.

The importance of this institution in the efficient and timely preventive reacting is of the key importance in several different areas:

- Quality climatic (space and time) analysis of the probability of occurrence of extreme meteorological phenomena shall provide necessary data for designing of the infrastructural objects in order to make them resistent to these risks.
- Short-term and middle-term weather forecast with warnings about the extreme meteorological phenomena have the key importance in early announcing of the extreme meteorological phenomena which can cause extreme situation. This early announcement is very important for the primary protection of human lives and material goods as well as for preparing of the protection measures by the organization which manages extraordinary situation. In case that extraordinary situation is not a result of natural catastrophes caused by meteorological of hydrological phenomena but a result of some other phenomena, weather can significantly influence the activities of protection and forecasting information can be precious. In short, analitical-forecasting system of the hydro-meteorological institute is irreplacable element in providing an early warning to the danger and in providing of forecasting information in the protection implementation stage.
- In short, analytical/forecasting system of the Hydro-meteorological institute is the irreplacable element in providing of early warning to the danger and in providing of the

forecasting information during the protection implementation stage. Hydro-meteorological information on probability of occurence of the extreme water level (stand pipe) and flow on the watercourses in Montenegro shall provide necessary data for designing of the structures and infrastructure in order to make them resistant to these risks. Forecasting activity is still not operational in this area, mostly due to the torrental character and small inertsia of the majority of water courses in Montenegro. However, implementation of the hydrological forecasting numerical model is envisaged to be integrated with meteorological model and shall base its forecasts on the basis of numerical forecasting of precipitations for the mentioned confluence.

- Forecasting of the sea situation (height, direction and frequency of waves) and extreme meteorological phenomena on the sea which can be provided by the Institute is of the highest importance for safety of the maritime traffic and other maritime activities first of all, tourism and nautical tourism.
- Forecasting activity is still not operational in the area of the water/air quality the monitoring of which is implemented by the Hydro-meteorological Institute. Hydro-meteorological Institute should be equipped for the forecasting of spatial/time distribution of the specific pollutants' concetration in the ground air layer but this activity would also be precious in the preventive stage for detecting of the cause of pollution which happenned through accident and during managing extraordinary situation caused by this type of technical/technological accident.
- Meteorological stations network which follows up physical and chemical situation with atmosphere has 3 locations with instruments for measuring of the overal radioactivity and during the set up terms send obtained data in the World Meteorological Watch System on a daily basis. Through this global observation system which is developed for the early announcement of nuclear accident, Institute would get warning about the possible accident and it should be obliged to be the key factor of the early announcing of this situations.
- Hidro-meteorological Institute with its network of meteorological, hydrological and ecological stations which make integral part of the global observation system of the World Meteorological Organization like the World Meteorological Watch, World Atmospheric Watch and others which in the realtime sends and receives an enormous number of the measured and observed data and forecasting information through global telecommunication system WMO, represents the most important institution for monitoring and forecasting of the atmospherically and hydrologically caused natural disasters for the support and managing of any other extraordinary situation.

### *III.4.6. J.U. MONTENEGRIN INSTITUTE FOR GEOLOGICAL RESEARCH WORK*

J.U. Montenegrin Institute for Geological Research Work is a governmental scientific/professional organization for the area of geology and basic carrier of the geological/professional activities in Montenegro. For more than sixty years it has successfully been carrying out research work of the geological problems of the terrain in Montenegro through the areas of:

- Regional geology,
- Tectonics,
- Engineering geology,
- Hydro-geology
- All types of mineral raw material research etc.

Geological Institute carries out creating of all types of geological maps for Montenegro starting from the Basic Geological Map which is printed on 16 separate sheets in proportion: 1:100.00, then various types of specialistic maps in proportions - 1:200.000, 1:100.000, 1:50.000 and for specific regions and localities, in proportions - 1:25.000, 1:10.000, 1:5.000 and in a very large proportion – 1:2.500, 1:1.000 i 1:500.

Knowledge obtained so far and geological documents from various geological disciplines provided Geological Institute with valid professional capacity for researching of all kinds of natural hazards which may result in extraordinary situation like devastating earthquakes and all other types of geological hazards.

## ORGANIZATIONAL STRUCTURE AND ACTIVITY

Pursuant to the Law on Geological Research and The Decree on Organizing of the Republic Institute for the Geological Research (Official Gazette of the Republic of Montenegro No. 41/95) the tasks of geological research which are significant for Montenegro are performed by the Public Institution: Republic Intitute for Geological Research which, apart from basic geological research work and geological research work of a strategic importance out of the exploatation areas, also perfoms complex geological foudations for approving concessions as well as all types of geological foundations which are important for Montenegro. Institute has been organized in four departments the activity of which encompasses practically all geological disciplines.

**Sector for regional geology, mineral raw material and concessions for mineral raw material** performs: planning, programming and designing of the research work from the area of regional geology and mineral raw materials; prepares: synoptic, basic and detailed geological, structural/tectonic, photo/geological, metalo-genetic, geo-chenical, paleo-geographic, seismo-tectonic, geo-morphological and other maps of various scales and purposes; performs paleontological, petrografic, sedimentological, mineralogical, chemical and other coal mining research work of metallic and non-metallic mineral ores and causto-biolites; prepares studies and reports on the research results, reports with the calculation of reserves, geological documents for approving concessions etc. This department includes laboratory for paleontology, petrography, sedimentology, mineralogy and chemistry. Computer technique has been increasingly used in all disciplines and activities and especially in creating various maps, drawings and pictures.

**Results:**

** **Basic Geological Map (BGM)** of the overall Montenegrin territory was made in proportion 1:100.000 within the period: 1960 - 1987. It has been printed on 16 special sheets. For each geological sheet the interpreting material has also been printed. On the basic of data from BGM, **Geological Map of Montenegro** was printed in the year 1985 in proportion **1:200.000**. Since 1994 **Geological Map 2, 1:50.000** has been under preparation by lists. Studies, monographies, PHD dissertations and numerous published works in domestic and foreign magazines have been processing various geological issues of regions, localities, individual or complex formations of Montenegro. ***Structural-tectonic map of Montenegro 1:100.000 and Geo-morphological Map of Montenegro, 1:200.000*** have been prepared but still not printed.

** Seven types of **mettalic mineral ores** have been explored on the territory of Montenegro: **red bauxite, lead and zync, copper, iron, mangane, chromite and radio-active mineral ore**. For the needs of the red bauxited exploration geological foundations have been prepared in the proportion 1:5.000, 1: 10.000, 1: 2.000. Drilling for the purpose of exploration, studies, calculation of reserves etc have not been made very much. Lead and zync ore were explored in the area of the north east of Montenegro where it was proved to be nine findings (in the area of the coal mines: »Šuplja stijena« and »Brskovo«) and 11 occurences. One finding of the copper ore was also revealed but its economic importance wasn't proved. Economic concetration of other metallic mineral ore has not been proved.

** With exploration of **non-metallic ore,** findings and occurence were revealed as follows: ***architectonic-construction stone, technical-construction stone, bigar, cobble and sand, brik clays, cement marls, white bauxites, dolomites, barrites, bentonites, quartz sand, hornies and asbestos.*** More than 20 findings and approximately the same number of occurences of ornamental stone were revealed. Also prospective formations were indicated with very great potentials of this mineral ore. Findings of the tecnical-construction stone were revealed all over Montenegro.Numerous findings and occurences were proved for white bauxites but unfortunately there is no adequate valorization or technological solutions for their utilization. Findings and potentials of dolomites, barrite, bentonite and roznac were proved but

still haven't been used. Occurence of asbestos and chrome in Montenegro does not have economic value.

** Our of energetic mineral ore in Montenegro the most important is the coal. In the area of Pljevlja reserves of the **dark lignite** were found out in all major neogene coal bassins while the dark coal reserves in Berane bassin are known but only partially sufficiently explored and defined. ***Bituminous limestones*** within the lijaskih, baremskih, aptskih i cenomanskih carbonate sediments are very outspread in the middle part of Montenegro but are not used. **Gas and oil** potential is supposed to be located in the coastal area and subterrenian sea area of Montenegro.

** Studies, monographies and PHD dissertations were printed and numerous scientific/professional works in domestic and foreign magazines were published about the overal mineral/raw material potential, about specific types of mineral ore (especially about the red bauxites) or about the mineral potential of specific regions. ***Metal-genetic Map of Montenegro, 1:200.000*** *was printed (1999) and* ***Map of Mineral Ore of Montenegro, 1:200.000, Geo-chemical Map of the Stream Sediments of Montenegro and Geo-chemical Map of the Montenegro rocks*** are in the completion phase, on 30 elements in the proportion: 1:200.000.

**Department for hydro-geology, engineering geology and concession for waters** performs the following tasks: planning, programming and designing from the area of hydro-geology and engineering geology; creates hydro-geological, engineering-geological, geotechnical and seismo-geological maps of various scales and purposes; for the needs of water supply, underground waters protection, building of hydro-energetic structures; creates engineering/geological and geo/technical explorations for the needs of building of urban settlements, public and economic structures, bridges, tunnels, railways, various traffic roads, for the need of sliding ground rehabilitation etc; performs exploration of mineral and therma waters; makes studies, reports and other documents for the needs of fundamental and applicative exploration from the area of hydro-geology and engineering geology. It prepares documents for approving of the concessions for waters. This department also encompasses laboratory for geo-mechanic exploration.

**Department for coal mining works and exploration drilling** performs: exploration drilling, manholes, digging, exploration mining and other tasks for the need of exploration of mineral ores, hydro-geological and engineering-geological explorations.

**Department for Legal, Common and Accounting/Financial Affairs** encompasses functioning of the Institute. It consists of two services:

1. Service for the Legal and **Common Affairs** performs the tasks from the legal regulations domain and Geologic Institute operations. Within this service, there is a library with the professional documents fund, issuance activity, exchange of publications on the domestic and international level.
2. **Service for the accounting\financial affairs** performs accounting, financial, commercial and book keeping affairs.

There are 55 employees in the Geological Institute of Montenegro out of which: 18 engineers of geology, 1 coal mining engineer, 1 engineer of chemistry and 10 technicians. Other employees are: borers, mechanicians, administrative workers and auxiliary staff. It should be mentioned that by 2000 there were 359 employees in the Institute out of them there were 118 engineers from the area of geology, coal mining and chemistry (18 doctors and 6 masters of science).

