MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

STATE OF THE ENVIRONMENT REPORT

SLOVAK REPUBLIC 2005

Exploitation of nuclear energy must be justified by the contribution, which would counterbalance eventual risks originating from such activities, especially in comparison with other ways, which can be used to reach the same goal.

§ 3 par. 3 of the Act No. 541/2004 Coll. on Peaceful Exploitation of Nuclear Energy (Nuclear Act)

ENVIRONMENTAL RISK FACTORS

• PHYSICAL RISK FACTORS

Radiation protection

Institutions dealing with radiation protection and safety of ionising radiation sources **in the SR**:

- **Slovak Hydro-meteorological Institute** (SHMI)
- **Office of Civil Protection** (OCP SR)
- **Armed forces of the Slovak Republic** (ASR)
- **Slovenské elektrárne, a.s.** (Slovak electric power plants) (SE) that operate the nuclear power facilities of Jaslovské Bohunice NPP EBO) and Mochovce (NPP EMO) also monitor the radiation situation in the vicinity of these facilities
- **Nuclear Regulatory Authority** (NRA SR)
- **Ministry of Health of the SR** (MoH SR)
- **Headquarters of radiation monitoring network of SR** (HRMN SR)

♦ **Air dose equivalent rate**

Pursuant to HRMN SR, input of the external photon dose equivalent in air **H** (nSv.h^{-1}) in 2005 in the early alarm networks of in the whole SR territory reached the average value of 117.2 nSv.h^{-1}. Average annual effective dose **E** (μSv) for the whole SR territory was 782.25 μSv in 2005.

♦ **Air Contamination**

Air contamination has continually been monitored by measuring the volume activity of individual radio nuclides in **aerosols** extracted in the ground atmospheric level. Their ^{137}Cs concentration in Slovakia in 2005 reached the maximum level of 19.8 ± 1.5 μBq.m^{-3}.

In 2005, no major air contamination by radionuclides was detected, ^{137}Cs radionuclide concentration in **radioactive fallout,** originating in the upper atmospheric layers as a result of nuclear weapons tests, was at the level of 3.2 ± 0.6 $Bq.m^{-2}$ in Slovakia.

- **Contamination of other environmental elements**

Soil contamination by the ^{137}Cs radionuclide in 2005 was at 158.5 ± 32 $Bq.kg^{-1}$. Average activity of the ^{137}Cs radionuclide **in water** in 2005 was below 5.27 $mBq.l^{-1}$. Tritium activity **in surface water** was at the level of 179.5 ± 3.4 $Bq.l^{-1}$. Tritium activity **in drinking water** in 2005 was 116 ± 3.1 $Bq.l^{-1}$.

- **Contamination of foodstuff and agricultural products**

Of all man-made radionuclides, in 2005, just like in the previous years, it was possible to detect in food samples only the ^{137}Cs radionuclide. Its contents in all measured commodities – excluding grasses and fungi – were around the level of units of $Bq.kg^{-1}$, or rather $Bq.l^{-1}$.

- **Radon and its radioactive decay products**

The largest source of **natural ionising radiation** is **Radon** and the **products of its radioactive change.**

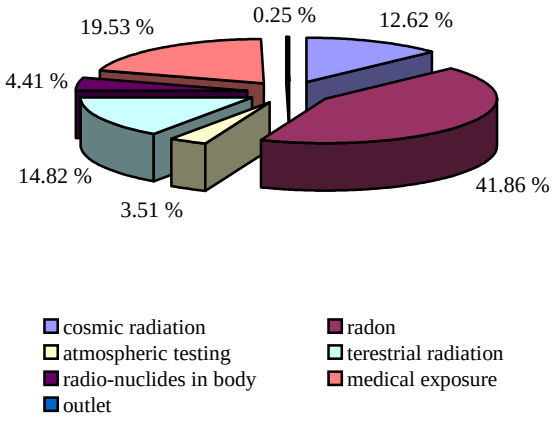
Outcomes from the volume Radon activity (OAR) monitoring in the SR households suggest that the areas with most OAR exposition are on the territory of East Slovakia – in the area of Slovenské Rudohorie. Highest values of the equivalent volume Radon activity (EOAR) were recorded inside old family houses with no cellar, especially in the ground-level rooms. This fact suggests that the main Radon source in the SR households is Radon found in the soil air. This relates to the increased Uranium concentrations in the geological aquifer, as well as to the geological structure of territory.

