

UNDP PROGRAM “DISASTER RISK MANAGEMENT”
Project “Efficient disaster risk management for sustainable development and human safety”

Situation analysis of disaster risk assessment in Kyrgyzstan
(country level)

Bishkek, 2014

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Acronyms and abbreviations

In English and German:

BCPR	Bureau for Crisis Prevention and Recovery/UNDP - Бюро по предупреждению кризисов и восстановлению ПРООН
CSA	country situation analysis – страновой ситуационный анализ
edge router	пограничный маршрутизатор
FDSN	Federation of Digital Seismograph Networks – Федерация цифровых сейсмографических сетей
GCM	General Circulation Models – модель общей циркуляции
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit – Германское общество международного сотрудничества
GRIP	Global Risk Identification Programme – Программа идентификации глобальных рисков ПРООН
GFDRR	Global Facility for Disaster Reduction and Recovery – Глобальный фонд сокращения бедствий и восстановления Всемирного Банка
IRIS	Incorporated Research Institutions of Seismology – Объединенные исследовательские институты сейсмологии
IPCC	The Intergovernmental Panel on Climate Change (IPCC) - Межправительственная группа экспертов по изменению климата (МГЭИК)
JICA	The Japan International Cooperation Agency – Японское агентство международного сотрудничества
KRNET	Kyrgyz network of digital seismic stations - Киргизская сеть цифровых сейсмических станций
SIERA	Systematic Inventory and Evaluation for Risk Assessment - Системное описание и оценка для определения рисков
UNEP	United Nations Environment Programme – Программа ООН по окружающей среде

In Russian and English:

АБР	Азиатский Банк Развития – Asian Development Bank (ADB)
АГПС	Агентство государственной противопожарной службы - Agency of the State Fire Service (ASFS)
АОХ MES KR	Агентство по обращению с хвостохранилищами при MES KR – Agency of Tailings Management under MES KR (ATM MES KR)
АЦГСБ	Азиатский центр готовности к стихийным бедствиям – ADPC - Asian Disaster Preparedness Center
АЦСБ	Азиатский центр сокращения бедствий – ADRC – Asian Disaster Reduction Center
ВБ	Всемирный Банк – World Bank (WB)
ВИЧ	вирус иммунодефицита человека - human immunodeficiency virus (HIV)
ВМО	Всемирная метеорологическая организация - World Meteorological Organization (WMO)
ВНИИГОЧС МЧС РФ	Всероссийский научно-исследовательский институт по проблемам гражданской защиты и чрезвычайных ситуаций при МЧС Российской Федерации - All-Russian Research Institute for Civil Defense and Emergencies of the Russian Federation, MES of the Russian Federation (RRICDE MES RF)
ВОЗ	Всемирная организация здравоохранения - World Health Organization (WHO)
ВПП ООН	Всемирная продовольственная программа Организации Объединенных Наций - World Food Programme of the United Nations (WFP)
ГАООСилХ	Государственное агентство охраны окружающей среды и лесного хозяйства при Правительстве КР - The State Agency for Environmental Protection and Forestry under the Government KR (SAEPF)
ГААСиЖКХ	Государственное агентство архитектуры, строительства и жилищно-коммунального хозяйства при Правительстве КР – The State Agency for

	Architecture, Construction and Housing and Utilities under the Government of the Kyrgyz Republic (SAACHU)
ГИЭиТБ	Государственная инспекция по экологической и технической безопасности при Правительстве КР - The State Inspectorate for Environmental and Technical Safety under the Government of the Kyrgyz Republic (SIETS)
ГИВиФБ	Государственная инспекция по ветеринарной и фитосанитарной безопасности при Правительстве КР – The State Inspectorate for Veterinary and Phytosanitary Safety of the Government of the Kyrgyz Republic (SIVPS)
ГСГЗ	Государственная система Гражданской защиты - State Civil Protection System (SCPS)
ДГСЭН	Департамент государственного санитарно-эпидемиологического надзора – The Department of State Sanitary and Epidemiological Surveillance (DSSES)
ДДТ	Дихлордифенилтрихлорметилметан – diclорdyphenyl trichlormethyl methane
ДМПЧС	Департамент мониторинга и прогнозирования чрезвычайных ситуаций БЧС КР – The Department of monitoring and forecasting of emergency situations of MES KR (DMFES)
ЕГДДС	Единая государственная дежурно-диспетчерская служба - Single state duty and dispatch service (SSDDS)
ЕИУС	Единая информационно- управляющая система – Unified information management system (UIMS)
ИС НАН КР	Институт сейсмологии Национальной Академии наук Кыргызской Республики – the Institute of Seismology of the National Academy of Sciences of the Kyrgyz Republic (IS NAS KR)
ИВПиГ НАН КР	Институт водных проблем и гидроэнергетики - Institute of Water Problems and Hydropower (IWPH)
ИГиОН НАН КР	Институт геомеханики и освоения недр - Institute of Geomechanics and Exploitation of Mineral Resources (IGEMR)
ИГ НАН КР	Институт геологии - Institute of Geology (IG)
ИФЗРАН	Институт физики Земли Российской Академии наук - Institute of Earth Physics of the Russian Academy of Sciences (IEP RAS)
КыргызГИИЗ	Открытое акционерное общество «Киргизский головной институт инженерных изысканий» - Open Joint Stock Company “Kyrgyz head engineering survey institute” (KyrgyzHESI)
ГПИ	Государственный проектный институт по землеустройству Министерства сельского хозяйства и мелиорации КР - State Design Institute of Land Management of the Ministry of Agriculture and Land Reclamation of the Kyrgyz Republic
Кыргызгидромет	Агентство по гидрометеорологии при MES KR - Agency on Hydrometeorology under MES KR (Kyrgyzhydromet)
МВК ГЗ	Межведомственная комиссия по Гражданской защите - Interdepartmental Commission for Civil Protection (ICCP)
МФОККи КП	Международная федерация организаций Красного Креста и Красного Полумесяца - International Federation of Red Cross and Red Crescent (IFRC)
МСК-64	12-балльная шкала интенсивности землетрясений Медведева — Шпонхойера — Карника – Earthquake Intensity Scale proposed by Medvedev, Sponheuer and Karnik
MES KR	Министерство чрезвычайных ситуаций Кыргызской Республики – The Ministry of Emergency Situations of the Kyrgyz Republic (MES KR)
МССБ	Международная стратегия сокращения бедствий – International Disaster Reduction Strategy (IDRS)
НПО	Неправительственная организация - Non-governmental organization (NGO)
РИП	Резкие изменения погоды - Significant weather changes (SWC)
РКИК ООН	Рамочная конвенция по изменению климата Организации Объединенных Наций - Framework Convention on Climate Change of the United Nations (FCCC)
ОГЯ / СГЯ	Опасные гидрометеорологические явления/ стихийные гидрометеорологические явления - Hydrometeorological hazards / extreme

	weather events
ОДС ЦУКС МЧС	Оперативная дежурная служба ЦУКС БЧС КР - Operational duty service of CMC MES KR (ODS CMC MES)
ОИВ	Органы исполнительной власти – Executive authorities
ОКСИОН	Общегосударственная комплексная система информирования и оповещения населения - State integrated population information and warning system
ПРООН	Программа развития Организации Объединенных Наций – United Nations Development Programme (UNDP)
ПХД / ПХБ	Полихлорированные дифенилы / полихлорированные бифенилы - Polychlorinated biphenyls (PCB)
СПИД	синдром приобретенного иммунодефицита - acquired immunodeficiency syndrome (AIDS)
СОЗ	Стойкие органические загрязнители - Persistent organic pollutants (POPs)
СНП СРБ КР	Секретариат Национальной платформы сокращения рисков бедствий Кыргызской Республики – The Secretariat of the National Platform for disaster risk reduction of the Kyrgyz Republic (SNP DRR KR)
ЦАИИЗ	Центрально-Азиатский институт прикладных исследований Земли - Central Asian Institute for Applied Geosciences (CAI AG)
ЦУКС	Центр управления кризисными ситуациями MES KR - Center for Crisis Management МЧС КР (CMC MES KR)
ЦОВ ЦУКС МЧС	Центр обработки вызовов ЦУКС МЧС КР - Call processing center of CMC MES KR (CPC CMC MES KR)
ЭСКАТО	Экономическая и социальная комиссия для Азии и Тихого океана - United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
ЮНИСЕФ	Международный чрезвычайный детский фонд ООН - United Nations International Children's Emergency Fund (UNICEF)

Executive summary

The objective of the State System of Civil Protection of the Kyrgyz Republic in transition of the country to sustainable development consists in formation of sustainable basis for disaster risk management in accordance with the international standards that ensure early and comprehensive safety of people, economic infrastructure and environment. At that, basic priority is to strengthen the capacity of public administration and local government bodies in **monitoring and assessment of disaster risks**, on the basis of which programs and projects for other system priorities will be implemented:

- early warning;
- increase the level of understanding and awareness of the risks and disaster risk management;
- prevention of emergencies, including a set of preventive measures of structural nature;
- disaster preparedness for subsequent effective response at all levels - regional, national and local ¹.

In strengthening the national system of disaster risk assessment, great assistance is provided by the international organizations such as UNDP, WFP, WB, ADB, GIZ, JICA, the Aga Khan Foundation, IFRC etc. that implement more than 30 joint programs and projects in Kyrgyzstan aimed at reducing the risk of disasters. In particular, UNDP Global Risk Identification Program (GRIP) and disaster risk management program of UNDP in Kyrgyzstan provide technical support to national experts in analysis of the country's current theory and practice of risk assessment. The importance of this study lies in the fact that it precedes all other research and practical actions to strengthen disaster risk management and implement disaster risk reduction strategies. Based on the results of situational analysis of risk assessment in the country one can determine not only the shortcomings and weaknesses, but also prospects of risk management system development, starting with strengthening of monitoring network and completing with introduction of decision-making based on risk assessment into the governance practices.

The study on the situation analysis of risk assessment at the national level was carried out on the basis of the UNDP/BCPR/GRIP methodology – Systematic Inventory and Evaluation for Risk Assessment methodology - SIERA. The situation analysis of risk assessment in Kyrgyzstan in accordance with SIERA methodology was focused on important elements, such as: 1) activities of the institutions for disaster risk management in the field of risk assessment - the concept and strategies, programs and plans of action, interaction, legal framework and enforcement procedures; 2) the methodology used by these institutions in risk assessment; 3) availability of basic and intermediate data for risk assessment; 4) public bodies, research institutions, civil society organizations acting as data providers; 5) professional experience and skills of specialists in risk assessment; 6) research in the field of risk assessment.

Given the multisectoral nature of risk assessment and the need for multilateral partnerships, during the study discussions, the interviews with managers and specialists of ministries, government agencies, academic institutions, industrial and non-governmental organizations have been conducted using SIERA questionnaires specially designed for this purpose. Working meetings of expert group on risk assessment were very important, which was also created with advice and support of the UNDP. At these meetings, the national experts discussed key issues of strengthening the role of assessment and monitoring of risks in making recommendations and decisions. On the basis of examination of the operation of disaster risk management institutions, programs, action plans, reports, studies, legal documents and practices

¹ The program of sustainable development of the Kyrgyz Republic for 2013-2017. Approved by the Regulation of the Government of the Kyrgyz Republic as of April 30, 2013 # 218.

of risk assessment in general system of disaster risk management in the country have been reviewed. The work performed allowed to make conclusions about the strengths and weaknesses of national practices for risk assessment and identify areas to improve them, on which it is necessary to integrate the efforts of all parties involved.

This publication presents the results of the study that define current state of the national system of risk assessment, the main problems and issues, strengths and weaknesses, needs for external support and prospects for cooperation with external partners in the relevant areas of risk assessment and exchange of information on disaster risks. Joint development of recommendations for further development of the national system of risk assessment in Kyrgyzstan is logical conclusion of the review of collected material.

1. Introduction

1.1. Objective and tasks

The objective of this study was to analyze the situation that prevailed in Kyrgyzstan in the field of disaster risk assessment (CSA – country situation analysis). The following tasks had to be addressed to achieve this objective:

- describe in detail the organizations and agencies related to disaster risk assessment, research and projects, publications and reports on risk assessment, sources of data on disaster risks;
- identify conceptual, methodological and institutional framework for risk assessment;
- identify human and technical capacity of organizations and institutions involved in disaster risk management;
- identify gaps in the national system of risk assessment and the need for external support to ensure its strengthening;
- identify the needs and requirements in information exchange, primarily between the national risk management institutions, as well as with their international partners;
- develop recommendations for further development of disaster risk assessment and information exchange.

1.2. Expected results

Expected results of the project:

- description of the national risk assessment system, with a focus on identifying the organizations and institutions, their research, projects, publications and reports on risk assessment, databases, human capacity, risk assessment methodologies and technical equipment;
- jointly identified problems, strengths and weaknesses, priorities and perspectives of development of risk assessment, and the needs for external support;
- recommendations for institutional strengthening of the system of risk assessment - a) development of a common methodological approach to understanding of risk assessment and identification of key operational concepts, b) normative and legal framework, c) functional distribution of risk assessment between national institutions in accordance with the profile of their activities and existing natural and manmade threats, d) interaction of the main partners in risk assessment and e) enhancement of information exchange.

1.3. Methodology

This study is based on the methodology of Systematic Inventory and Evaluation for Risk Assessment (SIERA) developed by the Global Risk Identification Programme (GRIP) in collaboration with the Bureau for Crisis Prevention and Recovery (BCPR) of the United Nations Development Programme for the integrated study of disaster risk assessment practice at country level. SIERA methodology allows to carry out comprehensive assessment of current situation in the field of risk assessment, which is based on information not only about disaster risks, but also about human and institutional capacities of the country together with information on research and program activities. At the same time, participation of government agencies, academic institutions, industrial structures, public organizations in the evaluation of the national system of risk assessment helps determine the reliability of the information and creates conditions for exchange of information and development of joint recommendations to improve the system of monitoring and evaluation, which the whole system of disaster risk management should be based on.

SIERA methodology requires focused and objective study of existing practice of disaster risk assessment for the seven main areas, which are shown in Figure 1:

Fig. 1. Sections of country situation analysis for disaster risk assessment (CSA DRA).



This approach allows to get answers to the key questions of analysis of disaster risk assessment practice in the State System of Civil Protection:

- Who is responsible for risk assessment in the country? Which departments, agencies, institutions? Are the risks of disasters assessed by business environment, are the NGOs involved?
- What methods of assessment are there? Is there a common understanding of risk assessment for all participants in disaster risk management? Has the country approved uniform risk assessment methodologies, such as assessment of potential damage?
 - What sources of information exist and what databases created? Their availability?
 - Which projects and studies are carried out?
 - Is there the practice of decision-making based on risk assessment?
 - What is the capacity of the country? What are information and external support needs?
 - What are the priorities in the area of strengthening the national risk assessment system?

The methodology of country situation analysis of risk assessment consists of three main stages that are clearly defined in the Guidelines developed by GRIP².

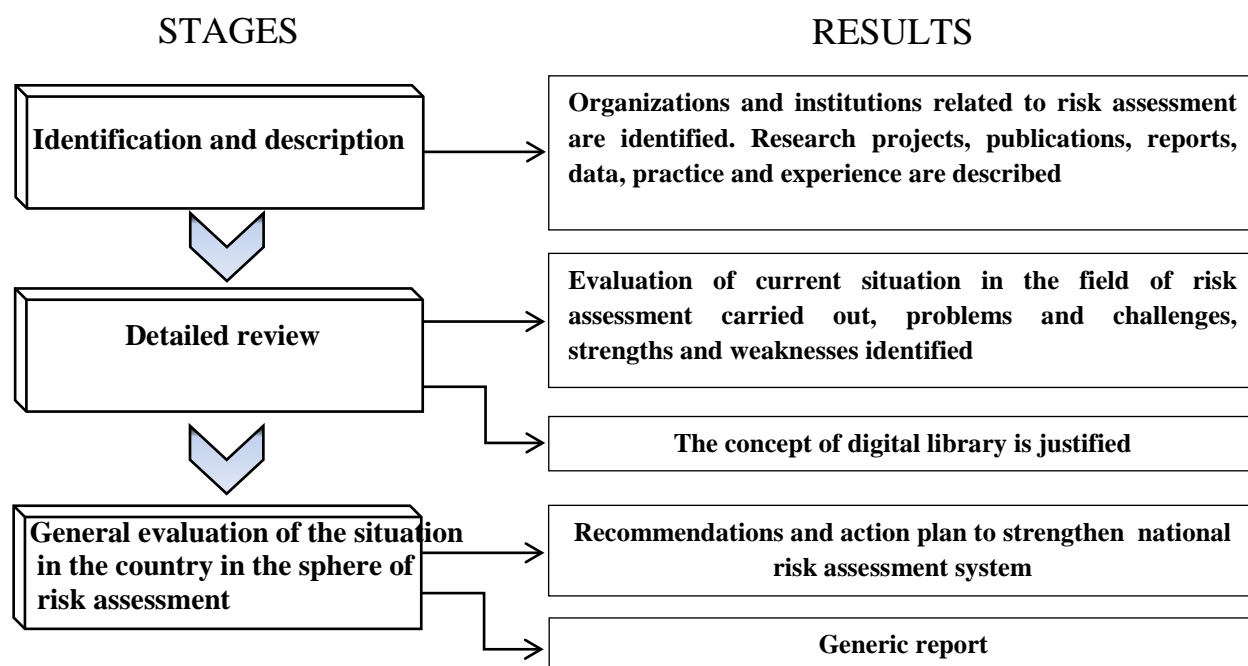
Stage 1: Preliminary identification and description of existing studies of risk, methodologies, data and their sources and national capacity. This work is conducted mainly in the form of expert interviews with managers and leading specialists not only of national organizations and institutions, but also with the international agencies involved in disaster risk reduction in Kyrgyzstan. Table 1 presents the information on the experts that were interviewed.

² Better Risk Information for Sound Decision Making, Country Situation Analysis for National Risk Assessment – Methodology and Guideline (Version 2.1), GRIP-BCPR/UNDP, Geneva Switzerland, December 2009.

Stage 2: Clarification of initial inventory and assessment of the identified data, methodologies, experience and skills, as well as institutional capacity, which can be used in strengthening the national system of risk assessment. It also envisages expert interviewing, but with the task of identifying value judgments with formulation of the recommendations. Basically, the experts are the same key specialists that were interviewed in the first stage. In addition to the interviews, the available materials were examined, such as programs, concepts, publications, research reports, work plans and profiles of organizations and institutions involved in risk assessment.

Stage 3: Writing a report that presents the results of the study and the recommendations.

