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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

LATVIA
Riga

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

11 - 13 October 2022

Reference: LV 22-04

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	Riga, Latvia
DATES	11 – 13 October 2022
REFERENCE	LV 22-04
TEAM MEMBERS	Mr Vesa Tanner (Team leader) Mr Raf Van Ammel
REPORT DATE	27 February 2023
SIGNATURES	

V. Tanner R. Van Ammel

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Abbreviations

AMS	Automatic Monitoring Station
BIOR	Institute of Food Safety, Animal Health and Environment
CBRN	Chemical, Biological, Radiological, Nuclear
EC	European Commission
EURDEP	EUropean Radiological Data Exchange Platform
GM	Geiger-Müller
HPGe	High-purity Germanium
IAEA	International Atomic Energy Agency
JRC	Joint Research Center
LEGMC	Latvian Environmental, Geological and Meteorological Centre
LIMS	Laboratory Information Management System
LLD	Lower Limit of Detection
LOQ	Limit of Quantification
MDA	Minimum Detectable Activity
MDL	Minimum Detectable Level
NaI	Sodium-Iodine (Detector)
NPP	Nuclear Power Plant
PE	Polyethylene
REM	EC Radioactivity Environment Monitoring database
TLD	Thermoluminescent dosimeter

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 Latvia of its decision to conduct an Article 35 verification in a letter addressed to Latvia Permanent Representation to the European Union. The Ministry of Environmental Protection and Regional Development of Latvia 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 20 September 2022

2.3 PROGRAMME OF THE VISIT

The Commission and the Ministry of Environmental Protection and Regional Development 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 Latvian 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:

Name	Organisation and position
Mr Edgars Barons	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, Head of Laboratory
Mr Andris Abramenkovs	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, Leading Analyst
Ms Madara Vanaga	Ministry of Environmental Protection and Regional Development of the Republic of Latvia, Senior Expert in Environmental Quality and Waste Management Division
Ms Kristīne Kazerovska	Ministry of Environmental Protection and Regional Development of the Republic of Latvia, Deputy director of the Environmental Protection Department
Ms Sandija Sniķere	Ministry of Environmental Protection and Regional Development of the Republic of Latvia, Head of Environmental Quality and Waste Management Division
Ms Aija Grīvīte	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, senior nuclear engineer, Information analysis department Chemical and hazardous waste division, function - supervision of the implementation and implementation of the environmental monitoring program of the radioactive waste repository "Radons"
Mr Egils Sparāns	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, radiological physicist, Information analysis department Chemical and hazardous waste division, function - measurements of gamma radiation dose rates in environment and premises, radioactive surface contamination of working premises, water, soil and air samples collecting and pre-treatment
Mr Vents Villers	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, radiological physicist, Information analysis department Chemical and hazardous waste division, function - implementation of the environmental monitoring program of the radioactive waste repository "Radons"
Mr Atis Konošonks	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, hydrologist, Monitoring department Field work division, surface and drinking water sampling
Mr Jānis Derums	State limited Liability Company “Latvian Environmental, Geological and Meteorological Centre”, dosimetrist, Information analysis department Chemical and hazardous waste division, function – implementation of the environmental monitoring program of the Salaspils research reactor

Name	Organisation and position
Ms Dace Šatrovska	Radiation Safety Centre of State Environmental Service, Director
Ms Linda Meistere	Radiation Safety Centre of State Environmental Service, Head of Inspection Division
Ms Džeina Zāģere	Radiation Safety Centre of State Environmental Service, Senior Inspector
Ms Liene Strīķe	Radiation Safety Centre of State Environmental Service, Senior Inspector
Ms Kristina Kokina	Institute "BIOR", Head of Elemental Analisys group, Laboratory of Chemistry
Ms Olga Kiriļina- Gūtmane	Institute "BIOR", Senior Expert of Elemental Analisys group, Laboratory of Chemistry
Ms Santa Līviņa	Food and Veterinary Service of Latvia, Senior expert
Ms Sarmīte Spiģere	Food and Veterinary Service of Latvia, Senior expert

3 LEGAL FRAMEWORK FOR RADIOACTIVITY MONITORING IN LATVIA

3.1 LEGISLATIVE ACTS REGULATING ENVIRONMENTAL RADIOACTIVITY MONITORING

The list below presents the Latvian legislation, which forms the basis for environmental radioactivity monitoring.

- Law on Radiation Safety and Nuclear Safety (23 November 2000) (https://likumi.lv/ta/en/en/id/12484-law-on-radiation-safety-and-nuclear-safety);
- Environmental Protection Law (28 December 2006) (https://likumi.lv/ta/en/en/id/147917-environmental-protection-law);
- Regulations for Protection against Ionising Radiation (Regulation No.149, 9 April 2002) (https://likumi.lv/ta/en/en/id/61173-regulations-for-protection-against-ionising-radiation);
- Regulations Regarding Notification, Registration, and Licensing of Activities with Sources of Ionising Radiation (Regulation No.65, 28 January 2021) (https://likumi.lv/ta/en/en/id/320612-regulations-regarding-notification-registration-and-licensing-of-activities-with-sources-of-ionising-radiation);
- Requirements for Operations with Radioactive Waste and Materials Related Thereto (Regulation No 129, 19 March 2002) (https://likumi.lv/ta/en/en/id/60882-requirements-for-operations-with-radioactive-waste-and-materials-related-thereto);
- Cabinet Order No 583 “Environmental Policy Framework 2021-2027” (31 August 2022) (https://likumi.lv/ta/id/335137-par-vides-politikas-pamatnostadnem-20212027-gadam).