## COOPERATION

For the past 60 years Geological Institute of Montenegro has permanently implemented cooperation on the domestic and international level. As for the domestic cooperation, until the splitting of the former SFRY, Institute actively cooperated with Geological Institutes of Croaia, Bosnia/Herzegovina, Serbia and Macedonia as well as with the Federal Geological Institute in

Belgrade, with the university centres of the same states and enterprises the activity of which is from the domain of geological exploration and performing of the coal mining woks. Now reconnecting of all connection is going on with the new born countries.

As for the international level, cooperation was implemented through: implementation of specific projects, specialization of professional staff and through short study visits, lecturing and personal contacts.

International cooperation for implementation of the following macro-projects is especially important:

1. Project: **Creating od Spatial Plan of the South Adriatic area** in cooperation with several UN agencies during the period:1960-1970. For the needs of this project the Institute prepared geological map of the area in proportion 1: 100.000 and engineering-geological maps of the selected areas in the proportion: 1: 10.000 as well as other documents and exploration on the basis of which rayonization of terrain was carried out for the area Podgorica-Budva-Ulcinj from four categories which are appropriate for building where 6 narrow areas were selected for the detailed urbanization.

2. Project: Exploring of mineral ores in Socialist Republic of Montenegro (YUG 73/010) which was financed by United Nations (UNDP) within the period 1974-1977. Exploring of metallic mineral ores in the area of the north esat Montenegro covering the surface of 6.500 $km^2$ has been done by regional geo-chemical exploration of the stream sediments. After that detailed geo-chemical exploration was performed concerning the stream sediments and ground, geo-physical exploration and detailed geologicall mapping by which 48 of prospective localities were identified for exploration of Pb-Zn sulphur mineralization. For these needs about 10.000 testing were carried out against Pb, Zn, Cu, Ni, Fe and Hg.

**Second goal of this Project was exploration of the red and white bauxites in the middle and coastal part of Montenegro. These explorations were carried out first through studying of comprehensive geological documents and then through field exploration and making more than 3000 bauxite analyses.**

In implementation of this project UN experts were engaged as well as 15 domestic experts and associates. Project was evaluated by UN as the best UNDP project ever implemented in Yugoslavia in that period. Project team leaders were: Dr. Anton Egger and Dr Peter Donovan and Project directors: engineer Milosav Kalezic and Marko Pajovic.

3. After catastrophic earthquake in Montenegro from 15th April 1979, for the purpose of removing consequences from the earthquake and reviewing of Spatial Plan of Montenegro, Geologic Insitute of Montenegro, on the basis of authorization of the Montenegrin Government, organized making of **Seismic Regionalization Programme** for the needs of spatial plan of Montenegro as well as making of the **Seismic Microrayonnization Projects** for the needs of general urban plans for all 20 municipalities in Montenegro.

Extremely complex and very comprehensive tasks of making and implementation of the mentioned Programme and Projects, Geological Institute of Montenegro implemented in cooperation with the Seismological Institute of Montenegro, Institute for Earthquake Civil Engineering and Engineering Seismology from Skoplje and Geological Institutes from Serbia, Croatia, Slovenia, Bosnia&Herzegovina and Macedonia.

Implementation of all tasks concerning the Programme and Project was managed by **Professional Council** consisting of 16 members – contractors' representatives headed by Dr Vasilije Radulovic and Dpt engineer Milosav Kalezic.

Implementation of the Programme and Projects was monitored by **International Consultative Commitee for renewing and construction of the area of FR Montenegro which was affected by the catastrophic earthquake of 15th April 1979**. This Committee consisted of 8 internaitonal and 8 Yugoslav experts headed by Adolf Ciborovski, UN expert.

International Consultative Committee evaluated that performed »seismological foundations for the spatial and urban planning represent the most contemporary and the complete technical documentation for successful planning and designing in the seismically active areas«.

4) Project« **Regional gero-chemical explorations of the carbonate terrains in SFR Yugoslavia,** was financed within the period: 1986-1988 by USA. Geological Survey of America amd Geological Institutes of Slovenie, Croatia and Montenegro took part in its implementation. The purpose of the Project was to determine the most favourable methodology of geo-chemical mapping in the carbonate terrains. Thanks to the positive results of this project and to the promoted methodology, during the period 1990-1991 the new international project of geo-chemical exploration started with its implementation for the purpose of determining level of environmental pollution. Unfortunately, war situation in SFRY interrupted continuation of this project. Basic Project Coordinator for Yugoslavia was Proffessor Dr Simon Pirc from Ljubljana and for Montenegro, Project was managed by engineer Ranko Svrkota. Co-researcher from the Geological Institute of America was Dr James Mc Neal.

Out of the numerous contents and results it should specially point out some of them though which a creative scientific-exploration is recognized as well as a successful activity of Geological Institute of Montenegro.

From the year 1956 Geological Institute has been issuing scientific-professional magazine: **»Geological messenger«.** Fifteen regular issues of this magazine and 18 special issues were published by the year 2000. Through this publication Institute has established cooperation through exchange of magazines with more than 40 countries i.e. with approximately 80 foreign scientific institutions. On the basis of this, Institute used to receive 177 various magazines. Since the year 1991 due to the changed situation in the former Yugoslavia areas, this kind of cooperation has been significantly reduced. It is important to mention that special issues of “Geological messenger” most frequently represent monographic acts i.e. Phd. Dissertations in which geological issues are encompassed in the integral method, most frequently from the Montenegro regions.

JU Republic Institute for Geological Research has an intenet presentation:: www.geozavod.cg.yu which includes basic information about the institution, its organization, status and operations, data on completed and current projects as well as information on the professional and published documentation which is kept in the Institute library.

### *III.4.7. SEISMOLOGICAL INSTITUTE*

Activity of Seismological Institute has been stipulated with the article 35 of the Decree on Organization and Method of the State Administration Work (Official Gazette NO. 54/04) as follows: Seismological Institute carries out tasks which are related to: instrumental registration of the earthquakes, seismic waves analysis, numeric processing of the observation results, interpretation of the registered seismic activity, research of the structural composition of the earth interior and phenomenology of the earthquakes genesis in the area of Montenegro; studying of the earthquake effects on the building structures, ground, water courses etc; making of maps of the seismic regionalization, seismic hazard, risk and other foundations with the elements of the long term and middle term forecasting of the seismic activity of the territory as well as making of the seismic micro-rayonization maps of the urban surfaces and micro-location of building structures; preparing and publishing of the bulletin and graphic foundations with seismological data; creating of studies, projects and elaborates on seismic parameters of the locations for the needs of building structures design; keeping of seismic documentation, creating and innovating of the seismic database, exchange of the seismological data with the foreign seismological centres; maintaining of technical correctness of seismological instruments and system of telemmetric transfer of seismic signals, modernizing, extending and continual enhancement of technical performances of Montenegrin seismological station network as well as other tasks for which it is competent“.

Within the area of making seismic parameters studies, Seismic Institute implements all types of the seismic rayonization maps for the whole territory of Montenegro as well as maps of the more detailed seismic micro-rayonization of the locations aimed at constructing of the significant building structures and wider urban surfaces. Seismological institute also performs the tasks from the domain of geophysical ground research.


Image 17. Structure of the automatic seismological telemetric network of Montenegro stations

Institute has two professional departments:

- Department for instrumental and engineering seismology which performs technical mainteinance and enhancement of technical devices for acquisition of seismological data and all other instruments in Institute and in the telemetric station network of Montenegro, acquisition, analysis and processing of macroseismical data for the strong and devastating earthquakes.
- Department for the analysis and data processing performing several levels of automatic acquisition of seismical signals to the generated earthquakes and explosions, modern numerical and graphical analysis and seismical data processing as well as publishing and exchange of these data.

At the end of the year 1982 within the international regional project: „Decreasing of the Seismical Activity on the Balkans“ (UNDP/UNESCO) seismological network with 10 telemetric stations (Image No. 17) was installed within the territory of Montenegro. Network was designed as the analogous radio-telemetric with the double channels of amplification seismic signals and with the frequency modulated radio transfer to the central observation station in Podgorica. By the end of the year 1990 this system of seismic monitoring of Montenegrin territory and region was improved by introducing automatic digital registering and processing of seismic signals within the realtime by which observation of seismic activity of that area was elevated at the high level.

During the previous 23 years applying of technical capacity belonging to the new seismologic stations network has enabled multiple augmentation of the quality and quantity of information on seismic activity of the whole region and structural composition of the earth cortex. As already emphasized on the basis of such innovated and enriched seismic database, by applying of modern methods of numerical processing, representative numeric seismogenic model for the territory of Montenegro has been determined. It is necessary for the contemporary numerical treatment of the seismic hazard elements. Implementation of the project of increasing the density of the seismologic stations network in the zone of Montenegro coast hinterland (northern part of Boka Kotorska and Skadar Lake) which shall result with the higher quality and more reliable seismologic data from these areas but also from the whole territory of Montenegro and from surrounding regions.

On the basis of technical capacities of the seismologica network of Montenegro all characteristics of earthquakes on the area of Montenegro and its surroundings can be well determined in only few minutes. Also, potential level of material devastations (and possibly, victims) in the field as well as the consequences of strong earthquakes can be forecast with the high level of reliability.

Seismologic Institute has its internet presentation: www.seismo.cg.yu which contains relevant information on the intstitution, its activity and parameters on actual and historical seismical activity as well as platform for exchanging of professional data with other institutions in the world as well as educational segment.

### *III.4.8. RED CROSS OF MONTENEGRO*

National Strategy for Extraordinary Situations as a preparatory document for legal regulation of the system and protection/rescuing in extraordinary situations represents a good conceptual background for setting up of measures and activities in this area which is of the mutual interest for Montenegro.

Montenegrin Red Cross Organization has a duty and legal obligation to actively participate in implementing of measures and tasks on protection and rescuing which makes an integral part of the overall system for acting in extraordinary situations.

By the new Law on Red Cross of Montenegro which was adopted on 20th April 2006 the following obligations of the Red Cross Organization were determined in the area of preparations for acting in the case of disasters and providing answers to the disasters.