Fig 2. The process of country situation analysis of disaster risk assessment



1.4. The structure of the report

This report consists of the introduction and 5 sections. The introduction describes the objective, tasks, expected results, the structure of the report and difficulties in the course of the study. Special attention was paid to SIERA methodology. The section “Profile of disaster risks in Kyrgyzstan” describes the main risks in accordance with hazard classification in the country, history of disasters and climate change impact on development of hazardous natural processes. Section 3 is dedicated to description of institutional and regulatory framework, methodology, programs and projects, research, data bases, technical capacity and practice of risk assessment application in the country. The section “Key problems and conclusions” describes the main problems related to management and coordination, exchange of the information, methodology and methods of risk assessment, along with strengthening the capacity of the national disaster risk assessment system. Sections 5 and 6 contain the recommendations to address the problems and the proposals on development and implementation of the plan on enhancement of disaster risk assessment.

1.5. The problems of the study

Certain difficulties appeared in the course of this study that need to be considered in further development of the national risk assessment system, particularly in strengthening the interaction

between the state civil protection structures both in joint assessment, and in exchange of the information. These difficulties are summarized as follows:

- lack of common understanding of risk assessment - its content, objective, tasks, values and place in the general system of disaster risk management;
- different interpretation of the definitions of key terms used in risk assessment;
- unwillingness of the individual institutions to participate in exchange of information due to weak mechanisms of information exchange, and partly due to commercialization of services;
- lack of access to research reports on disaster risks making it difficult to properly assess the capacity and introduce practice of decision-making based on assessment results.

The recommendations of this study reflect the above gaps; and upon development of a plan of action for development of national risk assessment system, standardization of terminology and institutional strengthening of inter-agency information sharing on disaster risks are envisaged.

Section 2: Profile of disaster risks in Kyrgyzstan

2.1. The main hazards

Geographical location, geophysical and climatic conditions of the country create its profile of disaster risks, i.e. determine special, peculiar for specific areas, set of interrelated risks of disasters of natural and anthropogenic origin. Therefore, in addition to natural conditions, social and economic factors further define risk profile that are primarily associated with the capacity of public risk management agencies, the state of economic and social infrastructure and the level of vulnerability to disasters.

Since Kyrgyzstan is located entirely within the Tien Shan - a mountain system that emerged due to interaction of the Indian and Eurasian lithospheric plates, a large part of its territory is located in a seismically hazardous areas with high risk of **earthquake of 8-9 grades of intensity** (MSK-64 scale). About 3000 seismic events are recorded each year, with 10-20 earthquakes with magnitude more than 5 grades are recorded as emergencies.³

Seismic risk is exacerbated by a high degree of vulnerability of the population and a high level of exposure to the destruction of most part of residential sector and social facilities. In 2011, the Institute of Seismology, National Academy of Sciences, has developed a new “Map of seismic zoning of the territory of Kyrgyzstan” and compiled the “List of settlements on the territory of Kyrgyzstan with an indication of intensity of expected earthquakes”, in accordance with which 495 settlements, including all major cities of the country, are located in areas of expected earthquakes with a magnitude of 9 grades. Engineering analysis of seismic stability indicates that 80% of houses in rural areas and more than 70% of schools and kindergartens across the country are not earthquake-proof.⁴

Given the probability, frequency and the scale of the consequences, **landslides** are the following natural disaster in order of priority. Currently, there are about 5,000 landslides on the territory of the Kyrgyz Republic. The number of landslides increases annually due to increased interacting of modern geodynamic movements, seismicity, the rise in groundwater levels, abnormal amount of precipitation, as well as engineering and human activities, and violates the

³ Map of seismic zoning of the territory of the Kyrgyz Republic, the Report of the Institute of Seismology of NAS KR

⁴ Reduction of vulnerability of children to disasters in Kyrgyzstan, UNICEF project; Monitoring, forecasting of hazardous processes and phenomena in the territory of the Kyrgyz Republic (Vol. 10 with rev. and ext.), B.: MES KR, 2012

balance of slope stability in mountain areas. Physical effects of landslides is expressed not only in the backsliding of soil and rocks, but also in the impact of debris flow during the outburst of dammed lake formed by the landslides. Total land area affected by landslide processes is about 7.5% of the territory of the country. MES KR has identified 600 landslide hazardous settlements and areas where there is a real threat of destruction and debris of residential and social, engineering and road facilities, industrial buildings and power lines, injury and loss of life. The landslides located near Maili-Suu, Min-Kush and Kadzhisai villages that can cause outburst of radioactive tailings and thereby create a regional (transboundary) environmental disasters are the most dangerous⁵ ones.

It should be noted that each year 3-4 extreme **weather disasters** occur covering the territories of a number of rayons and regions. The experts predict that due to climate change the share of hydrometeorological hazards among emergencies will increase. These include sudden changes of weather, frost, drought, intense heat, heavy precipitation, wind, frost and icing⁶. Such natural phenomena adversely affect human health and cause significant damage to the economy, especially in the agriculture – massive loss of domestic cattle (jute) and crop damage that exacerbates already difficult situation of farmers, most of which rely on subsistence agriculture and live in poverty (more than 1 million 380 thousand of rural residents)⁷.

On average about 73 emergencies annually occur in the country associated with **mudflows and floods**, which makes up 29-30% of all emergencies. The settlements (95% of all settlements of the republic are located on the banks of rivers or alluvial fans or ephemeral streams), transport communications, farmland, waterworks, irrigation and other facilities are exposed to mudflows and floods⁸.

According to the Kyrgyz Complex Geological Expedition, the list of **outburst-prone** objects includes 314 glacial lakes, 16 of them are classified in the first category, 34 in the second category, 264 in the third category of danger⁹. The first category lakes are the most dangerous, such as the Adygene, Ak-Say, Petrov, Teztor, Kultor, Jardy Jaindy, Keidy Kuchkach, Chirkanak, Tuyuktor and etc., which are in the stage of outburst; in this view it is required to implement safety engineering measures and preparedness measures for early warning and evacuation of the population from affected areas.

Especially hazardous natural phenomena also include **avalanches**, which are hazardous to human, infrastructure facilities, transport communications, power and communication lines. Cases of deaths, loss of livestock and destruction of forests during avalanches are not uncommon. 105,000 square kilometers, or 53% of the territory of the Kyrgyz Republic are subject to the effects of avalanches. Within 779 avalanche areas more than 30, 000 avalanche sites are identified, while about one thousand of them pose a threat to human life¹⁰.

⁵ I. Torgoev "Possible climate change and landslide processes regime in the basin of the Maili-Suu River"; I. Torgoev et al., "Evaluation of geo-environmental risks of landslides and tailings in mining region of Min-Kush"; Torgoev I.A., Aleshin G. "Landslide threat in the area of basic facilities of Kambarata HPP-2".

⁶ Classification of emergencies and their assessment criteria in the Kyrgyz Republic. The regulation of the Government of the Kyrgyz Republic as of November 17, 2011 # 733

⁷ The program of sustainable development of the Kyrgyz Republic for 2013-2017. Approved by the Regulation of the Government of the Kyrgyz Republic as of April 30, 2013 # 218.

⁸ Monitoring, forecasting of hazardous processes and phenomena in the territory of the Kyrgyz Republic (Vol. 10 with rev. and ext.), B.: MES KR, 2012.

⁹ Yerokhin S.A., Cerny M., Jansky B. Monitoring of glacial lakes in Kyrgyzstan.

¹⁰ Monitoring, forecasting of hazardous processes ...

Flooding from **groundwater rising** caused serious damage to property. There are 304 settlements in the underflooding zone, including the city of Bishkek, Talas, Kant, Tokmok and Balykchi. Groundwater is associated with hazardous **geocryological** processes - frost heave and cryogenic subsidence representing a serious threat to houses, industrial and social facilities.

Erosion processes require implementation of urgent mitigation measures. Every year thousands hectares of agricultural land drop from turnover, which is not permissible for mountainous country, where only 7.5% of the area is suitable for crop cultivation. Erosion phenomena in conjunction with some manifestations of climate change - reduction in surface water, strong wind, changing water flow, high temperatures and other increase areas of degraded land and promote desertification. The average degree of erosion in three types - water, wind and pasture - covers more than a half of the country's area, while the land affected by severe erosion occupy up to ¼ of the territory of Kyrgyzstan¹¹.

Every year there is **deterioration of the epidemiological situation** due to seasonal outbreaks of infant measles, hepatitis, influenza, acute respiratory viral infections and meningitis. The steady increase in the incidence of tuberculosis and the number of people living with HIV, especially among children is most alarming. Today the number of TB patients makes up 102.9 per 100,000 adults and the number of sick children is 39.4 per 100 thousand children. In 2013, 4745 HIV-positive patients were registered in Kyrgyzstan; in 2011, there were 1,300 people. Over the past 10 years the number of people living with HIV has increased 10 times. 191 children were HIV- infected in health facilities.

Together with meteorological disasters various animal diseases and plant pests cause significant economic damage to farmers. There are objective and subjective conditions for occurrence of **epizooties and epiphytities** in the country.

Energy, irrigation, mining and transport industries are the most likely sources of **technogenic emergencies**. There are 1538 existing industrial enterprises and organizations operating around 12 thousand dangerous facilities in the republic. **37 waste dumps and 35 tailings**, which buried 250 million cubic meters of toxic and radioactive waste are the most dangerous sources of man-made catastrophes. There are real conditions in the country for occurrence of environmental disasters, based on synergistic combination of man-made and natural hazards, the effects of which will be of a large-scale, cross-border nature of colossal damage to the economy, population and environment in Central Asia. The problem lies in the fact that, firstly, the tailings are located in mountain areas with high seismic, landslide and mudflow hazard and river drainage, and therefore, there will be a constant threat of destruction of dams as a result of impact of earthquake, landslide, debris flow and outburst of glacial lakes. Second, long periods of operation and improper maintenance of tailings have long led to geofiltration depressurization. For example, the content of uranium and radium in water and bottom muds of the Maili-Suu River exceeds permissible background concentrations thousands times. Therefore, implementation of operational and rehabilitation works mostly related to strengthening of dykes is a temporary, partial solution for tailings and waste dumps management. It is required to carry out remediation, reburial of radioactive waste into safer from natural hazards and specially waterproofed places¹².

In Kyrgyzstan, given high seismic risk the issues of safety and prevention of **emergencies on hydropower facilities** are particularly important. According to observation

¹¹ Monitoring, forecasting of hazardous processes ...

¹² Monitoring, forecasting of hazardous processes ...Ibid.

results, after Suusamyr earthquake occurred on 19.08.1992 with $M=7,3$ (grade 10-11 earthquake), changes were identified near the Toktogul reservoir and cascade of Naryn HPPs – at the dam abutments in supporting soil mass in the form of fractures and dislocations.¹³ Therefore it is necessary to undertake detailed examination of potentially dangerous facilities of hydropower, primarily of the reservoirs of hydropower stations of Naryn cascade.

Persistent organic pollutants cause serious harm to human health and environment - more than 2000 tons of pesticides, of which 1,200 tons of DDT, and energy waste containing polychlorinated biphenyls. 250 tons of PCBs have been identified. The problems of the National Plan for the Stockholm Convention on POPs related to regulatory support, management and control of recycling are still unresolved.

When assessing the risks of disasters it is important to consider high probability of **emergencies on transportation lines** (roads, railways, bridges, tunnels, avalanche galleries, trestles), especially in mountainous areas exposed to hazards of natural origin - earthquakes, avalanches, mudflows, landslides, fog, heavy rain.

In conclusion, it should be noted that natural, technological, environmental and climate risks are amplified due to **high level of social and economic vulnerability** of Kyrgyzstan. Of 28,993 families identified for resettlement from hazardous areas, 15,324 have been resettled, whereas 13,669 families still live in hazardous areas because of the lack of funds. The annual direct damage is USD 30 - 35 mln., while the state budget allocates about USD 6 mln. per year on prevention and elimination of emergency consequences.

2.2. History of disasters

The actors of disaster risk reduction process, and first of all structural units of MES KR – Crisis Management Center (CMC), operational department, Kyrgyzhydromet and the Institute of Seismology of NAS KR and CAI AG are engaged in recording historical events related to disasters that had catastrophic consequences to obtain the information to solve scientific - analytical and practical problems for development of preventive measures. Thus, the specialists of the Institute of Seismology NAS KR created a catalogue of large earthquakes, which includes information about 244 strong earthquakes that occurred in the territory of the Kyrgyz Republic and adjacent areas from ancient times to 2000¹⁴.

¹³ Ibid.

¹⁴ Djanuzakov K.D., Omuraliev M., Omuralieva A. et al. Strong earthquakes of the Tien Shan. Bishkek: Ilim. 2003. P. 216.

The catalogue was developed based on global database on earthquake hypocenters, which includes 46 global and regional catalogues¹⁵, including the catalogue on earthquakes on the territory of the USSR¹⁶.

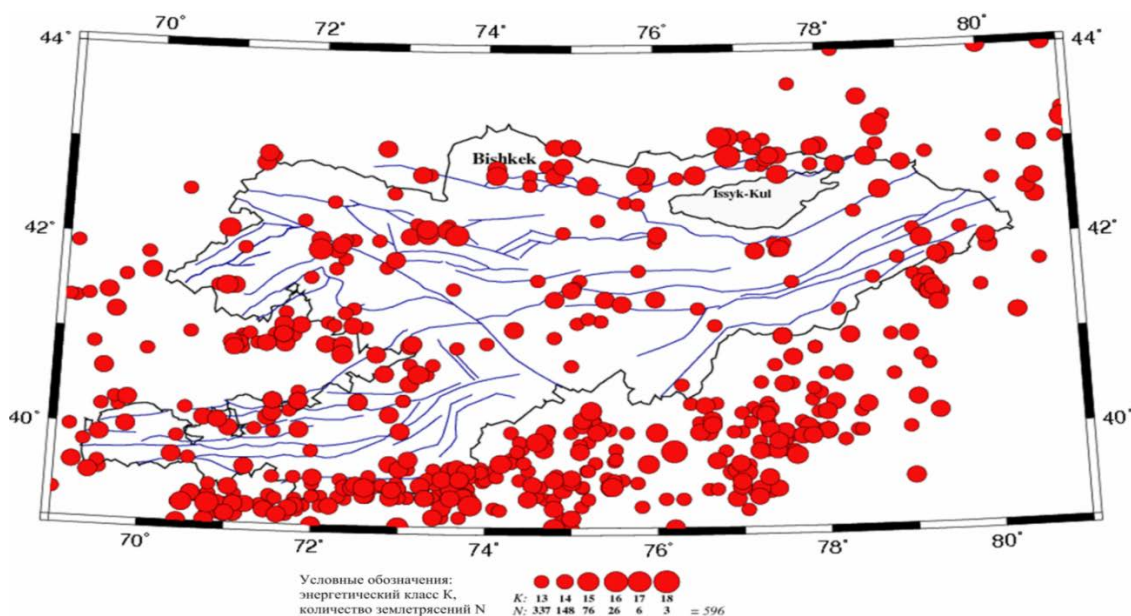


Рис. 1. Карта эпицентров сильных землетрясений с $K \geq 13$ ($M \geq 5$) с исторических времен по 2010 год по данным Института сейсмологии НАН КР.

The format of strong earthquakes description is given below:

#	Date (year/month /day)	Time (h:m:s)	Coordinates		Depth of focus, H, km	Magnitude			Rautian energy class K_R	Seismic moment M_0 , H·m	Angular frequency f_0 , Hz	Kanamori energy class K_{SK}	Areas of expected earthquakes (AEE), identified before the event and where strong earthquakes were expected
			$\varphi^\circ N$	$\lambda^\circ E$		M_s	M_w	m_b (A_s)					
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	2012/0 1/08	06:20:0 6	42.1 3	87.5 2	23.4	5.0	4.9	5.0	12.4 (w)	$2.86 \cdot 10^{16}$ (HRV)	1.43(HRV)	12.7 0	China
2	2012/0 2/05	07:10:2 0.4	41.5 9	74.7 6	30.6	5.2		5.2	12.2	$2.5 \cdot 10^{16}$ (HRV)	1.43(HRV)	12.5 7	Chaartash

¹⁵ Vvedenskaya N. A. Catalogue of strong earthquakes of the Tien Shan. //Funds of IEP AS USSR, Moscow, 1962; Djanuzakov K.D., Earthquakes in Kirghizia and seismic zoning of its the territory. // Ilim, Frunze, 1964.

¹⁶ Kondorskaya N.V., Shabalin N.V. New catalog of strong earthquakes in the USSR from ancient times until 1975, Moscow, 1975.

3	2012/0 2/09	18:57:3 .3	44.9 9	93.1 2	19.3	5.3	5.0	5.1	12.6 (w)	4.51· 10 ¹⁶ (HR V)	1.25(HRV)	12.8 9	China
4	2012/0 2/20	02:23:5 7	41.4 3	73.2 2	12	4.2		4.9	11.4	-	-	-	Karasu- Kokbel
5	2012/0 3/02	13:40:1 0.0	39.7 2	74.4 1	22.7	5.0	4.9	5.0	12.2	2.89· 10 ¹⁶ (HR V)	1.43(HRV)	12.7 0	Tajikista n

Table 1. Fragment from the Catalogue of strong earthquakes of the Tien Shan

The specialists of DMFES MES KR maintain recording of **tragic events associated with the landslides**¹⁷:

- 2003 – Sogot village, Osh oblast, 38 people died;
- 2003 – Kara-Taryk village, Osh oblast, 34 people died;
- 2004 – Budalyk village, Osh oblast, 33 people died;
- 2009 – Raikomsomol village, Jalal-Abad oblast, 16 people died.

and historical manmade disasters:

- 1958 – because of emergency decompression of the tailings dam, discharge and spread of about 600 thousand m³ of hazardous radioactive substances occurred in the riverbed of the Mailu-Suu River through the territory of Kyrgyzstan to densely populated Ferghana Valley;
 - 1959 - radioactive tailings dam washed away in the area of Kara-Balta. Radioactive substances spread to irrigation networks and irrigated fields.
 - 1964 - because of the earthquake of 5 grade intensity the tailings dam number 2 destruction and break near the Ak-Tuz village occurred, and about 680 m³ of ingredients containing salts of heavy metals and radionuclides were discharged in the Kichi-Kemin River to a distance of 40 km. Hazardous substances containing heavy metals and radioactive thorium were transferred by the river and irrigation system, covered the land, orchards and gardens, and got in a number of houses and public buildings in the form of a layer of mud sediment with the thickness from 5 to 60 cm. Test measurements made at discrete points in a contaminated area show that a dangerous situation is not liquidated still¹⁸.

Disease prevention unit of MOH KR collects statistics of particularly dangerous and quarantine diseases. The events associated with the risk of HIV should be noted in relation to **the history of medicine of catastrophes and biosocial disasters:**

- 2007 - 36 children under 2 years were infected with HIV in the Naukat district hospital.
- Cases of children infected with HIV in hospitals occurred in 2008 - 72 cases, including 26 infants were infected by their mothers.

¹⁷ Ibatulin H. V. Monitoring of landslides in Kyrgyzstan. Department of monitoring and forecasting of emergencies MES KR. Bishkek, 2011.

¹⁸ Monitoring, forecasting of hazardous processes ...