List of legislative acts establishing the responsibilities of the various actors in this domain

- Law on Radiation Safety and Nuclear Safety (23 November 2000) (https://likumi.lv/ta/en/en/id/12484-law-on-radiation-safety-and-nuclear-safety)
- Regulations for Protection against Ionising Radiation (Regulation No.149, 9 April 2002) (https://likumi.lv/ta/en/en/id/61173-regulations-for-protection-against-ionising-radiation)
- Cabinet Order No 448 “On liquidation of State Agency “Latvian Environmental, Geological and Meteorological Agency” and State Hazardous Waste Management Agency and establishment of State Limited Liability Company “Latvian Environmental, Geological and Meteorological Centre” (1 July 2009) https://likumi.lv/ta/id/194489-par-valsts-agenturas-latvijas-vides-geologijas-un-meteorologijas-agentura-un-bistamo-atkritumu-parvaldibas-valsts-agenturas-likvidaciju-un-valsts-sabiedribas-ar-ierobezotu-atbildibu-latvijas-vides-geologijas-un-meteorologijas-centrs-dibinasanu
- Cabinet Order No 583 “Environmental Policy Framework 2021-2027” (31 August 2022) (https://likumi.lv/ta/id/335137)

3.2 LEGISLATIVE ACTS REGULATING RADIOLOGICAL SURVEILLANCE OF FOODSTUFFS

The list below presents the Latvian legislation, which forms the basis for legislative acts regulating the radiological surveillance of foodstuffs

- Law on Radiation Safety and Nuclear Safety (23 November 2000) (https://likumi.lv/ta/en/en/id/12484-law-on-radiation-safety-and-nuclear-safety)
- Regulations for Protection against Ionising Radiation (Regulation No.149, 9 April 2002) (https://likumi.lv/ta/en/en/id/61173-regulations-for-protection-against-ionising-radiation)
- Mandatory Harmlessness and Quality Requirements for Drinking Water, and the Procedures for Monitoring and Control Thereof (Regulation No.671, 14 November 2017) (https://likumi.lv/ta/en/en/id/295109-mandatory-harmlessness-and-quality-requirements-for-drinking-water-and-the-procedures-for-monitoring-and-control-thereof)

List of legislative acts establishing the responsibilities of the various actors in this domain

- Law on Radiation Safety and Nuclear Safety (23 November 2000) (https://likumi.lv/ta/en/en/id/12484-law-on-radiation-safety-and-nuclear-safety)
- Regulations for Protection against Ionising Radiation (Regulation No.149, 9 April 2002) (https://likumi.lv/ta/en/en/id/61173-regulations-for-protection-against-ionising-radiation);
- Mandatory Harmlessness and Quality Requirements for Drinking Water, and the Procedures for Monitoring and Control Thereof (Regulation No.671, 14 November 2017) (https://likumi.lv/ta/en/en/id/295109-mandatory-harmlessness-and-quality-requirements-for-drinking-water-and-the-procedures-for-monitoring-and-control-thereof)

3.3 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 LATVIA

4.1 MINISTRY OF ENVIRONMENTAL PROTECTION AND REGIONAL DEVELOPMENT

The responsibility of the overall environmental radioactivity monitoring in Latvia is under the Ministry of the Environment Protection and Regional Development. The Ministry plans the monitoring programme and coordinates the work between the executive bodies below.

4.2 STATE LIMITED LIABILITY COMPANY "LATVIAN ENVIRONMENTAL, GEOLOGICAL AND METEOROLOGICAL CENTRE"

The State limited liability company "Latvian Environmental, Geological and Meteorological Centre" (LEGMC) coordinates and organises environmental radioactivity monitoring, including radioactivity in the surface water and drinking water. LEGMC as an operator carries out environmental radiation monitoring at two sites: the research reactor in Salaspils and the radioactive waste near-surface repository "Radons" in Baldone. Regarding these delegated responsibilities, the LEGMC is supervised by the Ministry of the Environmental Protection and Regional Development.

The LEGMC laboratory employs altogether 42 people, four of them work on radiation monitoring issues.

4.3 RADIATION SAFETY CENTRE OF THE STATE ENVIRONMENTAL SERVICE

The State Environmental Service (SES) is an institution under the Ministry of Environmental Protection and Regional Development. One of the main tasks of the SES is to perform monitoring and control of the radiation and nuclear safety in accordance with the procedures specified in the regulatory acts regulating radiation safety and nuclear safety.

SES was established on January 1, 2005. Its main office and its Radiation Safety Centre (RSC) are located in Riga. It is responsible for coordination of response to radiological emergencies and for providing information to the public.

The RSC has been a structural unit of the SES since 1 July 2009. RSC is the national competent authority in the field of radiation and nuclear safety. It has the following tasks:

- issue licences and control the users of ionising radiation sources;
- inform workers and public regarding radiation safety;
- prepare reports and legislation proposals;
- create and update databases on radiation workers and radioactive sources;
- co-ordinate technical assistance programmes;
- ensure identification and recovery of discovered unknown radiation sources (incl. state borders);
- ensure 24-hour readiness for early notification of a nuclear accident.