These obligations are set up as the tasks of public interest (article No. 9 of the Law) and in their performing Red Cross has a role of an organization which provides assistance to the governmental bodies. Within its framework of tasks of public interest in the area of acting in disasters, Red Cross performs the following tasks:

- Performs the tasks of the Search Service for the purpose of gathering and recording of data on evacuated, rescued, displaced and disappeared persons due to the war devastations, natural and other disasters and dangers both during the wartime and peacetime as well as for the purpose of seeking disappeared persons (article 9 paragraph 1, item 4);
- Participates in accepting and accomodating of the evacuated population, refugees and displaced persons, providing of aid and conducting other measures which can contribute to the taking care about the affected and jeopardized population (article 9, paragraph 1, item 5);
- Organizes gathering and allocates humanitarian aid received from the international organizations and other donors, national organizations of Red Cross and Red Crescent for the humanitarian social needs in the Montenegrin territory during the peacetime and wartime (article 9, paragraph 1, item 6);
- Starts, organizes and implements or participates in the regular and extraordinary solidarity actions in Montenegro for providing of assistance to the jeopardized persons and victims of the natural, ecological and other disasters with the consequences of mass destruction, epidemics and armed conflicts within the country and in the world, provides keeping of specific quantities of material goods for these needs (article 9, paragraph 1, item 7);
- Cooperates and participates in the international aid and solidarity actions (article 9, paragraph 1, item 8);
- Organizes and carries out training of lecturers for the first aid lessons for drivers in cooperation with the competent healthcare institution, keep records about the training and issues appropriate cerfiticates on professional qualification of lecturers (article 9, paragraph 1, item 9);

- Organizes and carries out training of candidates for the first aid drivers in cooperation with the competent healthcare institution, conducts examinations, keeps records and issues certificate on the passed first aid exams, trains police officers, firemen etc (article 9, paragraph 1, item 10);
- Organizes and trains teams for acting in the extraordinary conditions in the area of social protection, hygienic-epidemiological protection, taking care about the wounded and sick person, rescuing in the water and on the mountains, psycho-social support to the population and implements programme of preparations for acting in case of disasters in cooperation with the governmental bodies (article 9, paragraph 1, item 12);
- Promotes and organizes volontary actions of blood donations in cooperation with the healthcare institutions for the blood transfusion, keeps records about them, determines conditions for awarding of recognition to the voluntary donors and awards them acknowledgement (article 9, paragraph 1, item 13);
- Organizes service for rescuing on the waters and service for rescuing in the mountains, carries out training of rescuers for the purpose of working in these services, keeps records and issues certificates on qualification, each year organizes renewing of knowledge and testing of physical condition of rescuers (article 9, paragraph 1, item 14);

Basic tasks of the Red Cross of Montenegro in preparation for the extraordinary situations include capacity building and establishing network of Red Cross and its organizational units for training for efficient responses to the occurence of catastrophes caused by natural and human factor in well structures and coordinated way, for the purpose of decreasing number of victims and relieving consequences of disasters.

**1. Preparation shall go on through the following**

- Building of the teams network as a response to the accidents in all municipal, town and governmental organization also including mechanisms of activation and coordination;
- Capacity building – improving of the equipment which is necessary for the efficient response to accidents,
- Increasing of the activity standards in accordance with the international norms;
- Raising of awareness and public education level in the community;
- Relieving and decreasing of number of accidents and
- Regulating of the contractual relations with national bodies and institutions by providing operational basis for including of the Red Cross in rescuing and urgent responding to accidents;

Red Cross of Montenegro makes preparations so that, after making of the assessment on the danger from specific risks, it could be capable of appropriately answering to the following:

- Accidents caused by natural phenomena,
- Mass traffic accidents,
- Techical-technological accidents and
- Conflicts.

Red Cross of Montenegro as assisting governmental body (which does not replace government function and competence) prepares to provide assistance to the potential victims through the following action:

**1.** Successful and **efficient action managing** for the response to the accidents

Assessment of the accident consequences (if necessary creating of the domestic appeal)

Coordination with other participants in the response to accident;

Making of action plan;

Implementation (implementation of action plan),

Monitoring, evaluation and

Reporting.

**2. Healthcare measures:**

Human lives rescuing (first aid, PSP...),

Home care per person/developing and organizing of temporary accomodation by applying of Sphere Project (minimum of international standards as a response to the accidents)

**3. Care about the non-injured population:**

PSP and voluntary social work,

Temporary accomodation, food, water purification and water supply;

Gathering, acceptance and distribution of humanitarian aid (food, hygienic items, equipment etc);

**4. Search service:**

Gathering, arranging and providing of data on missing persons;

Family messages.

**5. Technical support to carrying out of action**

Setting up of the tents settlement

Rearanging of the solid structure for accomodation,

Providing of installations (for electricity, water etc),

Repairing of equipment,

Safety and security.

**6. Representation** (for preserving of the human dignity and rights of the victims

of accident)**7. Logistic support for performing of action**

Procurement, acceptance, storage, distribution

Transport , communications...

Telekom, radio connections/unique network and frequency DCK SCG

**8. Preventive activities and informing**

In accordance with the mentioned authorizations which are with the Law on Red Cross, transferred to the Red Cross of Montenegro, it is obvious that Red Cross of Montenegro, apart from the humanitarian activities has a very important role within the system of operation in the situation of accidents. In that sense, its concrete role, tasks and obligation ought to be determined by the National Plan for Extraordinary Situations of Montenegro i.e. with the strategy for action in accidents.

## IV. SUMMARY OF PRIMARY RISKS BY REGIONS AND TOWNS OF MONTENEGRO

It ought to be especially pointed out that the risk from the highly contageous disease epidemics with the high morbidity and lethality (caused in the natural way or as a consequence of bio-terrorism) is high, omnipresent and equally possible in all regions and municipalities of Montenegro.

### RISKS BY REGIONS

**SOUTHERN REGION** which encompasses the following municipal territories: ***Ulcinj, Bar, Budva, Kotor, Tivat and Herceg Novi*** has been characterized by specific geographic features, the sea aqua-territory presence, expansion of traffic infrastructure (still of a lower rank), significant increase of the population density during the summer tourist season, requirements in which the tourist season is implemented, very intensive construction of the building structures (tourist structures as well as public and housing structures), with the presence of the highly risky traffic and other public, economic and infrastructural objects. All mentioned elements considered togehter, make the issue of risk managing of implementation of numerous kinds of local and regional hazards, very important, complex and responsible.

From the aspect of the protection of specified resources it should be taken care that, looking from individual and general point of view, in this region there are very important public, infrastructural and other capacities with the high level of vulnerability and special attention ought to be paid to the following: Sozina tunnel, electric power installations and specific features of regional water supply, Tivat airport, Port of Bar, Zelenika and Kotor, installations of oil and oil products, liquid oil gas installations, technical gas installations, infrastructure of military structures, shipyard Bijela and Tivat, storage of hazardous substances, several quarries, tourist structures like a number of hotel-tourist capacities, public institutions of the healthcare type, structures of cultural/historical heritage, old towns: Bar, Ulcinj, Haj-Nehaj, Budva, Kotor, Herceg Novi, important sacral structures, sport structures.

The following risks should be pointed out as those that can be possibly expected: high seismic risk, risk from the traffic accidents especially risk from big accidents in the Sozina tunnel, risk of landslides and rocklides, risk from transport of dangerous substances, specific risks at sea, fires in the open area, risk form disasters on installations for oil products as well as airports disasters at the airports and in the air. Having in mind significant concetration of populaiton and tourists in the seashore area during the tourist season, epidemics of condagious diseases, bioterrorism and other biological risks and their consequences are especially present in that area.

**CENTRAL REGION** encompasses the following municipal territories: ***Podgorica, Nikšić, Cetinje, Danilovgrad***. This area has been characterized with the high level of seismic danger (with the expected maximum level earthquake intsnsity of VIII degrees MCS scale (excepting Nikšić, with the intensity of VII degrees MCS scale), high risk in transportation, rather big risk from the transport of dangerous substances, fires on the open air, risk on installations for oil products, risk from airplane disasters, damages on hydro-technical structures, bioterrorism and other biological risks.

**NORTHERN REGION** encompasses territories of the following municipalities: ***Bijelo Polje, Mojkovac, Kolašin, Berane, Rožaje, Plav, Pljevlja, Šavnik, Žabljak, Andrijevica, Plužine*****.** The most important hazards in this part of Montenegro is related to the potential damaging of hydro-technical structures, great fires in forests and forestal complexes in the open area, traffic risks, transportation of hazardous substances, snowy avalanches, floods, sliding terrains and rockslides. The basin of Berane is characterized by the relatively high level of seismic danger (VII level of MCS scale) while the territories of other municipality of this region are characterized by the moderate seismic danger, with the expected maximum earthquake of VII degrees MCS.