Radiation load of the population from natural radio-nuclides in year 2005

Source of radiation	Radiation load	
	Person (mSv)	Population (10^5 manSv)
Natural background together.	**2.40**	**650**
from that:		
- cosmic radiation	0.39	
- terestrial gama radiation	0.46	
- radio-nuclides in body	0.23	
- radon and the products of mutation	1.30	
Medical exposure together.	-	**165**
from that:	0.59	90
- diagnostics	-	75
- radiotherapy		
Atmospheric testing of nuclear weapons	-	30
Radio-nuclides outlet	-	2

Source: PHA SR

Percentage of individual sources of radiation of the population in the year 2005



Source: PHA SR

Average OAR values with estimated average whole-year effective E dose per capita from Radon exposition in households in individual regions in 2004

Region	OAR ($Bq.m^{-3}$)	E (mSv)
Bratislavský	53	0.88
Trnavský	88	1.47
Trenčiansky	98	1.64
Nitriansky	140	2.35
Žilinský	103	1.72
Banskobystrický	145	2.44
Prešovský	93	1.55
Košický	133	2.23
SR	**108**	**1.81**

Source: PHA SR

Districts with highest average OAR values – with estimated average whole-year effective dose per capita from exposition to Radon and its daughter compounds in residential areas in 2004

Region	OAR ($Bq.m^{-3}$)	E (mSv)
Rožňava	318	5.33
Krupina	268	4.49
Zlaté Moravce	260	4.37
Rimavská Sobota	255	4.28
Gelnica	215	3.61
Košice okolie	210	3.53
Banská Štiavnica	208	3.49
Brezno	200	3.36
Veľký Krtíš	190	3.19
Spišská Nová Ves	188	3.15

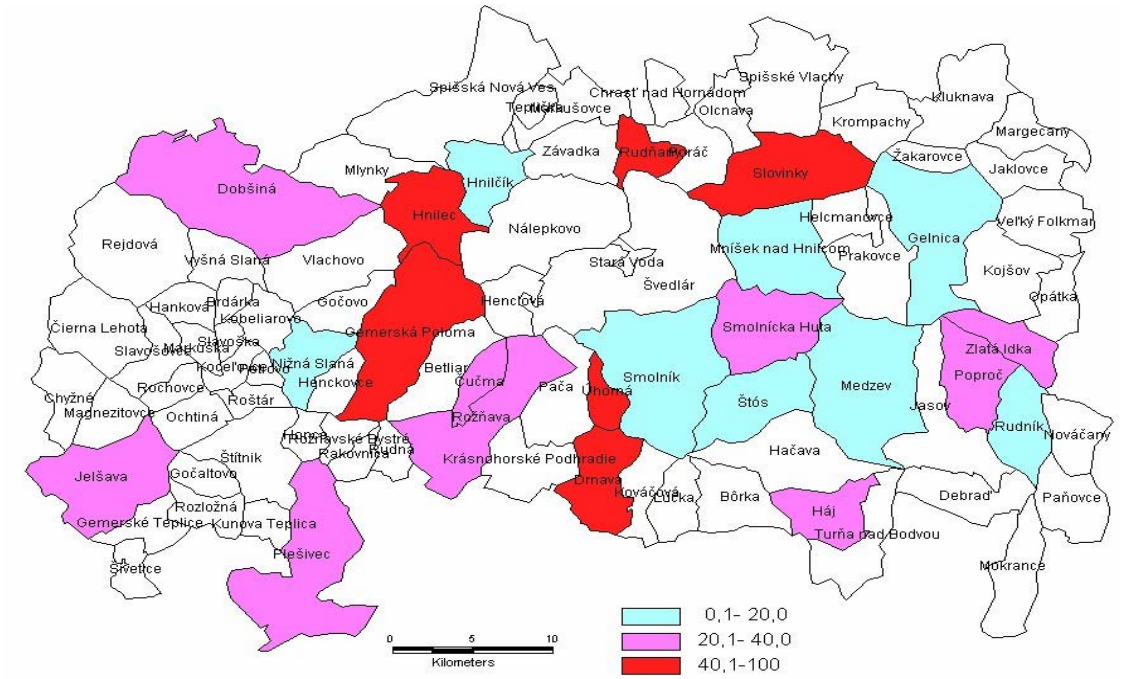
Source: PHA SR

Additional lungs cancer deceases for 100 thousand inhabitants annually as result of exposure of population to radon in indoor facilities