The RSC organises the monitoring of ambient radiation dose and dose rate, maintains a network of monitoring stations and ensures availability of monitoring data to the public and the European Commission EURDEP system. RSC provides annual reports on public ambient radiation dose.

According to the National Civil Protection Plan, the responsibilities of the RSC in the case of a large-scale radiological emergency are to notify other institutions about emergency, perform situation assessment, provide recommendations for the public and involved institutions, and assist in performing environmental monitoring. In case of a local scale emergency, the RSC performs a detailed inspection of the radiation source or radioactive contamination to make sure the radiation safety and nuclear safety requirements are met.

The RSC employs a staff of 15 people: Director, Head of the inspection division, 8 inspectors (of whom 3 are specialised in emergency management), head of licencing division, 3 experts and 1 project coordinator. Not all positions are always filled.

4.4 FOOD AND VETERINARY SERVICE OF LATVIA

The Food and Veterinary Service (FVS) is the authority responsible for the foodstuff sampling programme in Latvia. FVS is a direct administration authority under the supervision of the Ministry for Agriculture. It is responsible for organising the radioactivity monitoring of foodstuffs and providing this information to the RSC SES. The laboratory and diagnostic investigations related to radiological monitoring of foodstuffs are performed by the Institute of Food Safety, Animal Health, and Environment (Institute BIOR), which is a public research institute.

4.5 RADIOLOGICAL EMERGENCY MONITORING

In the event of a nuclear and radiological emergency, the monitoring responsibilities lie with several ministries. According to the National Civil Protection Plan, in local scale radiation accidents the response and mitigation of the accident lies on the RSC SES, but in regional or national scale radiation accidents the response and mitigation lies on the Ministry of Environmental and Regional Development.

It is possible for the RSC SES to receive assistance for dose rate measurements with radiation measuring equipment (e.g., personal radiation detectors) from other institutions to assess the radiological situation. Such radiation measuring equipment is available at the State Fire and Rescue Service, LEGMC, Health Inspectorate, National Armed Forces, Emergency Medical Services and State Border Guards. Using the obtained measurement results, the RSC SES can assess whether additional sample measurements are required in the laboratory (water, soil, food).

If soil, food or water is contaminated, the FVS, in consultation with the RSC SES, organises radiation monitoring of food products in the territory of Latvia. The Institute BIOR performs the measurements. The Health Inspectorate, in consultation with the RSC SES, organises the radioactivity monitoring of drinking water. LEGMC takes surface water and soil samples for the assessment of the radiation situation.

5 RADIOACTIVITY MONITORING IN RIGA

5.1 INTRODUCTION

There are no nuclear power plants in the Riga area. The main radiological facilities in the vicinity of Riga are:

- The research reactor site at Salaspils (Salaspils Research Reactor, SRR). The reactor is out of operation since July 1998 and its decommissioning started in 1999. Waste conditioning installations were installed on site (e.g. for cementation). The spent fuel was sent to Mayak in Russia in May 2008 within a bilateral governmental agreement. Conditioned waste were transported to the "Radons" waste repository.
- The national radioactive waste near-surface repository “Radons” in Baldone. The repository is designed for disposal of low-level waste (LLW according to IAEA classification).

Environmental radioactivity monitoring systems are installed to assess the radiation situation in Latvia. There are no nuclear power facilities in Latvia, but it is necessary to carry out an assessment of the impact of the existing facilities and to monitor possible cross-border pollution by implementing appropriate monitoring. The closest operational nuclear site is the Belarusian NPP in Belarus (~110 km from state border). Ignalina NPP (under decommissioning) in Lithuania could be also a possible source of elevated radioactivity in the environment on the Latvian territory.