| Municipality | RISK BY MUNICIPALITIES<br>Type and scope of the potential hazard and risk |
|---|---|
| **HERCEG NOVI** | High level of seismic risk (which creates seismic hazard of IX degrees of MCS scale), risk in accidents during transportation of hazardous substances, risk on the oil products installations, risk on installations for the liquid oil gas, risks at sea, big fires, traffic risks, dangers from the sliding land and rockslides, bio-terrorism and other biological risks. |
| **KOTOR** | High seismic risk from the hazard of IX degrees of MCS scale, risk from transportation with hazardous substances, risk on the oil products installations, risk at installations for the liquid oil gas, risks at sea, fire, traffic risk, bio-terrorism and other biological risks. |
| **TIVAT** | High seismic risk generated with the seismic hazard of IX degrees MCS, risk from transportation of hazardous substances, risk at installations for oil products, risk at installations for the liquid oil gas, risks at sea, fire, traffic risk, risk from the air disasters, bio-terrorism and other biological risks. |
| **BUDVA** | High seismic risk generated with the seismic hazard of IX degrees MCS, risk from transportation of hazardous substances, risk at installations for oil products, risk at installations for the liquid oil gas, risks at sea, fire, traffic risk, risk from the air disasters, bio-terrorism and other biological risks. |
| **BAR** | High seismic risk (seismic hazard of IX degrees MCS), risk in traffic as well as a risk from big accidents in the Sozina tunnel, risk from transportation of hazardous substances, risk at installations for the oil derivates, installations for the liquid oil gas, risk at installations of the vinegar acid , risk at silo for cereals, risk at installation for the bulk cement, risks at sea, fire, traffic risk, bio-terrorism and other biological risks. |
| **ULCINJ** | High level of seismic risk caused by seismic hazard of IX degrees MCS, risk of transportation of hazardous substances, traffic risk, risks at sea, fire at open area, risk at installations for the oil products, bio-terrorism and other biological risks. |
| **PODGORICA** | Relatively high (middle) level of the seismic risk (caused by seismic hazard of VIII degrees MCS scale), risk from transportation of the hazardous substances, airplane accidents, traffic risk, risk at installations for the oil products and installations for the liquid oil gas, risk from the higher fires, bio-terrorism and other biological risks. |
| **CETINJE** | Seismic risk is relatively high and is created with the seismic hazard of VIII degrees of MCS scale, risk of transportation of hazardous substances, floods, traffic risk, bio-terrorism and other biological risks. |
| **NIKŠIĆ** | Seismic risk is moderate (hazard is VII degrees of MCS scale), risk from transportation of hazardous substances, risk at installations for the liquid oil gas, risks at the technical gas installations, fire, snowy deposits and avalanches, risks from the airplane crashes, traffic risk, bio-terrorism and other biological risks. |
| **DANILOVGRAD** | Seismic risk is important (hazard has a level of VIII degrees MCS), risk from transportation of hazardous substances, risk at installations for the liquid oil gas, fire, traffic risk, bio-terrorism and other biological risks. |

Specific risks by municipalities of Montenegro are mentioned in the next table.

| Municipality | Type and scope of the potential hazard and risk |
|---|---|
| **BIJELO POLJE** | Risk from transportation of the hazardous substance, risk at installations for the oil products, risk at installations for the liquid gas, moderate sesmic risk level has been caused by the VII degrees MCS hazard, floods, fire, snow deposits and avalanches, traffic risk, bio-terrorism and other biological risks. |
| **MOJKOVAC** | Risk from transportation of hazardous substances, moderate seismic risk (up to VII degrees MSC), fire, snow deposits and avalanches, traffic risk, bio-terrorism and other biological risks. |
| **KOLAŠIN** | Risk from transportation of hazardous substances, moderate seismic risk (VII degrees MCS), fire, snow deposits and avalanches, traffic risk, bio-terrorism and other biological risks. |
| **BERANE** | The whole Berane basin is characterized by the relatively high level of seismic risk caused by the seismic hazard of VII degrees MCS, risk from transportation of hazardous substances, floods, fire, snow deposits and avalanches, traffic risk, bio-terrorism and other biological risks. |
| **ROŽAJE** | Risks from transportation of hazardous substances, moderate seismic risk (with the VII degrees MCS hazard), fires, traffic risk, snow deposits and avalanches, bio-terrorism and other biological risks, floods. |
| **PLAV** | Risks from transportation of hazardous substances, moderate seismic risk (with the VII degrees MCS hazard), fires, traffic risk, snow deposits and avalanches, bio-terrorism and other biological risks. |
| **PLJEVLJA** | Risks from transportation of hazardous substances, moderate seismic risk (with the VII degrees MCS hazard), fires, traffic risk, bio-terrorism and other biological risks, snow deposits and avalanches, air pollution. |
| **ŠAVNIK** | Risks from transportation of hazardous substances, moderate seismic risk (with the VII degrees MCS hazard), traffic risk, bio-terrorism and other biological risks. |
| **ŽABLJAK** | Risks from transportation of hazardous substances, snow deposits and avalanches, moderate seismic risk (VII degrees MCS hazard), bio-terrorism and other biological risks. |
| **ANDRIJEVICA** | Risks from transportation of hazardous substances, fire snow deposits and avalanches, moderate seismic risk (with the VII degrees MCS hazard), bio-terrorism and other biological risks, floods. |
| **PLUŽINE** | Risks from transportation of hazardous substances, floods, fires, snow deposits and avalanches, moderate seismic risk (with the VII degrees MCS hazard),bio-terrorism and other biological risks, floods. |

## V. STRATEGY OF THE PROTECTION FROM CATASTROPHES

In the third chapter of this Strategy an objective analysis and quantification have been made for all potential natural hazards, technical/technological damages and the most important biological hazards the implementation of which the extraordinary sutations in Montenegro may appear. The following risks have been identified as the most important and potentially most dangerous on the Montenegrin territory: risk form devastating and catastrophic earthquakes, risk from other geological hazards, extreme meteorological occurences, technical/technological hazards which encompassed possilibty of occurrence of the following big accidents: regional scale fire, disasters on the installations for the oil and oil products, risk in the transport, explosion, radiological and other accidedents, detrimental influence upon the environment, big traffic accidents, damages on big electrical power installations and hydro/technical structures, chemical/radiological contamination, other techical/technological disasters, combined effects of technological disasters, radio-activity and contamination with dangerous chemical substances. Possibility of appearance of contagious disease with a big number of the diseased and dead persons is a specially high risk.

The analysis of all processed types and scale of the possible hazards gives a reliable indications for the significant degree of the risk for the people, material goods, cultural/historical heritage and environment in Montenegro which may be jeopardized with implementation of some of the mentioned dangers.

On the basis of the determined hazard components, Strategy for Extraordinary Situations is aimed at determining of the fundamental elements of the organized activities of the governmental and other institutions in relieving the consequences of extraordinary situaitions which were caused by all types of big natural disasters, technical/technological disasters and biological hazards, due to the decrease of the number of disasters by preventing their occurence with the preventive action, relieving of their consequences as well as with the development of preparation of the adequate governmental and institutional capacities and entire social community in all cases of their occurences in future.

Basic concept of National Strategy for Extraordinary Situations caused by natural and other catastrophes can be summarized in the following priority destinations:

1. Normative regulation of the regions of rescuing and preventive action for the purpose of protection from the natural catastrophes, technical/technological disasters and biological hazards,
2. Creating of governmental system of the protection from catastrophes through the Department for Extraordinary Situations and Civil Safety through organizaitonal units of the Ministry of Interior of Montenegro through the stage of constituting which shall functionally integrate all present relevant institutions which are involved in the process of monitoring of all natural and techical/technological hazards, protection and rescuing,
3. Initiating of social processes for the purposes of long-term development of scientific research in the domain of the natural catastrophes phenomenology and their influence upon the social community,
4. Strengthening of general level of preparedness of social community and citizens' awareness about the importance and need of organized and efficient social acting on prevention and relieving of the detrimental effects and extraordinary situations along with active and organized participation of the very citizens in these processes on the regional and local level,
5. Enhancement of the system of continual monitoring of all important convenient, technical/technological and biological hazards for the purpose of the reliable and efficient relieving and timely informing about their situation and occurences in order to prevent their detrimental effects and create direct danger for the people's life and health, citizens' property or the significant jeopardizing of environment or cultural/historical heritage,
6. Equipping and training of specialized institutions and individuals for the protection and rescuing in the conditions created in the extraordinary situations,
7. Undertaking of all necessary types of preventive measures for the purpose of preventing risks and decreasing of detrimental effects of catastrophes,

8. Creating of formal foundations and establishing of international cooperation with other protection/rescuing systems in the region for the purpose of creating conditions for realization of regional urgent assistance in the extraordinary large scale situations.

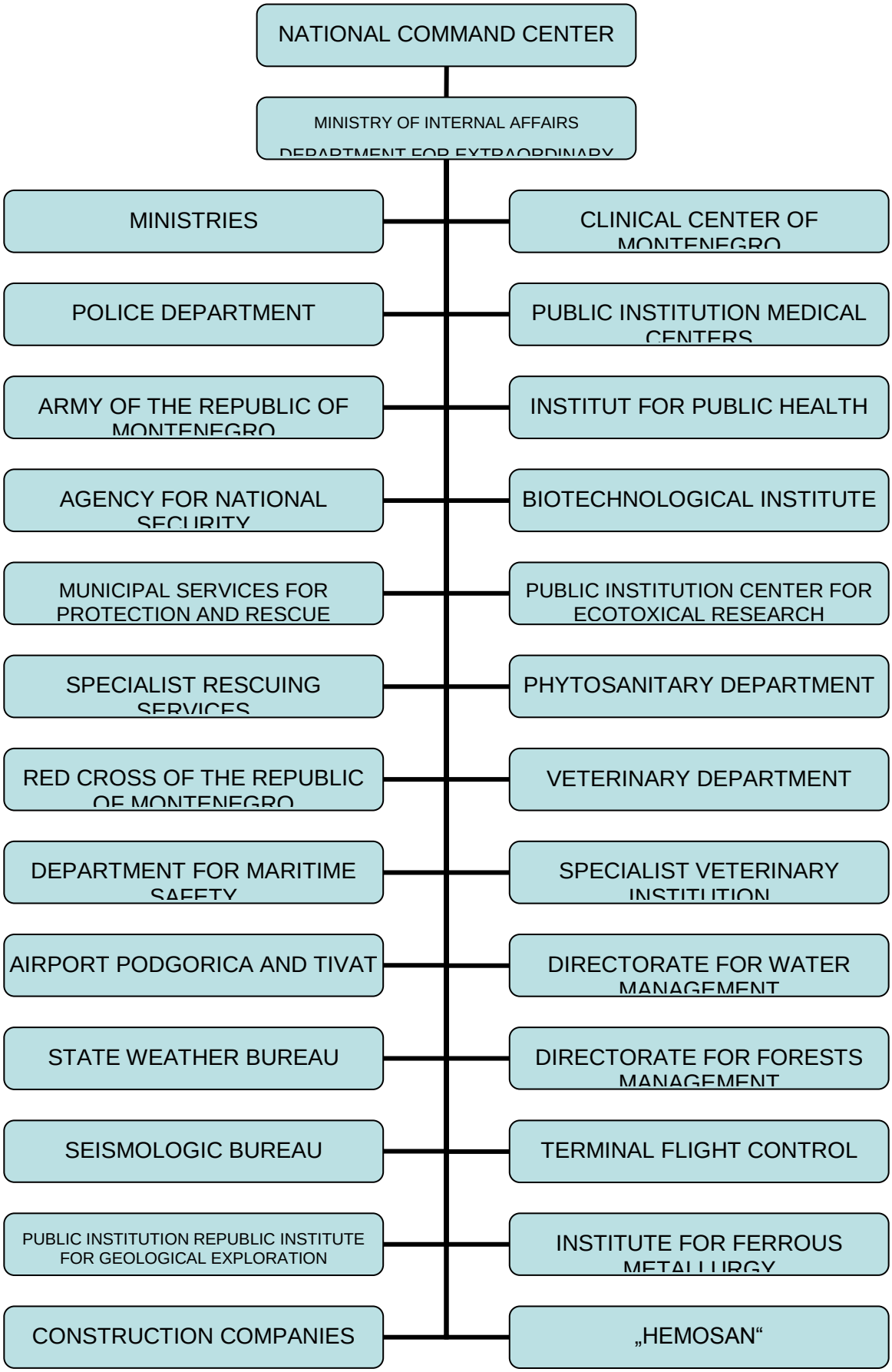


Image 18. System of coordination of activities on the protection and rescuing.