Region	Men	Women	Population
Bratislavský	9.60	4.37	6.87
Trnavský	15.94	7.25	14.42
Trenčiansky	17.75	8.07	12.71
Nitriansky	25.35	11.54	18.16
Žilinský	18.65	8.49	13.36
Banskobystrický	26.26	11.95	18.81
Prešovský	16.84	7.67	12.06
Košický	24.08	10.96	17.25
SR	**19.56**	**8.90**	**14.00**

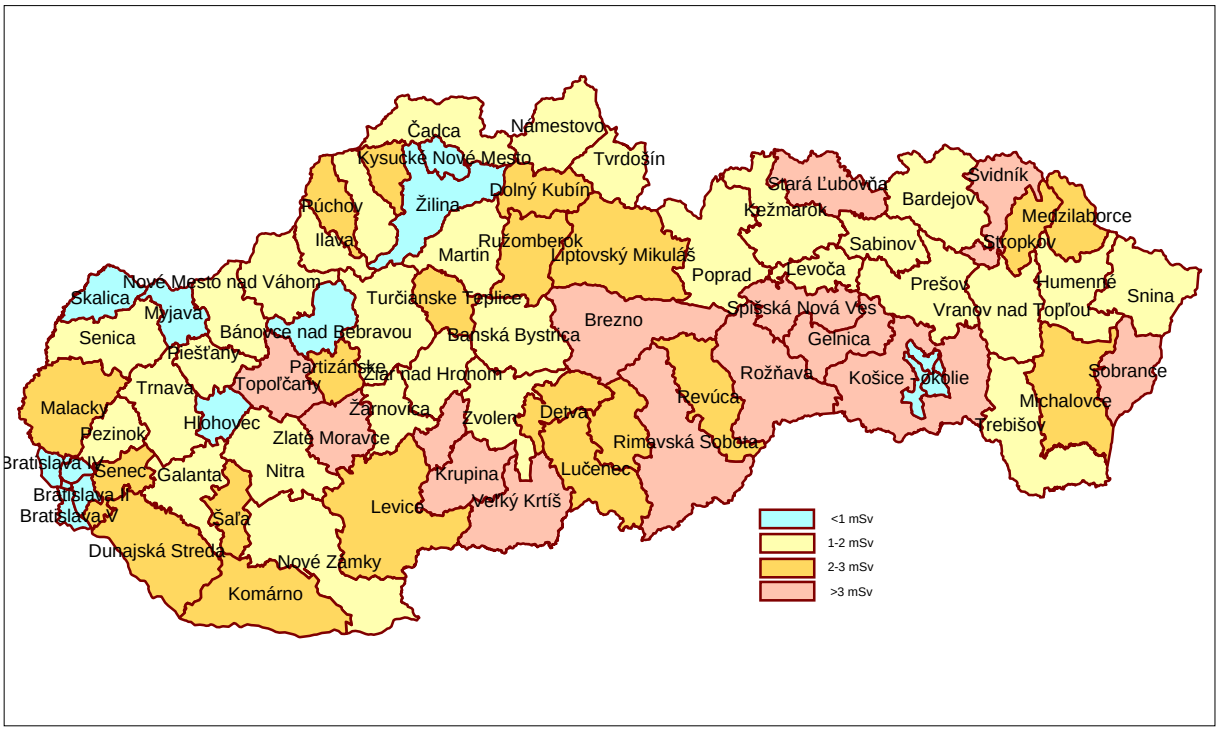
Source: PHA SR

Overview of districts by percentage of residential areas that extend beyond the reach of the OAR area



Source: PHA SR

Average year long effective amount for one inhabitant from inhalation of radon and its filial products in residential places in the regions of SR in year 2004



Source: PHA SR

Nuclear institutions

List of operated nuclear power plants in the SR

Nuclear Power Plant (NPP)	Start of operation	Reactor type	Operator
NPP Bohunice V-1	1978, 1980	VVER 440/230	SE
NPP Bohunice V-2	1984, 1985	VVER 440/213	SE
NPP Mochovce 1,2	1998, 1999	VVER 440/213	SE

Source: SE

State Inspection of Nuclear Safety with handling radioactive waste and burnt nuclear fuel is carried out by the **Office of Nuclear Supervisions of the SR** (NRA SR). The Act No. 541/2004 Coll. on peaceful exploitation of nuclear energy (**"Atomic Act"**) is the basic instrument for peaceful use of nuclear energy. NRA SR is an independent central state administration authority, headed by the Chief Officer. The **Institute of Public Health** (PHA SR) ensures **state supervision over radiation safety** under the Act No. 272/1994 Coll., as amended.