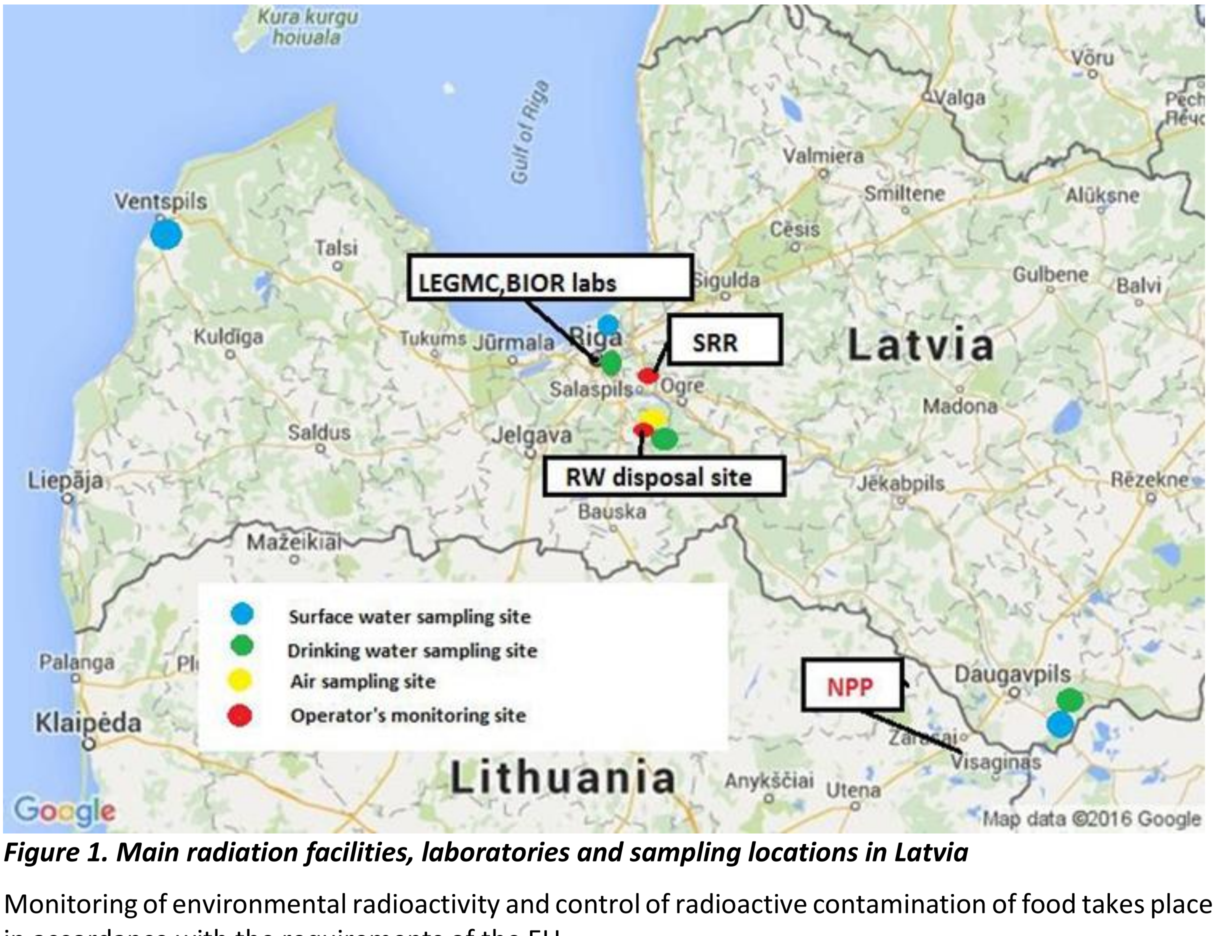

Figure 1. Main radiation facilities, laboratories and sampling locations in Latvia

Monitoring of environmental radioactivity and control of radioactive contamination of food takes place in accordance with the requirements of the EU.

LEGMC coordinates and organises the state environmental monitoring, including the city of Riga. The basic principles of environmental radioactivity monitoring are defined in the Law "On Radiation Safety and Nuclear Safety", while monitoring is implemented in accordance with the Environmental Monitoring Program (hereinafter ‘the Program’). The Program determines the responsible institutions for the monitoring, the environmental monitoring network, parameters, regularity and methods to be used. The Program consists of four sections: Air monitoring program, Water monitoring program, Soil monitoring program and Biological monitoring program. In addition to the monitoring of environmental radioactivity according to the Program, the data obtained by the operators managing sources of ionizing radiation of national importance are also considered.

In addition to the national environmental radioactivity monitoring, the operator who has a licence to perform activities with sources of ionising radiation, and who is responsible for the radiation safety and nuclear safety in the area controlled thereby, also are responsible for implementing environmental radioactivity monitoring.

5.2 AUTOMATIC MONITORING NETWORKS

Latvia operates an on-line continuous environmental monitoring network mainly focused on the air component. A total of 20 stationary spectrometric monitoring stations (AMS) (ENVINET RAMS-01) are installed on the territory of Latvia for measuring the ambient gamma dose rate in air (Fig. 2). These stations are also equipped with radionuclide identification capabilities. Four of the 20 dose rate stations are located in the Riga area (Jelgava, Baldone (2 stations) and Salaspils). In addition, there is one automatic station measuring dose rate in water (Daugava). One mobile automatic monitoring station is also available in Latvia.

All stations use NaI detectors; they are operated with a time resolution of 10 minutes both in routine and in emergency situations. In emergency situations the time resolution can be modified. Typical LLD for dose rate is 0.01 µSv/h; the LLD for I-131 and I-133 is in the order of 190 Bq/m^3. The stations operate in the gamma energy range of 30 keV – 3 MeV.

Additionally, there is one automatic aerosol monitoring station (ENVINET RAMS-01-A) in Daugavpils, using a $Bi_4Ge_3O_{12}$ (Bismuth Germanate) detector. It operates with a time resolution of 10 minutes both in routine and in emergency situations. This station has LLD values in the order of 10 mBq/m^3 for beta and gamma emitters, and 4 mBq/m^3 for alpha emitters.

There are also two automatic measurement stations (ENMS WGS-D5b) located in Kekava and Kraslava for the radiological monitoring of surface waters. These stations use NaI detectors; they are operated with a time resolution of 10 minutes both in routine and in emergency situations. The LLD values for Cs-137 of these stations are as follows:

- 0.55 Bq/L for 1-hour measurement.
- 0,2 Bq/L for 24-hours measurement;
- $5x10^{-3}$ Bq/L for 30-days measurement;

The RSC SES radiation monitoring network also includes two automatic river water monitoring stations. They are located at the river Daugava. Monitoring stations are necessary to assess the radiological situation in the Daugava in the event of a nuclear accident. The Daugava river water is used as drinking water in Riga.

The on-line radiation monitoring systems are operated by the RSC SES with specialized software, which processes the data obtained by the stations. The stations provide continuous radiation monitoring, i.e. perform gamma radiation dose rate and spectral measurements, measurements of radionuclide concentration in air aerosols, and measurements of alpha/beta radiation. The system software provides centralized management and control of the stations' operations. The software provides processing and evaluation of the radiation monitoring data, as well as visualization of the measurement data in graphs, tables and on digital maps.