So far in Montenegro there has been no possibility for unique operational assessment of the level of danger from natural catastrophes, big technical/technological accidents or biological hazards, appropriate protection plan from these types of accidents, realistic insight into the possible natural disaster levels and scope of risk from the occurence of technical accidents. There is no developed concept of coordination and managing in such situations. Coordinating and managing of special organized protection forces and rescuing in the natural disasters and catastrophes represent very important issue which hasn't been regulated with the current regulations in accordance with the increased needs. This issue ought to be solved in future as soon as possible.

For the purpose of the rational, efficient and economical utilization of all forces and means in the system of protection and rescuing in the circumstances of occurence of big accidents, it is necessary to institutionally create a special body which shall in such circumstances secure unique planning and organizing of forces as well as their utilization on the governmental and municipal level. Apart from the adequate and efficient utilization of forces in relieving of consequences of extraordinary situations, permanent follow up and assessment of the situation ought to be provided from the aspect of detecting conditions for appearing of extraordinary situations as well as undertaking of the realtime preventive measures.

Having in mind that today there aren't either civil protection headquarters nor The Law on Protection from the Natural Disasters it is necessary, on the basis of the experience from the surrounding countries concerning involving of the headquarters into the operational function during the tourist season, to define these headquarters in big urban surroundings and define them by the Law as a regular bodies with specific responsibilities at the level of the Montenegro state.

It is necessary to study and define organization and principle of managing in the actions of rescuing and relieving of consequences of big disasters as well as training of the command staff for such tasks (selection of the command post, identifying of the tasks for the subordinated forces, organization of the managment, supplying, healthcare protection, reserve task forces, documents on intervention and reporting of the superior bodies).

There is an indicative need for increasing of the level of regional connectedness and intensifying of cooperations in actions of extinguishing of fires. It is also necessary to study possibility of establishing of lasting cooperation with the neighbouring countries in rescuing actions in all major disasters or catastrophes, ecpecially when such disasters are attacked by the cross border areas.

It is necessary to create specially trained teams of specialists for interventions during the extraordinary circumstances, as special teams of the republic centres out of which they would be taken to the place of disaster. In such way their efficient and rational utilization would be achieved and decreased number of people died in disasters as well as the scope of the overall disasters.

### *V.1. LEGISLATION*

Within the framework of national development policy and strategy, current legislation from all social, scientific and professional areas which are involved in the issues of natural disasters implementation, biological hazards and techical/technological accidents ought to be adjusted to the international regulations which will enable achieving of hign standards in the protection and rescuing of the jeopardized population, material goods, cultural heritage and preserving of natural resources in extraordinary situations as well as the established sustainable development principles.

For such purpose it is necessary to initiate adopting of regulations which would cover all relevant areas of governmental activity which are important for preventing occurrence of extraordinary situations and relieving of the consequences which will be harmonized with the EU legislations, especially:

- The Law on Protection and Rescuing,

- The Law on Transportation of Hazardous Substances (purchase, using, storage and transport,
- The Law on Transportation of Explosive Materials,
- The Law on Trading with Weapon, Military Equipment and Double destination Goods,
- The Law on Explosive Substances, Inflammable Liquids and Gasses,
- The Law on Seismological and Hydro-meteorological Activity, due to the integral regulation of these areas that are significant for monitoring, studying and control over natural phenomena which may lead to catstrophes, for early warning and forecasting of these processes,
- Technical normatives for building of structures in the seismic areas (in accordance with the EU norms – EUROCODE 8) as well as with technical normatives for oscultation of all major hydro-technical structures,
- The Law on Protection of Forests.

### *V.2. GOVERNMENTAL PROTECTION SYSTEM CATASTROPHES AND ACCIDENTS*

This system ought to encompass:

- Establishing of the Department for Extraordinary Situations and Civil Safety as an organizaitonal unit of the Ministry of Interior of Montenegro and National Command Centre which shall, in a functional sense, encompass all relevant institutions performing monitoring of natural and technical/technological hazards and which are functionally oriented towards risk management, protection and rescuing of the extraordinary situation consequences,
- Capacity building of the state institutional mechanism for efficient preventing and protection from catastrophes and rescuing of human and material resources, cultural heritage and environmental protection,
- Enhancing of the present (and possible creating of the new) institutions which will be bearers of activities in case of future catastrophes,
- Creating of permanent budget resources for funds necessary for constituting of the governmental system of the protection from catastrophes and accidents and for its long implementation in practice,
- Creating of the detailed and all-encompassing national action plans for all types of extraordinary situation, individually, for all types of quantified hazards. Plans ought to closely elaborate entire mechanism of preventive measures, systems for observation, notification and systematical elimination or minimizing of the conditions for occurence of disasters and elaborate detail plans of rescuing and providing aid to the persons in need. It is necessary to envisage the place, role and responsibility of all relevant institutions in all types of extraordinary situations at the state level as well as at the local community level and to precisely describe tasks, role and responsibility in the chain of managing of rescuing actions, assistance and implementation of the preventive measures for all individual functions in the coordination system,
- In national action plans for extraordinary situations it is especially important to identify bearers of activities for all significant areas of social activities especialy for: transport, communications, public works and engineering, rescuing activities, protection of population, accomodation of persons injured in accidents, support in resources for rescuing, function of the public healthcare institutions and medical service, carriers of tracing and rescuing on the governmental and local level, response to all types of natural catastrophes, all types of accidents and mass diseases of people and animals.

### *V.3. HAZARD MONITORING AND EVALUATION*

For the purpose of creating of necessary prerequisites for the successful and efficient management in the protection and rescuing, it is necessary to implement the system of continual observing of all potential causes of extraordinary situations and for re-evaluation of the relevant hazard elements especially:

- By creating of new and enhancing of the current technical capacities for the reliable continual monitoring of all natural phenomena and technical/technological processes as well as of biological hazards which might result in catastrophes, especially: seismologic, hydrologic and meteorological phenomena and radiological, ecological and healthcare situations and parameters; by equipping of the existing laboratories and by creating of necessary new laboratories for the efficient detecting of technological and radiological disasters for the purpose of efficient preventing and decreasing of accidents,
- By developing of modern integral information system (GIS) with the programmes for automatic monitoring of all significant processes as a background system for managing in extraordinary situations,
- By casual re-evaluation of all types of significant hazards in Montenegro for the purpose of providing valid data for the reliable preventive acting and managing in the created extraordinary situations as well as for the researching of the vulnerability functions of all relevant systems (human resources, building construction stock, economic and industrial capacities, material goods as a whole, cultural heritage and environment),
- By providing, in all responsible institutions which perform monitoring of natural phenomena and technical/technological accidents of permanent, equipped and trained orderly or services ready for cases of accidents, disasters or incidents as well as for the purpose of preventing of their occurences.

### *V.4. PREVENTIVE MEASURES*

- It is necessary to build structures and installations in accordance with all parameters influencing decrease of the extraordinary situations risk i.e. to respect technical norms from that area,
- Standardize and continually secure microbiological laboratories, introduce permanent supervision over their work
- It is necessary to implement monitoring of hazardous substances and trading with weapon, military equipment and double purpose goods,
- It is necessary to create appropriate protection plans in relation to all important hazards for undertaking concrete measures and activities on the protection of detrimental consequences occurence as well as measures and activities in case of occuring of such consequences and for their relieving;
- Carry out casual check up of readiness of the personnel in charge and mobile teams for all types of the assumpted potential catastrophes. Such check ups along with mandatory additional training should be carried out at least once a year;
- Provide peacetime reserves of the necessary material for all envisaged potential catastrophes.
- Establish preventive protection measures of the fresh water supply for major urban environment by applying:
    1. Continual ensuring of the spring and protection zones with the sentry services, urgent iforming of the services in charge of the control of water in case of damage or terrorist action; if needed, activating of the organized service for undertaking measures for cleaning of the polluted soil; creating of the laboratory for the fast and reliable identification of toxic substance and microbiological agents,

2. Preventive technological improvement of safety and decreasing of the risk in industrial installations for the purpose of controlling of accidents occurence as well as for improving of the safety management system.
3. Organizing of the inspection system by the competent bodies along with the procedures which will ensure that appropriate preventive measures for preventing of disasters and decreasing of consequences are undertken in the new and already existing installations (facilities);

- Development of the state plans for cases of danger which are based on the internal plans about the facilities and specific activities in case of danger.
- In case of accident, interventions ought to be coordinated. Efficient and all-encompassing gathering and exchange of information on accidents are necessary for improving methods of preventing and procedures of fast action in case of danger. Procedures for gathering and exchange of informations must be defined and established.

### *V.5. TRAINING*

- It is necessary to implement programme of professional staff education for the purpose of implementing the latest scientific and professional knowledge as well as strengthening of scientific/research work at natural phenomenology which might be the generator of catastrophes i.e. with the high hazard for continuation of extraordinary situations.
- It is necessary to ensure conducting permanent campaign for the purpose of informing of publicity on methods of protection and conducting in cases of extraordinary situations as well as on the importance of preventive action intended for decreasing of the detrimental consequences in accidents.
- It is necessary to provide conducting of permanent education of all responsible individuals working in relevant institutions for the purpose of their timely training and preparation for acting in extraordinary situations.
- It is necessary to intensify education programme for farmers and responsible persons in the area of cattle breeding about the importance of dangerous contagious diseases and carry out permanent education of veterinarian personnel at all levels for acting in extraordinary situations.