Slovakia is a signatory to all major international agreements and conventions in the area of peaceful exploitation of nuclear energy.

- **Activity of nuclear institutions in SR**

NPP V-1 Bohunice (NPP EBO V-1)

Since 1990, the NPP EBO V-1 has permanently been implementing safety improvements in order to increase nuclear safety in this power plant, following the recommendations of the International Atomic Energy Agency (IAEA). Although the planned activities of the programme to ensure safety were ended in 2000, much attention is still paid to further increasing of nuclear safety.

With both NPP – EBO V-1 blocks in operation in 2005, there were 8 occurrences, 6 of them within the INES 0 degree, and none in the INES 1 degree. Total number of occurrences has been successfully reduced to the level of previous years. The number of fast automatic shutdowns – that equalled to zero in 2005, showed analogical positive tendency.

NPP V-2 Bohunice (NPP EBO V-2)

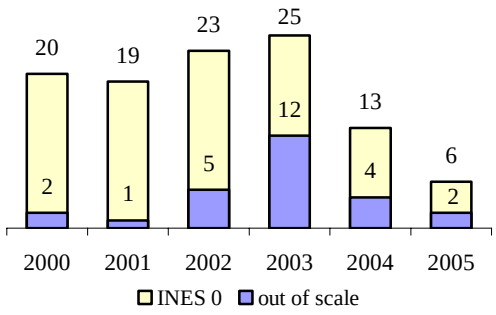
In 2005, the NPP V-2 blocks met the demands of the energy control centre. These NPP blocks served as the heat source to distribute heat to Trnava, Hlohovec, and Leopoldov.

The programme called "Modernisation and increase of the NPP V-2 safety" implemented a number of tasks performed on NPP V-2 over the course of the year. Pursuant to the decision of the NRA SR to modernize the NPP V-2 blocks, inspectors supervised project changes to the equipment, relating to nuclear safety. All works and tests were carried out in accordance with agreed strategies, deadlines, and in good quality. Tightness of the hermetic zone is greater than the required limit value.

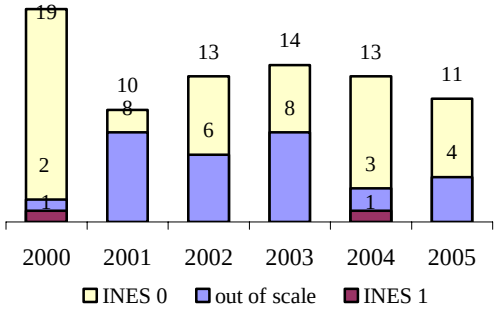
In 2005, there were 15 operation occurrences, including 11 under the INES 0 degree, on both NPP EBO V-2 blocks. Four occurrences were outside the INES classification scale. Fast automatic shutdowns were not recorded.

Based on the results of control activities and assessment of the safety indicators, together with inspection activities, NRA SR evaluated the operation of both NPP V-2 blocks as safe and reliable.

Trend in the count of events noticed on blocks of NPP Bohunice V-1



Trend in the count of events noticed on blocks of NPP Bohunice V-2



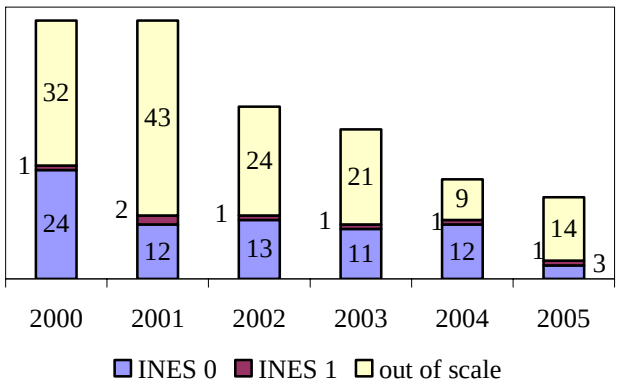
Source: NRA SR

NPP Mochovce (NPP EMO)

NPP Mochovce (NPP EMO) consists of two VVER 440 blocks with V213 reactors with increased safety. First block began operation in 1998, second block in April, 2000.