- In 2009, because of negligence of medical staff, 35 children were HIV- infected, of which 15 infants infected by their mothers;
- in 2010 44 HIV-positive children were identified, including 22 were infected in medical institutions.
- In 2011, 33 children were HIV - infected, including 11 of them by their mothers.

The reports of scientific research specialists of the Geotechnical Party of the State Agency for Geology and Mineral Resources under the Government KR describe the events of **mountain lakes outburst**.

Starting from 2010, CMC MES KR maintains **the catalogue of emergency situations** occurred on the territory of Kyrgyzstan indicating the time, location, emergency type, the number of victims, material damage, the consequences and the measures taken.

The need to maintain a history of disasters requires no special justification, since the value of a database on natural disasters covering long periods of time is obvious¹⁹. For example, in the domestic scientific practice disaster records are used to determine frequency and periodicity of disasters²⁰. At the same time, it should be noted that the history of disasters is recorded fragmentarily by separate structures, and quite often not experts, but rather the representatives of the media inform the public about the disaster with catastrophic consequences. Applied importance of the history of disasters manifests itself in three ways – a) research work, particularly in risk analysis and assessment; b) in developing and implementing mitigation and adaptation measures in order to enhance disaster preparedness and prevention; c) in raising public awareness about disasters and building a culture of health and safety. Very often when covering the history of disasters social aspects are overlooked, first of all, the lessons learned by the participants of disaster management and disaster-prone population. Therefore, now there is a need to systematize the procedures of recording and descriptions of events from the history of disasters and formulation of operational concepts, standardization of terms, normative justification, definition of goals, objectives and formats, institutionalization of procedures of descriptions and application of the database on the history of disasters are the priorities.

2.3. Climate change in Kyrgyzstan

In the research of domestic and foreign experts, there is a general statement of the fact that climate change in Kyrgyzstan and Central Asia led to intensive melting of glaciers and snowfields, and in the near future - after 10-20 years - there will be a significant reduction of water resources, reduction and imbalance of water runoff, which in turn will increase the geophysical, biosocial and meteorological risks. In 2009, with the support of the Government of Switzerland the document was drafted “Climate Change in Central Asia”, which indicated that according to climate change scenarios for 2030 - 2050, temperature rise in Central Asia will make up 1-3 degrees, while by the end of the century temperature rise may reach 3-6 degrees.²¹ Domestic scientists agree with this conclusion. In their opinion, “on average for the entire territory of Kyrgyzstan average annual temperature in the twentieth century based on 100 years increased by 1.6°C, which is significantly higher than the global warming being 0.6 ° C. Maximum warming was observed in winter (2.6 ° C), and the smallest warming in summer (1.2 ° C). At that, it was significantly different both for separate climatic areas, and for the stations

¹⁹ René Favier. Lord God, expert and natural disasters, <http://www.diplomate.gouv.fr>

²⁰ Yerokhin S. A. Frequency of outburst risk of mountain lakes of different types.

²¹ This conclusion was spelled out earlier in 2007 in **IPCC Fourth Assessment Report (AR4)** Climate Change 2007: Synthesis Report

within these areas, i.e. altitude zones. In the northern and north-western Kyrgyzstan the range of annual warming for 100 years made up 0.8...2°C, in southwest – 0.6...2.4°C, in the Issyk-Kul basin warming was about 2.4 ° C, in the Inner Tien Shan - 1,2 ° C (the same for the three stations). At most stations, winter warming was more significant than in summer. At that, for Naryn in January it reached 5.2 ° C per 100 years. Trends of annual temperature values for 7 of 9 stations are statistically significant at a confidence level of 0.99. This indicates that the temperature increase was beyond random fluctuations”²².

This “warming will manifest itself not only in the evolution of glaciers and glacial runoff volumes, the overall flow will change – it will decline. Air temperature increase of 1 ° leads to increased evaporation rate by 16%, and this is even against the preservation of rainfall, not to mention its decline, will be accompanied by reduction in water availability”.

For the Issyk-Kul basin, with warming of 1 ° the area of ice on the southern slope of Kungei Ala-Too and on the northern slope of Terskey Ala-too mountain ridges will reduce by 19% and 5% respectively, while with 2° warming, the area of glaciers will reduce by 76% and 32%. Volumes of glacial runoff in the rivers of the northern coast will decrease by 75%, and the ones of southern coast will increase by 23%. Both runoff imbalances invite natural disasters. With warming of 2 ° the Naryn River basin glaciers may lose up to 50% of their surface²³. Figure 2. shows the graph of mass change of glaciers of the Tien Shan ²⁴ that demonstrates sustainable reduction of glaciation. For example, the most catastrophic losses are observed at the Abramov glacier - in the period from 1975 - 1995 the height of the glacier has decreased more than by 17.5 m.

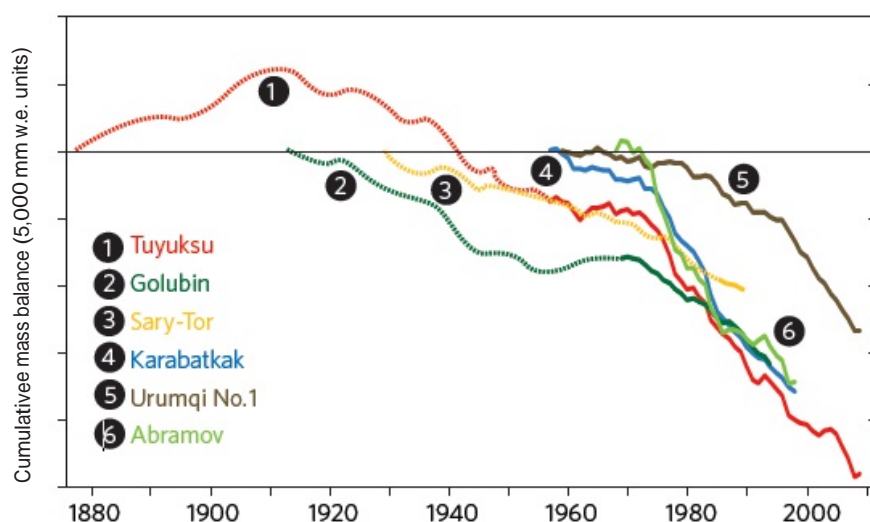


Fig. 2. The mass balance of certain glaciers of Central Asia

Intensive melting of glaciers initially will lead to sharp increase in runoff. Thus, combined model estimates of foreign researchers show that the volume of runoff from glaciers in Central Asia in 2050 could increase three-fold leading to significant changes in the regional structure of water and land use.²⁵ Rapid melting of glaciers and increased runoff will increase the

²² Podrezov O. A., Bakirov K. B., Zakurdayev A. A., Mayatskaya I. A/ Modern climate of Kyrgyzstan and a scenario of its changes in the XXI century.

²³ Dikikh A. N., Podrezov O. A. Climate and water availability in Kyrgyzstan.

²⁴ A.Sorg, T. Bolch, M. Stoffel, O. Solomina, M. Beniston. Climate change impacts on glaciers and runoff in Tien Shan (Central Asia).

²⁵ Arnell N.W., 2004. Climate change and global water resources: SRES emissions and socio-economic scenarios. Global Environmental Change. 2004; Shiklomanov, I.A., Rodda, J.C. World Water Resources at the Beginning of the Twenty-first Century. Cambridge University Press, Cambridge, UK, 2001, 449 pp.

frequency of glacial lakes outburst, which can cause devastating mudslides in mountainous areas of Kyrgyzstan. Increased erosion is another negative manifestation of increased runoff.²⁶

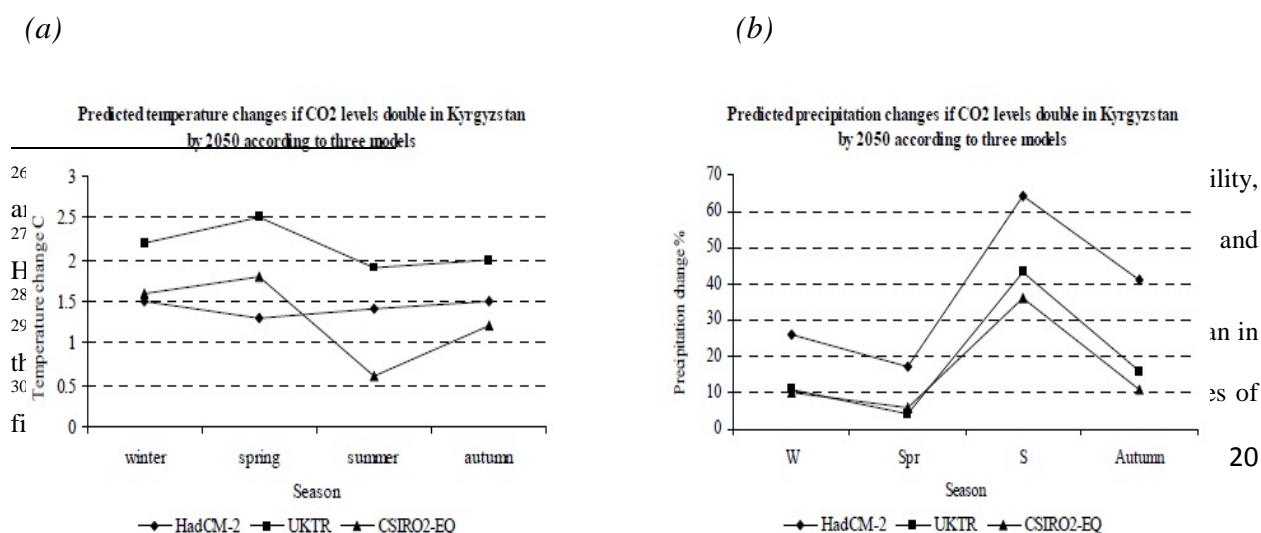
Climate change is evident in the climatic norm of rainfall. The data on climate and hydrological processes in the mountains of Kyrgyzstan and Tajikistan are well documented and indicate a steady increase in precipitation during the last decades.²⁷ In three climatic regions for 100 years, annual precipitation increased as follows: by 31-93 mm (6-22% of normal) in the north-western region, by 5-60 mm (up to 22%) in the Issyk-Kul basin, by 61-239 mm (16-32%) in south western region. Higher values in this region reflect the high moisture transfer by western air currents.²⁸ In the Inner Tien Shan that occupies a significant part of the territory of Kyrgyzstan, on the contrary, Suusamyr weather station data show a significant decrease in precipitation - by 126-167 mm per 100 years, which is 41-47% of normal. According to Tien Shan weather station, reduction trend in precipitation for 68 years (1930-97) made up 108 mm (from 338 to 230 mm), which gives an average speed of reduction of 1.59 mm / year. This is mainly due to the decrease in summer precipitation (by 83%).²⁹

According to the forecasts of the National Communication of Kyrgyzstan 2003, it is reasonably to expect temperature increase by 2.5 C - 3.00 C by 2100 and precipitation increase by 10-15%:

Table 1: Predicted temperature and precipitation changes (Source: The First National Communication to the UNFCCC).³⁰

Country	Reporting year	Global climatic model used (GCM)	Base period	Year of expected doubling of CO ₂	Temperature increase by that time	Percent change in precipitation by that time, %
Kyrgyzstan	2003	HadCM-2	1961-1990	2100	3	54
Kyrgyzstan	2003	UKTR	1961 - 1990	2100	4.4	23
Kyrgyzstan	2003	CSIRO2-EQ	1961 - 1990	2100	2.9	17

Fig. 3: Temperature (a) and precipitation (b) forecasts from the National Communication of Kyrgyzstan for 2003.



In the National Communication on the state of environment of the Kyrgyz Republic for 2006-2011 it was concluded that the general trend of average annual temperature growth generally coincides with the global trend according to the Intergovernmental Panel on Climate Change. Temperature growth is sharply accelerated in time. Thus, over the period of 1960-2010, increase in average annual temperature amounted to 2.39 degrees C, and 5.82 degrees C for 1990-2010. (Figure 3). At the same time it was noted that the general trend of the average annual air temperature change for the entire territory of the Kyrgyz Republic is identified at all weather stations of Kyrgyzhydromet network for the entire period of instrumental observations, i.e., for 1885 - 2010. Actually observations began in 1883 at Karakol weather station, but since 1885 observations for the whole country were carried out relatively regularly.³¹

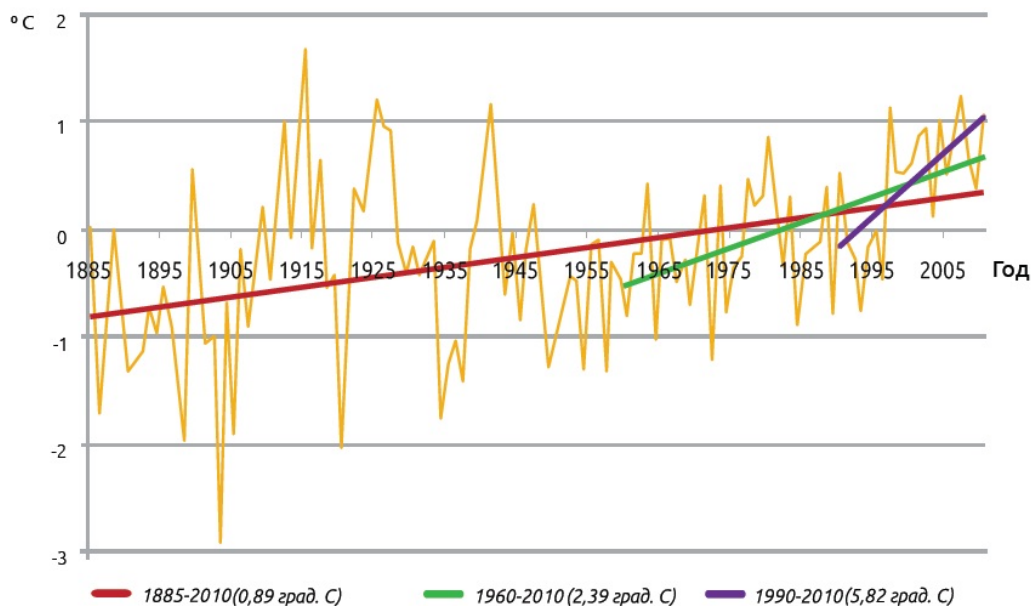


Fig. 4. Trends in average annual values of surface temperature over time. The rate of temperature change for various time periods in degrees C / 100 years is shown in parentheses

Temperature increase, changing water balance and runoff will necessarily lead to significant changes in the environment, which ultimately will manifest in the following negative consequences:

³¹ <http://www.undp.kg/en/resources/e-library/article/28-e-library/2246-national-environment-report-2006-2011>

- increased number of geophysical disasters and their impact – landslides, mountain lakes outburst, floods;
- increased share of meteorological, glaciological and biological emergencies;
- increased frequency and intensity of droughts in the foothill zone, increased threat of forest and steppe fires;
- initial increase in runoff can potentially accelerate soil erosion, especially in case of increased frequency of catastrophic rainfall;
- changed timing of occurrence of autumn and spring frosts, snow and summer floods.

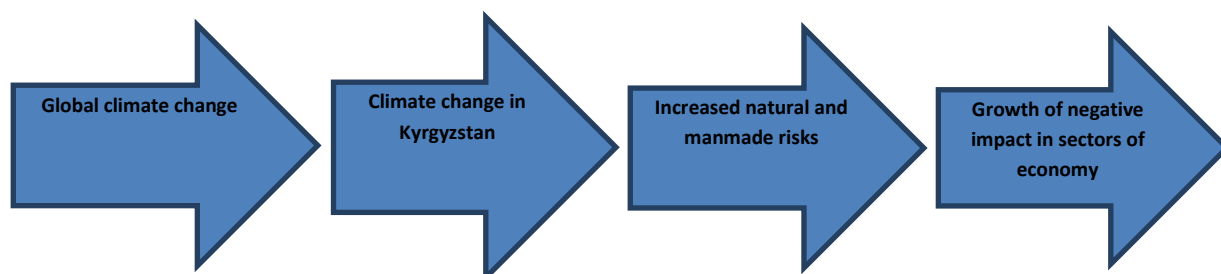


Fig. 5. The general scheme of dependence of increasing economic losses on the effects of global climate change

Changes in climatic conditions of formation and manifestation of disaster risks will strengthen vulnerability of Kyrgyzstan and negative impact on the most important sectors of economy:

- decreased precipitation in combination with drought and wind erosion will increase soil degradation, which will lead to reduction of fertility and productivity of the agricultural land, including pastures;
- drought, heat, frost, heavy snowfall, ice formation will cause reduction of crop yield and livestock productivity;
- access to water resources will be even more limited due to inadequate state of the irrigation infrastructure that does not meet changed characteristics of runoff;
- changes in water balance will have negative impact on hydropower;
- meteorological risks will affect health - increase in cardiovascular diseases, increased prevalence of infectious diseases, encephalitis, increased threat of cholera, plague, malaria and anthrax³².
- increased consumption of drinking water because of projected population growth and potential reduction of drinking water;
- reduced amount of available fresh water and land suitable for agriculture will enhance migration processes, drought and crop failures will force the inhabitants of areas with rainfed agriculture and desert pastures to move to the city and to the area of irrigated agriculture.

Impact of climate change on frequency of manifestations and impact of natural disasters can be judged based on a number of events over the past decade. For example, increased precipitation contributed to landslide activity and large landslides in 90th of the 20th century and in the beginning of 21st century in the southern regions of the country, which led to loss of life and significant losses in economic and social infrastructure of subsidized aiyl aimaks³³. Decrease

³² Domashov I., Korotenko V., Koshoyev M. Climate change: examples of adaptation practices at community level. Bishkek, 2012

³³ Ibatulin Kh. V. Ibid.; I. A Torgoev, Yu. G. Aleshin, G. E. Ashirov Effect of climate on occurrence of landslides in Kyrgyzstan. http://www.mountainhazards2013.com/conference/menu/Torgoev_Aleshin_paper_3_rus.pdf

in rainfall negatively affected the condition of pastures and livestock productivity³⁴. Sudden frosts in September 2010, a cold snap and snowfall in June 2013 caused massive loss of livestock in Naryn and Issyk-Kul oblasts. Extreme prolonged low (Suusamyr 2011) and high temperatures (July 2013) are observed more and more often. Exposure to high or low temperatures results in increased cases of blood and blood-forming organs diseases, especially among vulnerable groups - elderly people and children who are the most sensitive to changes in temperature.³⁵

The trend of climate change and its negative manifestations of multisectoral nature require strengthening public policies in the study of modern climatic conditions of the country in order to implement adaptation and mitigation programs developed on the basis of detailed assessment of climatic and environmental risks.

³⁴ Penkina L. M. Monitoring observations of SDI Kyrgyzgiprozem. 2012.

³⁵ Environment and human health. National Communication on the state of environment for 2006-2011.

