EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY

DIRECTORATE D – Nuclear energy, safety and ITER
D.3 – Radiation protection and nuclear safety

Verification under the terms of Article 35 of the Euratom Treaty

Technical Report

THE SLOVAK REPUBLIC
Bratislava

Routine and emergency radioactivity monitoring arrangements
Monitoring of radioactivity in drinking water and foodstuffs

25 - 29 April 2022

Reference: SK 22-01

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35

OF THE EURATOM TREATY

FACILITIES	Routine and emergency radioactivity monitoring arrangements Monitoring of radioactivity in drinking water and foodstuffs
LOCATIONS	Bratislava, the Slovak Republic
DATES	25 – 29 April 2022
REFERENCE	SK 22-01
TEAM MEMBERS	Mr Vesa Tanner (Team leader) Ms Elena Luminita Diaconu
REPORT DATE	27 September 2022
SIGNATURES	

V. Tanner E-L. Diaconu

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Abbreviations

CBRN	Chemical, Biological, Radiological, Nuclear
EC	European Commission
EURDEP	EUropean Radiological Data Exchange Platform
GM	Geiger-Müller
HPGe	High-purity Germanium (detector)
IAEA	International Atomic Energy Agency
JRC	Joint Research Center
LIMS	Laboratory Information Management System
MDA	Minimum Detectable Activity
NaI	Sodium-Iodine (detector)
NPP	Nuclear Power Plant
OUSA	Oncological Institute of St. Elizabeth
PE	Polyethylene
PHA	Public Health Authority
REM	EC Radioactivity Environment Monitoring database
RT	The Slovak Republic government official journal
SHMI	Slovak Hydrometerological Institute
TLD	Thermoluminescent dosimeter
WRI	Water Research Institute

TECHNICAL REPORT

1 INTRODUCTION

Under Article 35 of the Euratom Treaty, all Member States must establish the facilities necessary to carry out continuous monitoring of the levels of radioactivity in air, water and soil and to ensure compliance with basic safety standards[1]. Article 35 also gives the European Commission the right of access to such facilities to verify their operation and efficiency. The radiation protection and nuclear safety unit of the European Commission's Directorate-General for Energy is responsible for undertaking these verifications. The Joint Research Centre Directorate-General provides technical support during the verification visits and in drawing up the reports.

The main purpose of the verifications under Article 35 of the Euratom Treaty is to provide an independent assessment of the efficiency and adequacy of monitoring facilities for:

- liquid and airborne discharges of radioactivity from a site into the environment;
- levels of environmental radioactivity at the site perimeter and in the marine, terrestrial and aquatic environment around the site, for all relevant pathways;
- levels of environmental radioactivity on the territory of the Member State.

Taking into account previous bilateral protocols, a Commission Communication[2] describing practical arrangements for Article 35 verification visits in Member States was published in the Official Journal of the European Union on 4 July 2006.

2 PREPARATION AND CONDUCT OF THE VERIFICATION

2.1 PREAMBLE

The Commission notified the Slovak Republic of its decision to conduct an Article 35 verification in a letter addressed to the Slovak Republic Permanent Representation to the European Union. The Public Health Authority (PHA) of the Slovak Republic was designated to lead the preparations for the visit.

2.2 DOCUMENTS

To assist the verification team in its work, the national authorities supplied an information package in advance[3]. Additional documentation was provided during and after the verification visit. The information provided was used as a source during drawing up the descriptive sections of the current report.

[1] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ L 13, 17.1.2014)

[2] Commission Communication *Verification of environmental radioactivity monitoring facilities under the terms of Article 35 of the Euratom Treaty — Practical arrangements for the conduct of verification visits in Member States* (OJ C 155, 4.7.2006)

[3] Replies to the preliminary information questionnaire addressed to the national competent authority, received on 4 April 2022

2.3 PROGRAMME OF THE VISIT

The Commission and the Public Health Authority discussed and agreed on a programme of verification activities (Annex 1) in line with the Commission Communication of 4 July 2006.

The opening meeting included presentations on the Slovak Republic automatic radiation monitoring system and other environmental radioactivity monitoring arrangements. The verification team pointed to the quality and comprehensiveness of all the presentations and documentation.

The team carried out the verifications in accordance with the programme in Annex 1. It met the following representatives of the national authorities and other parties involved:

Organisation	Representative
Public Health Authority of the Slovak Republic	Dr. Ján MIKAS (Chief Public Health Officer of the Slovak Republic and Director General) Dr. Juraj LOVÁSIK (Deputy Director General) Dr. Veronika DRÁBOVÁ (Head of Radiation Protection Department)
Slovak Hydrometeorological Institute	Dr. Terezia MELICHEROVÁ
Water Research Institute	Dr. Gabriela WALLOVÁ, (Head of Radiochemistry Department) Dr. Michal Kirchner (Head of National Water Reference Laboratory for Slovakia)
Public Health Authority of the Slovak Republic, Radiation Protection Department	Dr. BÖHM Karol BÖHMOVÁ Ivana, MSc. BRINZA Marek, MSc. DOKTOR Miloš, MSc. DURDYOVÁ Veronika, MSc. Dr. GALBAVÝ Andrej GAŽÍK Juraj HELEJ Markus, MSc. JANOŤÁKOVÁ Lucia, MSc. Dr. JURINA Vladimír KUŠNYÉROVÁ Alexandra MSc. LISÝ Andrej MONOKOVÁ Miriama, MSc. ONDRUŠKOVÁ Anna, MSc. VADOVIČOVÁ Anna VOJTKOVÁ Mária, MSc. VOLFOVÁ Eulália ZEMKOVÁ Kristína, MSc. ZUBÁKOVÁ Anita, MSc.

3 LEGAL FRAMEWORK FOR RADIOACTIVITY MONITORING IN THE SLOVAK REPUBLIC

3.1 LEGISLATIVE ACTS REGULATING ENVIRONMENTAL RADIOACTIVITY MONITORING

Table I below presents the Slovak legislation, which forms the basis for environmental radioactivity monitoring.

Table I.

