ENVIRONMENTAL RISK FACTORS

• PHYSICAL RISK FACTORS

Key questions and key findings

How significant is the load effecting the population due to the contents of artificial radionuclide agents in the food chain components?

- **Contents of artificial radionuclide agents in the basic food groups and forage types was at the detection limit and their contribution to radiation load on the public resulting from their potential ingestion is insignificant.**

Is the operation of nuclear power plants in Slovakia safe?

- **Similarly, even the special tests of nuclear facilities following the Japan accident of 2011 confirmed that nuclear power plants in Slovakia represent a safe option and are able to handle even exceptionally extreme events.**

Radiation protection

Environmental radioactivity monitoring was carried out in compliance with the MoE SR Act 355/2007 Coll. on protection, promotion and development of public health, and pursuant to the MoE SR Resolution 524/2007 Coll. which sets forth details regarding the radiation monitoring network.

Public Health Authority of the Slovak Republic carries out radiation situation monitoring and collection of data in Slovakia for the purposes of irradiation assessment and assessment of the effects of radiation on the health of the population.

In 2012, total number of 766 samples from the environment was extracted and 1 036 radiochemical analyses were conducted, along with 6 550 radiometric measurements.

Basic radiology indicators found in the samples of drinking water abstracted within the environmental monitoring did not exceed the reference values for implementation of measures under Annex 4 to Decree 528/2007 Coll. ^{90}Sr volume activities were at 0.005 Bq/l and less than 0.015 Bq/l for ^{137}Cs.

Surface and wastewater showed the maximum activity of 0.020 Bq/l for ^{90}Sr, and 0.066 Bq/l for ^{137}Cs.

Volume activities of tritium within drinking water samples and atmospheric precipitations stayed at the MDA level (1.9 Bq/l), and in the interval of up to MDA – 126,0 Bq/l for surface water. Highest tritium activities were recorded in the wastewater from NPP Mochovce (maximum value of 4 200.0 Bq/l). No exceeded values for the concentration limit $1.95.10^5$ Bq/l were detected in tritium discharged into the environment.

The highest ^{90}Sr activity in atmospheric fallout was 1.11 Bq/m^2 (quarterly) and 5.56 Bq/m^2 for ^{137}Cs.

Activity of nuclear installation

Nuclear facilities in Slovakia are operated under strict safety regulations, technical and environmental norms, public health and environmental protection standards.

List of nuclear installation in the SR and their operators

Location	Nuclear installations	Operator
Mochovce	NPP Mochovce, 1st and 2nd. block NPP Mochovce 3rd and 4th block under construction	**SE, Inc.**
Bohunice	NPP V-2 , 3rd and 4th block	
Bohunice	NPP Bohunice V-1 NPP Bohunice A-1 Interim Spent Nuclear Fuel Storage The Bohunice RAW Treatment Centre	**JAVYS, Inc.**
Mochovce	Liquid RAW Final Treatment Facility National Radioactive Waste Repository	