Section 3: Country DRA situation

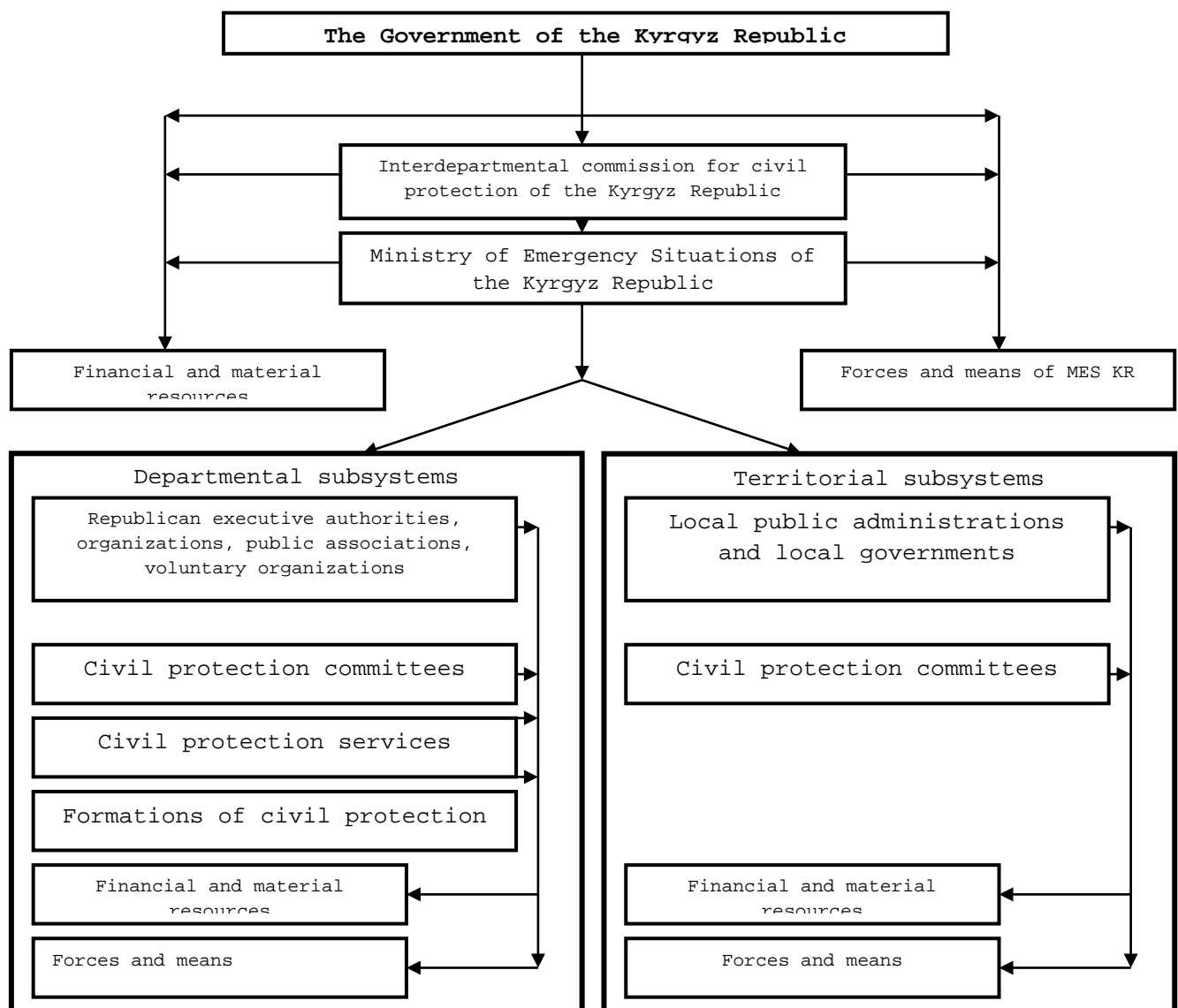
3.1. Institutional framework for risk assessment

In Kyrgyzstan the State System of Civil Protection is established with the objective to create conditions of safety for the population and sustainable socio-economic development on the basis of effective implementation of measures to reduce disaster risks and ensure emergency preparedness. The institutions of Civil Protection at all levels should develop and implement activities in the field of disaster risk management on the basis of risk assessment and analysis.

The state civil protection system consists of departmental and territorial subsystems created at the following levels:

- republican;
- oblast;
- rayon;
- local – in aiyl aimaks;
- object – at the enterprises and organizations.

Fig.6 . Management structure of the state system of civil protection of the Kyrgyz Republic

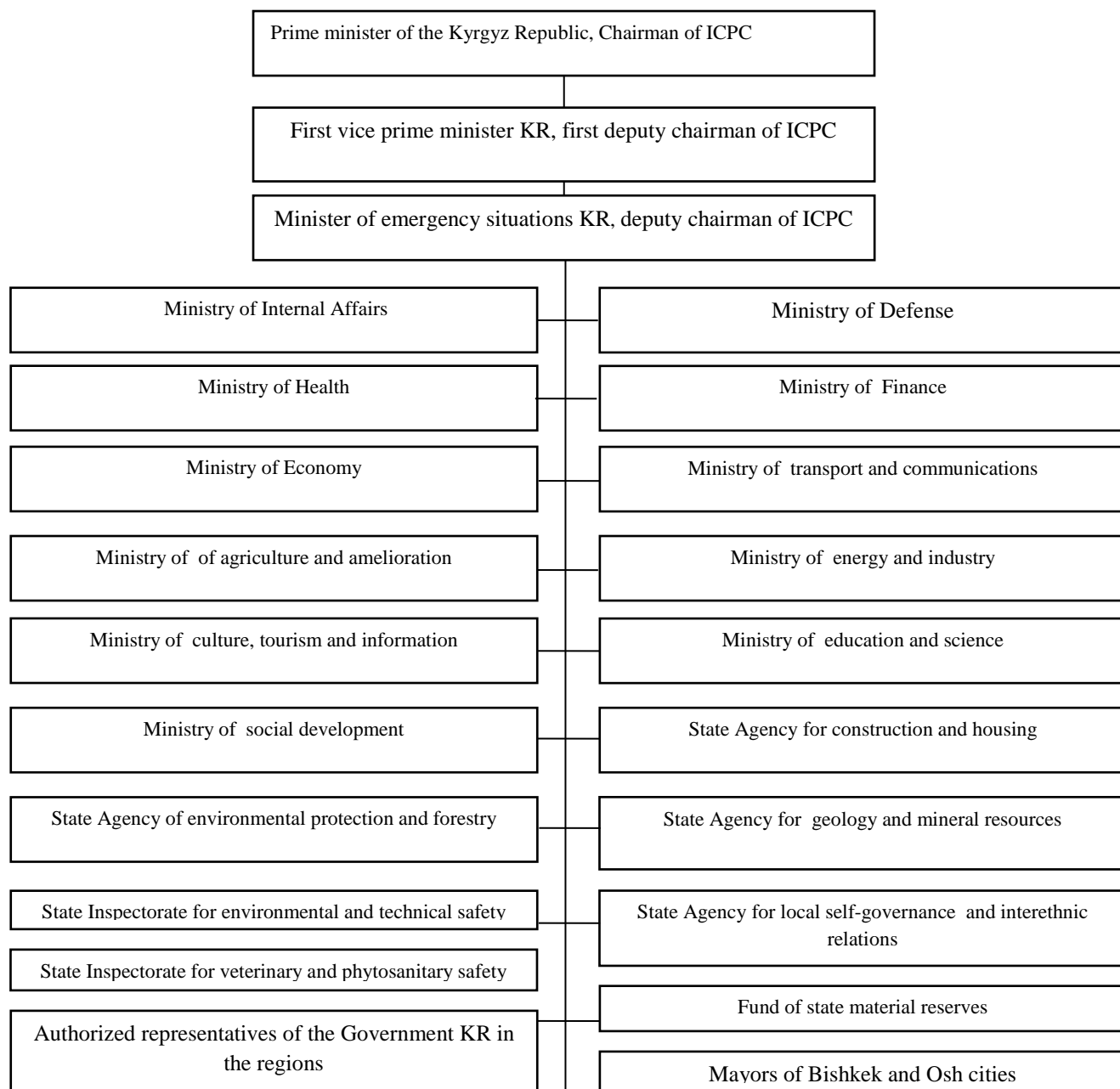


Departmental subsystem includes management bodies, forces and means of republican

executive authorities and organizations of the Kyrgyz Republic regardless of their ownership forms. Territorial subsystem of civil protection consists of management bodies, forces and means of local state administrations, local governments, territorial subdivisions of the Ministry of Emergency Situations and other executive bodies of the Kyrgyz Republic.

Interdepartmental civil protection commission (ICPC) is a coordinating body headed by the prime minister of the Kyrgyz Republic, who is the Head of civil protection of the country and the chairman of the committee. First vice prime minister is the first deputy chairman of the Interdepartmental commission, the minister of emergency situations of the Kyrgyz Republic is the deputy chairman. Supervision of the Commissions for Civil Protection established at other levels is assigned to the heads of regional and district administrations, mayors and heads of aiyl aimaks and the heads of businesses.

Fig.7 Composition of ICPC



The Ministry of Emergency Situations of the Kyrgyz Republic is an authorized state body of executive authority of the Kyrgyz Republic, which activity is aimed at development and implementation of the unified state policy in the sphere of civil protection. Structural subdivisions of MES KR carry out assessment of risks of hazardous processes and phenomena

by the degree of probability, impact and potential consequences within the frame of monitoring and forecasting of natural and manmade emergencies, and first of all the Department of monitoring and forecasting of emergencies, Kyrgyzhydromet, Agency for tailings management, Agency for state fire service, operative department and the Department for protection of the population and territories and the Department *Selvodzaschita* (mudflow and water protection). Crisis management center and information-analytical unit of central apparatus of MES KR are engaged in information sharing within the frame of measures on prevention and liquidation of consequences of emergencies.

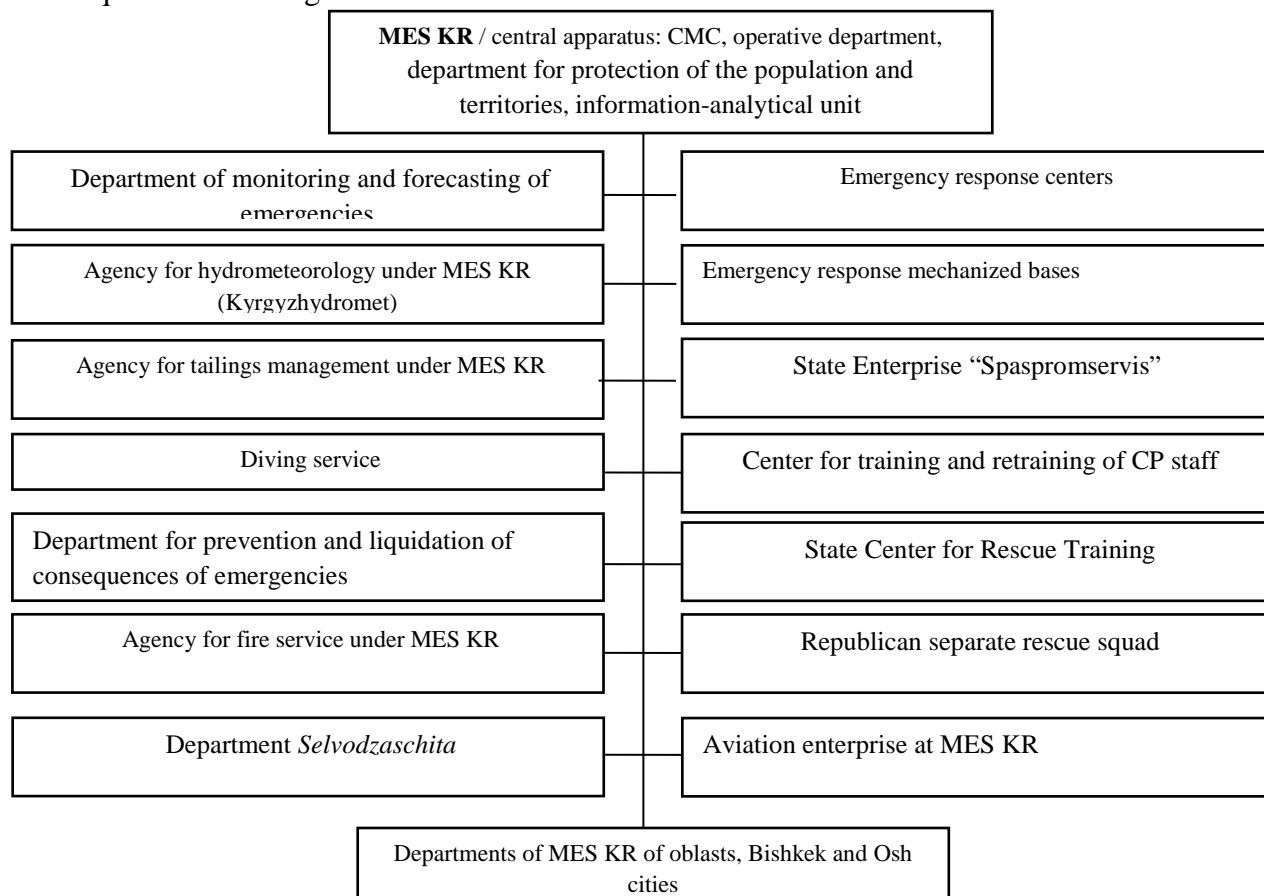


Fig. 8. Structure of MES KR (subdivisions engaged in monitoring and forecasting of emergencies and information management are highlighted in red)

Signing by the Kyrgyz Republic of the Hyogo Framework for Action was the turning point in the policy change in the field of civil protection. This first of all is manifested in an effort to implement an integrated approach to securing the population of the country and its territories from natural and man-made disasters³⁶.

Another remarkable fact consists in establishment of National Platform for Disaster Risk Reduction, which aims to combine and coordinate the efforts of all participants in disaster risk management in the country - government agencies, academic institutions, NGOs, the media,

³⁶ The concept of integrated security of the population and territory of the Kyrgyz Republic in emergency and crisis situations to 2020; the Strategy of integrated security of the population and territory of the Kyrgyz Republic in emergency and crisis situations to 2020 approved by the Regulation of the Government of the Kyrgyz Republic as of June 2, 2012 # 357

business community and the international organizations³⁷. Secretariat of the National Platform was created that was designed to provide technical assistance to the Interdepartmental Commission for Civil Protection. For this purpose, expert groups were formed, including on disaster risk assessment and disaster information management³⁸ composed of various structures dealing with monitoring and forecasting of hazardous biosocial, climatic and manmade processes. Most part of these studies is related to the study of probability of occurrence, degree of exposure, the level of disaster consequences and practical application of research results.

Table 2. The list of organizations dealing with monitoring and forecasting of hazardous natural and manmade processes

Organization (public authority / research institute / enterprise)	Tasks of the organizations approved by the Statutes of organizations
Institute of Seismology NAS KR	<ul style="list-style-type: none"> - seismic hazard assessment and preparation of conditioned multiscale seismic zoning map; - study of seismic regime of the Tien Shan and its relationship with geodynamic features of the region; - forecast of seismic situation and mapping of areas of expected earthquakes; - quantity assessment of the impact of earthquakes on soils and structures, seismic risk assessment on developed areas; - development of practical recommendations to reduce damage from seismic catastrophes and improvement of seismic stability of the facilities.
Department of monitoring and forecasting of emergencies MES KR	<ul style="list-style-type: none"> - monitoring, prediction and prevention of emergencies to protect the population and territory from dangerous natural and anthropogenic processes; - development and implementation of state programs for prevention of natural and man-made disasters to ensure protection of the population and territory; - development of forecasts for development and intensification of hazardous natural processes and events in the territory of the Kyrgyz Republic;
Central Asian Institute for Applied Geosciences	<ul style="list-style-type: none"> - multidisciplinary scientific and applied research on disaster risk reduction, water resources management and adaptation to global changes in Central Asia for making science-based decisions; - development of new methods and achieving scientific results that contribute to practical application in the field of disaster risk reduction and sustainable development of the region. - study of the processes of global and regional changes and their impact on the environment; - monitoring of hazardous natural processes and events, multidisciplinary assessment of risk, reduction of vulnerability to disasters; - applied research in the areas of: Geodynamics and geocatastrophes; climate, water and geo-ecology; technical infrastructure and data management.
Kyrgyzhydromet under MES KR	<ul style="list-style-type: none"> - hydrometeorological and agrometeorological forecasts; - interaction with other government agencies and organizations in terms of identification of priorities and conducting scientific and research works on hydrometeorology; - organization and participation in development of the regulations and organization of advocacy and dissemination of knowledge in the field of hydrometeorology
State Agency for Geology and Mineral Resources under the	<ul style="list-style-type: none"> - system integrated geological studies; - state regulation of subsoil use and improving the management of the state

³⁷ The Order of the minister of emergency situations KR “On establishment of National Disaster Risk Reduction Platform” as of July 9, 2011 # 686.

³⁸ The Order of the minister of emergency situations KR “On approval of thematic group” as of October 1, 2013 # 956.