Title of the document	Number of the document, date of issue	Link to the website where the document can be consulted
National environmental radioactivity monitoring		
Act No. 87/2018 Coll. on radiation protection	*Act No. 87/2018 Coll. on radiation protection, 13 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/87/20180401
MoH SR Decree No. 99/2018 on securing radiation protection	*Decree No. 99/2018 of the Ministry of Health of Slovak Republic, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/99/20180401
MoH SR Decree No. 96/2018, laying down the details on operation of radiation monitoring network	*Decree No. 96/2018 of the Ministry of Health of Slovak Republic, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/96/20180401
MoH SR Decree No. 98/2018, laying down the details on reducing exposure of workers and population from natural sources of ionizing radiation	*Decree No. 98/2018 of the Ministry of Health of Slovak Republic, laying down the details on reducing exposure of workers and population from natural sources of ionizing radiation, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/98/20180401
MoH SR Decree No. 100/2018, laying down details to limit exposure from drinking water, natural mineral water and from spring water	*Decree No. 100/2018 of the Ministry of Health of Slovak Republic, laying down details to limit exposure from drinking water, natural mineral water and from spring water, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/100/20180401
Monitoring of radioactivity content of foodstuffs		
Food Law Act. 152/1995 Coll. on Foodstuffs	*Act No. 152/1995 Coll. on Foodstuffs, 27 June 1995*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/1995/152/20191214
Food Code of the Slovak Republic		http://potravinarstvo.com/pksr/obsah_pksr.htm
Regulation (EC) No 2017/625 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products	*Regulation (EC) No 2017/625, 15 March 2017*	https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0625&from=EN
Monitoring of radioactivity content of drinking water		

MoH SR Decree No. 100/2018, laying down details to limit exposure from drinking water, natural mineral water and from spring water	*Decree No. 100/2018 of the Ministry of Health of Slovak Republic, laying down details to limit exposure from drinking water, natural mineral water and from spring water, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/100/20180401
Environmental radioactivity monitoring in emergency situations (if treated separately in specific documents)		
Act of the NC SR No. 42/1994 Coll. on Civil Protection	*As last amended by Act No. 177/2018 Coll.*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/1994/42/20200409
ÚJD SR Decree No. 55/2006 Coll. on particulars in emergency planning in case of an incident or an accident	*As last amended by ÚJD SR Decree No. 9/2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2006/55/20180201
MoH SR Decree No. 96/2018, laying down the details on operation of radiation monitoring network	*Decree No. 96/2018 of the Ministry of Health of Slovak Republic, 19 March 2018*	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2018/96/20180401
Legal acts establishing the responsibilities of different organisations for the areas previously mentioned (if not included in the documents already listed)		
Act No. 575/2001 Coll. on Organization of Governmental Activities and of Central State Administration Organizations	As last amended by Act No. 313/2018 Coll.	https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2001/575/20190601

3.2 INTERNATIONAL LEGISLATION AND GUIDANCE DOCUMENTS

The list below presents the Euratom and the European Union legislation and the main international standards and guidance that form the basis for environmental radioactivity monitoring and the radiological surveillance of foodstuffs and feeding stuffs.

Euratom and European Union legislation

- The Euratom Treaty
- Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom
- Council Directive 2013/51/Euratom of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption
- Council Decision 87/600/Euratom of 14 December 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency
- Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety
- Council Regulation (Euratom) 2016/52 of 15 January 2016 laying down maximum permitted levels of radioactive contamination of food and feed following a nuclear accident or any other case of radiological emergency, and repealing Regulation (Euratom) No 3954/87 and Commission Regulations (Euratom) No 944/89 and (Euratom) No 770/90

- Council Regulation (EEC) No 2219/89 of 18 July 1989 on the special conditions for exporting foodstuffs and feedingstuffs following a nuclear accident or any other case of radiological emergency
- Council Regulation (EC) No 733/2008 of 15 July 2008 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station
- Council Regulation (EC) No 1048/2009 of 23 October 2009 amending Regulation (EC) No 733/2008 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station
- Commission Regulation (EC) No 1609/2000 of 24 July 2000 establishing a list of products excluded from the application of Council Regulation (EEC) No 737/90 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station
- Commission Regulation (EC) No 1635/2006 of 6 November 2006 laying down detailed rules for the application of Council Regulation (EEC) No 737/90 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station
- Commission Implementing Regulation (EU) 2016/6 of 5 January 2016 imposing special conditions governing the import of feed and food originating in or consigned from Japan following the accident at the Fukushima nuclear power station and repealing Implementing Regulation (EU) No 322/2014
- Commission Recommendation 2000/473/Euratom of 8 June 2000 on the application of Article 36 of the Euratom Treaty concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole
- Recommendation 2004/2/Euratom of 18 December 2003 on standardised information on radioactive airborne and liquid discharges into the environment from nuclear power reactors and reprocessing plants in normal operation
- Commission Recommendation 2003/274/Euratom of 14 April 2003 on the protection and information of the public with regard to exposure resulting from the continued radioactive caesium contamination of certain wild food products as a consequence of the accident at the Chernobyl nuclear power station

International legislation and guidance documents, issued mainly by the International Atomic Energy Agency (IAEA)

- *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna, 2014
- *Clearance of materials resulting from the use of radionuclides in medicine, industry and research*, IAEA-TECDOC-1000, IAEA, Vienna, 1998
- *Generic models for use in assessing the impact of discharges of radioactive substances to the environment*, Safety Reports Series No 19, IAEA, Vienna, 2001
- *Handbook of parameter values for the prediction of radionuclide transfer in temperate environments*, Technical Reports Series No 364, IAEA, Vienna, 1994
- *Management of radioactive waste from the use of radionuclides in medicine*, IAEA-TECDOC-1183, IAEA, Vienna, 2000
- *Regulatory control of radioactive discharges to the environment: Safety Guide*, Safety Standards Series No. WS-G-2.3, IAEA, Vienna, 2000
- *Sources and effects of ionizing radiation*, United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 2000, Report to the General Assembly, Vol. I, United Nations, New York, 2000
- *Guidelines for drinking-water quality*, 4th ed. 2011, World Health Organisation (WHO)

4 BODIES HAVING COMPETENCE IN RADIOACTIVITY MONITORING IN THE SLOVAK REPUBLIC

4.1 PUBLIC HEALTH AUTHORITY

The Public Health Authority (PHA) of the Slovak Republic is a state organisation with competence on the territory of the Slovak Republic with registered office in Bratislava. It has regional offices in Nitra, Bratislava, Košice and Banská Bystrica. Its activity falls under the responsibility of the Chief Hygienist of the Slovak Republic, who is also the director of the office. The chief hygienist is appointed and dismissed upon proposal of the Minister of Health of the Slovak Republic by the director of the office of the ministry.

The Public Health Authority of the Slovak Republic is the supreme office for the regional public health authorities. It manages, controls and coordinates the execution of state administration carried out by regional public health offices.

The Radiation Protection Department of the Public Health Authority is the Slovak regulatory authority in the field of radiation protection. It maintains the national registries of radiation doses, radioactive sources, radiation protection officers and radiation protection experts. It is also in charge of the environmental radioactivity monitoring programme, including emergency monitoring. The institute has a radiological laboratory for carrying out the environment monitoring programme.

4.2 SLOVAK HYDROMETEOROLOGICAL INSTITUTE

The Slovak Hydrometeorological Institute (SHMI) is a specialized organization providing hydrological and meteorological services at national and international level. It is a state-subsidised organisation operating under the Slovak Ministry of Environment.