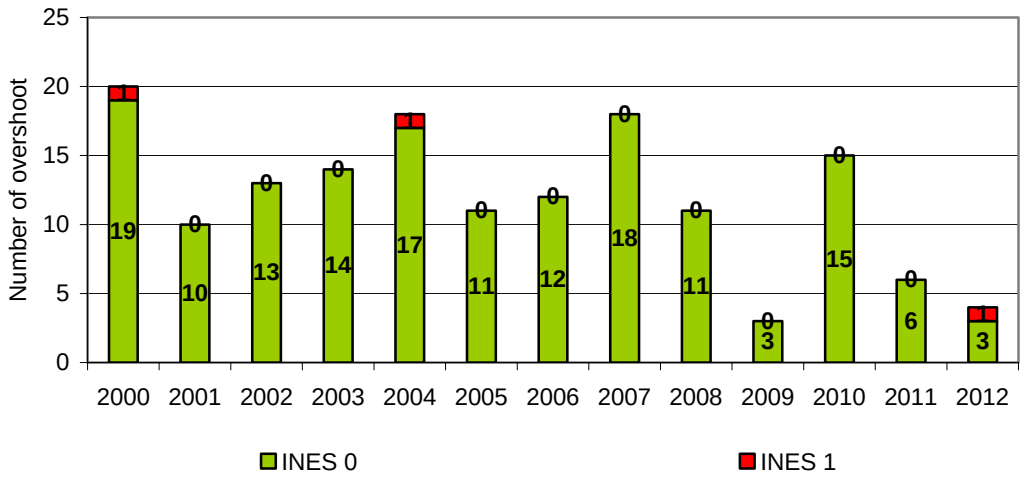
Source: NRA SR

Nuclear power plant of Bohunice V-2

The Bohunice V-2 nuclear power plant (NPP) comprises 2 nuclear blocks of the VVER 440/213 type. Since 2012, both blocks have been operated at increased thermal (1 471 MWt) and electric (505 MWe) reactor outputs. Besides, they are located at the site of NPP Bohunice V-1 and NPP Bohunice A-1 that are phased-out. In 2012, besides standard control and assessment activities related to everyday operations of power plants, the most significant activity in terms of nuclear safety was the ongoing project of implementing measures to mitigate the aftermath of so-called grave accidents.

The number and character of events under the International Nuclear Events Scale (INES) in 2012 was within the range of common technical malfunctions, without any major safety issues. Events that occurred at the power plant did not have a major impact on nuclear safety. Nuclear Regulatory Authority of the SR (NRA SR) assessed the operation of both NPP V-2 blocks in 2012 as reliable, with no major failures in the area of nuclear safety.

Number of occurances of block NPP Bohunice V-2



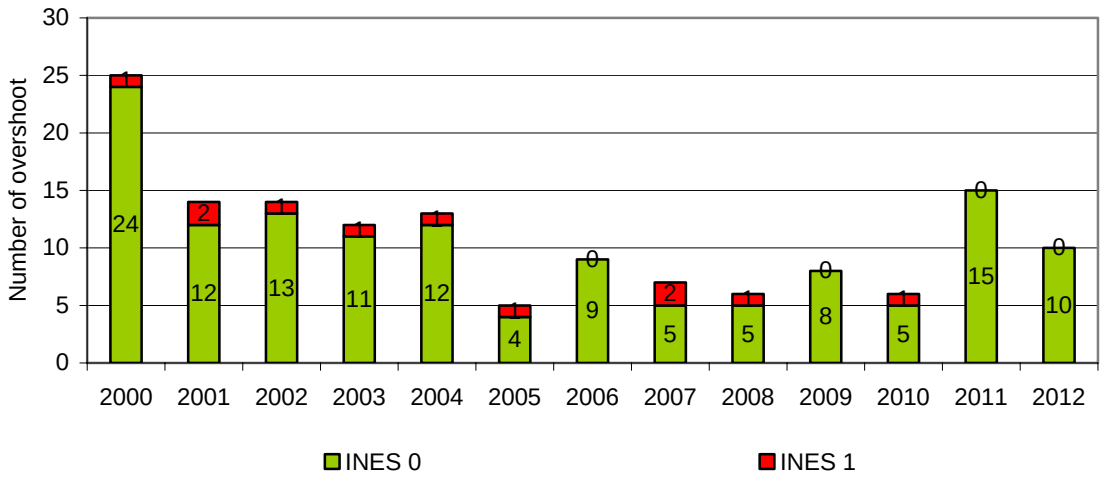
Source: NRA SR

Nuclear power plant of Mochovce 1, 2

The NPP Mochovce comprises two blocks with the VVER 440-type reactors of the nominal output of 470 MWe. Other two blocks, VVER 440/213, of this substantially improved project are under construction (3rd and 4th block of the NPP Mochovce). In 2012, both blocks of 1 and 2 NPP Mochovce met the demands of the Slovak energy control centre.

The number and character of events and occurrences in 2012 was within the realm of common technological malfunctions and did not require special attention in terms of unique safety issues.

Number of occurances of block NPP Mochovce 1, 2



Source: NRA SR

Interim Spent Nuclear Fuel Storage (ISFS) of Jaslovské Bohunice

MSVP found at the Bohunice site serves for temporary storage of spent fuel from the Bohunice V-2, Mochovce 1 and 2, and Bohunice V-1 nuclear power plants.

The facility comprises two bitumenization lines, cement line of the Bohunice RAW processing centre, fragmentation line, large-capacity decontamination line, site for the treatment of used air-conditioning filters, and RAW storage capacities.

Technology of processing and treatment of radioactive atomic waste (RAW)

It is operated by the JAVYS, Inc. This installation includes two bitumen lines, cement line, and the Bohunice RAW Treatment Centre. Outcomes of the control activities suggest that the operation of NI Technologies for radioactive waste processing and treatment may be assessed as safe.