All data is stored in a central database server. Every 10 minutes the measurement data is sent automatically from the monitoring stations to the central database server in on-line mode. Ambient gamma dose rate data are also communicated to the EURDEP platform. Staff of the State Environmental Service follow the results of radiation measurements in a 24/7 regime.

For ensuring continuous operation, as well as regular calibration and maintenance, a service contract has been concluded with the Limited Liability Company "Dozimetrs" on ensuring the maintenance of the radiation monitoring early warning system. The contract includes technical specifications and the requirements for system maintenance.

Specifically, near Riga there is one spectrometric AMS and one mobile spectrometric AMS, one water AMS in Kekava Municipality, one spectrometric AMS in Salaspils (near the Salaspils Research Reactor site) and two spectrometric AMS stations in Baldone (near the national radioactive waste near-surface repository Radons).

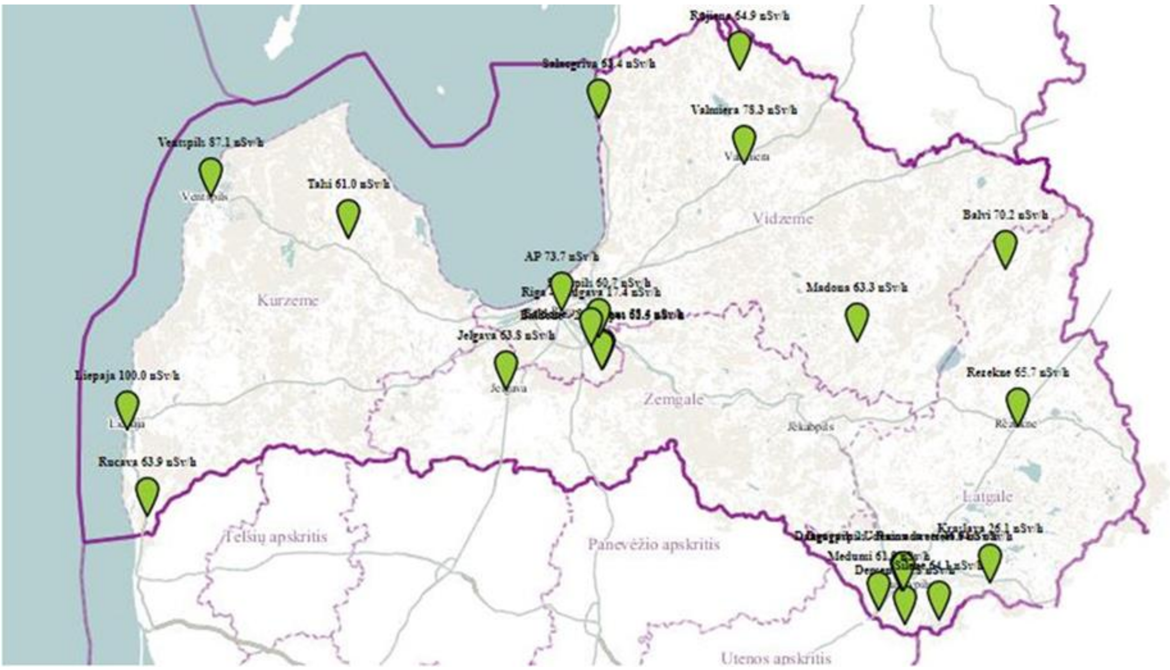

Figure 2. Automatic radiation dose rate monitoring locations in Latvia

5.3 ENVIRONMENTAL SAMPLING

5.3.1 General

Latvia has a national off-line radioactivity monitoring programme covering the following:

- Aerosols
- Surface-, drinking- and sea water
- Sediments
- Vegetables, fruits, grain
- Milk, meat, fish, mixed diet, and some imported foodstuffs such as dried aromatic herbs, spices and vegetable seasonings, berries, wild mushrooms and products from Japan.

Table I presents the programme outline. Aerosol monitoring is based on continuous sampling followed by periodic (off-line) measurement and analysis (aerosols at the 'Radons' site in Baldone).

The off-line monitoring programme for water and air in Latvia is focused on the radiological sites. Additionally, specific attention is paid to the area nearby the Ignalina NPP in Lithuania.

The sampling and measurement frequency depends on complexity of the sampling and/or measurement (from 6 times a year to once a year).

Table I. Main radionuclides monitored within the off-line program in Latvia

Off-line monitored media	Main radionuclides monitored	Measurement frequency (Riga frequency in brackets)
Aerosols	Be-7, Cs-137, K-40, Th-232, U-238, iodine radionuclides and other gamma radionuclides	12 samples/year (sampling performed for 1 week, 4 times/ year)
Surface water	Gross alpha/beta counting, Cs-137	12 (4) samples/year (sampling performed 4 times /year)
Drinking water	H-3, Ra-222, gross alpha/beta counting, Cs-137	16 (8) samples/year (sampling 4 times/year)
Other vegetables and fruits, grain	Cs-137, Sr-90	30 samples/year (sampling 2 to 3 times/year)
Milk	Cs-137, K-40 (not in raw milk), Sr-90	50 samples/year (sampling 4 times/year for cow milk samples and 1 time/year for raw milk samples)
Meat	Cs-137, Sr-90	30 samples/year (sampling 6 times/year)
Fish	Cs-137, Sr-90	30 samples per year (sampling 6 times/year)
Mixed diet	Cs-137, Sr-90, K-40	4 samples/year (sampling 4 times/year)
Other foodstuffs: Food supplements, dried aromatic herbs, spices and vegetable seasonings, berries, wild mushrooms and products from Japan	Food supplements (treatment with ionising radiation), dried aromatic herbs, spices and vegetable seasonings (treatment for ionising radiation), berries (Cs-134, Cs-137, I-131, Ru-103, Ru-106, Am-241), wild mushrooms (Cs-137, Cs-134 (together with k-40)) and products from Japan (Cs-137, Cs-134)	Around 10-20 samples/year