Government KR	<ul style="list-style-type: none"> subsoil fund; - protection of subsoil and environment in exploration works and development of mineral deposits; - creation of favorable conditions for mining industry development; - implementation of single technical policy in development of topographic and geodetic and cartographic works, introduction of the latest achievements of science and technology and best practices in performing cartographic, topographic and geodetic works.
State Agency for Protection of Environment under the Government KR	<ul style="list-style-type: none"> - implementation of policies and regulations in the field of environmental protection and natural resources use, as well as accounting, assessment of the state of natural resources and components, including forest and hunting management - prevention of influence of possible negative consequences of the proposed administrative, economic and other activities on the environment by state environmental review; - establishment and development of the international cooperation of the Kyrgyz Republic in the field of environmental protection, environmental safety and environmental management.
State Inspectorate for Veterinary and Phytosanitary Safety under the Government KR	<ul style="list-style-type: none"> - prevention, detection and suppression of violations of laws of the Kyrgyz Republic in the field of sanitation, veterinary, phytosanitary and food safety, products of plant and animal origin; - conducting state supervision over observance of sanitary, veterinary and phytosanitary standards; - prevention of importation, exportation and spread of diseases common to humans and animals, and plant pests in places determined by the Government of the Kyrgyz Republic
State Inspectorate for Environmental and Technical Safety under the Government KR	<ul style="list-style-type: none"> - state supervision and monitoring of compliance with normative and legal acts, technical regulations on mechanical, seismic, fire, environmental, industrial, energy, biological, chemical and radiation safety for products (facilities) and/or related production processes, construction, installation, adjustment, operation, storage, transportation, use, sale, burial, placement and disposal; - supervision over compliance with labor rights of citizens and standards of occupational safety and health; - ensure performance of the obligations on the international agreements within its competence; - protection of interests of the state and all participants of legal land relations in accordance with effective land legislation.
Department of State Sanitary and Epidemiological Supervision of the Ministry of Health KR	<ul style="list-style-type: none"> - participation in implementation of state policy in the field of sanitary and epidemiological welfare and radiation safety of the population; - organization and implementation of the state sanitary and epidemiological surveillance; - organization and management of the State Sanitary and Epidemiological Service of the Kyrgyz Republic; - coordination of activities of public administration bodies of the Kyrgyz Republic and businesses on sanitary and epidemiological welfare of the population; - sanitary-epidemiological regulation, improvement of legal regulation of public health in relation to human exposure to adverse factors of environment and living conditions; - identification of priority activities in organization of scientific research related to provision of sanitary-epidemiological welfare of the population.
Agency for tailings management under MES KR	<ul style="list-style-type: none"> - implementation of unified technical policy in design, rehabilitation and maintenance of protective engineering structures on tailings and waste dumps, which are administered by the Ministry of Emergency Situations of the Kyrgyz Republic; - formation and implementation of annual programs of emergency recovery and rehabilitation works on tailings and waste dumps, which are administered by the Ministry of Emergency Situations of the Kyrgyz Republic; - technical supervision of implementation of rehabilitation and

	remediation activities at the tailings and waste dumps, which are administered by the Ministry of Emergency Situations of the Kyrgyz Republic; - development and implementation of state programs for safe maintenance of tailings and waste dumps, which are administered by the Ministry of Emergency Situations of the Kyrgyz Republic; - development of proposals to attract investments for implementation of programs aimed at ensuring safety of tailings and waste dumps, which are administered by the Ministry of Emergency Situations of the Kyrgyz Republic
Main Department for Traffic Safety of MIA KR	- State control over observance of effective traffic rules, laws and regulations of the Kyrgyz Republic that establish the rights and responsibilities of road users; - conduct state technical inspection of motor vehicles and trailers; - to register and keep records of vehicles, regardless of ownership, issue registration papers and number plates on vehicles registered;
Department of Water Resources and Melioration, Ministry of Agriculture	- manage, monitor and control the status and use of water resources, irrigation and drainage infrastructure; - implementation of executive and administrative and coordinating functions for implementation of unified state water management policy; - implementation of unified state policy in the field of rational use and protection of water resources, water resources management and state-owned water infrastructure, meeting water requirements of all water users; - planning, organization and implementation of administrative, economic and legal regulation of water use, operation of water facilities, water fund land protection, and regulation of interstate water relations on the use of water resources formed in the territory of the Kyrgyz Republic;

3.2. Normative and legal framework of disaster risk assessment

The Constitution of the Kyrgyz Republic and the following laws of the Kyrgyz Republic represent legal framework for civil protection system³⁹:

- “On civil protection” as of July 20, 2009 # 239;
- “On emergency rescue services and status of rescuers”, as of January 21, 2000 # 35;
- “On status of servicemen”, as of June 1, 1992 # 930-XII;
- “On fire safety”, as of June 17, 1996 # 22;
- Technical regulation “On fire safety”, as of July 26, 2011 # 142
- “On radiation safety of the population of the Kyrgyz Republic”, as of June 17, 1999 # 58;
- “On tailings and waste dumps”, as of June 26, 2001 # 57;
- “On state of emergency”, as of October 24, 1998 #N 135

The Regulations of the Government of the Kyrgyz Republic:

- “On services of civil protection of the Kyrgyz Republic”, as of December 17, 2010 # 327;
- “On approval of the classification of emergencies and assessment criteria in the Kyrgyz Republic”, as of November 17, 2011 # 733;
- “On creation of permanent headquarters for prevention of avalanches, landslides and other slope processes and liquidation of their consequences on public roads of the Kyrgyz Republic”, as of July 29, 2011 # 435;
- “On approval of the Regulations on the system of civil protection”, August 22, 2011 # 475;

³⁹ Annexes to the report contain expanded list of NLAs governing state policy in the field of civil protection.

- “On Interdepartmental Commission for Civil Protection of the Kyrgyz Republic”, as of December 30, 2010 # 344;
- “On legal status of subordinate units of the ministries, state committees, administrative departments and other executive bodies of the Kyrgyz Republic with the status of legal entity”, as of March 10, 2009 # 15;
- “On approval of the Regulations on single information management system in emergency and crisis situations in the Kyrgyz Republic”, January 3, 2011 # 1;
- “On issues of evacuation commission under the Government of the Kyrgyz Republic”, July 29, 2011 # 435;
- “On approval of the Regulations on permanent “Single hotline” service, the list of emergency services of the Kyrgyz Republic and approval of the Concept of creating a system providing call of operational services by 112 unified state duty and dispatch service on the basis of subdivisions of the Agency on fire safety under the Ministry of Emergency Situations of the Kyrgyz Republic for 2011-2014”, as of October 6, 2011 # 618;
- “On the Center for training and retraining of civil protection specialists of the Ministry of Emergency Situations of the Kyrgyz Republic”, as of February 9, 2011 # 35;
- “On approval of the Regulations on the procedure for issuance of state mortgage certificates for provision of state subsidies for construction and reconstruction of individual houses to persons affected by the disasters occurred on the territory of the Kyrgyz Republic”, as of May 8, 2007 # 155;
- “On approval of rules of human life protection in water bodies of the Kyrgyz Republic”, August 13, 2011 # 466;
- “On the Ministry of Emergency Situations KR” as of February 20, 2012 # 115;
- “On approval of the program for creation and development of the state integrated system of public information and warning for 2011 and 2014” # 516 as of 25.08.2011;
- “On approval of the unified information management system in emergencies in the Kyrgyz Republic” as of January 3, 2011 # 1;
- “On approval of the Regulations on civil protection formations of the Kyrgyz Republic” # 349 as of July 1, 2011;
- “On approval of the Concept and Strategy for integrated safety of the population and territories of the Kyrgyz Republic in emergency and crises situations till 2020”, # 357 as of July 2, 2012.

In these legal acts in a view of introduction of an integrated approach to disaster risk management, more attention to aspects of emergency prevention and prioritization of mitigation, adaptation and preventive measures, risk assessment and information management on disaster risks should be regulated. Currently, however, they lack the regulation of issues related to risk assessment, which is a basic element of the government policy in the field of civil protection.

In the law “On civil protection”, regulatory aspects of risk assessment, management of information on disaster risks and making decisions based on risk analysis and assessment are not sufficiently clear, and in some cases contradictory. In Article 4 “The main tasks of the state civil protection system”, despite of priority, the last task is “implementation of research on risk assessment for the population and territories from potential emergencies of natural and manmade character”. Civil protection commissions that should deal with the issues of prevention and liquidation of consequences of emergencies and thus being the basis of the state civil protection system are not entrusted to carry out risk assessment. Article 14 states: “The structure of the Commission for civil protection, the number of deputy chairmen and members of the commission, their functions shall be established taking into account its tasks, staff schedule of local state administration, and depending on the number of potentially hazardous objects located

at the given territory, risks of emergency occurrence and their possible consequences...”. Objective, tasks, functions, and then the structure, composition of the commissions are determined, first of all, based on the results of disaster risks that are caused by existent hazards of natural and manmade character. Similarly, the tasks, structure and composition and staffing of emergency rescue services should be determined not so much “on a voluntary basis”, but rather on the basis of risk assessment.⁴⁰

Efficiency of functioning of state civil protection system depends largely on disaster risk management in the field - at the level of cities and aiyl aimaks and aiyls. The Law of the Kyrgyz Republic “On Local Self-Government and Local State Administration” among local issues provides for “assistance in prevention and liquidation of consequences of emergency situations”, while in accordance with the Law “On civil protection”, local governments should implement the entire complex of preventive and liquidation activities within their competence on the territory of cities and aiyl aimaks. Local governments to the same extent as the central executive authorities should consider the “risks and challenges in transition to sustainable development”⁴¹. Without introduction of risk assessment in socio-economic planning and in the process of practical measures sustainable development of local communities will be impossible.

In the law “On the hydro-meteorological activities in the Kyrgyz Republic” there is no assessment of climate risks among the tasks of special authorized body. Kyrgyzhydromet, in accordance with the Regulations, has the task to forecast hazardous and extreme weather events, release weather forecasts, water availability and water inflow to the reservoir, forecasts of avalanche danger, agro-meteorological forecasts, predictions of high and extremely high pollution of natural environment.

The Regulations “On state civil protection system”, risk assessment and information exchange on the risks between the structures that represent this system are not provided among regular activities of the state civil protection system. Risk assessment and information exchange is the basis of interaction of entities, without which it is impossible to coordinate, especially at the operational management, ensure integration of capabilities, optimization of management and efficiency at social and economic levels.

In conceptual apparatus of legal acts in the field of civil protection there are no such conceptual notions of disaster risk reduction used to explain the goals and objectives of the Hyogo Framework for Action as “risk”, “risk assessment”, “vulnerability”, “danger”, “disaster”, “safety culture”, “potential” and etc.

Hyogo Framework for Action being one of the components of regulatory legal framework for the operation of the institutions of National disaster risk reduction platform defines “identification, assessment and monitoring of disaster risk factors” as priority and indicates that “the starting point to reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in short and long term, followed by action taken on the basis of this knowledge”⁴².

⁴⁰ The Law KR “On emergency rescue services and status of rescuers” as of January 21, 2000 N 35

⁴¹ The Program for Sustainable Development of the Kyrgyz Republic for 2013-2017. The Regulation of the Government KR as of April 30, 2013 # 218

⁴² Hyogo Framework for Action for 2005–2015: Capacity building on disaster resilience at the state and community levels

Obtaining and use of knowledge on hazards and vulnerabilities is possible only based on disaster risk assessment results.

Due to the fact that this priority is reflected in the Strategy for integrated safety of the population and territory of the Kyrgyz Republic in emergency and crisis situations until 2020, there is a necessity to develop and amend the regulatory framework governing and regulating risk assessment and information management on disaster risks. For this purpose in the near future it is necessary to conduct a detailed inventory of legal framework of the state system of civil protection in the part related to risk assessment and management of risk information.

3.3. Risk assessment methodologies

Because of devastating effects leading to large number of human victims, sudden onset and secondary effects the earthquakes take a special place in the country's disaster risk profile in Kyrgyzstan. The Institute of Seismology of NAS KR Performs the role of national seismological service that has the status of Coordination center to collect and process the information related to earthquakes in Central Asia and develop the maps of seismic danger of Central-Asian region and is a co-founder of the International Centre of Geodynamic - Bishkek prognostic polygon (IRC-GPG). By the decision of the Government of KR the Institute was included in the list of organizations that provide an opinion on the areas and sites intended for construction of various facilities. In this view, one of the main functions of the Institute is related to seismic hazard assessment, which is carried out using mapping method. Currently the Institute of Seismology and Central Asian Institute for Applied Geosciences developed new seismic zoning maps.

Monitoring of seismic regime in Kyrgyzstan is conducted by experimental base of the Institute of Seismology consisting of 15 digital and 5 analog seismic, 5 geomagnetic, 4 hydrogeochemical and 4 hydrodynamic stations. Telemetric network of seismological stations KRNET (Kyrgyz network of digital seismic stations) is created at the Institute of Seismology with the installation of edge-router, which readings enter in the Data Center of the Institute in real time. KRNET is registered (from 2009) with FDSN (International Federation of digital seismographic networks - IRIS, USA). This means that KRNET digital seismic station network is included into the world catalogue of seismic stations of the Earth planet.

Methods of studying and forecasting of landslide processes are developed and implemented by the specialists of the Department for monitoring and prevention of emergencies at MES KR, Institute of Geology of National Academy of Sciences, Research and Engineering Center "Geopribor" of the Institute of Geomechanics and Exploitation of Mineral Resources of the National Academy of Sciences, Open Joint Stock Company "Kyrgyz head engineering survey institute" (KyrgyzHESI). The work of Ibatulin H. V. "Monitoring of landslides in Kyrgyzstan" shows a number of techniques that are widely used by the experts to determine the slope stability of the landslide - method of circular cylindrical surface, Maslov-Bearer method of horizontal forces, Fp method, method of V. V. Sokolovsky, hydrographic method of V. N. Slavyanov, countdown method.

The Institute of Physics and Rock Mechanics of NAS of the Kyrgyz Republic developed methodology for assessing the stressed state of the covering deposits on the mountain slope, determination of the deformation characteristics of the slope at different hypsometric levels, assessment of seismic impact on the change in stress-deformational state of covering deposits on the slope, assessment the impact of changes in soil moisture on stability of loam on the slope,

determination of forecast soil characteristics in the pits, performing measurements of slope surface displacement.

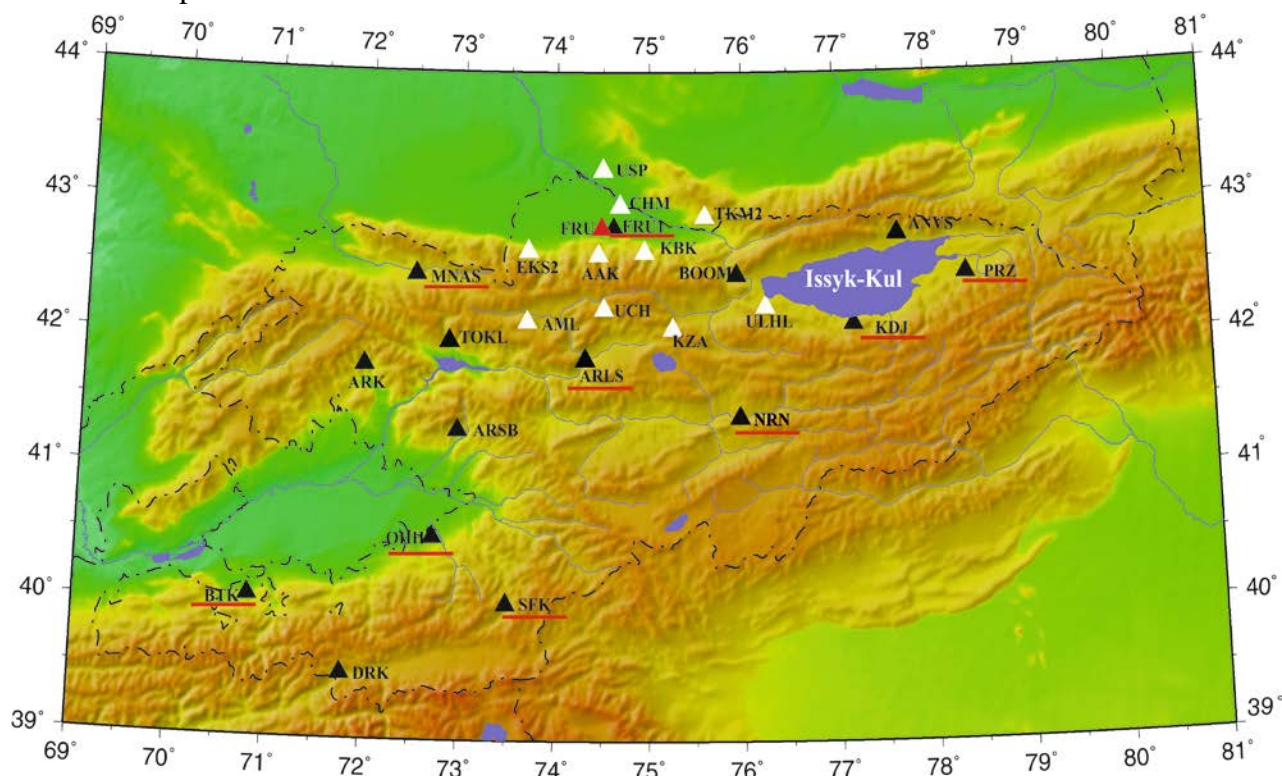


Figure 9. Schematic map of seismic monitoring network of IS of NAS KR: white triangles mark KNET station network, black triangles mark KRN station network. Red triangle marks analog station (CSS “Bishkek”). Station network KRN operating in real time are underlined with a red line.

Scientific Engineering Centre “Geopribor” of the Institute of Geomechanics and Exploitation of Mineral Resources, NAS KR successfully implements automated monitoring of landslides using complex of instruments and equipment – sensors for monitoring landslide displacements and deformations, portable digital geotester for recording data on the size of displacement directly on the site and by radio channel, multichannel system of landslide displacements recording with data transfer on radio channel and device for early warning on threat of landslides. In 1996 - 1998 an automated system of landslide processes monitoring was created in Maili-Suu at the site of uranium tailings and waste dumps. Due to the system of automated monitoring individual phases were recorded and the duration of various stages of landslides development, the relationship was identified between kinematic parameters of landslide displacements and complex of landslide forming natural and anthropogenic factors, evidence found of predictive sudden movements of seismic sensitive landslides directly 20-50 hours before strong earthquakes, correlations identified between displacement velocity of landslides and amount of precipitation and air temperature, changes of groundwater, water flow in the Maili-Suu River and seismic and solar activity.⁴³

It should be noted that national specialists have high capacity in the field of risk assessment methods of geo-physical character and meteorological hazards⁴⁴. Table 3. shows the

⁴³ Torgoev I., Aleshin Yu. G., Ashirov G. E. Regularities and forecast of development

⁴⁴ Guidelines for hydrological forecasts. Issue 1.2. Gidrometeoizdat, 1989; Guidelines on short-term weather forecasts. Part 2 Issue Central Asia. Gidrometeoizdat, 1986; Instruction. The procedure for compiling and transfer of warnings of natural hydrometeorological disasters. Bishkek 2001.

main methodologies used by risk management entities in Kyrgyzstan to assess the risks of geo-physical, climatic, biosocial and technogenic character:

Table 3. Techniques for prediction and monitoring of hazardous processes

Processes and phenomena of natural character		
Types of hazards	Structure	Monitoring and forecasting techniques
Earthquake	Institute of Seismology, National Academy of Sciences KR, Central Asian Institute for Applied Geosciences	examination of statistical data, instrumentation measurement, installation of sensors, satellite radar interferometry (InSAR).
Mudflow and flooding	Department of Monitoring and Forecasting of Emergencies, Kyrgyzhydromet, IWPB NAS KR, OJSC Kyrgyz HIES, Department of Water Resources, SRC “Geopribor” of the Institute of Geomechanics and Exploitation of Mineral Resources, NAS KR	synoptical method, mathematical model of snowmelt runoff of mountain rivers, technique of long-term forecasts of water levels and flow, integral equations of water absorption and runoff, non-filtration capacitive model of water absorption, factors of flood hydrograph, the linear model of the spring flood hydrograph.
Avalanche	Kyrgyzhydromet, State Agency for Geology	Analysis of statistics, precipitation and temperature forecasts, calculation of snow accumulation, assessment of snow accumulation
Rockfall Landfall	DMFES, State Agency for Geology, Ministry of Transport	Surveys, mapping, observations
Landslide	DMFES, CAIAG, State Agency for Geology, OJSC Kyrgyz HIES, SRC “Geopribor”	Surveys, mapping, observations, marking, tacheometrical survey of landslides, special landslide survey, topographic survey, hydrogeological observations
Geocryological processes	OJSC Kyrgyz HIES, Department of Hydrogeology and Engineering Geology KSMI	Surveys, mapping, observations
Waterlogging	DMFES, OJSC Kyrgyz HIES, State Agency for Geology IWPB NAS KR, Department of Water Resources	Analysis of statistics, precipitation forecasts
Meteorological hazards (strong long rains, strong winds, snow, hail)	Kyrgyzhydromet, Department of Meteorology, Ecology and Environmental protection KRSU	Meteorological observations, methodology of detailed climatical description of mountainous areas and assessment of climatic conditions parameters
Forest fire	State Agency for Environmental Protection and Forestry Kyrgyzhydromet	Monitoring