National Radioactive Waste Repository in Mochovce (NRWR)

Designated for the final storage of solid and reinforced low and medium active RAW. In 2011, the ÚJD SR issued a decision permitting the operation of RÚ RAO for the next 10 years.

Liquid RAW Final Treatment Facility in Mochovce (LRW FTF)

This facility treats liquid RAW from the operation of the nuclear power plant of Mochovce and processes it into a form suitable to be stored at RÚ RAO. Technology consists of two individual processes involving bituminization and cementation.

Inspection activity focused on controlling the compliance with the nuclear safety criteria, as well as the criteria for supervising the RAW handling and RAW minimisation, with no major faults detected.

In response to the accident at NPP Fukushima (March 2011) in Japan, top representatives of the EC and the member states agreed to perform on-target assessment of the security risks (so-called stress testing) at NPP in the EU member states. Thorough inspections of nuclear facility safety were implemented in also in Slovakia. A number of non-standard tests and in-depth inspections to identify the areas for possible increase of nuclear power plants' resistance were carried out under the stress testing implemented at nuclear power plants.

• CHEMICAL RISK FACTORS

Key questions and key findings

What is the trend in the contents of xenobiotics within the food chain?

- **Comparison of the outcomes from the long-term monitoring suggests, especially in the case of heavy metals, a considerable improvement in the situation with the agricultural production in Slovakia. The most significant reduction is shown for cadmium. At present, most non-compliant samples result from the assessment of the mercury content.**
- **There is a gradual decrease in the contamination of game and fish; however, contamination still persists in industrial areas such as the region of Spiš and Gemer, Michalovce, and the area of Žiar nad Hronom. High average findings have been recorded for copper, lead, and mercury.**
- **In terms of the maximum permissible intakes by the human organism, none of the contaminants reached even half of the permissible limit.**

Monitoring of xenobiotics in the food chain

Volumes of xenobiotic substances in foods are regulated by limits published in the Slovak Food Code and compatible with the EU limits.

Monitoring for xenobiotic substances within the food chain focuses on the food chain components such as soil and inputs into soil, drinking water, feeding and irrigation water, forage, feedstock and food of the plant and animal origin from domestic production as well as from import. It has been implemented through the Partial Monitoring System (PMS). Partial monitoring system called: **Xenobiotic in foods and forage** is composed **of three subsystems**:

- Coordinated focus-specific monitoring (CFM) has been used since 1991
- Consumption pool monitoring (CPM) has been used since 1993
- Monitoring of game, wildlife, and fishes (MGF) has been implemented since 1995

Partial monitoring system has been connected to the GEMS/FOOD EURO international monitoring system since 1994.

♦ Coordinated focus-specific monitoring (CFM)

Coordinated focus-specific monitoring (CFM) has the objective to determine actual mutual relationship between the degree of contamination of agricultural land, irrigation water, feeding water, crop and animal production, within the primary agricultural production, and obtain information on the contamination of individual food chain components.

53 081 samples were extracted over the entire monitored period (22 years), containing **3 042** limit-exceeding samples, which represents **5.7%**. **In 2012**, **395 samples** analysed for the content of chemical substances, nitrates and nitrites were extracted from 202 hunts and 37 agricultural enterprises. Monitoring was carried out for 30 agricultural subjects, analyzing soil samples from 9 485

ha, including the crop produced from this soil. Samples with limit-exceeding values in 2012 have been detected in feeding water, especially for nitrates (2 samples). In other commodities, no limit-exceeding samples were found in 2012 (soil, forage, feedstock).

♦ Consumption pool monitoring (CPM)

Objective of the **Consumption pool monitoring (CPM)** is to obtain data on contamination of foods within the consumer network and subsequently assess exposition of the population to the monitored contaminants. Samples are purchased from the commercial network twice a year (May, September) at 9 Slovak sites.

Exposition of the public to xenobiotic substances is compared with permissible tolerable weekly intake for arsenic, cadmium, mercury, lead, tolerable daily intake for nickel, recommended daily dose for chromium, and acceptable daily intake for nitrates, PCBs, and pesticides. In each consumption basket there are analyses conducted for chemical elements, nitrates, nitrites, polyaromatic hydrocarbons, PCBs, selected pesticides residuals, residuals from veterinary medications, from microtoxins, as well as selected additives. Radioactive contamination was monitored for the samples of milk and drinking water.