In addition to the national programme, there are two site-specific monitoring programs:

- Monitoring of the National Radioactive Waste Near-Surface Repository “Radons”. The LEGMC establishes the monitoring programme and coordinates this programme with the RSC SES. LEGMC carries out the programme. The main parameters to be monitored are radiation in ambient air, radioactive surface contamination of working premises, specific activity of ground/surface water and radioactive contamination of precipitation, soil, and plants.
- Monitoring of the Salaspils Research Reactor. The LEGMC establishes the monitoring programme and coordinates this programme with the RSC SES. It covers groundwater, sewage, ground deposition, precipitation, soil, and radiation in the ambient air. The programme is implemented by the LEGMC.

5.3.2 Air

There is one air filtration facility located in the national radioactive waste near-surface repository “Radons” in Baldone. The LEGMC maintains the facility and takes a sample at least once a month. Analytical laboratory methods are used to determine ^{137}Cs and ^{7}Be on aerosol filters. If the ^{137}Cs activity exceeds 0.3 Bq/m^3, also ^{90}Sr and other radionuclides are measured.

Air sampling is performed using the following parameters:

- Filter type: Petryanov filter cloth

- Flow rate: 1000 m^3/h
- Filter size: 1050 x 320 mm
- Operation time: 1 week every month

LEGMC carries out aerosol radioactivity monitoring as shown in Table II.

Table II. Aerosol radioactivity monitoring programme in Baldone

No	Position	Latitude	Longitude	Frequency	Assessed radionuclides
1	"Radons" in Baldone	56,76345	24,328156	12 / year	^{7}Be, ^{137}Cs, ^{40}K, ^{232}Th, ^{238}U, iodine radionuclides, other gamma radionuclides

5.3.3 Atmospheric deposition

Radioactivity monitoring of dry/wet deposition is performed in operator-controlled zones, not within the framework of national environmental monitoring programme.

5.3.4 Surface waters

LEGMC carries out the monitoring programme in the Daugava river, as described in Table III. Sampling quantities are 20 l for gamma analysis and 250 ml for total alpha and beta analysis.

Table III. Daugava river water sampling programme

No	River	Position	Latitude	Longitude	Frequency	Assesses radionuclides
1	Daugava	Daugava, estuary	57.05687299	24.0467069	4 / year	$\sum\alpha$, $\sum\beta$, ^{137}Cs

5.3.5 Ground water and drinking water

Within the framework of the national environmental radioactivity programme, the LEGMC carries out sampling of drinking water in accordance with Table IV. Sampling quantities are 20 l for gamma analysis, 250 ml for total alpha and beta, 250 ml for tritium and 20 ml for radon analysis.

Ground water monitoring is carried out by the LEGMC in the operator supervised zones, i.e. the national radioactive waste near-surface repository “Radons” in Baldone and the Salaspils Research Reactor site.

Table IV. LEGMC drinking water monitoring programme

No	City	Position	Latitude	Longitude	Frequency	Assessed radionuclides
1	Baldone	Baldones city, Riga Street 67	56,082694	27,261888	4 / year	^{3}H, ^{222}Ra, $\sum\alpha$, $\sum\beta$, ^{137}Cs
2	Riga	Brīvības Street	55,744694	26,541888	4 / year	^{3}H, ^{222}Ra, $\sum\alpha$, $\sum\beta$, ^{137}Cs
3	Daugavpils	Vingri	55,892633	26,549531	4 / year	^{3}H, ^{222}Ra, $\sum\alpha$, $\sum\beta$, ^{137}Cs
4	Daugavpils	Ziemeļi	55,910811	26,539736	4 / year	^{3}H, ^{222}Ra, $\sum\alpha$, $\sum\beta$, ^{137}Cs

5.3.6 Soil, sediments and aquatic biota

Within the framework of the national environmental radioactivity monitoring programme in Riga, soil sampling is not implemented. However, it is carried out by the LEGMC in the operator supervised zones i.e., the national radioactive waste near-surface repository “Radons” in Baldone and at the Salaspils Research Reactor.

Terrestrial and aquatic biota and flora radioactivity control is not implemented in Latvia.

5.4 FOOD SAMPLING

5.4.1 Milk

In accordance with the Regulation for Protection Against Ionising Radiation, milk sampling is carried out four times per year at two sites, as presented in Table V. In addition, raw milk samples are taken in milk processing enterprises (Table VI).