### *V. 6. PROVIDING OF AID AND RESCUING*

Obligations within the system of acting in accidents ought to be implemented in accordance with the elaborate detailed action plan:

- Apart from the Montenegro Red Cross representatives, the highest Montenegrin coordination body for extraordinary situations ought to have experienced representatives from all institutions of Montenegro who are, by their function, involved into the process of observing, notifying, preventive action, rescuing and providing of aid.
- Experts and trained employees in all relevant institutions for acting in accidents as well as trained volonteers must have specific deployment in the activity structure for acting in accidents for the purpose of providing their efficient activating and engaging in extraordinary situations in operations of responding to accidents.

### *V.7. COOPERATION IN THE REGION*

It is necessary to establish permanent communication with relevant international institutions which would, in case of big catastrophes, provide adequate assistance like: International Red

Cross, WHO, FAO, UNEP, UNCOPS, UNIDO, IAEA (International Agency for Atomic Energy etc).

It is necessary to systematically and permanently strengthen and develop international cooperation with all states in the region in Europe for the purpose of acquiring of new experience and improving of methods of responding to accidents, preventive action systems and technical monitoring of all processes which might lead to mass accidents.

### *V.8. OTHER OBLIGATIONS*

5) To provide continual participation of all healthcare institutions of Montenegro and especially of the Public Health Institute for the purpose of efficient detectig of the occurence of quarantine and infective diseases, their insulation in quarantines in order to prevent bringing in of these diseases in Montenegro.

6) In order to protect bringing in of contagious animal diseases into Montenegro, it is necessary to implement:

- In the shortest possible term to prepare detailed Action Plan for all diseases especially for dangerous contagious diseases from the former A list of OIE, especially for the Veterinarian Administration, field service and laboratory, starting from the highest priority diseases like mouth and foot disease. It is also very important to maintain exercises and simulation of occurence of contagious diseases in regular intervals in order to ensure that national protection plans are efficient and that personnel at all level and in all services, which ought to be included (veterinarian and police service and army) are completely informed with their roles and responsibilities.
- Having in mind that Montenegro has borders with several states and has a relatively long borderline, in order to decrease risk from bringing in of the disease it is necessary to maintain efficient control at entrance points, at main roads, ports and airports.
- Extending, strengthening and modernization of the animal healthcare protection programme in accordance with EU requirements.
- System of identification, registration and movement control at all kinds of domestic animals ought to be urgently introduced.
- Standard of structures and equipment at the cattle market ought to be improved for the purpose of producing and trading animals, raw materials, products and animal origin commodities, animal food and their functioning, which would decrease the risk for the health of people and animals.
- It is necessary to establish veterinarian hygienic service (VHS) in accordance with the Law on Veterinary and provide personnel, vehicles, structures and equipment necessary for its functioning. Structures include collection centres and burning places for the harmless and enviromentally safe removal of animal corpses and slaughtering waste material.
- It is necessary to have reserves of appropriate equipment, funds, medicines, vaccines, means for DDD and other necessary means for acting in extraordinary situations.

## VI. MEASURES FOR IMPLEMENTATION OF THE STRATEGY AND GUIDELINES FOR ACTION PLAN

As already pointed out, preventing of accidents by preventive action, relieving of their detrimental consequences and strengthening of the social community preparedness for their occurrence at the same time represent a great moral imperative and obligation of the society as a whole. In that sense, Strategy for Extraordinary Situations also encompasses organizational concept, structure and contents of direct actions undertaken in all cases when people understand that they are endangered by all types of big natural disasters, technical/technological disasters, nuclear, chemical, biological and radiological contaminations and contagious diseases epidemics.

Because of these reasons, Ministry of Interior which is, apart from other things, in charge of extraordinary situations, ought to implement the following:

1. To immediately establish organizational unit: Department for Extraordinary Situations and Civil Safety.
2. To propose to the Government of Montenegro structure and composition of members of National Team for managing in extraordinary situations,
3. To complete activities on overtaking of the civil protection system in the Department for Extraordinary Situations and Civil Safety as an integrated system of the managing extraordinary situations,
4. To propose to the Government of Montenegro to adopt budget of the Department for Extraordinary situations and Civil Safety as the organizational units of the Ministry of Interior for the purpose of implementation and conducting of measures and activities aimed at managing risks, protection, rescuing and relieving of the consequences in extraordinary situations,
5. To provide appropriate premises for accommodation and functioning of the organizational unit of the Ministry of Interior – Department for Extraordinary Situations and Civil Safety.
6. To establish Centre 112 in accordance with European recommendations and standards (Directive 2002/22/EC) within the Department for Extraordinary Situations and Civil Safety.
7. That „Motorola" system which was within the framework of the Ministry of Defense civil protection system, place to the Department for Extraordinary Situations and Civil Safety as a part of its competences.
8. To propose to the Government of Montenegro establishing of continual cooperation through the Ministry of Interior (Department for Extraordinary Situations and Civil Safety) with the relevant international institutions which , could, in case of big catastrophes, provide adequate aid to the Republic of Montenegro through International Red Cross, WHO, FAO, UNEP, UNCOPS, UNIDO, IAEA (International Agency for Atomic Energy etc).
9. To prepare Programme for making national action plans for all kinds of extraordinary situations which will also include the following:
    - Determining of the bearers of activity on preparing of individual national action plans,
    - Preparing of methodology and guidelines for making of action plans,
    - Preparing of linear management scheme in extraordinary situations for each national action plan,
    - Systems of the connections for implementation of action plans for extraordinary situations,
    - To adopt the Decree on Implementation of the National Action Plans through the competent ministry for extraordinary situations.
10. To perform detailed survey on the preparedness of rescuing services in the Republic of Montenegro and to propose to the Government of the Republic of Montenegro a Procurement Plan for the necessary equipment and funds as a response to the extraordinary situations in accordance with the determined National Strategy for Extraordinary Situations.

# VII ATTACHMENTS

## *VII.1. RULES ON INTERNATIONAL RESPONSE TO DISASTERS ON THE BALKANS*

These rules were determined on IDRL meeting of the Balkan Red Cross National Societies and Red Crescent which was held in Belgrade from 24th until 26th September 2004.

**RECOMMENDED RULES AND PRACTICE**

**A. INTRODUCTION:**

1. **28. International Conference of the Red Cross and Red Crescent** (Geneve, December 2003) adopted recommendations concerning the Law on International Response to the Disasters, laws, rules and principles (hereinafter referred to as: IDRL) . It has supported initiative of the International Federation of the Red Cross and Red Crescent Associations (IF) described in the IDRL project due to considering of the legal framework on which the actions of the international response to the disasters are based. International Conference defined future tasks also including the tasks on regional level as the **Agenda for Humanitarian Action**, item 3.2 (3.2.1 – 3.2.6). It invites states and integral parts of the International Red Cross and Red Crescent Movement to apply these recommendations.
2. The IF initiative is related to the disasters **during the peacetime**, not only to these which happen in the periods of conflict as they had already been covered with the **internaitonal humanitarian law** which is a well developed and recognized branch of international law. In that case, Red Cross International Committee (ICRC) is in charge of acting, not IF. This is not either the place nor there is a need to discuss rules of **international humanitarian law** (IHL). Thus the IF initiative has been restricted to the peacetime disasters and to the international agreement in this case.
3. A distinction ought to be made concerning: A. aid operations which are carried out **only by the Red Cross and Red Crescent** as a part of the response and B. Such operations in which **different participants** are involved: intergovernmental organizations, non-governmental organizations and others. In the first case there are rules like the **Principles and rules of the Red Cross and Red Crescent for the Aid in Disasters,** Agreement from Seviglia, resolutions of the Movement bodies etc. Also, there are no regional and bilateral agreements between National Associations. There is no need for introducing of the additional rules as the existing rules must be applied. In the other case, the rules of the Movement are not applied on participants that are not the part of the Red Cross. Thus there is a need for applying IDRL rules. The existing legal corpse is not appropriately developed, applied and known. Due to these reasons IF has started IDRL project.
4. There are **many actions** which may be undertaken in order to apply appropriate items of the Agenda (3.2.1 – 3.2.6). Some of them are contained in the "IDRL Strategic Plan 2004 – 2007". There are also other actions based on the Chapter 3.2 of the Agenda which help the government in easing suffering of the victims. Item 3.2.4 suggests the states that they should review current laws for carrying out actions in case of disasters and also suggests operational instruments in order to stimulate their harmonization with the appropriate IDRL. The task ought to be carried out in cooperation with their national associations and IF. This action is significant for the success of each operations of responding to the disasters as it covers implementation of international response operation at the national level of the states – aid beneficiaries but also of the states which offer aid. International agencies also have an important role but these organizations must identify their role themselves and which rules they must obey. These are not Balkan national associations which ought to define it. In this case, item 3.2.4 of the Agenda makes an obligation of the participants of the 28th Conference and they are expected to meet it. Regional approach has also been underlined by this item.
5. **The Balkan countries are faced with numerous disasters**. Therefore, on their 14th Conference in Athens in 2003 their national associations decided to convoke a special

meeting dedicated to applying of the future IDRL recommendations from 28th Conference in that region. After that Conference we chose as the first topic, item 3.2.4 of the Agenda. Meeting for which a text was prepared, was held from 24th to 26th September 2004 in Belgrade. Participating associations were informed about the proposed Agenda. There were no objections and on 7th July 2004 draft of one text was sent to the participants. It is valid only for this region or sub-region. Text is a **compilation** of laws, rules and principles of the international response to the disaster (see item 3.2.6) from different sources but also includes practice of the Balkan national associations in numerous humanitarian aid actions of providing response to the disasters. Heading of the text is RECOMMENDED RULES AND PRACTICE. It includes rules of **different legal character** and in the different stages of **development** and extensive acknowledgment: applicable rules of international law, although sometime they are agreements with a small number of ratifications, rules in the process of creating and development, the "soft law" rules, national rules and other internal legal acts but also extensive accepted good practice. These are the reasons why they cannot be understood as mandatory but only as recommendations. It can be expected that their respect and implementation may contribute to the general effort to **improve legal framework** at which operations of the international response to the disasters are based which can improve delivering of humanitarian aid to the victims of disasters and better protect human dignity. They are limited to the cases of natural and technological disasters as well as to the aid to refugees and displaced persons, not to the victims of the … where the rules of IHL were implemented.