Over the period of **twenty years, 12 947 samples** were analysed, including **517 samples**, i.e. **4.0%** that exceeded permitted limit values, especially in nitrates and chemical elements.

21 basic food items and drinking water (abstracted since 2007) are sampled for the consumption basket. 256 samples were analysed in 2012. Of these, 1 sample (dioxines) extracted from beef did not comply with the set limits (chain of stores in Moldava nad Bodvou).

♦ Monitoring of game, wildlife, and fishes

Monitoring of game, wildlife and fishes has been carried out since 1995 with the goal to gather information on the impact of the environmental contamination on the selected species of game and fish. (from free water formations) Since 1995, in total, there have been analysed **4 001 samples** of fish, game, mushrooms, forest products, as well as feeding water and sediments from water formations. The set limits were exceeded by **18.9%**; in the case of fish the findings were mainly negative due to increased contents of PCB, dioxins, mercury, and cadmium. Higher values for cadmium and mercury have been shown also for game and mushrooms. **In 2012**, there were **134 samples** abstracted, of which **8.96%** exceeded the limit, just like in the previous time period, exceeded were the limits for PCB in fish from 7 regions of Slovakia (Trebišov, Košice, Michalovce, Prievidza, Banská Bystrica, Martin and Prešov).

• ENVIRONMENTAL LOADS

Key questions and key findings

What is the documented scope of environmental loads?

- **As of the end of 2012, the total of 905 probable environmental loads was recorded in Slovakia, and 260 existing environmental loads.**

Present situation in the area of environmental loads and its solutions

Methodological Order no. 1/2012 of January 27, 2012 on the elaboration of risk analysis of the contaminated area came into effect in 2012 together with the published **Methodological guidance accompanying the schedule of works pursuant to Act 409/2011 Coll. on certain measures in the area of environmental load as amended** (of December 20, 2012).

A call to the **priority axis 4, target 4.4.** was ended on 10/02/2012 within the **Operation programme of Environment (OPE). : Addressing the issue of environmental loads and their elimination.** This call´s objective was to implement **EL survey, EL monitoring, involving the public, and promotion.**

Ministry of Environment of the Slovak Republic and its contributory or budgetary organisations were designated as the recipients of the assistance. Total allocated funds were set at 18 mil. Eur.

The following projects were submitted as part of the on-going call:

- Survey of environmental loads at selected sites of the Slovak Republic (2012-2013) submitted by: Ministry of Environment of SR
- Monitoring of environmental loads at selected sites of the Slovak Republic (2012-2015) submitted by: SGI DS
- Promotion, involving the public as a support to solving the environmental pressures (2012-2015) submitted by: SEA

All of the above-mentioned projects were launched in the Fall of 2012.

Works on the project of **Completion of the Information System of Environmental Pressures,** SEA (2008-2013) The project's aim is to complete the environmental loads information system, including its connectedness to other IS, as well as to implement an awareness-raising campaign regarding the system.

As of the end of 2012, the information system of environmental loads contained **905 probable and 260 existing environmental loads, and 726 remedied and recultivated sites.**

• NATURAL AND TECHNOLOGICAL HAZARDS

Key questions and key findings

What is the trend in the number of events that negatively impact the environment?

- **Number of events of extraordinary deterioration of water quality (EDW) showed fluctuating characteristics with 2 388 events over the monitored period of 1993-2012. In the period of 2000-2012, the least number of reported EDW occurred in 2001 (71), and most in 2003 (176). In 2012 there was a slight increase compared to the previous year.**
- **65 events of extraordinary deteriorations of air quality were detected in the period of 1993-2007. Over the last five years the Slovak Environmental Inspection Authority (SEI) has not detected any event leading to deteriorated air quality.**
- **In the period of 1993-2012, 216 800 fires were reported in Slovakia. The number of casualties over this period was 1 096, with 3 819 injured persons. In the period of 2000 - 2012, fires showed fluctuating characteristics and in none of these years the number dropped below 8 000. In 2012, there was a small increase compared to the previous year with the numbers copying those in 2007.**

What is the trend in the consequences of events that negatively impact the environment?