The SHMI's activities include the following: monitoring of quantitative and qualitative parameters of the air and water in the Slovak territory; collecting, verifying, interpreting and archiving data and information on the condition and regime of air and water; describing developments in the atmosphere and hydrosphere; and issuing forecasts, warnings and other information regarding the atmosphere and hydrosphere. All the aforementioned data, information and other research are made available to the public.

The SHMI obtains most of its data on the quantity and quality of air and water from the various monitoring facilities of the state hydrological and meteorological network. These include automatic monitoring stations for ambient radiation dose rate.

4.3 WATER RESEARCH INSTITUTE

The Water Research Institute (WRI) is a public organization under the supervision of the Ministry of Environment. The scope of responsibilities and activities of the Water Research Institute is defined under the Foundation Charter No. 21/2006 - 1.6. issued by the Ministry of Environment of the Slovak Republic on 29 May 2006. The WRI is the only organization in Slovakia conducting comprehensive water management research and other related activities resulting from the needs of water sector in the Slovak Republic. Its main activities are aimed at research and development, expertise, professional water management consulting services and solutions for water management and ecological problems.

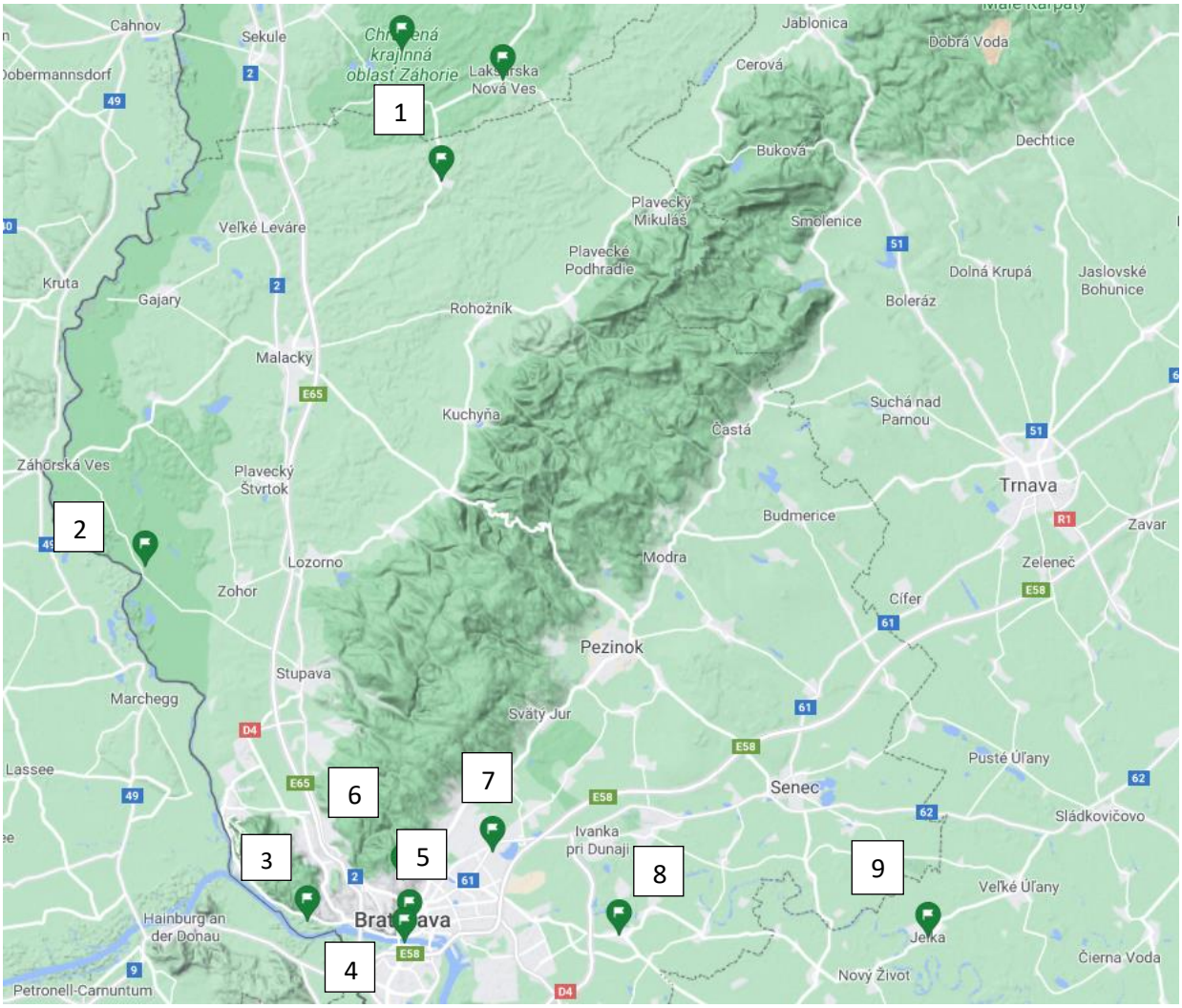
The WRI has a radiological laboratory for analysis of radioactivity in water samples.

5 RADIOACTIVITY MONITORING IN BRATISLAVA

5.1 ROUTINE MONITORING

5.1.1 Introduction

Slovakia has a comprehensive monitoring programme for radioactivity in the environment (Annex II). The monitoring systems in Bratislava are an integral part of this programme. Figure 1 below summarises the sampling programme in Bratislava and the surrounding region.



1 – mushrooms, 2 – surface water, 3 - drinking water, 4 - surface water, 5- mixed diet, 6 - dry/wet deposition, 7 – milk, 8 – milk, 9 – drinking water

Figure 1. Environmental sampling locations in the Bratislava region

5.1.2 Radiation dose rate

There are two automatic radiation dose rate monitors in Bratislava: one at the Slovak Hydrometeorologial Institute (SHMI) and one at the Public Health Authority of the Slovak Republic (Fig. 2). The SHMI station is a part of the national automatic monitoring network ((30 dose rate monitors); the PHA station is a stand-alone station with an alarm function (PHA has one such station in each of its five offices). Both stations are based on a GM-tube detector.

Figure 2. SMHI and PHA automatic dose rate monitors in Bratislava

5.1.3 Ambient radiation dose

PHA monitors environmental ambient dose on one location in Bratislava. This is a part of the national programme including 56 locations on the Slovak territory. Monitoring is carried out using an environmental TLD (Fig. 3), in which four TLD units are placed in a plastic shield. TLD reading is carried out every three months.