Table V. Milk monitoring

No	Food stuffs samples	Sampling site	Number of samples	Frequency	Assessed radionuclides
1	Cow milk	Demene district	5	4 times per year	^{137}Cs, ^{40}K, ^{90}Sr
2	Cow milk	Medumi district	5	5 times per year	^{137}Cs, ^{40}K, ^{90}Sr

Table VI. Raw milk monitoring

No	Food stuffs samples	Sampling site	Number of samples	Frequency	Assessed radionuclides
1	Raw milk	Milk processing enterprise	3	1 time per year	^{137}Cs, ^{90}Sr

5.4.2 Mixed diet

Mixed diet samples are taken in one of the largest Latvian public catering enterprises, which is located in the Pauls Stradiņš Clinical University Hospital in Riga. Each sample consists of three meals (breakfast, lunch, dinner).

Table VII. Mixed diet monitoring

No	Food stuffs samples	Sampling site	Number of samples	Frequency	Assessed radionuclides
1	Daily food samples	Pauls Stradiņš Clinical University Hospital	4	4 times per year	^{137}Cs, ^{40}K, ^{90}Sr

5.4.3 Foodstuffs

Sampling for foodstuffs in Latvia is carried out in accordance with the FVS Radiation Safety Control Programme, adopted on 22 January 2021. Samples are taken in accordance with the sampling procedure KR.10.P.229 "Methodological guidelines for food stuffs sampling for testing in laboratories to determine the level of radiation pollution and assess testing results". Fish samples are taken from Baltic Sea fish used as raw material in food production companies. Meat samples are taken in slaughterhouses – animals can be delivered from all over Latvia. Vegetables (beetroots, potatoes, carrots) are taken in the eastern and south-eastern part of Latvia.

Table VIII. Foodstuffs monitoring

No	Food stuffs samples	Number of samples	Frequency	Assessed radionuclides
1	Fish	3	once a year	^{137}Cs, ^{90}Sr
2	Meat	3	once a year	^{137}Cs, ^{90}Sr
3	Vegetables	3	once a year	^{137}Cs, ^{90}Sr

5.5 MOBILE MONITORING

The RSC SES has terrestrial mobile radiation monitoring equipment, which consists of one mobile AMS monitoring station (for in-situ ambient gamma dose rate) equipped with a GPS system, one mobile radiation survey system and several hand-held radiation monitoring devices. In addition, the fire brigades have dose rate monitors as a standard equipment in each fire truck.

LEGMC or BIOR laboratories do not possess any mobile monitoring equipment.

There is no marine or airborne radiation mapping capability in Latvia.

6 ANALYTICAL LABORATORIES

6.1 LEGMC RADIOLOGICAL LABORATORY

6.1.1 Introduction

The LEGMC Environmental Laboratory Division has two main departments, both located at the LEMGC headquarters in Riga: the individual TLD dosimetry and the Material radioactivity testing departments. LEGMC reports to the Ministry of Environmental Protection and Regional Development.

The Environmental Laboratory Division is responsible for most of the analytical measurements of the national and site-related environmental monitoring programmes in Latvia. It measures radionuclides in groundwater, surface water, precipitation, soil (operator's monitoring programme), air filters and biological samples (pine needles from Baldone).

The LEGMC possess an ISO 9001:2015 certificate; the laboratory has an ISO 17025:2017 accreditation covering both the above-mentioned departments, valid until 4 December 2023. Whether it will be continued depends to a large extent on the number of personnel at the laboratory.

Laboratory TLD sector is equipped with RADOS and MIRION TLD readers and one MIRION TLD irradiator. These are used for personnel dosimetry; there is no TLD application in environmental measurements.

6.1.2 Sample reception

LEGMC laboratory staff collects most of the samples themselves. The procedures for sampling, analysis and data handling are defined (labelling of samples, responsibilities of individuals, record keeping, etc.) according to QA manuals LP70300 and LIN70300. Incoming samples are registered in the laboratory registration book and entered into the LIMS programme "STARLIMS". Every sample receives an individual identification number.

6.1.3 Sample preparation

LEGMC laboratory has two calibrated furnaces for drying or ashing samples and a calibrated drying cabinet. The laboratory uses electrical scales, which are calibrated by an external calibration service every two years.

For size reducing activities, the laboratory has sample crushing and milling facilities.

6.1.4 Sample measurements

The following measurement devices are available in the laboratory:

- Ortec gamma-ray spectrometer (50% detector relative efficiency);
- Canberra gamma-ray spectrometer (40% detector relative efficiency);
- Liquid scintillation counter: Quantulus 1220 for determination of tritium, radon, total alpha and beta in water samples;
- Eberline FHT-40G radiometer with alpha, beta and gamma probes for determination of gamma fields and surface contamination.

The Ortec gamma-ray spectrometer is used for water sample measurements. 1L, 0,5 L Marinelli beakers and 1 L plastic bottles are used for gamma radioactivity measurements. According to the manual, the counting time should be ≥24 hours, depending on necessary accuracy and MDL. The spectrometer is calibrated annually.

The Canberra gamma spectrometer is used for soil, biota and filter sample measurements. Different geometries are used: 1 l Marinelli beaker, 0.5 l Marinelli beaker, 170 ml beaker G170 and plastic bottle with 100 ml volume for gamma radioactivity measurements. According to the manual, the counting time should be ≥24 hours, depending on necessary accuracy and MDL. The spectrometer is calibrated annually.

The liquid scintillation counter Quantulus 1220 is used for determination of tritium, radon, gross alpha and beta in water samples. Each type of measurement has different counting times, according to the manuals. Tritium activity usually is measured for 12 hours, radon activity 6 hours, and total alpha/beta for 24 hours. Each method is validated annually.