- **Total direct damage caused by fires in 2012 increased compared to the previous year. The extent of damage over the period of 1993-2012 reached the value of 551.129 mil. Eur with the most extensive damage detected in 2012 (69.148 mil. Eur). In the period of 2000-2012, the extent of damage caused by fires did not drop below 15.000 mil. Eur.**
- **Total costs and the damage relating to the floods of 2012 reached 3.27 mil. Eur, which is approximately the value recorded in 2007. Over the monitored period of 1998-2012, total costs and damage amounted to 1 111.2 mil. Eur with the least damage caused in 2003. The most devastating floods were reported in 2010.**

Accidental deterioration of water quality

In 2012, the Slovak State Environmental Inspection statistics showed sligt increase in the number of events and recorded 117 emergency deteriorations or threats to water quality (EDW). Of all recorded events, 67 were cases relating to surface water, and 50 were cases of threats or contamination of ground water.

Special declination or quality menace of water of the SR in the years 1993, 2000-2012

Year	EDW recorded by SEI	Special deterioration of water					
		Surface			Ground		
		Total number	Watercourses and basins	Water courses	Total number	Pollution	Endanger-ment
1993	142	95	3	12	47	10	37
2000	82	55	2	9	27	3	24
2001	71	46	1	4	25	1	24
2002	127	87	1	6	40	5	35
2003	176	134	2	3	42	0	42
2004	137	89	1	10	48	11	37
2005	119	66	2	5	53	2	51
2006	151	94	0	3	57	6	51
2007	157	97	1	4	60	4	56
2008	102	49	0	6	53	4	49
2009	101	50	1	3	51	7	44

2010	100	42	0	2	58	2	56
2011	115	59	2	5	56	1	55
2012	117	67	0	7	50	2	48

Source: SEI

Compared to the previous year, the number of EDW caused by crude oil compounds and other compounds declined, with wastewater and other toxic substances staying at the level of last year. Caustic substances, insoluble substances, and the excrements of livestock caused increase in the number of EDW. In fourteen cases it was impossible to detect the type of the harmful or very harmful agent.

Progress in number of EDW according to the sort of WDS in the years 1993, 2000–2012

Sorts of water deteriorative Substances (WDS)	1993	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Oil substances	70	33	64	59	70	63	69	76	65	65	60	76	66
Alkalis	5	2	5	3	1	0	3	4	2	0	3	0	1
Pesticides	2	0	1	0	3	0	2	0	0	0	0	0	0
Excrements of farm animals	8	5	9	21	15	14	14	12	7	2	10	10	13
Silage fluids	0	4	2	1	1	0	0	0	0	0	0	0	0
Industrial fertilisers	0	0	0	1	0	0	0	0	0	0	1	0	0
Other toxic substances	5	12	3	3	0	4	4	5	2	1	1	3	3
Insoluble substances	11	5	6	11	3	4	3	3	2	2	4	0	3
Waste water	8	10	17	35	20	10	28	24	15	17	12	14	14
Other substances	4	2	3	7	10	8	6	7	3	1	6	7	3
Water detrimental substances impossible to determine	29	9	17	35	14	10	22	24	6	1	3	5	14

Source: SEI

Besides, in 2012 most EDW were caused by humans (including traffic accidents caused by drivers) and inadequate technological state of equipment and facilities handling harmful or very harmful substances.