Figure 3. Environmental TLD dosimeter in a plastic shielding with copper foil filter

5.1.4 Air

PHA carries out continuous sampling of particulate matter in air using a medium-volume air sampler in Bratislava (Fig. 4), located at the PHA building roof. The filter is analysed every two weeks. The system does not include charcoal filters, so gaseous radioactive iodine is not monitored.

Figure 4. Air sampler at the PHA building roof

5.1.5 Atmospheric deposition

PHA carries out monitoring of radioactivity in dry/wet atmospheric deposition using two stainless steel collection vessels in Bratislava, located at the PHA building roof (Fig. 5). Sample analysis is carried out monthly (weekly in the event of an emergency).

Figure 5. Atmospheric dry/wet deposition collectors at the PHA roof

5.1.6 Surface waters

PHA carries out monitoring of water radioactivity in the Danube and Morava rivers. Manual sampling (5-10 litres) is carried out monthly.

5.1.7 Ground water and drinking water

PHA carries out monthly monitoring of ground water at the ground water pumping station in Bratislava (5-10 litre samples directly from the tap at Sihot, Jelka and PHA).

WRI carries out drinking water sampling from consumers (schools, houses, offices, etc.) as well as directly from drinking water sources. Usually 2 L of sample is taken for gross alpha/beta determination and 250 ml for Rn–222 determination (5 samples per week).

Figure 6. Drinking water sampling

5.1.8 Soil, sediments and aquatic biota

PHA carries out soil sampling in Bratislava and in the surroundings of the Slovak NPPs. The programme includes also aquatic biota and sediments. The purpose of sampling is to obtain information on the radioactive contamination deposited on the ground in different regions of the Slovak Republic, and to obtain information on the levels of naturally occurring radionuclides in the soil. The number of sampling locations annually varies from 2 to 4 (sampling in May – October). Monitoring frequency in each sampling location is once per year.

5.1.9 Milk

PHA carries out milk sampling in Bratislava and in the surroundings of the Slovak nuclear power plants. 3-litre samples are collected directly from the production farms. Radiological monitoring of milk provides information on the radionuclide content of milk produced in the Slovak Republic. Milk is analysed by regions (counties) to observe regional differences in radionuclide content, which may provide information on the levels of radioactivity in the natural environment of the area. The aim is to periodically analyse raw milk produced in every county where there is dairy industry.

5.1.10 Mixed diet

PHA collects samples of a person's daily diet for analysis of the contents of artificial radionuclides (^{137}Cs and ^{90}Sr) and one natural radionuclide (^{40}K). Samples are collected from the OUSA hospital canteen in Bratislava.

5.1.11 Foodstuffs

PHA food monitoring programme measures the content of ^{137}Cs and ^{40}K in the most commonly consumed foods grown and produced in the Slovak Republic. Samples are collected from the markets

in Bratislava and the surrounding area. Sampling frequency of foodstuffs is every third month (quarterly).

5.2 MOBILE MONITORING

PHA has no mobile laboratory, but its mobile monitoring group is equipped to carry out terrestrial monitoring using hand-held monitoring devices (Table II).

The Slovak authorities have no capabilities (helicopters or drones) to carry out airborne radioactivity or radiation monitoring on the Slovak territory.

Table II. PHA mobile monitoring equipment

Available hand-held equipment
Dosimeter ESM FH40G
Dosimeter FH40G-L10
Personal electronic dosimeter DMC 3000
CONTAMAT FHT 111M surface contamination monitor
SPIR-ACE (nuclide identification, gamma dose rate, NaI-spectrum and neutron dose rate)
RDS-30 digital hand-held dose rate meter
FH 40FE telescope dose probe with FH 40F2 dosimeter
In-situ gamma spectroscopy system with a HPGe detector
Personal Radiation Detector RADEYE
Nuclide identification device (Indentifinder R400)
Radiation Detection Backpack (FHT 1377 PackEye)

5.3 INFORMATION FOR THE GENERAL PUBLIC

Information from the radiological monitoring programmes is made available to the public both in routine and emergency situations. Results of the off-line programme, together with interpretation and conclusions, are also made available to the public through periodic reports published by the PHA[4]. The current radiation dose rate readings are made available on-line at the SHMI website[5].

Besides these communications, the nuclear regulatory body, the nuclear operators and the environmental protection authorities also have responsibilities to communicate information to the public in case of routine and emergency situations.

In the event of an emergency, communication to the public is the responsibility of the emergency response organisations, the local administration and the regional government.

[4] http://www.uvzsr.sk/index.php?option=com_content&view=category&layout=blog&id=25&Itemid=34
[5] https://www.shmu.sk/en/?page=1&id=radioaktivita

6 ANALYTICAL LABORATORIES

6.1 PUBLIC HEALTH AUTHORITY

6.1.1 Introduction

The PHA has a main laboratory in Bratislava and regional laboratories in Banská Bystrica and Kosice. A gammaspectrometry laboratory is currently under establishment at the regional public health authority in Bratislava. The laboratories participate in the monitoring of the following media:

- Air (ambient (integrated) gamma dose rate, aerosols);
- Rain (precipitation), dry atmospheric deposition;
- Water (ground, surface, drinking water);
- Soil (sediment, cultivated soils);
- Vegetation (aquatic biota, leafy vegetables, fruits, grain, grass and others (moss, mushrooms, feed etc.));
- Food (milk, meat, fish, mixed diet, and others (food products, flour, rice, etc.)).

6.1.2 Sampling, sample preparation and counting

The PHA has altogether 22 persons for collecting, preparing and analysing environmental samples. Samples are taken by the laboratory assistants, who fill in the sample sheets. Each sample is registered in the Sample Register Book (written form, PC form) after receipt in the laboratory. The identification information includes sample code, type of sample, locality, volume (mass), sampling date, time and type of analysis.

Sample preparation is performed in accordance with the Slovak technical standards and standard working procedures of the laboratory. Laboratory procedures of sample preparation include evaporating, ashing, filtration, distillation, drying, weighing, homogenisation, extraction, mineralization, milling, cutting and radionuclide separation. Some types of samples can be stored in racks (storage room) before the treatment. Plant and soil samples are dried.

Water samples can be stored in PE vessels for 1 month after conservation by acid. Dry fodder and grain samples are stored in PE bags for a period of 1 year. Soil and aquatic sediment samples are stored in 800 ml PE vessels after gamma spectrometry measurement for a period of 1 year.

6.1.3 Counting equipment

Table III below presents the counting equipment available at the PHA laboratories.

Radioactive standards for calibration are stored in separate locked rooms. Calibration is performed in accordance with standard working procedures. Laboratories use the following certified standards for efficiency determination: ^{90}Sr, ^{137}Cs, ^{3}H (type ER), ^{226}Ra, uranyl nitrate, ^{40}K (KCl) and mixture of radionuclides for energy and efficiency calibration of gamma spectrometers produced by the Czech Metrological Institute. Calculation of results is done on a PC with manual input.