6. **The resources** of the text: Recommended Rules and Practice are numerous, as follows: existing bilateral and multilateral conventions and other agreements, general aor concrete actions as the response to disaster; resolutions of UN General Assembly, especially 2816/XXV, 32/56, 46/182, 57/150; practice and resolutions of the UN Security Council; ECOSOC resolutions, between others - 2102/LXIII and Resolution VI from 23rd International Red Cross Conference from 1977 (about facilities); draft of the UNDRO convention on acceleration of delivering the emergency aid from 1984, Principles and Rules for Aid in Disasters, provided by the Red Cross and Red Crescent from 1995 as model;Codex of behavior for International Movement of Red Cross and Red Crescent and NGOs for aid in disasters from 1995; Convention from Tampere on providing communication resources for relieving of disasters and aid operations from 1998; Agreement of the Balkan National Associations on Mutual aid during disasters from 2000 which still hasn't entered into foce, as models; some provisions of IHL as a model; Kiotto Conventions on cooperations concerning the issues of customs duty; recommendations of IATA; various UN projects on the new international humanitarian order; conventions on deploying various UN teams for providing of humanitarian aid during disasters; national legal acts; as models, different text proposed in the doctrine (San Remo Institute, proff. Michael Bothe from the Association for International Law, Dr. Peter Macalister Smith, Mohamed el Baradej and others from UNITAR publications, Dr. Boško Jakovljević etc.). Majority of the proposed rules have background in some of the above mentioned texts and other acts. Apart from that, there are the rules from the rich experience and long practice of Red Cross/Red Crescent widely accepted as a good and recommended practice on improvement of IDRL.

7. The opinion was that national associations at their meeting should accelerate identification of IDRL and its applying on their area and therefore, to adopt **operational rules text** consisting of various resources, the rules which were really applied during responding to the disaster and region of Balkan. Such approach would mean a contribution to clarification, acknowledgment and development of IDRL. Text encompasses main aspects of the response to disaster. They are more or less well known to the persons who are in charge of the operations of responding to the disaster but so far they haven't been collected in one act. During the debate, formulations were improved among many ammendments to the text. Such action would have **advantage** of exposing the experiences of the regions, it would encompass at one place main stages of the operation of the response to disaster, by creating unique view to the humanitarian action as a whole and it would also remove

**loopholes** and contradictions. Submitted text doesn't tend to cover all potential aspects, problems and details of the response to disasters but only to contain main rules.

8. Main purpose of submitting of this text is to enable the **Balkan states** to consider it. The opinion was that if the government applied preparation measures and observed proposed rules in some future disasters, specific operations of the response to disasters would be improved which would, at the same time, be useful for the victims. Disasters are happening in the unexpected way so that there is no need to defer concrete efforts for improving of the legal foundation of international operations of the response to disasters.
9. This text is the **first step** which will be followed by the new one undertaken by international bodies especially International Federation.

## B. RECOMMENDED RULES AND PRACTICE

It is recommended to states that they should adopt their internal laws, regulations and rule books in accordance with the rules mentioned in the underneath texts, in order to demonstrate commitment of the state to the existing international agreements and other legal resources as well as for the purpose of improving successfullness of international response to disaster.

Parties ought to be flexible during applying of these rules.

### *FIRST PART – STATES RECEPIENTS*

## I. PREPARATION MEASURES

Before potential disasters happen, it is recommended to the governments:

i. To adopt **national plan** which determines effective organization for aid including the role of each stakeholder. National association ought to participate in drafting of plan and applying of that plan.

ii. The existing national plan for disasters may require that the state recipient **review** it in order to be in accordance with the rules mentioned in the **underneath** text. Reviewed plan ought to be sent to all parties and participants by specifying their roles within that plan. They ought to get instructions and their personnel ought to be trained how to use them.

iii. To establish **advisory** body consisting of all structures which could be invited to participate in action of providing aid during the disaster;

iv. To appoint a national coordination body (or person) – in further text: „**national coordinator“**;

v. To consider providing of necessary **facilities** for dispatching of goods and for the personnels like:

- Releasing from paying of customs duties;
- To send instructions to the customs to accelerate and simplify customs procedure;
- To decide which documents necessary during the normal time for the customs duty, shall be excepted for the operations of aid in disaster;
- To regulate possibility of temporary import of equipment and transport means and their return to the country of origin when they are not necessary any more;
- To release aid from other duties, taxes, licences etc;
- To adopt measures so that the competent body could issue, without deferring, visas for the personnel which participates in the aid operations in the disasters;
- To try to reach agreement with national airplane companies, railways and shipping companies in order to provide free of charge transport for despatches and for the personnel or, at least, to apply minimal tarrifs and priority in transport;

- To order the competent bodies to issue permitances for flying and landing for the planes and their personnel with international aid transports;
- To establish official tracing service and to release from paying of postal costs;
- To propose Tampere Convention on Telecommunications from the year 1998 to be ratified, to approve and accept it or to accede to it;
- To try to conclude bilateral and multilateral agreements in the region in accordance with the article 4 of the Tampere Convention;
- To advise national services for communication how to ease using of telecommunication resources in response to disasters.

vi. To take into consideration **legislation** and other measures ( economic, financial, administrative, organizational, material resources, procurement of modern technical means) which could prevent or decrease consequences of the potencial future disasters and improve aid operations having in mind that they ought to help recovery and long-term development.

vii. To propose to donors if help is expressed in money, to provure asisstance on the **local market** when necessary and more favourable economically and when it saves the time and the money. However, in the end, donors will decide where to procure goods from.

## *II. DECISION MAKING PROCESS*

When disaster happens the following is recommended to the governments:

1. To put into operation internal mechanisms for the situations of disasters.
2. To determine needs of victims for humanitarian aid and their number, to determine users categories, to determine the type of aid and quantities for the period which encompasses close future, together with the competent international agencies for providing of aid which offer their aid.
3. To **decide whether** they will ask or accept international aid by taking into consideration situation of victims, their right to humanitarian aid, expected effects of national response as well as possible effects of international operations to rehabilitation and development of the affected areas.
4. If the decision is brought to **accept** international aid, the following steps can be undertaken:
    a) propose to their national associations to address **other Balkan national assotiations** and Federation with the request for humanitarian aid in which the Red Cross/Red Crescent Principles and Rules are applied in providing of aid in disasters and Agreement as of 15th April 2000.
    b) To address the most important international and national agencies and some states with the **request** for humanitarian aid; or
    c) To **accept** offer from these bodies.
5. To give instruction to the **national coordinator** how to apply decision on accepting of international aid.
6. When necessary to demand from some donors to address **public appeals** for donations in means or goods in accordance with their regulations.
7. To inform donors and potential donors on **national coordinator**, in cooperation with whom the operation of providing aid will be carried out.

8. To accept **coordination role** of international body determined by donors or which will be determined in accordance with regulations, like UN coordinator for aid in extraordinary circumstances (ERC) or Federation.
9. To follow up development of situation in the area affected by the disaster and its consequences as well as the results of responses and to make **new decisions** in accordance with that. To inform donors on these decisions if they influence progress of operation related to providing of aid.
10. To conclude **agreements** with foreign donors when necessary like the agreements on their missions' status.
11. To consider legislative and **other measures** which may become necessary, especially those that are missing in the beginning.

## III. DELIVERING OF AID

In order to apply decision on receiving of international aid, the following is recommended to the governments:

1. To observe the decisions of the **UN Security Council** concerning international aid operations, for instance, sanctions.
2. To receive regular **reports** from the national coordinator and to undertake actions when necessary to solve problems which might appear.
3. To follow up develoment of international operations of aid provision and to **intervene** in case of disturbances or irregularities which could affect operations in course.
4. To check **remarks** or interventions of international coordinator and see whether they need some actions.
5. To **inform** victims, publicity, foreign donors and media on development of the aid operations. Information ought to be collected from all possible resources.
6. To **protect** good dispatches and personnel who works in the aid delivery from the attack and interfering in executive of their mission. To ensure safety of dispatching of goods, services and personnel from the theft, robbery and similar proceedings which might obstruct operation.
7. To provide donors and foreign media necessary **telecommunication** resources in accordance with the appropriate international regulations.
8. To ask donors to inform national coordinator in advance about **dispatching** of such aid by providing him/her with necessary data on transportation means, expected time and place of arrival and contents.
9. To take care that necessary **facilities** for aid are provided.
10. To try with the common donor to solve problem of the humanitarian aid **transit**.
11. To see whether the priority for the dispatches at the customs duty and during the transport is ensured.
12. To provide that personnel who works on providing of aid get free of charge entrance **visas** , ensure approach to the places of disaster, accomodation of the goods and equipment which is given as aid to the victims.
13. To ensure observing of the provisions concerning the **personnel working on the delivery of aid**, their privileges and immunities when they are determined by the agreement.
14. To ensure legal acknowledgment of the **professional expertise** and work permits.
15. To allow **identification** of goods and services as well as a personnel who works on that aid in accordance with the law and especially, identification of the Red Cross/Rec Crescent designation.

16. To ensure that **distribution** of goods or providing of services are in line with the applicable agreements and that it is directed toward the categories of beneficiaries who satisfy the agreed criteria.
17. To **include** victims into providing of aid whenever it is possible.

## IV. MONITORING AND CONTROL

Governments are recommended the following:

### MONITORING

1. To accept **monitoring system**, proposed by donors, when they agree about it or when it corresponds to the donors' rules or international coordinator's rules or the adopted practice.
2. To provide personnel engaged in monitoring with all facilities that are necessary for obtaining of their mission. That includes access to all places of aid operations: customs duty, transport up to the warehouse or the storing place, places of distribution, places at which victims obtain services and where they live, obtained aid records etc.
3. To **consider** remarks, suggestions and proposals of monitors and to undertake necessary actions in order to improve operation and avoid abuses.
4. To **protect** warehouses, other places for storage, equipment from theft and robbery but also from damages occured due to the inappropriate storage or from other procedures which affect aid provision operation.
5. To suggest that donors, when the monitoring is performed, should coordinate and internally **rationalize** the very activities in order to avoid sending of the improportional number of monitors which not only disturb operation of aid provision but can also decrease value of aid, especially if monitoring costs are covered from the funds identified for humanitarian aid.