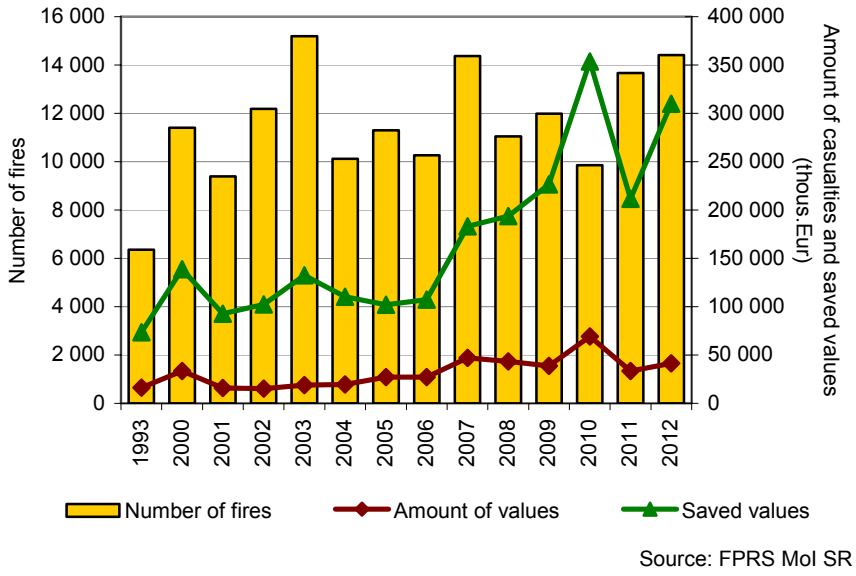
Fire risk

In 2012, Slovakia reported 14 413 fires, which is 736 cases more than in the previous year. As a consequence of these fires, 44 persons died (12 less than in the year before) and 232 people sustained various types of injuries (which is 35 people less). Direct material damage reached 41 394.5 thous. Eur, while the volume of preserved values was calculated at 309 865.6 thous. Eur.

In terms of damage caused by fires in individual economic sectors, **most fires occurred in agriculture** – 2 129 with the damage amounting to 1 745.1 thous. Eur, two casualties, and 7 injured persons. 1 985 fires occurred in the sector of **household management**, killing 25 and injuring 138 persons. Direct material damage reached the value of 7 361.1 thous. Eur. In terms of fire statistics, **transport** shows the third greatest number of fires – 1 279, occasioning direct material damage at 6 027.1 thous. Eur, killing 9 persons and injuring 22.

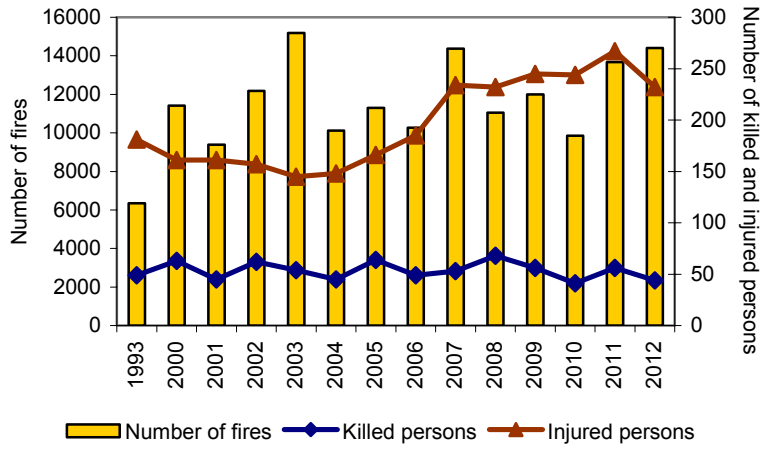
From the perspective of administrative distribution of territory, **most fires** occurred in 2012 in the Košice region (2 927), while **least** fires were recorded in the Trenčín region (1 172). **Greatest damage** due to the occurrence of fires was recorded in the Košice region (12 801.9 thous. Eur) and the **least** in the Nitra region (2 252.2 thous. Eur).

Relationship between number of fires and number of casualties or amount of saved values in 1993, 2000-2012



Source: FPRS MoI SR

Relationship between number of fires and number of killed or injured persons in 1993, 2000-2012



Source: FPRS MoI SR

Floods

In 2012, there were 146 municipalities afflicted with floods, with 269 houses flooded (cellars and basements), 64 non-residential premises flooded, 352.76 ha of flooded agricultural land, 24.00 ha of flooded forestland, and 161.12 ha of flooded municipal land. In total, 140 inhabitants suffered from the aftermath of the floods. There were no casualties reported.

Total cost and damages by floods in the SR in 2012 amounted to 3.27 mil. Eur, including the rescue costs of 0.46 mil. Eur, safety works of 0.37 mil. Eur, and material damage amounted to 2.44 mil. Eur.

Damage to state-owned property caused by floods totaled 0.59 mil. Eur, while damage to private property reached 0.05 mil. Eur. Damage to municipal property reached 0.69 mil. Eur and 0.90 mil. Eur in case of properties belonging to upper regional administrative areas. Damage to the property of legal and natural entities reached 0.21 mil. Eur.

As part of the legislation activities related to Act no. 7/2010 Coll. on flood protection, the Ministry of Environment´s **Decree no. 112/2011 Coll.** was approved. This Decree defines details relating to the contents, revisions, and updates to the flood risk management plans. In total, 559 areas with the occurrence of a significant flood risk were defined in Slovakia. These include 378 geographical areas with existing potentially significant risk of floods, and 181 geographical areas with anticipated probable occurrence of a significance flood risk.