Table III. PHA laboratories' main equipment

Laboratory	Equipment	Measurement
PHA laboratory in Bratislava	1 TLD reader Harshaw 4500	Integrated gamma dose
	1 Stationary high volume air sampling system	Air sampling
	1 Alpha Analyst system	Alpha spectroscopy applications
	1 Perkin-Elmer Quantulus GCT 6220 LSC	Measurement of H-3 and Rn
	2 Gamma spectrometry systems LYNX HPGe detector GC	Gamma emitters
	1 Gamma spectrometry system LYNX HPGe detector BE	Gamma emitters
	1 Thermo Scientific FHT 770T Multi Low Level Counter	Sr, Cs, I and alpha/beta analysis
PHA laboratory in Banská Bystrica	Alpha spectrometry systems	Alpha spectrometry
	1 In-situ gamma spectroscopy system with a HPGe detector	In-situ gamma spectrometry
	1 Stationary high-volume air sampling system	Air sampling
	1 Portable air sampling system	
	5 Portable devices for ambient dose rate measurement	Ambient dose rate
	1 Thermo Scientific FHT 770 T6 gas flow proportional counter	Gross alpha/beta
	3 Gamma spectrometry systems HPGe detector	Gamma spectrometry
PHA laboratory in Košice	1 Gamma spectrometry system Canberra with GC detector and DSA analyzer	Gamma spectrometry
	1 Gamma spectrometry system Canberra with GC detector and LYNX analyzer	
	1 Gamma spectrometry system with NaI(Tl) detector and a Tesla single channel analyser	
	1 Canberra LB 4200 alpha/beta low level counter	Measurement of Rn in water
	1 EcoGamma Canberra	Environmental gamma monitoring
	1 LUK 3RD system	Radon in soil

6.1.4 Data handling and reporting

PHA has no dedicated laboratory information management system (LIMS). The measurement results are recorded and saved in the form of spectrums and reports in the control computers of the devices. The measurement results are recorded on an Excel spreadsheet, where the measurement result is presented together with the measurement uncertainty or measurement MDA.

Results are used for the following reports and databases:

1) Annual report of the Public Health Authority of the Slovak Republic, chapter on radiation contamination of environment and in the vicinity of NNPs,
2) Report for JRC Ispra (Euratom Art. 36),
3) Report on the radiation situation in the Slovak Republic, compiled by the PHA Headquarters,
4) Environmental databases of the Radiation Protection Departments,
5) Ad hoc information and reports for the public information or for local authorities.

6.1.5 Accreditations and proficiency tests

Laboratories of the Public Health Authority of the Slovak Republic and the regional public health authorities that are either certified in accordance with ISO 9001:2015 or accredited in accordance with ISO 17025:2017 are in charge of the analysis of the environmental samples and food chain samples of the national monitoring program. In order to maintain the quality, above mentioned laboratories regularly participate in intercomparison exercises organized by the IAEA, EC, ASLAB (Czech Republic), and by the Water Research Institute (Slovakia).

The Public Health Authority of the Slovak Republic has participated in a significant number of international and European laboratory intercomparison projects and proficiency tests.

6.2 WATER RESEARCH INSTITUTE

6.2.1 Introduction

The Laboratory of Radiochemical Analysis is one of the WRI analytical laboratories. It is equipped to carry out measurements of gamma, alpha/beta and ^{3}H in water samples. It has a staff of five.

6.2.2 Sample receipt and preparation

Samples are collected by the laboratory staff and registered in a LIMS system upon receipt at the laboratory. Typically, the water samples are measured without any pre-treatment. For the H-3 analysis also electrolytic enrichment is used before liquid scintillation counting.

6.2.3 Counting equipment

The laboratory has the following counting equipment:

- Gammaspectrometer
- Liquid scintillation counters
- Alphapsectrometer
- Gas-flow proportional counters

6.2.4 Data handling and reporting

The measurement results are recorded and saved in the form of spectrums and reports in the control computers of the devices. The measurement results are recorded on an Excel spreadsheet, where the measurement result is presented together with the measurement uncertainty or measurement MDA.

6.2.5 Accreditations and proficiency tests

The WRI laboratories are accredited according to ISO 17025. The Laboratory of Radiochemical Analysis participates annually in international proficiency tests.

7 VERIFICATIONS

7.1 INTRODUCTION

Verification activities were carried out in accordance with the agreed programme. This chapter summarises the verifications carried out by the verification team. The team has assessed the monitoring arrangements based on their own expertise and comparison with similar arrangements in other Member States.

The outcome of the verification is expressed as follows:

- A '*Recommendation*' is made when there is a clear need for improvement in implementing Art. 35. These are included in the main conclusions of the verification. The Commission requests a report on the implementation of the recommendations – lacking implementation of a recommendation can lead to a reverification.
- A '*Suggestion*' is made when the verification team identifies an action, which would further improve the quality of the monitoring.

In addition, the team may '*commend*' particularly good arrangements, which could serve as a best practice indicator for the other EU Member States.

7.2 PUBLIC HEALTH AUTHORITY LABORATORY

7.2.1 General

The verification team verified the analytical process of the PHA laboratory in Bratislava[6]. The laboratory has good working facilities and adequate staff. No equipment of staff shortages were reported to the verification team.

When samples are received at the laboratory, they are recorded in an Excel sheet and a paper logsheet. The laboratory does not have a dedicated laboratory information management system[7].

The laboratory has sufficient equipment for sample preparations (evaporation, drying, ashing, etc.).

> *The verification team recommends that the PHA implement a dedicated laboratory information management system (LIMS).*

7.2.2 Gamma spectroscopy

The counting capacity consist of three Canberra HPGe-detectors (Fig. 7) with Genie2000 software. The estimated number of samples annually is about 300. The verification team was informed that the counting times are set individually for each sample; there is no fixed time used for all samples.

Calibration of the gamma spectroscopy systems for water samples is based on an activity standard provided by the Czech Metrological Institute. An activity certificate was presented to the verification team. There is no activity standard for air filter calibration - Canberra software "Geometry composer" is used to obtain an efficiency calibration.

The laboratory performs weekly controls of HPGe-detector efficiency and energy stability, but these controls do not include detector system resolution.

[6] Trnavská cesta 52, 826 45 Bratislava

[7] The verification team was informed that a LIMS system is being prepared for the laboratory. The estimated installation time will be July 2022.

The verification team recommends that the PHA laboratory initiates regular control of gamma spectroscopy system resolution (FWHM of the Co-60 peak at 1332 keV) and logs the control results in a long-term trend graph.

The verification team suggests that the PHA laboratory sets fixed counting times for each environmental sample type.