High mountain outburst-prone lakes	State Agency for Geology, DMFES, Kyrgyzhydromet, OJSC Kyrgyz HIES	Surveys, assessment of potential risk
Erosion of river banks	DMFES, IWPB NAS KR, CAIAG	Survey
Ground subsidence	DMFES, OJSC Kyrgyz HIES, Kyrgyz design institute for water management, Department of Hydrogeology and Engineering Geology KSMI	Analysis of statistics, soil study, risk assessment
Degradation of glaciers	Institute of Geology NAS KR, Kyrgyzhydromet, CAIAG, SAEPF	Monitoring
Desertification, salinization, erosion of lands	IWPB NAS KR, SAEPF, State design institute for land management	Monitoring
Technogenic processes		
Tailings and dumps	Agency for Tailings Management under MES KR, SIETS under the Government of KR, Kara-Balta Mining Plant, OJSC Kyrgyz HIES	Measurement of radioactivity level, Periodicity of observations
Bursting of dams, dykes, sluices, and etc.	Ministry of Agriculture	Monitoring
Emergencies on utilities	Kyrgyzzhilcommunsouyz (Kyrgyz housing and utilities design institute)	Control, survey
Emergencies of energy facilities	Ministry of Energy, OJSC “National Electrical Grid”, OJSC “National Electrical Stations”	Monitoring, control
Road accidents	Ministry of Internal Affairs, Ministry of Transport	Analysis of statistics, prevention
Radiocative waste release	MES, State Agency for Environmental Protection and Forestry, Ministry of Health, SIETS under the Government of KR	Monitoring, risk assessment
Emergency related to release, threat of release of hazardous chemical substances (PCS)	MES, State Agency for Environmental Protection and Forestry, Ministry of Health, SIETS under the Government of KR	Monitoring, risk assessment
Emergency related to emission, threat of emission of hazardous biological substances	State Agency for Environmental Protection and Forestry, Ministry of Agriculture, Ministry of Health	Monitoring, risk assessment
Fire, explosion, threat of explosion	SIETS under the Government of KR	Monitoring, risk assessment, prevention
Hazardous processes of biosocial nature		
Epidemic	Ministry of Health SCSES	Monitoring, forecasting based on the fact of infection
Epizootic	Ministry of Agriculture, State Inspectorate for Veterinary and Phytosanitary Safety under the Government of KR	Monitoring, forecasting based on the fact of epizootic

Mass damage of crops by pests, weeds and epiphytotics	State Inspectorate for Veterinary and Phytosanitary Safety under the Government of KR	Monitoring, forecasting based on the fact of epiphytotics
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The main conclusion from analysis of methodological support of risk assessment system is that along with the use of proven best practices for forecasting of geophysical, meteorological and biosocial risks, assessment methodology in the country is poorly developed, and in some areas of risk management there is no assessment methodology for:

- potential economic damage
- physical and social vulnerability;
- environmental consequences.

Methods to assess the economic damage from the disaster that is used by public authorities aimed to assess the direct damage in the response or early recovery phase, that is after the event. Thus, in assessing the damage caused by natural disasters or man-made disaster the main role is performed by the Commission of identification of damage created depending on the types of emergencies, for the most part, at the level of regions, districts with involvement of civil protection specialists representing the territorial structures of executive branch of power. The Commissions:

- conduct a visual inspection of disaster-affected houses and buildings;
- daily, upon receipt of applications and based on the results of visual inspection of affected houses, prepare the lists of affected houses and types of their destruction
- daily provide written operational information on disaster-affected houses and buildings;
- daily submit operational information with the lists of affected homes to the regional emergency departments;
- conduct examination of affected houses and buildings;
- prepare acts based on results of examination of private houses and buildings and their technical characteristics on the form of the State Agency for Construction, Housing and Utilities;
- determine the extent of their destruction, give recommendations for their repair and restoration;
- on the basis of examination acts prepare the lists of affected houses with addresses, names of the victims and severity of damage;
- submit the lists of affected houses to the district Commission on Emergency Situations;
- the lists with destruction of grade 3 and 4 are signed by the members of ESC of the district, are approved by akims - the heads of district state administrations.
- send the lists to the Department of Architecture and Urban Planning of the city and district state administration.

At that, instruction describing the characteristics of 4 degrees of destruction is main tool to assess the damage in the work of the Commissions.

The results of direct damage assessment do not allow to obtain adequate data on the volume of financial costs of site restoration and identify sources to attract the necessary financial resources. The current procedure of damage assessment is left from the old system of civil defense, when the focus was made on liquidation of consequences during an emergency. There are quite different objectives today in disaster risk management, namely prevention of emergencies and implementation of effective preventive measures of mitigation and adaptation characters,

effective implementation of which is possible on the basis of risk analysis and assessment, including assessment of potential damage. It is extremely important to pay more attention to the economic and social aspects of disaster risk assessment as a basic element of human safety along with the safety of socio-economic infrastructure of cities, regions, rural communities vulnerable to disasters. Determination of potential economic consequences of disasters expressed in monetary terms promotes development of effective measures to reduce disaster risks. At the same time, indicators related to reduction of socio-economic damage and effective use of limited financial and logistical resources should be performance indicators of social and economic damage caused by the disaster. In particular, benefit-cost ratio should be the main argument in justification of projects within the frame of special preventive and liquidation activities (SPLA) implemented by MES KR. Estimates of probable damage in developing SPLA will enable to include not only the objects in the residential sector, but also the agricultural land and production plants, preservation and development of which will lay the foundation for construction and reconstruction of social infrastructure within the framework of sustainable development. Consideration of economic and social aspects of risk assessment is the basis for implementation of disaster risk management in planning and implementation of measures to create conditions for sustainable development of the country.

3.4. Programs and projects in the sphere of disaster risk assessment

Due to complexity and diversity of formation and manifestation of natural and manmade disasters, their multisectoral impacts and the need for multidisciplinary scientific approach involving significant financial resources, the majority of risk reduction projects is implemented in Kyrgyzstan with the support of the international organizations. Thus, integration of disaster risk assessment was a prerequisite for implementation of these projects⁴⁵:

- PF “MSDSP KG” – Poverty reduction by high altitude risks reduction “PAMIR” ;
- UN World Food Programme in collaboration with the UNDP - integration of the programs “Food for Work” of WFP and “Disaster Risk Management” of UNDP in support of small scale mitigation projects in rural communities vulnerable to disasters;
- United Nations Children Fund (UNICEF) – “Reducing the vulnerability of children to disasters in Kyrgyzstan”;
- UNDP – “Effective disaster risk management for sustainable development and human safety”;
- World Bank – “Modernization of Hydrometeorological support in Central-Asian countries”;
- World Bank - Disaster risk management;
- IAEA - Condition of uranium tailings in the Tuyuksu tract;
- World Bank - Strengthening the capacity of the Kyrgyz Republic in the field of disaster risk reduction and response;

⁴⁵ Projects implemented since 2012.

- PF “MSDSP KG” The initiative of Aga Khan Foundation - Promoting resilience of communities in mountainous and remote regions of Tajikistan and Kyrgyzstan to disasters;
- IF “Save the Children” - Reducing the vulnerability of communities and strengthening the capacity for disaster risk management in selected areas in Tajikistan, Kyrgyzstan and Uzbekistan through support of education and awareness and protection of children;
- UNICEF – Support of activities of disaster risk reduction institutions and vulnerable communities in Central Asia
- INGO “ACTED” – Natural disaster preparedness and response in Central Asia
- World Bank - Modernization of information management system and early warning system for the Ministry of Emergency Situations;
- World Bank - Capacity building of the Kyrgyz Republic in the field of disaster risk reduction and response;
- UNICEF, the United States Agency for International Development - Evaluation of safety of buildings and areas of schools and pre-school educational institutions of the Kyrgyz Republic

The following projects are at the planning stage:

- Turkish International Cooperation Agency - Technical equipment of fire service;
- Japan International Cooperation Agency - Capacity building on response and risk assessment in Kyrgyzstan and dialogue on regional cooperation;
- EurAsEC - Reclamation of tailings in Min-Kush and Kadji-Sai;
- European Union - Comprehensive environmental impact assessment and feasibility study for the rehabilitation of former uranium production facility in Min-Kush village.

Projects related to GIS – technologies application:

- “Natural disaster risk management in transport infrastructure: shelterbelts”, Partners - Austrian Federal Research and Training Centre of forest, natural hazards and landscape - BFW, Department “Geodesy and Geoinformatics” of KSUCTA;
- “Hydropower potential of small rivers in the Pamir-Alai region (PALM)” (UNU), 2010-2011;
- “Transboundary Disaster Risk Reduction” (InWent) together with the Central Asian Institute for Applied Geosciences;
- “Sustainable development of Issyk-Kul “ (ADB) together with the Central Asian Institute for Applied Geosciences;
- “Approach to implementation of Hyogo Framework for Action in Central Asia with involvement of all stakeholders”, component - Knowledge network in Central Asia (UNISDR) .

3.5. Studies in the field of disaster risk assessment (publications and reports).

The works on prediction of seismic risk are research priorities for the country, and the Institute of Seismology, National Academy of Sciences is the leading research center in this field. In 2011, the Institute of Seismology developed probability maps of seismic hazard in the republic for the period 2011-2020 indicating areas of expected earthquakes, energy class of possible

earthquakes and their intensity. In 2012, under contract with MES KR the Institute of Seismology, National Academy of Sciences, carried out predictive research on the project “Analysis of seismic regime and seismic hazard assessment in southern Kyrgyzstan for the period 2013-2018 to reduce economic losses from expected strong earthquakes”. The analysis of expected changes in seismic regime of South Ferghana fault and a forecast of expected seismic catastrophes until 2030 were carried out. Given the intensification of strong aftershocks within the eastern Tien Shan, additional forecast of seismic hazard assessment for the territory of Talas, Chui and Issyk-Kul region was given⁴⁶.

The Department of monitoring and forecasting of emergencies of MES KR, Institute of Geology of National Academy of Sciences KR, Geotechnical detachment at Kyrgyz Geological Expedition of the State Agency for Geology and Mineral Resources of the Government of the Kyrgyz Republic carry out research on landslide hazard. Noteworthy results of studies of the Scientific and Engineering Center “Geopribor” to be considered for the decision-making to undertake preventive measures. For example, prediction of the landslide near the village of Min-Kush and formation of dammed lake threatening “Tuyuk suu” tailings⁴⁷ or a description of landslides in the area of Kambarata HPP – 2⁴⁸. Since 1998, the SRC “Geopribor” on assignments of MES and with the support of the international organizations - UNDP, World Bank, TACIS - completed complex of research and survey works on assessment of landslide risk and potential environmental impacts of landslide displacements near the tailings of radioactive and toxic waste. Currently SRC “Geopribor” develops “Methods of probabilistic forecasting of periods of mass activation of landslides based on statistical analysis of the variability of meteorological factors of landslides formation” and “Guidelines for geophysical researches on landslide-prone slopes of the South-West Tien Shan”.

Kyrgyzhydromet in turn publishes the following annual bulletins:

- The water balance of reservoirs;
- Yearbook of evaporation from water surface;
- Yearbook of the Issyk Kul Lake water balance;
- Yearbook of Agrometeorology;
- Annual Technical Report on avalanche stations of Chon-Ashu, Theo-Ashu and Itagar;
- Annual data on ambient air quality in cities and towns of the Kyrgyz Republic;
- Annual data on the water quality of surface waters of the KR;
- Annual data on radiation contamination of the territory of the Kyrgyz Republic.

These yearbooks are kept in the State Fund of hydrometeorological data.

Scientific Research and Design Institute of seismic resistant construction of the State Agency for Architecture, Construction and Housing and Communal Services of the Government of the Kyrgyz Republic has implemented the following projects:

- “Assessment of seismic risk in the Chui Valley” (1999). Theme identifier № KR-242 (ISTC – NATO);
 - “Thin rubber-metal bearings for seismic isolation of buildings” (2000). Theme identifier № KR-568 (ISTC – NATO);
 - “Assessment and mitigation of seismic risk in Tashkent (Uzbekistan) and Bishkek (Kyrgyzstan)” (2000-2002). Theme identifier № SFP-97.19.23 (NATO);
 - “Assessment of safety of school and pre-school educational institutions in the Kyrgyz Republic” (2011-2013). UNICEF CAIAG.

⁴⁶ Annex to the report contains the list of research papers of the Institute of Seismology, NAS KR.

⁴⁷ I. Torgoev et al. “Assessment of geo-environmental risks of landslides and tailings in mining region of Min-Kush”

⁴⁸ Torgoev I. A., Aleshin Yu. G. “Landslide threat in the area of basic facilities of Kambarata HPP-2”

In assessment of climate risks the study conducted by the State Agency for Environmental Protection and Forestry under the support of UNDP “National Report on the State of Environment of the Kyrgyz Republic for 2006 -2011” is noteworthy. UNDP also supported the NGO “CAMP - Ala-Too” in conducting country climate risks profile analyzes.⁴⁹

Thus, the national structures and professionals either with assistance of the international organizations in the form of projects, or as part of research work financed from the budget, conduct research on various aspects of risk assessment.

3.6. Disaster risk databases.

The Concept and Strategy of the integrated safety of the population and territory of the Kyrgyz Republic approved by the Regulation of the Government as of June 2, 2012 № 357 provide for the following priorities and measures in the field of information exchange:

- advance risk assessment of emergency and crisis situations;
- creation of geographic information system for monitoring and prediction of emergency and crisis situations, including with the use of remote sensing data of the Earth artificial satellites;
- introduction of a system of dispatching and monitoring of safety of potentially dangerous objects and warning about the threat and appearance of emergency and crisis situations;
- ensuring compatibility of existing and emerging information and technical systems;
- creation and development of a data bank on emergency and crisis situations, geographic information system;
- improvement of single observation network;
- organization of information exchange, coordination of the operation and control of functioning of all institutions;
- creation of “State integrated system of public information and warning”.

Crisis Management Center and the Department for monitoring and forecasting of emergencies are leading subdivisions within the MES KR structure that are engaged in formation of disaster risk information systems and databases. There is regulated procedure for collection of the information about emergencies, according to which all national actors of disaster risk management should submit their operative reports on events occurred.⁵⁰ The procedure of information transfer is shown on “Structural scheme of emergency information provision” (see Annex 3). But the task lies in accumulation and transmission of data for risk assessment, the results of which will serve as the basis for making decisions on development and implementation of preventive measures. In this view, DMFES and CMC MES KR together with the World Bank embarked on the project “Capacity building of the Kyrgyz Republic in the field of disaster risk reduction and response” that should have the following results:

- development and implementation of a unified methodology for assessing the damage, loss and restoration needs;
- creating data platform on disaster risk management.

The products of this project will contribute to improvement of information exchange between risk management actors and creation of public information and warning system.

⁴⁹ Climate Risk Assessment Guide – Central Asia; Kyrgyzstan Climate Risk Profile. <http://cdkn.org/wp-content/uploads/2013/08/Kyrgyzstan-Climate-Risk-Profile-Report.pdf>

⁵⁰ The Regulation of the Government of the Kyrgyz Republic as of December 1, 2010 # 214 “On structural scheme for emergency information provision”. The scheme is presented in the annexes to the report.

The databases are created by the research centers such as the Central Asian Institute for Applied Geosciences, Institute of Seismology, National Academy of Sciences, the Department “Geodesy and Geoinformatics” of KSUCTA, the department of “Meteorology, Ecology and Environmental Protection” of KRSU.

The Department “Geodesy and Geoinformatics” of the Kyrgyz State University of Construction, Transport and Architecture named after N. Isanov is profiling on “Geodesy and Remote Sensing” and “Cartography and Geoinformatics”. This department takes an active part in implementation of the international projects, such as TEMPUS, PALM, InWent, DAAD with the support of ADB, UNISDR and other partner donors. Currently “Austrian-Central Asian Center for GIScience” and “Kyrgyz Center for Geographic Information System” are operating at the Department. Austria-Central Asia Centre of GIScience was created in 2008 to establish and strengthen the links between Austria and the Central Asian countries for joint development of the opportunities, to encourage exchange of information and ensure promotion of education and research and it plays active role in promotion of public awareness and wide application of modern geoinformation technologies in Central Asia. The center is engaged in distance training of Masters in GIS for Central Asia, together with the GIS Center at the University of Salzburg (Austria).

Based on initial analysis of the information management on disaster risks in the country one can conclude about the requirement for priority measures to systematize procedures for information exchange. Existing scheme of information exchange in the State civil protection system regulates exchange of information between government agencies only when there is the threat or occurrence of a disaster. Very often the data do not go beyond monitoring, do not receive further consideration at the stage of analysis and assessment followed by development of practical recommendations. It is necessary to develop and implement a system of information exchange on disaster risks for risk analysis and assessment to ensure implementation of preventive measures. This system should include the following:

- development of state regulation defining the areas and structures that carry out monitoring and forecasting of hazardous natural and manmade processes;
- introduction of standard operational procedures for information exchange;
- identification of structures responsible for risk analysis and assessment with further development of risk reduction policies / programs / projects;
- control and monitoring of implementation of activities.

3.7. Technical capacity of risk assessment actors

Depending on status and specificity of research, disaster risk management actors have the relevant monitoring networks and technical staff, whose main function is to analyze the data and issue forecast materials.

For example, monitoring hydro meteorological network of Kyrgyzhydromet consists of:

- 4 automated meteorological stations;
- 10 agrometeorological posts;
- 3 specialized snow and avalanche stations;
- 6 unified hydro meteorological stations;
- 4 regional hydro meteorological centers;
- lake observatory at the Issyk-Kul Lake;
- 77 river hydro posts;
- 5 lake hydro posts;
- 12 environmental pollution monitoring points.

Functioning of monitoring network is supported by the unit of state observation system at Kyrgyzhydromet of MES KR. All information received from 85 observation points is transferred to Communication and Information Department and to the units dealing with hydro, agro, meteorological forecasting and avalanche service. The specialists of these units prepare synoptic forecasts and communicate this information to the customers.

The experimental base of the Institute of Seismology of the National Academy of Sciences KR that carry out monitoring of seismic regime in Kyrgyzstan consists of 15 digital and 5 analog seismic, 5 geomagnetic, 4 hydrogeochemical and 4 hydrodynamic stations. The readings from the telemetric network of seismological stations KRNET - Kyrgyz network of digital seismic stations - come in real time in the Data Center of the Institute, which conducts a rapid assessment of the level of seismic hazard in the territory of the Kyrgyz Republic.