Floods aftermath over the period of 1998-2012

Year	Number of flood stricken residential	Flooded Territories (ha)	Damages by floods (mil. Eur)	Costs (mil. Eur)		Total costs and damages (mil. Eur)
				Rescue activities	Maintenance and safety activities	
1998	75	3 952	33,34	3,94	1,28	38,56
2000	220	76 494	40,97	0,30	1,84	43,11
2001	379	22 993	65,08	1,90	1,07	68,05
2002	156	8 678	50,64	2,13	1,66	54,43
2003	41	744	1,43	0,19	0,14	1,76
2004	333	13 717	34,91	1,23	3,42	39,56
2005	237	9 237	24,03	2,24	2,67	28,94
2006	512	30 730	47,90	5,98	6,42	60,30
2007	60	339	2,49	0,30	0,21	3,00
2008	188	3 570	39,75	3,59	2,51	45,85
2009	165	6 867	8,41	1,59	1,30	11,30
2010	1 100	103 006	480,85	17,93	27,53	526,31
2011	87	3 076	20,01	2,00	12,58	34,59
2012	146*	538	2,44	0,37	0,46	3,27

* Number of municipalities with declared III. degree of flood activity

Source: WRI

• GENETIC TECHNOLOGIES AND GENETICALLY MODIFIED ORGANISMS

Key questions and key findings

Is there an impending risk for Slovakia associated with the use of genetic technologies and genetically modified organisms?

- **Slovakia adopted a system of legal protection in the area of using genetic technologies and genetically modified organisms, that is fully compatible with the EC policies. The use of genetic technologies and genetically modified organisms is subject to a stringent process of assessment and approval in order to minimize the risk.**

Using of genetic technologies and genetically modified organisms

Use of genetic technologies and genetically modified organisms (GMO) in Slovakia falls under the following provisions:

- Act 151/2002 Coll. on the use of genetic technologies and genetically modified organisms as amended that was revised in 2012 by Act 448/2012 which amends and supplements Act 151/2002 Coll. on the use of genetic technologies and genetically modified organisms as amended and on supplementation to Act 24/2006 Col. on environmental impact assessment and on change and supplementation to certain laws as amended.
- MoE SR Resolution 399/2005 Coll., and MoE SR Decree 312/2008 Coll., which executes Act 151/2002 Coll., on the use of genetic technologies and genetically modified organisms as amended.

The law makes it possible to use genetic technologies and genetically modified organisms in the following ways:

- in enclosed areas (devices),
- intentional release, including a) introduction to the environment,
  b) introduction to the market.

♦ Using of genetic technologies and genetically modified organisms in vitro

Plans the use of genetic technologies and genetically modified organisms in enclosed areas (laboratories, greenhouses, cultivating rooms, and other enclosed facilities) is divided into four at risk categories (RC), while the RC 1 represents no or negligible risk, RC 2 means small risk, RC 3 means medium risk, and RC 4 means significant risk.

On the basis of received applications and notifications, Ministry of Environment issued a permit to 27 confined areas in 2012 for their first use. The Ministry did not have any objections as to the beginning of activities classified in RT 1 in 101 confined areas, and those classified under RT 2 in 15 confined areas.

In 2012, the Ministry did not receive applications for permission to start the RT3 and 4 activities.

♦ Intentional release

Intentional release is a purposeful introduction of GMO or GMO combination into the environment (experiments) without the use of protective measures, pursuant to part B of the European Parliament and of the Council Directive 2001/18/EC or making them available to third parties as marketed products according to part C of this Directive.

In 2012, the Slovak Ministry of Environment issued a permit for growing genetically modified corn types - MON 89034 × NK603 and NK603 × MON 810.

♦ Biological safety commission

Commission for the biological safety (commission) is the professional consulting body to the Ministry of Environment of the SR in the area of biological safety. Commission administered by the department of biological safety of the Slovak Ministry of Environment of the SR has 14 permanent members and 16 experts who come from a wide spectrum of professionals in the area of science or other sectors, together with state officers appointed for the individual involved resorts, and representatives of the public, including users and citizens. The committee met 25 times in 2012. It responded to the proposals for issuing permits for the first use of confined areas, to the notices on activities started in confined areas, and to the introduction of generically modified crop into the environment.