The verification team suggests that the PHA validates the simulated efficiency calibrations by a physical activity standard.

Figure 7. PHA gamma spectrometer

7.2.3 Alpha counting

The verification team verified the PHA laboratory alpha-counter Thermo FHT 770 (Fig. 8), which is used for total-alpha counting of water samples. The system has six counting positions; 9000 second counting time is used.

The PHA laboratory has also a new 12-chamber alpha counter Canberra AlphaAnalyst, which is not yet operational. In the future, this system will be used for Pu-, U- and Am analysis.

No remarks.

Figure 8. PHA alpha counter

7.2.4 Liquid scintillation counting

The verification team verified the PHA laboratory LSC (Quntulus GCTG220, Fig. 9), which is used for ^{3}H- and Rn-analysis. The system has been operational since 2021.

No remarks.

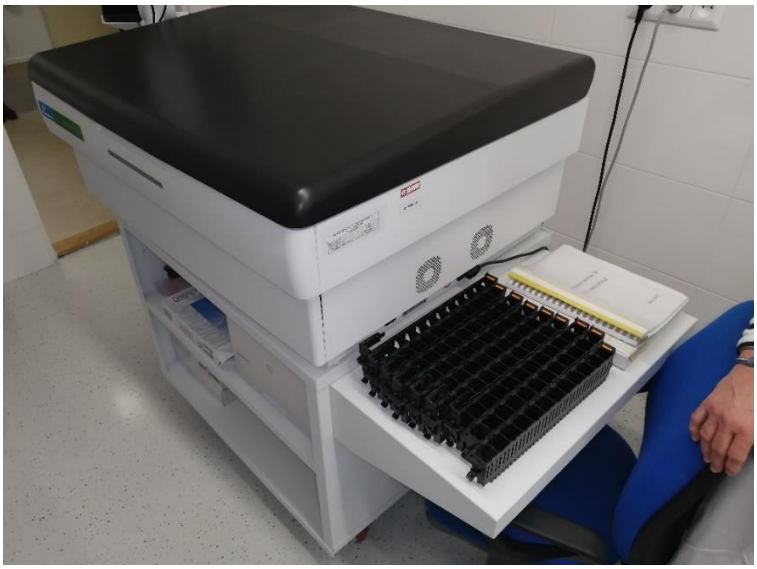


Figure 9. PHA liquid scintillation counter

7.2.5 Ambient radiation dose monitoring

The verification team verified the environment TLD (Fig. 10), which is placed outside the PHA laboratory building in a tree at about 2 meter height. The location is protected from public access (fenced area).

PHA laboratory has a THERMO 4500 TLD reader for reading the environmental TLDs. Four TLDs are used in a plastic shielding. The set-up is not identical to the TLD used for personnel dose monitoring. TLDs are placed on a plastic shielding equipped with a copper foil to make them representative of H*10 dose. The average reading of the four TLDs is recorded in a paper logbook. About 329 TLDs are measured annually.

No remarks.

Figure 10. Environment TLDs in the plastic holder

7.2.6 Sample storage

The verification team was informed that PHA does not keep the water samples; air filters are kept for 10 years. A dedicated sample storage room is available.

No remarks.

7.2.7 Monitoring during an emergency

The verification team was informed, that the PHA laboratory has sufficient space for storing and managing increased number of incoming (radioactive) samples in the event of an emergency, and by reducing the counting times the laboratory capacity could be increased to facilitate higher sample throughput, but there is no formalised plan for a this type of situation.

The verification team recommends, that the PHA drafts an internal preparedness plan for laboratory operation in an emergency situation, taking into account the increased number of incoming environmental samples with radioactive contamination.

7.3 WATER RESEARCH INSTITUTE LABORATORY

The verification team verified Laboratory of Radiochemical Analysis of the Slovak Water Research Institute (WRI)[8], which carries out monitoring of water (drinking, ground and mineral) radioactivity throughout the Slovak territory. The laboratory is accredited according to ISO 17025. It is very well equipped and adequately staffed (five staff members). About 800 water samples are analysed annually, about 25% of them on commercial basis.

The main equipment of the WRI laboratory is the following:

- Two Gas flow proportional counters (Berthold LB 4200 and Canberra IN20)
- Two liquid scintillation counters (Tri-Carb 2900 and Quantulus GCT 6220)
- Gamma spectrometer (Canberra)
- Alpha spectrometer (Canberra AlphaAnalyst 7200)
- ICP-MS iCap Q

[8] Nábrežie armádneho generála L. Svobodu 5, 812 49 Bratislava

In addition, the laboratory is equipped with an electrolytic ^{3}H-enrichment system (Fig. 11) to lower the LLD in ^{3}H monitoring (nuclear site vicinity ^{3}H-programme).

The verification team commends the extensive programme and good equipment for monitoring water radioactivity at the Water Research Institute.

Figure 11. WRI laboratory electrolytic ^{3}H-enrichment system

7.4 ENVIRONMENTAL SAMPLING

7.4.1 Surface water

The verification team witnessed surface water sampling of rivers Donau and Morava (points 3 and 4 on Figure 1). On both locations, sample is taken using a bucket, which is thrown into the river in order to obtain two 5-litre samples. No sample pre-treatment is applied; filtration is carried out in the laboratory. A sampling sheet is filled on the spot.

No remarks.

7.4.2 Drinking water

The verification team witnessed drinking water sampling at the Bratislava water company ground water pumping station. Two samples are taken directly from the tap: a large 10-litre sample (2×5 litres) for the total alpha/beta, H_3- and Sr-measurements and a smaller sample (3×250 ml) for the radon measurement.

The verification team noted, that the radon water sample was taken by filling the sample bottle slowly from the tap in order to minimise loss of radon gas during the sampling. This method can be biased, since a small part of the radon gas is lost during the sampling; filling the bottle completely submerged in a larger container would lead to smaller loss of radon gas.

The verification team suggests that the PHA changes the radon in water sampling procedure to the method described in the document 'Technical report on the REM 2018 radon-in-water proficiency test'[9].

[9] https://op.europa.eu/en/publication-detail/-/publication/2c953632-6349-11ea-b735-01aa75ed71a1/language-en

7.4.3 Air

The verification team verified the air sampler on the roof the PHA building. This is the only air sampling system in Bratislava. It is a medium-volume sampler F&J DH-50810E, equipped with a flow meter and a total flow counter. Filter (fibreglass; 20.32 x 25.4 cm) is changed once in two weeks. The airflow is about 80 m^3/h. The system does not have a position for installing a charcoal filter for gaseous iodine monitoring.

The verification team noted that the sampler is quite old (20 years), so it is getting close to the end of its operating life. The flow counter had not been recalibrated; the original factory calibration is used for calculation of the total air volume.

The air filter change procedure was demonstrated to the verification team.