Number and type of occurrences in 2005 did not show any unusual technical malfunctions. In terms of nuclear safety, systems and devices functioned reliably the whole year. During 2005, there was one occurrence of insufficient in one of the hermetic areas, as a result of a failure to comply with effective limits and conditions of safe operation. While the nuclear safety was not put at risk, because of inappropriate personnel response and poor internal policies, assessment of the safety significance of the occurrence was increased from degree 0 (i.e. deviation) to degree 1 (i.e. malfunction) under the INES international scale. There were 18 occurrences in NPP Mochovce, including 3 under INES 0, and 1 under INES 1. No automatic shutdown of reactor occurred in either of the blocks.

Trend in the count of events noticed on blocks of NPP Mochovce



Source: NRA SR

♦ **Storage of spent nuclear fuel and radioactive waste**

Burnt nuclear fuel (BNF) is defined as a fuel irradiated in the reactor's active zone and permanently taken out of the zone. Basic principles of the strategy for handling **burnt nuclear waste** (BNF) and **radioactive waste** (RAW) are found in SR Government Resolutions No. 930/1992, No. 190/1994, and No. 5/2001.

Burnt nuclear waste is stored in special containers. Current storage capacity is 14 112 pcs of burnt nuclear waste. The programme of gradual translation of burnt nuclear fuel from the original T-12 containers to KZ-48 compacted containers continued in 2005.

♦ **Handling with radioactive waste**

In Slovakia, **radioactive waste** (RAW) is defined as unused material that due to its radionuclide content or contamination by radionuclides cannot be introduced into environment.

Handling of radioactive waste constitutes an integrated system that includes the collection, separation, storage, processing, treatment, manipulation, and discharge of radioactive waste.

Processing and treatment of radioactive waste includes activities leading to the increased safety and economic effectiveness in handling radioactive waste, as well activities that prepare radioactive waste to be discharged or stored.

Major part of these activities is concentrated in a nuclear facility of Technologies for processing and treatment of radioactive waste, operated by SE-VYZ. The mentioned nuclear facility includes two bituminisation lines, and the Bohunice processing centre of radioactive waste. Bituminisation lines with the capacity of 120 l/h are designed to bituminize concentrations from the VVER and NPP-1 nuclear power plants types into 200-liters barrels.

Transportation of radioactive waste makes it possible to connect individual elements within the radioactive waste handling system. Procedure of licensing radioactive waste transport consists of two steps. First step is to approve the type of transport device, while the second step is to approve radioactive waste transport inside this facility.

More than 200 pcs of fibre-concrete containers were transported to the national discharge site of radioactive waste. During the year 2005, major occurrences that would lead to accidents or malfunctions did not occur at the radioactive waste handling or transport facilities.

Discharge is the final step in the process of radioactive waste handling. Packaged forms of radioactive waste are permanently placed at the site of radioactive waste discharge.

National discharge site of radioactive waste Mochovce is designed to receive packaged forms of low to medium-active radioactive waste. This discharge site is of the surface type, designed to receive solid and solidified low to medium-radioactive waste from the operation of nuclear facilities and other institutions in the SR, that deal with activities producing radioactive waste. As of the end of 2005, there were 1 000 pcs of fibre-concrete containers for low to medium-active radioactive waste placed

here. Recent calculations show that the blocks of individual power plants will produce 2 500 t of burnt nuclear fuel and 3 700 t of radioactive waste over their projected lifetime. Current effective legislation does not allow these volumes to be placed at the National discharge site of radioactive waste. Today, there are plans to place the burnt nuclear fuel together with this type radioactive waste in the **underground discharge site.**

Noise and vibrations

Results from monitoring the noise load on public in selected Slovak cities in 2005, based on equivalent noise levels from road transport

Region - population	External noise level		Number of persons
Košice Idanská ul.	>55 dBA	1	
	>60 dBA	2	
	>65 dBA	3	**cca. 600**
	>70 dBA	4	
	>75 dBA	5	
Žilina	>55 dBA	1	
	>60 dBA	2	
	>65 dBA (69.2 dB)	3	**532**
	>70 dBA	4	
	>75 dBA	5	
Žilina bilingv. gymn.	>55 dBA	1	
	>60 dBA	2	
	>65 dBA (66.4 dB)	3	**600**
	>70 dBA	4	
	>75 dBA	5	
Čadca Horelica	**>55 dBA (56.5 dB)**	1	**8**
	>60 dBA	2	
	>65 dBA	3	
	>70 dBA	4	
	>75 dBA	5	

Source: SHI SR