Due to the efforts of the employees of some departments of the Kyrgyz-Russian Slavic University (KRSU) and the Kyrgyz State University of Construction, Transport and Architecture named after N. Isanov (KSUCTA) technical capacity was created that allows to successfully carry out not only learning process, but also research work in risk assessment in their respective areas. In this view, the capacity of the following departments should be noted:

- the Department “Geodesy and Geoinformatics” of KSUCTA, which has the laboratory of “Engineering Geodesy”, “GIS-laboratory”, the laboratory of “Photogrammetry and Cartography” with modern surveying equipment, such as single-frequency and dual-frequency GPS / GNSS receivers of LEICA TRIMBLE, electronic tacheometers Leica Geosystems TPS 800, electronic roulette Leica DiSTO A5, levels Leica Geosystems NA730, optical theodolites and geodetic levels;

- the Department “Hydraulic engineering construction and water resources” of KRSU with laboratory facilities of hydraulic engineering structures (HES), integrated use and protection of water resources (IUPWR), hydraulics and hydropower (HHP) and the polygon of Hydraulic Engineering and Energy. The laboratories are equipped with operating installations for the study of absolute and relative rest of fluid, Bernoulli equation, hydraulic resistance, water hammer in pipes, models of hydraulic machines, including turbine of power plant, pumping installations, installations for the study of filtering in dams and hydraulic structures under the base, models of modern water intake structures on mountain rivers and canals, measurement devices “dispenser of river sediments” and “capacitive wave- plotting” with electronic control and computer processing of laboratory data, sets of surveying instruments from theodolites, levels, plane-table telescoping alidade and hydrometric instruments. In the laboratory of the integrated use and protection of water resources there are satellite positioning devices GPS, satellite images of river basins of Kyrgyzstan, electronic theodolite, modern personal computers, UPS, GPS receivers and HUB switch. “Statistics” software is used in the laboratories for planning and mathematical processing of experimental results, along with Autocad, ArcView and REVAH for simulation of mountain river runoff formation;

- the Department “Meteorology, Ecology and Protection of Environment” of KRSU has meteorological center (MC), which is equipped with modern processing, graphic plotter and analyzing software GIS – Meteo (Roshydromet) capable to daily develop training weather forecasts for 3 days online, and hydrometeorological observatory equipped with standard meteorological equipment allowing to conduct operational meteorological observations.

In spite of successful results in technical capacity building of the individual risk management actors achieved mainly within the framework of the international projects, in general, technical support and training system of civil protection requires increased attention and implementation of comprehensive measures, especially in the field of risk assessment and management of information on disaster risks.

At the moment the Ministry of Emergency Situations of the Kyrgyz Republic with the support of the World Bank and UNDP conducts program activities to establish unified information management system in emergency and crisis situations, which involves the application of innovative information technology - creation of special telecommunication systems for information processing, communications and data transmission for the purpose of prevention and response measures implementation.

Unified information management system is designed to automate the activities of the Department of state civil protection, increase efficiency, reliability, validity and quality of managerial decision-making on matters of civil protection through the integration of information resources, broad and comprehensive automation of processes of SCPS management and control, bringing management decisions and early warning signals about emergencies and crises to the governments and the public.⁵¹

In conclusion, it should be noted that technical capacity of the State System of Civil Protection in risk assessment and information management on disaster risks just begins to develop – a foundation of telecommunication facilities is being created. However, already at this stage, there are questions of an institutional nature, which should be addressed together with the tasks of technical equipment.

3.8. The practice of risk assessment results application

The results of seismic hazard assessment are of great practical application in decision-making of economic, environmental and socio-political nature. In particular, in order to ensure seismic safety, various scale maps of seismic zoning of the country and the individual areas are used compiled by the Institute of Seismology, which based on the order of the State Agency for Architecture and Construction are regulatory documents to assess seismic hazard during design, construction and rational placement of industrial, social and residential facilities. MES KR uses forecast maps for special preventive measures to reduce the economic and environmental damage from expected earthquakes and to assess the extent of possible damage. At the request of Insurance Company OJSC IC “Kyrgyzstan” the Institute of Seismology issues certificates on occurrence of earthquakes in the country and abroad.

Applied nature of Kyrgyzhydromet performance is caused by the tasks of the agency that are regulated by the Statute of the Agency:

- implementation of monitoring of the environment to protect the public from extreme weather events, prevent or reduce damage;
- forecasting of hazardous and extreme weather events, release of weather forecasts, along with the forecasts of water availability and water inflow into the reservoir, forecasts of avalanche danger, agro-meteorological forecasts, predictions of high and extremely high pollution of natural environment;
- meeting the needs of the population, government and industries in hydrometeorological information and information about pollution of environment, including on dangerous extreme weather events.

Thus, in case of identification based on risk assessment results of natural hydrological events (NHE) and sudden weather changes (SWC) Kyrgyzhydromet, in accordance with the Regulations “The procedure for making and transmitting warnings of natural disaster hydrological phenomena” should announce storm warning . This document indicates the date of sharp weather change or timeframe for mudflows or avalanches occurrence as well as the

⁵¹ The Regulations on unified information management system in emergency and crisis situations in the Kyrgyz Republic. The Regulation of the Government of the Kyrgyz Republic as of January 3, 2011 #1.

characteristics of hazardous natural disaster and potential consequences. The list of recipients includes the President of the Kyrgyz Republic, the Prime Minister of the Kyrgyz Republic, the First Vice Prime Minister, the Parliament, the Minister of Emergency Situations, the Ministry of Energy and Industry, the Ministry of Agriculture and Land Reclamation, JSC “Electrical Stations” and the media. Then the stage of decision making comes, when according to the geographical coverage and the degree of threat MOE management together with other actors identify response activities.

The Regulations on permanent headquarters for prevention of avalanches, landslides and other slope processes and liquidation of their consequences on the public roads of the Kyrgyz Republic approved by the Regulation of the Government of the Kyrgyz Republic as of July 29, 2011 N 435 is another example of domestic practice of decision-making based on the information on disaster risks. This document defines the following:

- the status of the document and authorized body;
- tasks and objectives of authorized body;
- key partners;
- algorithm of actions of involved structures.

From the analysis of decision - making practice based on the information on disasters it can be concluded that the place of risk assessment in the state system of disaster risk management is not explicitly stipulated yet. The same example on the regulation of activities of public institutions on prevention of hazardous slope processes demonstrates that risk assessment is fully absent, since right after “permanent monitoring”, disaster risk management actors start “implementing preventive measures” without analysis and assessment of monitoring data on the threat of hazardous slope processes occurrence. Absence of risk assessment may lead to either false alarms about the threat and ineffectiveness of preventive measures, or in the worst case, to late action, when the event is happening and we had to conduct search-and-rescue operations to save the victims of an avalanche or landslide.

Section 4. Key problems and conclusions

4.1. Problems of risk coordination and assessment.

The Strategy of complex safety of the population and territory of the Kyrgyz Republic in emergency and crisis situations to 2020⁵² (hereinafter the Strategy) identifies the following main problems of SCPS:

- increase of natural emergencies due to global climate change;
- insufficient funding for emergency prevention;
- inadequate funding of local government, local state administrations providing financial resources for prevention of emergency situations;
- failure to perform their responsibilities by local state administrations and local authorities under the Law of the Kyrgyz Republic “On Civil Protection”.

However, along with the lack of financial resources and executive discipline it is necessary to note the problems caused by weak institutionalization of SCPS. The second priority of the Strategy is identified as “**identification, assessment and monitoring of disaster risk** factors and enhancement of early warning”, wherein the objective is defined as “improving disaster **risk assessment**, monitoring and early warning in the Kyrgyz Republic” by implementing the problem formulated as “identification of threats, vulnerabilities and disaster risks for all populated areas of the Kyrgyz Republic”. It should be noted that the Concept and Strategy of integrated safety of the population and territories are radically different from previous regulatory and policy documents in the field of civil protection. This difference is mainly manifested in prioritization of risk assessment as a pivotal element of civil protection, which obliges management systems to move from the policy of maintaining forces and means for liquidation of emergency consequences to integrated disaster prevention by development and implementation of mitigation and adaptation activities based on risk assessment. It is no coincidence that Hyogo Framework for Action was the methodological basis for developing strategies and concepts. In this context, the question is - what structure in civil protection system should deal with analytical work - risk assessment based on database of monitoring network with recommendations for decision-making and follow-up control / monitoring of their implementation?

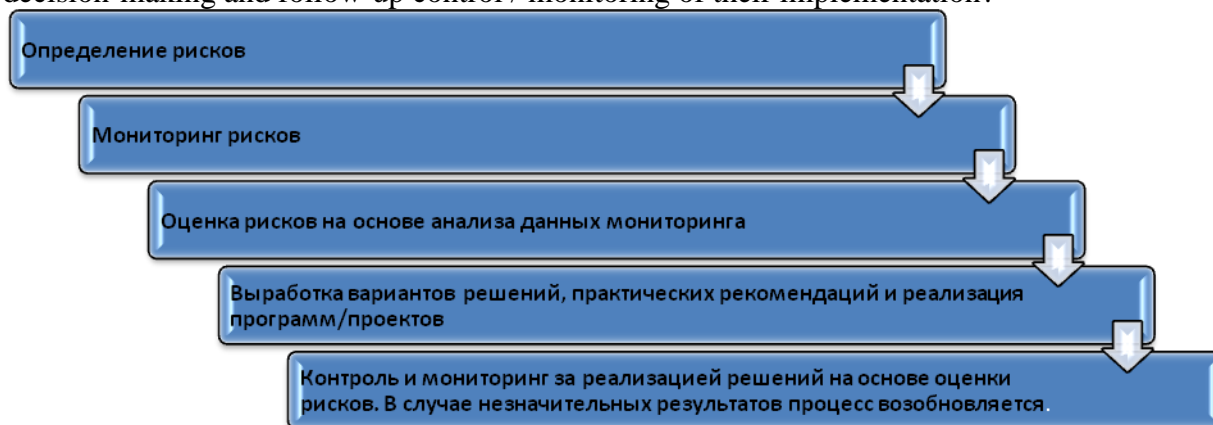


Fig. 10. Process of management based on risk assessment

The point is that in the Regulations of any of the structural units of executive authorities involved in disaster risk management, risk assessment function and subsequent development of practical measures are not provided. This function is not stipulated in the Regulations on state civil protection system, Interdepartmental Commission for civil protection KR, which is “national level coordinating management authority of state civil protection system”, and MES KR being “authorized state body of executive power in the Kyrgyz Republic that implements unified state policy in the sphere of civil protection”.

⁵² The Regulation of the Government of the Kyrgyz Republic as of June 2, 2012 a N 357

Moreover, the Strategy for integrated safety of the population and territory of the Kyrgyz Republic in emergency and crisis situations to 2020 defines creation of comprehensive system of public monitoring and prediction of natural hazards on the basis of GIS technologies and remote sensing in the Kyrgyz Republic as the most important activity in risk assessment. Within the framework of this activity MES KR is currently implementing a program of step by step creation of Unified information management system (UIMS) with daily management bodies being Centers of Emergency Management of the Ministry of Emergency Situations of republican and territorial levels (CMC). However, in the “Program for development of daily operation (crisis management centers) of the Unified information management system (UIMS) in emergency and crisis situation of the state civil protection system of the Kyrgyz Republic”⁵³ and in the “Regulations on the Unified information management system in emergency and crisis situation in the Kyrgyz Republic”⁵⁴ the task of risk assessment is defined neither in the field of emergency prevention, nor in rapid response and liquidation of emergency consequences.

In the Regulations on UIMS a number of tasks is formulated, including “timely analysis, monitoring and modeling of natural and man-made disasters”, including “**short-term forecasting of seismic situation**”, and “creation of joint databases on hazardous natural processes on emergency and crisis situations for further generalization and prediction of events”. From this document that regulates the operation of the main structural subdivision of MES KR that is responsible for management of emergency prevention and response it may be seen that the database will be “**summarized**”, but not analyzed in the framework of disaster risk assessment. There is an obvious discrepancy between the policy documents and regulations that define the functions of executive authorities and their structural units. For example, if the Strategy for integrated safety states that in order to improve risk assessment the following activities will be carried out:

- **development of new methods to assess the probability** of major accidents in complex technical systems, **assessment of the probability** of emergency and crisis situations of natural character in the territory of the Kyrgyz Republic;
- development of **scientific-methodological framework** for assessing the environmental, social and economic consequences of emergencies and crisis situations and their risk for the population;
- development of a system of **integrated indicators of risk** of emergency and crisis situations for comprehensive analysis and summation of risks of different nature and (or) with different consequences, **introduction of methods for integrated risk analysis** of emergency situations,

then in the Regulations of the institutions of the state civil protection system and in the first turn of authorized executive bodies in various sectors of disaster risk management, functions to perform complex tasks in the field of risk assessment referred to in the Strategy should be formulated. There is no answer to the question - who will be engaged in a comprehensive risk assessment?

Thus, in order to introduce risk assessment in state civil protection system, the following institutionalization issues should be addressed:

- identify the institutions involved in risk assessment and their profile in risk assessment;

⁵³ The Regulation of the Government of the Kyrgyz Republic as of April 3, 2012 N 224.

⁵⁴ The Regulation of the Government of the Kyrgyz Republic as of January 3, 2011 N 1

- formulate functions in the sphere of risk assessment;
- distribute functions and functional duties in risk assessment;
- develop and introduce standard operational procedures in risk assessment and interaction between the state civil protection structures;
- to complement institutional scheme of emergency information transfer with exchange of databases for risk assessment;
- provide regulatory framework for risk assessment.

Implementation of these activities will allow creating a subsystem of risk assessment of civil protection that will support subsequent elements of the system.

4.2. Problems of information exchange in risk assessment.

In the state civil protection system there is an institutional structure for exchange of information on emergencies. Thus, the Regulation on the state civil protection system states that “within the frame of functioning of the state civil protection system the following is implemented:

- provision of the information on emergency to government agencies, local state administrations, local authorities and organizations in accordance with the procedure established by the Government of the Kyrgyz Republic;
- receiving information about emergencies, including those caused by fire, from the public free of charge by a single three-digit phone number;
- collection and processing of the information on emergencies, operational management departmental volunteer and other rescue and fire services and units that deal with firefighting, rescue and other emergency operations, using a unified state duty and dispatch service”.

Similarly, the state integrated public information and warning system that is organizational and technical union of forces and means of communication and warning is aimed mainly at bringing information and alerts to the management bodies and the forces of the state system of civil protection and to the public during an emergency.

In accordance with the above regulatory documents for provision of information about the activity of structural subdivisions of MES KR, the Report priority log of structural subdivisions of MES KR is approved, according to which the heads of regional departments, agencies of the state fire service, commanders of MES KR divisions are required to provide timely information about emergencies on prescribed forms. At that, the time for information provision are established by the decision of structural subdivisions.

Report priority log includes the following reporting forms:

- 1/ES “Report on the threat (forecast) of emergency”;
- 2/ES “Report on the fact and the main parameters of emergency”;
- 3/ES “ Report on the fact and the main parameters of emergency”;
- 4/ES “Report on forces and means engaged to liquidate an emergency”;
- 7ES/OTC “Report on the course of construction and allocation of loans to the population”;
- 2ES/OTC “Report on resettlement of people from potentially hazardous areas”;
- 3/PPE CP “Report on the course of construction of protective facilities”.

As can be seen, the formats are also designed to transfer the information in an emergency situation, and basically cover the exchange of information during response and early recovery activities.

The existing practice of information management in the state civil protection system is governed by the Regulation of the Government KR as of December 17, 2010, # 214 “On structural scheme of providing emergency information”, and exchange of information between the ministries and agencies is limited by the information about consequences and actions taken during an emergency. At the same time, informing of the population is implemented not fully, or is absent.

The Department of monitoring and forecasting of emergency situations under MES KR (DMFES) performing the role of unified coordinating center in this area collects the information to predict hazardous natural and manmade processes in two ways:

- based on inquiries of MES KR management to other ministries and departments, research institutes for information;
- within the frame of joint projects or based on the results of planned research and design and survey works when DMFES acts as the customer.

In general, exchange of information on risk assessment is fragmented, without systemic organization that assumes the following:

- identification of sources and building search of the information;
- development and introduction of data collection methods;
- institutionalization of transfer process with installation of hardware;
- introduction of uniform methods of information processing;
- adoption of the regulations on information use;
- installation of database protection.

4.3. Problems of methodology and methods of risk assessment.

At the moment, general methodological approach to understanding disaster risk assessment is not developed and approved in the state civil protection system. This gap does not allow to resolve the issue related to building efficient risk assessment system. Quite often risk assessment is reduced to the notion of risk identification and forecasting excluding the aspects of potential damage assessment, social vulnerability of the population and territories exposed to risk and the capacity of the actors involved in disaster risk management.

Terminological apparatus of disaster risk management is not standardized. From the moment of adoption of Hyogo Framework for Action, in accordance with the international disaster risk reduction strategy, it was required to remove old and introduce new operative notions, and in the first turn such as “hazard”, “disaster”, “risk”, “risk assessment”, “vulnerability” and etc., without which it is impossible to achieve integrated safety of the population and territories. In the Concept of integrated safety of the population and territories of the Kyrgyz Republic, among the main notions there are no definitions of “risk”, “risk assessment”, “integrated indicators of emergency occurrence probability”, “integrated risk analysis” despite of the fact that these terms are widely used in the Strategy. In the Response Plan attached to the Strategy when defining the “risk” it is stated that the risks include “landslides, industrial facilities that use chemicals in their production process, petroleum storage depot ...” and thus there is confusion between the concepts of “risk”, “hazard”, “sources of hazard» or “potentially hazardous objects”.

In the field of development and introduction of risk assessment methodologies there is a task of their standardization, which is substituted by unification of the techniques. It is impossible to bring various techniques into a single unified system, and furthermore, such a proposal is a mistake. Every branch of science that studies the risks of disasters differs in subject of their research, and therefore should differ not only in their terminology, but also in study methods. The question is in standardization, giving legitimacy and mutual recognition of effectiveness of scientific and practical use of specific techniques.

Creation and introduction of the state standard of disaster risk assessment methodologies will systematize scientific support of disaster risk management and strengthen the application of the results of scientific research in the field of risk assessment for practical decision-making.

Methodological basis of risk assessment is formed of two main sources. The first is our science and practice, whereas the second is the world practice of disaster risk reduction, the best examples of risk assessments of which can be successfully adapted and used in Kyrgyzstan. In this context it is required to consider that constant search and examination of the techniques of

leading international centers of risk reduction should be among daily tasks of analytical structures of disaster risk management⁵⁵.

4.4. Problems of SCPS capacity building in risk assessment.

There are the following problems in the sphere of risk assessment capacity building in the Kyrgyz Republic:

- inadequate existing monitoring networks to meet the requirements of increased number and scale of emergency and crisis situations of natural and manmade character;
- lack of risk assessment system with clear roles and responsibilities of the institutions;
- poorly developed practice of decision-making based on risk analysis;
- disaster risk assessment is not taken into account in planning of socio-economic development;
- low level of information exchange between the actors of risk management and public awareness about disasters;
- lack of regulations and standard operational procedures for public administration bodies and local authorities in risk assessment;
- poorly trained young specialists in risk assessment, particularly in the application of geo-information technologies, and the lack of continuity in personnel policy.