The verification team recommends that the PHA proceed to acquire a new medium– or high-volume air sampler for Bratislava (preferably two of them) in the near future.

The verification team recommends that the PHA implement a system for monitoring gaseous radioactive iodine in Bratislava.

The verification team suggests recalibration of the air sampler total flow counter.

Figure 12. PHA air sampler

7.4.4 Atmospheric deposition

PHA atmospheric deposition sample is collected using two small metal buckets placed on the laboratory roof (Fig. 13). The system collects both dry and wet deposition. Sample volume is fairly small due to the small collection surface. Evaporation may lead to bucket being completely dry during the sampling period, which could lead to loss of dry deposition sample.

The verification team suggests that the PHA builds a deposition collector system with a larger collection area, a funnel and a closed container for sample collection.

Figure 13. PHA dry/wet deposition samplers

7.5 AUTOMATIC RADIATION DOSE RATE MONITORING

7.5.1 Slovak Hydrometeorological Institute

The verification team verified the automatic dose rate monitor located at the meteorological garden of the Slovak Hydrometeorological Institute[10] (Fig. 14). There are 30 such stations in the Slovak Republic (RADIS network), two of which are located in the Bratislava region. The system provides gamma dose rate and precipitation data on a continuous basis. The data is provided also to EURDEP and other partners (PHA, Nuclear Regulatory Authority, KATVED and Meteoservice Budapest, Radiation Warning Centre Vienna, SÚJB Prague).

If the dose rate value of 400 nSv/h is exceeded, an email message is automatically sent to two members of the radiation monitoring team in the institute. The values are also checked through the Nuclear Regulatory Authority system, which receives them in real time together with the relevant meteorological data.

These stations are calibrated every two years by the Slovak Metrological Institute. A demonstration of the network data collection and display software was provided to the verification team.

No remarks.

[10] Jesséniova 17, Bratislava

Figure 14. RADIS system automatic dose rate monitor

7.5.2 Public Health Authority

The verification team verified the dose rate monitor located at the roof of the PHA building. This is a stand-alone system, not part of the RADIS network. Monitor electronics unit is located in the laboratory. The dose rate reading is automatically recorded in the laboratory database and made available to the public at the PHA website.

If the dose rate values exceed the determined investigation levels (reference levels), an e-mail message and SMS are automatically sent to all the employees of the department of radiation protection. Emergency duty workers investigate the reasons and take appropriate measures as necessary.

No remarks.

Fig. 15. PHA automatic dose rate monitor

7.6 EMERGENCY MONITORING EQUIPMENT

7.6.1 Public Health Authority

The verification team verified the emergency monitoring kit, which is available at the PHA laboratory. The kit consists of the following:

- Dosimeter ESM FH40G
- Dosimeter FH40G-L10
- CONTAMAT FHT 111M surface contamination monitor
- SPIR-ACE (nuclide identification device, gamma dose rate, NaI-spectrum and neutron dose rate)
- RDS-30 digital hand-held dose rate meter
- In-situ gamma spectroscopy system with a HPGe detector
- FH 40FE Telescope dose rate probe with FH 40F2 dosimeter
- Personal Radiation Detector RADEYE
- Nuclide identification device (Indentifinder R400)
- Radiation Detection Backpack (FHT 1377 PackEye)

In addition, the kit contains personal dosimeters, communication radios, personal protective equipment and swipe test kits.

Altogether nine two-person teams have been trained to use the mobile monitoring equipment. They can reach any location in the Slovak Republic and initiate monitoring in 4-5 hours.

The verification team points out that the mobile equipment kit does not contain a mobile air sampler, or any other device to detect gaseous radioactive iodine in air. In addition, the team noted that the number of each equipment available at the PHA is fairly small, typically only one of two pieces of each equipment.

> *The verification team recommends that a mobile small-volume air sampling capability (aerosols and gaseous iodine) be included in the PHA mobile monitoring equipment.*
>
> *The verification team suggests that the PHA acquires additional dose rate monitors and nuclide identification devices.*

Figure 16. Hand-held radiation monitoring equipment of the PHA

8 CONCLUSIONS

All planned verification activities were completed successfully. The information supplied in advance of the visit, as well as the additional documentation received during and after the verification activities, proved very useful.

The information provided and the verification findings gave rise to the following observations:

(1) Overall, the environmental radioactivity monitoring programmes in Bratislava comply with the requirements of Article 35 of the Euratom Treaty.

(2) The verification activities found that the facilities needed to carry out continuous monitoring of levels of radioactivity in air, water and soil in Bratislava are adequate. The Commission ascertained that these facilities are in operation and running efficiently.

(3) The verification activities found that the facilities needed to carry out monitoring of levels of radioactivity in the air, water and soil in the event of a radiological emergency in Bratislava are adequate. The Commission ascertained that these facilities are continuously available.

(4) A few recommendations and suggestions have been formulated. They concern in particular monitoring of gaseous radioactive iodine, renewal of sampling equipment, laboratory equipment maintenance and laboratory management in the event of an emergency. Notwithstanding these recommendations, the verified parts of the monitoring system for environmental radioactivity in Bratislava are in conformity with the provisions laid down under Article 35 of the Euratom Treaty.

(5) The team's recommendations are set out in the 'Main Conclusions' document addressed to the Slovak competent authority through the Slovak Republic Permanent Representative to the European Union.

(6) The Commission services kindly request the Slovak authorities to submit, before the end of 2024, a progress report on how the team's recommendations have been implemented, and on any significant changes in the set-up of the monitoring systems. Based on this report the Commission will consider the need for a follow-up verification in the Slovak Republic.

(7) The verification team acknowledges the excellent cooperation it received from all people involved in the activities it undertook during its visit.

ANNEX 1

VERIFICATION PROGRAMME

EURATOM ARTICLE 35 VERIFICATION THE SLOVAK REPUBLIC (BRATISLAVA)

27 - 29 APRIL 2022

Wednesday 27 April

09.30 **Opening meeting**
(Public Health Authority of the Slovak Republic, Trnavská cesta 52, Bratislava)

- Welcome address
- European Commission Art. 35 verification programme introduction
- Discussion on the past verifications in the Slovak Republic by the Commission
- Verification planning

11.00 **Overview of radioactivity monitoring arrangements in the Slovak Republic and in Bratislava**

- Dose and dose rate monitoring
- Air sampling
- Dry/wet deposition sampling
- Soil sampling
- Water sampling
- Food stuff and feeding stuff sampling
- Mobile monitoring systems
- Emergency monitoring systems
- Public information arrangements

14.00 **Public Health Authority**
(Trnavská cesta 52, Bratislava)