### CONTROL

1. That control is performed by **national bodies**, in accordance with the law.
2. To ascertain whether **managing** of operation is done in accordance with the agreements, general rules or the accepted practice.
3. To ensure **sound financial operations** and that recordings of goods are transparent, to respond to the real situation with the stores and to be maintained in line with the naitonal law and donor's requests.
4. To enable donor's representatives **control** over the financial and material managing the received assisstance when agreed or contained in the rules of donor through whom the humanitarian assistance is provided.
5. To enable **auditing** of the accounts by the external independent auditor determined by donors when agreed.
6. To **discuss** observations or proposals of the bodies which perform control and inform donors about the undertaken actions that are in relation to these findings.
7. To demand from the bodies which perform monitoring or control not to **exceed** limits of their mandate.

### C. LEGAL DEMANDS

1. To **bear responsibility** for risks and requirements which are made within its territory except for the risks or requirements for which the state which provides aid explicitly agrees to bear responsibility.

## V. REPORTING AND EVALUATION

The following is recommended to the government:

1. To **periodically report** donors about the situation of managing operation of providing of aid in disasters pursuant to the national law and practice. Reporting period ought to be set up by the agreement.
2. That reporting to donors shall be performed in accordance with **their rules** (UN, Federation etc) or if it is agreed so in their rules as a requirement for providing of aid.
3. To submit **final report** after completing of operation.
4. At the end of operation **to evaluate** good and bad practice, operation effects, learned lessons, potential changes in the plans for preparation and providing of aid and in corresponding legislation.
5. To **publish** final report and evaluation.
6. In case of disagreement about the control findings in case when operation managment breaks the conditions of agreement or when different interpretation of the agreement is provided, to accept **arbitration** which has been envisaged by the appropriate agreements.

**SECOND PART – COUNTRIES THAT ARE PROVIDING AID**

It is recommended to the government:

1. To seriously consider **possibility** of providing humanitarian aid to the country which asks for it. For that purpose, to contact its national coordinator or government.

   **National associations** of the Balkans will offer aid to the victims of

   disasters in this region.
2. To respect **type** of aid determined by the competent national body of the affected country and appropriate international organization.
3. To test chances to obtain aid at the **local market** (if the aid is expressed in money) when it is possible and economically more favourable and where the time and money are saved. Hovewer, donors will eventually decide where to obtain goods from.
4. To **cooperate** with all stakeholders in the current operation and to accept coordination role of the competent national and international coordinators.
5. To encourage states to allow **transit** of aid and when it is approved, to protect aid shipments and personnel while it stays within their territory.
6. To demand that personnel providing aid **do not exceed limits of its mission** and to observe the laws of the recipient state.
7. To provide, as much as possible, **facilities** for delivery of goods on the territories of the states – aid recipient and transit.
8. To observe resolutions of the **UN Security Council** in relation to the aid operations.
9. To encourage state – recipients to accept control of the **states that provide aid** and to submit **final report** on operaitons of providing aid to which they contributed.
10. Many **duties** of state-recipients are the rights of countries that provide aid and vice versa.
11. Many **rights** belonging to the states which recieve aid are duties of **international organizations** which have a mandate to provide humanitarian aid to the victims of disasters. **On the contrary**, many duties of the states recipients are the rights of the corresponding international organizations.
12. To decide on **termination** of international operations of providing aid, independently or with the agreement from the recipient state as stipulated by appropriate agreement or the rules. It can also decide about termination of its contribution to the international operation of aid delivery.

## VII.2. GLOSSARY OF THE PROFESSIONAL TERMS THAT ARE USED IN STRATEGY

**EPICENTRE OF EARTHQUAKE** is a point of maximum effect of earthquake on the land surface and represents vertical projection of the **hypocentre** on that surface. The earthquake hypocentre is a point of maximal concetration of the stress in the rocks, immediately before the rock cracks (faults) (at tectonic earthquakes) i.g. its cracking (faulting). Therefore, it is the point where that fault begins.

**EARTHQUAKE INTENSITY** represents the earthquake effect on the building structures expressed in the appropriate full-number intensity scales ranging from I to XII degrees. There are numerous scales of the kind and MSK-64 is in the official use in Montenegro. It is approximately numerically equivalent to the European macroseismic scale EMX-98. Elementary profile of the MSK-64 intensity scale is represented in the following table.

| DEGREE | BASIC EARTHQUAKE EFFECTS |
|---|---|
| **I** | Earthquake is registered only by seismographes. |
| **II** | During inactive period, only sensitive persons react. |
| **III** | Earthquake is felt (noticed) by greater number of people in the buildings' interior. |
| **IV** | Major part of population feel earthquake within houses while in the field only the individuals can feel it. Dishes and windows rattle. Some people are awaken from sleeping. |
| **V** | Soil tremor is felt by many persons in the field, too. Hanging objects start to swing. Some people are seized with smaller scale panic. |
| **VI** | Shaking is felt by all persons. They flee from their houses. Pictures fall from the walls. Smaller scale damages appear on the weaker buildings. |
| **VII** | Destruction and devastation occur with significant damages on furniture in apartments. Damages also appear at the good quality houses. Chimnies are demolished and tiles fall from the roofs. |
| **VIII** | About 25% of houses are damaged. Some houses are demolished. Small cracks appear in the humid soil and in the slopes. |
| **IX** | About 50% of houses are very damaged, many of them are demolished and majority of them are not usable for further residing. |
| **X** | Heavy damages appear on about 75% houses and majority of them are demolished. Cracks up to several centimeters appear on the soil. Rocks fall from the slopes and big landfalls in the soil are created. |
| **XI** | All buildings are demolished. Wide cracks occur in the soil and water penetrates out of them, filled with sand and mud. There are big rockslides. |
| **XII** | There is no artificial structure which can stand earthquake. Soil and relief change their appearance, lakes are burried, rivers beds are changed. |

**HAZARD** represents any natural phenomenon, process or event induced by people, potentially capable of causing endangering of human lives, material property, cultural heritage or environment.

**CATASTROPHE** is an event which, due to the effect of some hazard to the human population and material resources, resulted in the loss of the significant number of human lives, material goods or cultural heritage elements or significant devastation of environment occurred.

**SOIL LIQUIFICATION** is a natural phenomenon which occurs in the dynamic conditions of strong shaking of soil during the effects of earthquake and represents the abrupt soil transition from the untied condition (sand and mud) in the liquid condition along with constant presence of the shallow

subterranean water. The occurence is manifested with the partial or complete loss of the soil bearing capacity and is frequently followed by throwing of sand with water through the cracks in the soil. This phenomenon was noticed, for instance, during the Montenegrin earthquake as of 15th April 1979 along the Skadar Lake coast and at many places on the seashore. From the building construction stability aspect this occurrence is always very detrimental for the structures which have foundation in such soil.

**EARTHQUAKE MAGNITUDE** expresses the equivalent (not absolute value) of the released seismic energy in the earthquake pocket. Magnitude is not denominated number and is defined as a log of the quotient of the maximal amplitude or the registered seismic wave and appropriate referent value of the Richter standardized amplitude, so called zero earthquake which is in the function of distance up to epicentre. Magnitude doesn't have either upper or lower limit.

**DISASTER** is an event with fatal consequences which leads to losing of life, great human sufferings and danger as well as to big material damage.

**RISK** (from appearance of natural or technological hazards) represents a level of the expected losses or damages which might be expected as a consequence of implementation of some hazard at certain place and within the certain time. Important factors in the risk assessment and understanding are: assessment of the expected hazard level, evaluation of all elements of human value which are sensitive to the hazard implementation, evaluation of location or positions of the value elements in relation to hazard, assessment of the vulnerability of social community as follows: physical, social and economic. As it is possible to relieve risk but is practically impossible to eliminate it completely, it is necessary to determine a level of the acceptable risk at the state level. This is a dynamic social/political procedure which is implemented in the conditions of the specific nature of the expected hazard and exposure to the appropriate risk.

**SEISMIC HAZARD** represents probability of occurrence within the specific period of time and on the specific place, of the earthquakes with specific features which will be manifested on some location, with the specific level of maximal soil acceleration or the soil shaking intensity.

**VULNERABILITY** represents situation caused by the physical, social, economic or ecological factors or processes and which increases vulnerability of the community on implementation of some hazard.

**ATMOSPHERIC NATURAL DISASTERS** – atmospheric occurence which has as a consequence, significant damages on the local, regional or extensive area. According to data from period: 1963 – 1992 the occurence of the overal damages on the Earth were caused by: tropical storms (30%); droughts (22%); floods caused by heavy rains (32%); earthquakes (10%) and other natural disasters (hail, electric discharging, heat, thick fog, icy rain etc). According to mentioned factors, natural disasters are, according to the damages they cause, practically atmospheric natural disasters or meteorological diasasters.

**REALISTIC THRESHOLDS** – minimal necessary values of the meteorological scale during which damages are made. Individual areas are also defined for each month in the year. They can be changeable from year to year at the place where factors on which they depend, are changed. By determining of the real thresholds situations with the achieved extremes without damages are excluded.

**METEOROLOGICAL VALUES' THRESHOLDS** – includes referent value for the specific meteorological value through which the values are classified as big, **bigger and the biggest**. Values exceeding such determined thresholds shouldn't be called extraordinary, dangerous or catastrophic, except in case when they are followed by damages which correspond to the used terms.

**METEOROLOGICAL DROUGHT** - deficit of the precipitations quantity in relation to the normal value for the specific area and season. If this lasts for a long time, hydrological drought occurs.

**HIDROLOGICAL DROUGHT** – it is characterized by the significant fall of the water level in the water accumulations: lakes, rivers and underground waters.

**AGRICULTURAL DROUGHT** – appears when, during the vegetation period, soil humidity is decreased and precipitations are insufficient to enable plants to reach the maturity stage, which causes damaging and fading away.

**Abbreviations:**

HC – Healthcare Centre

KC – Clinical Centre

HES – Hygienic-Epidemiological Service

DDD – Desinsection*, disinfection and deratization.

WMO – World Meteorological Organisation.

Desinsection* – extermination of insects