These problems require solutions based on multilateral partnerships and integration of the capacity of all actors of disaster risk management. For example, expansion and modernization of the monitoring network for seismic hazard should be based on the interaction of the Institute of Seismology and CAIAG, monitoring of landslides requires integration of the capacity of the Institute of Geology, Institute of Rock Mechanics and Development of Mineral Resources, the Kyrgyz complex hydro-geological expedition of the State Agency for Geology and Mineral Resources, DMFES ME KR, CAIAG and etc. At the initial stage, the expert groups under the Secretariat of the National Platform for DRR can become the basis of integration of national management institutions formed based on multi-stakeholders approach of the leading experts of academic and research institutions, ministries and departments, followed by involvement of the representatives of business community, the media and the NGOs. The second way consists in development of joint projects involving integration of resources and achievement of common outcomes, such as “Single integrated monitoring network of the Kyrgyz Republic”. Integration projects will eliminate difficulties of subjective nature - a conflict of interest of institutions or lack of political will of the leadership.

Integration of national partners should cause the adequate, appropriate action of the international organizations, because to date more than 30 international organizations provide technical assistance to Kyrgyzstan in the field of risk management. In this regard, there is the problem of duplication and lack of coordination among the international partners. The first step in this direction has already been made - a group for coordination of emergency response (CG ER) to enhance cooperation and coordination between the Government of the Kyrgyz Republic and the UN agencies, IFRC, German Society for International Cooperation and other international organizations for effective humanitarian response in emergencies has been

⁵⁵ АИГКСБ (2010), Urban management and community resilience. Guidelines for risk assessment in the cities. <http://tinyurl.com/cxbgquh>;

UNEP (2008). Assessment of vulnerability of local communities to disasters. <http://tinyurl.com/d4re8ew>;

IDRS. The methods used in assessing the risk of disasters - United Nations Human Settlements Programme <http://www.disasterassessment.org>;

World Bank (2011) Risk assessment in the cities. Search of common approach. <http://go.worldbank.org/VW5ZBJBHA0>

established. However, coordination of activities of the international organizations with national partners is required in all areas of disaster risk management, and primarily in risk assessment. The initiative for development of procedures for interaction, coordination and information exchange should belong to the Department of International Cooperation of the Ministry of Emergency Situations of the Kyrgyz Republic - the authorized state body of executive power in the Kyrgyz Republic implementing unified state policy in the field of civil protection.

In capacity building it is required to take into account an integrated approach that provides the relationship between the institutional aspects and technical upgrade, at that, the institutionalization is a priority measure. Technical efficacy can be achieved only on the basis of complex interrelation of basic capacity elements.



Fig. The main elements of disaster risk assessment notion.

Section 5. Recommendations

Disaster risk management in general and disaster risk assessment in particular are implemented based on interdisciplinary and multilateral basis with involvement of many stakeholders. In this context, development and adoption of common methodological approach to understanding of risk assessment is required.

In the first place, risk assessment system in the system of disaster risk management is closely linked with monitoring of hazardous natural and man-made processes, and is designed to develop and adopt practical decisions to reduce the risks that in the process of implementation are monitored and controlled:



Fig.11 Interrelation between assessment and monitoring and decision-making

Taking this into account, it is proposed to consider the following structure of risk assessment as an integrated system consisting of the following elements:

- forecasting of natural and man-made disasters, which are the subject of special branches of science and technology;
- assessment of potential damage within the competence of economists and technologists;
- assessment of vulnerability of the population or infrastructure facilities to the impacts of disasters;
- assessment of the capacity of disaster risk management structures. Vulnerability and capacity assessment is carried out largely by the sociologists and management specialists.



Fig.12 Risk assessment structure

The indicators of disaster risk forecast are as follows:

- natural or technological conditions causing formation of hazards;
- external factors that enhance formation of hazards;
- frequency or cyclicity of disasters;
- probability of occurrence;
- impact factors;
- potential consequences;
- range zone/area of exposure.

The main indicators of direct economic damage may be as follows:

- loss of the main production and non-productive assets (buildings, utility systems, structures, crops, livestock);
- loss of working capital (raw materials, fuel, semi-finished goods, seed fund);
- loss of finished goods;
- loss from reduction in output;
- costs of rescue and other urgent operations including evacuation of the population and provision of necessary facilities in a safe place;
- lump sum payments to the families of those killed and affected;
- cost of restoration of the state enterprises and facilities of social and economic infrastructure;
- subsidies to affected private sector;
- loss of personal property of citizens;
- disablement and temporary disablement of citizens.

The indicators of indirect economic damage include:

- loss of profit;
- expenses on social support for persons affected by an emergency;

- loss in related industries;
- payment for the period of production downtime;
- reduction of financial income in the revenues of the budgets of all levels by reducing the tax base of businesses affected by an emergency or indirect effects of emergency.

The indicators of capacity and vulnerability can be the same as the difference between them lies only in the fact that, in assessing the capacity, the ability is evaluated of authorized risk management government agencies and local governments to implement the measures of prevention and response. In vulnerability assessment, the economic, social, physical conditions causing inability of communities exposed to disasters to protect the population, infrastructure, environment from disasters on their own are identified.

The next recommendation on risk assessment methodology is to develop a common conceptual apparatus. Again, given participation of specialists from different disciplines and sectors of the economy in disaster risk management, it is necessary to adopt and approve the state level standard terms and definitions of basic concepts. At the same time, conceptual apparatus is viewed not as a set of mechanical concepts, but rather as structurally ordered unity. Combining the categories and terminology should be based on their interdependence and interconnectedness, which is caused by the system approach to disaster management and disaster risk assessment. As a result of logical coherence of the concepts, none of them is independent, they mutually determine each other and impose restrictions on possible interpretations of each concept separately⁵⁶. Dependence of concepts is manifested in the fact that their value is revealed through each other: the subsequent concept includes characterization of the previous one. If one term determines the content of another, the latter is derived.

It is proposed to use the principles and methods of the International Organization for Standardization as a methodology for conceptual apparatus development⁵⁷.

Procedurally - cyclical approach is another important methodological basis that requires standardization when the process of emergency management is divided into a sequence of standard stages and phases. This approach makes it necessary to develop a strategy and tactics of behavior of disaster management actors based on analysis of factors that affect the actions of decision makers. Stadial approach makes answer the question about the role and functions of decision-makers at each stage of disaster management cycle. Cyclical approach being flexible and universal conceptual design allows to see, first, the process of disaster management in terms of its complex dynamics and development demonstrating interlacing and intersection among various actors of the process and, secondly, opens wide possibilities of differentiation of management activity between them on functional tasks at each stage.⁵⁸

The recommendations of the study are presented in the table:

Table 4. The recommendations regarding the methodology and techniques of risk assessment:

problem	recommendation	outcome	implementers
“methodological approaches of the concept of disaster risk reduction are not developed fully and not stipulated in the State civil protection system, which does not allow to	Develop and approve methodological framework for disaster risk management	The state standard “Methodological framework for disaster risk management in the Kyrgyz Republic” developed and approved. Risk assessment is	MES KR, Expert groups of SNP DRR

⁵⁶ Kozlov V. A. Conceptual apparatus.

⁵⁷ ISO 704: 1987 Principles and Methods of Terminology.

⁵⁸ W. N. Carter. A Disaster Manager’s Handbook.

efficiently use risk assessment as basic element of national disaster risk management system in the context of sustainable development of the country” ⁵⁹ .		defined as basic element of disaster risk management for sustainable development of the country. Additions are introduced to the Concept and Strategy of the integrated safety of the population and territories of KR in emergency and crisis situations to 2020 in terms of risk assessment.	
“absence of an approved conceptual apparatus complicates implementation of an effective system of interaction and coordination between the actors of disaster risk management”	Develop and approve the conceptual apparatus of disaster risk management at the level of state standard.	The state standard “Disaster risk management in the Kyrgyz Republic. Terms and definitions of basic concepts” is approved .	MES KR, Expert groups of SNP DRR
“lack of knowledge and failure to use the methods of risk assessment does not allow state agencies and local governments to implement risk assessment in planning and implementation of measures for sustainable development”	Develop the guidelines on procedure of disaster risk assessment for executive authorities and local self-government and introduce the procedure for taking into account disaster risks in sectoral programs and policies development.	Sectoral programs and plans for development of urban and rural communities are approved with mandatory consideration of disaster risks. Approved by the regulation for development of plans for sustainable socio-economic development of cities and ayil aimaks.	IC KR on CP, Expert groups of SNP DRR,
“because of the lack of common methodology for assessing damage, public administrations constituting civil protection system can not determine actual direct and indirect damage caused by disasters, and to streamline the procedure for payment of compensation to the families affected by the disaster”	Develop and approve unified methodology for assessing damage.	The state standard “Unified methodology of estimating losses from disasters in the KR” is considered at the IC KR on CP and approved by the Regulation of the Government KR.	IC KR on CP
“lack of practices of	Introduce the system	The system of integrated	MES KR

⁵⁹ ISDR. Guidelines on establishment of National Platforms for Disaster Risk Reduction.

financial and economic justification of preventive measures of structural nature based on comparison of potential and prevented damage with integrated indicators of economic, technical and social efficiency. This would allow rational use and budget savings, and would contribute to transparency of the use of funds for implementation of structural work on disaster prevention and liquidation of consequences of emergencies”.	of performance indicators of preventive measures	performance indicators is introduced to the procedure of justification, monitoring, control and reporting on implementation of special preventive and liquidation measures	
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Table.5. Recommendations regarding improvement of regulatory and legal framework for risk assessment:

problem	recommendation	outcome	implementers
“ adoption of the concept of disaster risk reduction as a basis of civil protection system is not stipulated by the legislation of the Kyrgyz Republic”	Based on review of regulatory and legal framework on civil protection to develop amendments and addenda to ensure provision on disaster risk reduction concept as the basis of civil protection system	Risk assessment is recognized as basic element of disaster risk management in the country at all levels.	MES KR
“inconsistency between the Strategy and Concept of the integrated safety of the population and territories of KR in emergency and crisis situations to 2020 and the Law “On civil protection”, the Regulations on the state civil protection system, IC KR on CP, MES KR, the Regulations on structural subdivisions of MES KR in terms of definition of risk assessment as the main task	Develop and introduce changes to bring normative and legal acts and regulations of structural subdivisions in line with program documents of the state civil protection system (Strategy and Concept of integrated safety) in terms of risk assessment.	Risk assessment received regulatory support at all levels of the vertical of disaster risk management and economic sectors.	MES KR

of disaster risk management and implementation of civil protection activities based on risk assessment. The legislation does not define structures responsible for risk assessment. Risk assessment actually is just a declaration”.			
“there is no risk assessment task among that of local state administrations and local self-governance bodies. In the Regulations on oblast and rayon Commissions of civil protection the responsibility is not provided for the decision-making based on risk assessment and the interaction between civil protection services is not defined regarding integrated and intersectoral risk assessment”	Develop and introduce changes in terms of risk assessment to the Regulations “On oblast and rayon administrations”, “On civil protection services” and “On Commissions for civil protection”.	Functional responsibilities of disaster risk management structures in the field of risk assessment and their interactions are stipulated in the legislation.	MES KR, the State Agency for local self-governance affairs and interethnic relations under the Government KR
“introduction of disaster risk reduction concept into the management of sustainable development of the areas, cities and aiyl aimaks is impossible without its stipulation in regulatory acts that regulate the operation of local state administrations and local governments among the tasks of risk assessment in civil protection sphere”	Introduce the relevant changes to the Laws “On civil protection” and “On local self-governance and local state administration” in terms of expansion of local issues and powers of LSA in local governance.	Disaster risk management at the local level is stipulated by the legislation.	MES KR, the State Agency for local self-governance affairs and interethnic relations under the Government KR

Table 6. Recommendations on institutionalization of disaster risk assessment:

problems	recommendation	outcome	implementers
“in the state civil protection system there is no clear distribution of functions of public administration bodies regarding disaster risk assessment. Structural subdivisions, which are responsible for analytical work on risk assessment and decision-	Carry out functional analysis to enhance efficiency of public authorities operation on disaster risk assessment and introduce the recommendations on specifying the objective,	Based on the recommendation s of functional analysis the institutional structure for risk assessment is introduced in	MES KR

making based on risk assessment are not defined”	tasks and functions of the agencies, optimize their structure and redistribute the capacity in risk assessment.	civil protection system.	
“There is no mechanism of interaction and information exchange on risk assessment between the structures of civil protection system. Existing system of information exchange is limited to exchange of information during an emergency, while risk assessment is primarily aimed at disaster prevention by means of development of mitigation and adaptation measures. In this view, the system of information management on disaster risks is required before emergency occurrence”.	Develop proposals to form the system of information exchange on disaster risks.	The Regulation of the Government KR developed and approved the rules for information exchange between the institutions of SCPS on disaster risks in order to conduct a comprehensive assessment of disaster risks and develop practical recommendations”.	MES KR
“In the Regulations on unified information management system the tasks of risk assessment and development of managerial decisions is not provided; structural subdivision of UIMS that should carry our risk assessment is not defined”.	Introduce changes to the regulations on UIMS in terms of definition of tasks on risk assessment and information exchange on disaster risks.	Among the tasks of UIMS in the sphere of disaster prevention the task of risk assessment is defined, which provides for the status of UIMS as the institution that covers the whole cycle of disaster risk management.	MES KR
“In the strategy for the integrated safety of the population and territories of KR, monitoring and analysis of disaster risks are defined as a priority. However, in the annex to the strategy in the Emergency Response Plan, measures for establishment of unified monitoring network and institutional framework for risk assessment are not defined”	Develop annex to the Strategy “Action Plan on establishment of unified monitoring network and arrangement of integrated risk assessment”	Specific measures are defined and gradually implemented on establishment of National Disaster Observatory – NDO that includes the	

		main components, such as integrated disaster risk database, standardized methodologies and tools for data collection and analysis, network for disaster recording	
<p>“The Plan of emergency response of the Kyrgyz Republic” and “Action Plan for creation of the framework for involvement of local authorities in the process of emergency management in the Kyrgyz Republic for 2012-2016” are general in nature, specific actions are not identified with a particular goal, objectives, interrelation to sustainable development, sources of funding, performers and deadlines. Plans are developed without taking into account cross-sectoral risk assessment and therefore are not comprehensive”.</p>	<p>Strengthen the strategy based on development of sectoral preparedness and response plans of the ministries, mayors offices of the cities based on joint analysis of disaster risks in areas and sectors of the economy.</p>	<p>Preparedness and response plans of the ministries, agencies and mayors offices of the cities are discussed at the meetings of IC CP KR and “Comprehensive plan to ensure disaster safety of the country till 2020” is approved.</p>	<p>IC KR on CP, MES KR.</p>
<p>“From analysis of country situation in risk assessment follows the need for urgent risk assessment in cities across the country followed by development of measures to ensure resilience of the cities. Country situation analysis showed high degree of vulnerability of cities not only regarding seismic hazard, but also to hazards of man-made, biosocial, climatic, ecological nature, which have enhanced synergies in urban environments. Mayor’s offices of the cities along with other actors of risk management in the cities are not informed and do not use best practices in planning preparedness and prevention activities, for example the</p>	<p>City Mayor’s offices together with territorial structures of MES KR to carry out disaster risk assessment in the cities and based on assessment results to develop “Preparedness and response plans” with the annex “Action Plan” developed based on integrated risk assessment and having systemic character. For example, measures on deratization and fire safety should be considered as well as prevention of secondary risks after earthquake.</p>	<p>Activities on emergency prevention and emergency preparedness in the cities of the country are approved and are being implemented.</p>	<p>City Mayor’s offices, MES KR, IC KR on CP</p>

experience of San Francisco related to control over compliance with the rules of construction, the experience of the City Hall of Sendai (Japan) to ensure resilience to disasters”			
“Technical assistance to SCPS structures in terms of risk assessment system establishment is provided by various international organizations. In order to ensure integration of efforts and capacities of the partners, coordination of cooperation with the international organizations is required. The results are not followed-up upon completion of the projects. National actors do not carry out analysis of project efficiency”.	Develop annotated index (register) of the international programs and projects in the field of disaster risk assessment describing the goals, objectives and outcomes. Hold donor coordination meetings with national partners for cooperation in risk assessment.	Programs and projects of the international organizations on risk assessment are coordinated and do not duplicate each other. Authorized body maintains the register of the international projects with description of sustainability of their results.	MES KR, SNP DRR.
“In disaster risk assessment, poor interaction between state agencies and private insurance companies is observed. Joint assessment and promotion of the system of disaster insurance pools would allow attracting investments and technical capacity of business community, which would release pressure on the state budget from the problem of compensation of damage to the citizens of the country in emergencies”.	MES KR together with insurance companies to develop recommendations on implementation of state program of disaster insurance.	The state program of disaster insurance is adopted by the Regulation of the Government KR	MES KR, insurance companies
“Low level of training modules development for risk assessment does not allow to implement high-quality training on disaster risk management of the staff of the ministries, LSA and LSG bodies”	Develop training modules on risk assessment with involvement of experts from higher education institutions.	Training modules on risk assessment are developed and approved by the order of the minister of emergency situations	MES KR, KRSU, KSTU, KSUCTA
“SCPS has poor interaction with the public and the NGOs engaged in environmental protection and risk management. UNDP provides assistance in establishing alliances of NGOs	Develop mechanisms and instruments of efficient PR system within the frame of state integrated system of public information and	MES KR policy on public relations is developed and is being introduced within the frame	MES KR

and this initiative should be supported by MES KR. It is required to determine who in the MES KR will continue this work “	warning	of state integrated system of public information and warning	
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Section 6. Introduction of the plan on strengthening National risk assessment system

Upon completion national risk assessment situation analysis the following task appears – development and introduction of action plan for its strengthening, which should cover both the aspects of institutional nature, and expansion and technical equipment of the monitoring network. At that, institutionalization is a priority.

Identification of the institution that should control the activity related to risk assessment of all national partners involved is the first step in this direction. Structural subdivision of MES KR – the Department of monitoring and forecasting of emergency situation is proposed as such an institution that in cooperation with newly formed analytical unit of CMC MES KR could systematize the process of risk assessment and information exchange on the risks. This choice is conditioned by 4 factors – 1) leading experts in the field of monitoring and forecasting of hazardous natural processes and phenomena are working in DMFES; 2) mechanism of interaction between DMFES and all national and international partners in the sphere of risk assessment is in place; 3) DMFES in accordance with National program for sustainable development should develop the state program of monitoring and forecasting hazardous natural processes and phenomena; 4) DMFES is responsible for the support of national information platform on disaster risks.



Fig. 11. Proposal for profiling disaster risk assessment

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