- Radiological laboratory
- Monitoring equipment
- On-site monitoring equipment

Thursday 28 April

09:00 **Public Health Authority**

- Drinking water sampling – practical demonstration
- Surface water sampling – practical demonstration

13:00 **Slovak Hydrometeorological Institute**
(Jeséniova 17, Bratislava)

- Monitoring equipment
- Network introduction

Friday 29 April

09:00 **Mobile/emergency monitoring capabilities in Bratislava**
(Trnavská cesta 52, Bratislava)

- Emergency radioactivity monitoring and prognosis software
- Emergency set of monitoring equipment

11:00 **Review of SK data on the Commission Art. 35 database**

13.00 **Water Research Institute**
(Nábrežie armádneho generála L. Svobodu 5, Bratislava)

- Radiological water laboratory

15.30 **Closing meeting**
(*Trnavská cesta 52, Bratislava)*

ANNEX 2

ENVIRONMENTAL RADIOACTIVTIY MONITORING PROGRAMME IN THE SLOVAK REPUBLIC

Main monitored media Environmental media monitored		On-line continuous monitoring	Off-line monitoring	
			Continuous collection, periodic measurement	Periodic samples collection followed by measurement
Air	☒ Ambient dose rate	☒	☐	☒
	☒ Integrated dose	☐	☒	☐
	☒ Aerosols	☒	☒	☐
	☐ Radon (outdoor)	☐	☐	☐
	☒ Rain (precipitation)	☐	☒	☐
	☒ Dry atmospheric deposition	☐	☒	☐
Water	☒ Groundwater	☐	☐	☒
	☒ Surface water	☐	☐	☒
	☒ Sediment	☐	☐	☒
	☒ Drinking water	☐	☐	☒
	☐ Seawater	☐	☐	☐
	☐ Sewage water	☐	☐	☐
	☒ Aquatic biota	☐	☐	☒
Soil	☒Cultivated	☐	☐	☒
	☐Uncultivated	☐	☐	☐
Vegetation	☒ Leafy vegetables	☐	☐	☒
	☒ Other vegetables and fruits	☐	☐	☒
	☒ Grain	☐	☐	☒
	☒ Grass	☐	☐	☒
	☒ Others: moss, mushrooms, feed, algae, etc.	☐	☐	☒
Food	☒ Milk	☐	☐	☒
	☒ Meat	☐	☐	☒
	☒ Fish	☐	☐	☒
	☒ Mixed diet	☐	☐	☒
	☒ Others: food products, flour, rice, poppy, tea, etc.	☐	☐	☒
Industrial*	☒ Dose rate	☒	☐	☐
	☒ Integrated dose	☐	☒	☐
	☒ Other media? Please specify: Environmental, foodstuff and drinking water samples around Mochovce NPP and Bohunice NPP	☐	☐	☒

(*) Industries discharging radioactivity in the environment, which should monitor the radioactive discharges in the receiving media.

ANNEX 3

ENVIRONMENTAL RADIOACTIVTIY MONITORING LABORATORIES IN THE SLOVAK REPUBLIC

Executive organisation/Laboratory	Monitoring programs in which the organisation/laboratory is involved		Other information on executive organisation/laboratory
Public Health Authority of the Slovak Republic in Bratislava and Regional Public Health Authorities in Banska Bystrica and Kosice Location: Bratislava, Banská Bystrica and Košice	Air	☒ Ambient dose rate ☒ Integrated dose ☒ Aerosols ☒ Rain (precipitation) ☒ Dry atmospheric deposition	ISO 17025 accredited[1]: ☒ Yes - ☐ No Authorized by competent authority: ☐ Yes - ☐ No Recognized by nuclear regulatory body: ☐ Yes - ☐ No Involved in the following monitoring situations: ☒ Routine - ☒ Emergency Participation in professional network: ☐ IAEA ALMERA
	Water	☒ Groundwater ☒ Surface water ☒ Sediment ☒ Drinking water ☒ Aquatic biota	
	Soil	☒Cultivated	
	Vegetation	☒ Leafy vegetables ☒ Other vegetables and fruits ☒ Grain ☒ Grass ☒ Others: moss, mushrooms, feed, algae, etc.	
	Food	☒ Milk ☒ Meat ☒ Fish ☒ Mixed diet ☒ Others: food products, flour, rice, poppy, tea, etc.	
	Industrial*	☐ Dose rate ☐ Integrated dose ☐ Other	
Environmental Radiation Monitoring Laboratory of Mochovce NPP Location: Levice	Air	☒ Ambient dose rate ☒ Integrated dose ☒ Aerosols ☒ Rain (precipitation) ☒ Dry atmospheric deposition	ISO 17025 accredited: ☐ Yes - ☒ No Authorized by competent authority: ☒ Yes - ☐ No Recognized by nuclear regulatory body: ☒ Yes - ☐ No Involved in the following monitoring situations:
	Water	☒ Groundwater ☒ Surface water ☒ Sediment ☒ Drinking water ☒ Aquatic biota (algae)	
	Soil	☒ Uncultivated	
	Vegetation	☒ Leafy vegetables ☒ Other vegetables and fruits	

Executive organisation/Laboratory	Monitoring programs in which the organisation/laboratory is involved		Other information on executive organisation/laboratory
		☒ Grain ☒ Grass	☒ Routine - ☒ Emergency Participation in professional network: ☒ IAEA ALMERA
	Food	☒ Milk ☒ Fish	
	Industrial*	☒ Dose rate ☒ Integrated dose ☒ Other media? Environmental, foodstuff and drinking water samples around Mochovce NPP	
Environmental Radiation Monitoring Laboratory of Bohunice NPP Location: Trnava	Air	☒ Ambient dose rate ☒ Integrated dose ☒ Aerosols ☒ Rain (precipitation) ☒ Dry atmospheric deposition	ISO 17025 accredited: ☐ Yes - ☒ No Authorized by competent authority: ☐ Yes - ☐ No Recognized by nuclear regulatory body: ☒ Yes - ☐ No Involved in the following monitoring situations: ☒ Routine - ☒ Emergency Participation in professional network: ☒ IAEA ALMERA ☒ Others: ASLAB
	Water	☒ Groundwater ☒ Surface water ☒ Sediment ☒ Drinking water ☒ Aquatic biota	
	Soil	☒ Cultivated ☒ Uncultivated	
	Vegetation	☒ Leafy vegetables ☒ Other vegetables and fruits ☒ Grain ☒ Grass ☒ Others: Clover	
	Food	☒ Milk	
	Industrial*	☒ Dose rate ☒ Integrated dose ☒ Other: Environmental, foodstuff and drinking water samples around Bohunice NPP	

(1) PHA laboratory in Bratislava has only a certified management system (based on ISO 9001); RPHA laboratory in Banská Bystrica has accreditation (based on ISO 17025) for drinking water sampling and analysis