Measurement results are processed using STARLIMS, according to the Quality Assurance manual LIN 71100. All measurement certificates are prepared using STARLIMS. This system also deals with archiving procedures. Results are also printed out and stored in corresponding file for 10 years, according to the Quality Assurance handbook.

6.1.5 Data handling and reporting tools

Data handling is done on Excel-spreadsheets and computer programme "STARLIMS". Spectrum analysis and activity calculations are done with the analysis programmes Canberra Genie 2000**,** Gamma Vision-32 or Easy View. Correction coefficients for density and coincidence summing are added manually on Excel spreadsheets.

Detector test results are transferred into the STARLIMS system for the preparation of test certificates.

Environmental sample results for the national radioactive waste near-surface repository "Radons" in Baldone are submitted to the Baldone municipality and to the RDC annually by the LEGMC. Environmental data for air, surface and drinking water is reported to the REM database annually.

6.1.6 Sample storage requirements

Environmental samples (air, surface and drinking water) are stored for 1 year. The same procedure is used for operator's monitoring samples, and in most cases also for the commercial samples. Radon measurement samples are discarded after the measurements. Disposal of samples is regulated by the Quality Assurance manual LP 70401.

6.1.7 Quality assurance and control procedures

The laboratory has an ISO 17025:2017 accreditation issued by the Latvian National Accreditation Bureau (LATAK). The laboratory is audited regularly. A quality assurance and control manual is in place and implemented through a compilation of written working instructions.

The accredited methodologies for radioactivity measurements are:

- Determination of radionuclide concentration in water with gamma spectrometry (Method LVS ISO 10703:2021) (2021);
- Determination of radionuclide concentration in construction materials with gamma spectrometry (Method LVS ISO 257:2000) (2017);
- Determination of total alpha and beta activity in water samples using liquid scintillation counter (Method T105-R-01-2017) (2017);
- Determination of tritium activity concentration with liquid scintillation counter (Method LVS ISO 9698:2019) (2019);
- Determination of radon activity concentration with liquid scintillation counter (Method T105-R-02-2017) (2017);
- Determination of alpha, beta and gamma surface radioactivity (Method T105-R-04-2018) (2018);
- Determination of gamma dose rates (Method T105-R-05-2018) (2018).

Calibration of the measurement devices (spectrometers) is done annually by the laboratory staff. The radiometer (ESM FH-40 G -L with probe FHZ 380AB) is calibrated every second year in the Secondary Standard Dosimetry Laboratory of the LEGMC. Calibration of gamma spectrometers' efficiency, energy and peak width (FWHM) is controlled using a ^{137}Cs standard. Calibration procedures for germanium detectors are described in the methodology of measurements. Calibration sources and reference materials are kept in a safe at sufficient distance from germanium detectors.

LEGMC laboratory regularly participates in the IAEA proficiency tests, international ALMERA comparison exercises and JRC ILC proficiency test exercises.

6.2 INSTITUTE BIOR RADIOLOGICAL LABORATORY

6.2.1 Introduction

The BIOR institute is a research centre of national importance; it develops innovative research methods and creates new knowledge in the following areas: public and environmental health, food, fishery, and veterinary medicine.

The Laboratory of Chemistry of the BIOR institute is responsible for analytical measurements related to national surveillance and official control of radioactivity in food and feed. There are two staff members responsible to radioactivity measurements.

BIOR does not outsource radiological analysis to third parties.

6.2.2 Sample reception

Food and feed samples are provided to the laboratory by the state veterinary inspectors or by private laboratory clients. The BIOR laboratory operates an electronic registration system JUNDA, which allows sample registration (date and time of receipt and description of sample (form, amount, packing)).

6.2.3 Sample preparation

BIOR laboratory handles only food samples, so typical sample preparation procedures are drying, ashing and chemical separation for Sr-90 determination. Table IX summarises the preparation and measurement procedures.

Table IX. Sample preparation, measurements and measurement devices at the BIOR laboratory

	Sample preparation methodologies used to prepare samples before measurement	Measurement device	Calibration and maintenance procedures, standards used
^{90}Sr	Sample is grinded, ashed, dissolved in hydrochloric acid and ^{90}Y is extracted with 10% of di (2-ethyl-hexyl) phosphoric acid in toluene, preventing mono- and divalent ions remaining in the acid solution. Then ^{90}Y is extracted from the organic phase with nitric acid and converted to yttrium hydroxide.	Liquid scintillation counter Quantulus 1220	Quality control in every measurement batch with a reference material (Unquenched LSC Standard for Liquid Scintillation Counter, No. 1215-111, Perkin Elmer), built-in calculation of results
^{137}Cs, ^{40}K	Sample is grinded to fill a Marinelli beaker	Gamma spectrometer BSI GS-02-97	Quality control once per week with reference material (IARMA-010, IARMA Limited), built-in calculation of results

6.2.4 Measurement results

The BIOR laboratory is responsible for testing and reporting the obtained test results in accordance with the LVS EN ISO/IEC 17025:2018. According to the internal procedure, data handling proceeds using a PC connected to the measurement device. If necessary, the operator converts the obtained test result according to legislation or method specification. Test results are reported using the electronic registration system JUNDA. A test report is an electronically generated document that contains a time stamp. If the obtained test result is below the quantification limit, the result is reported as below LOQ.

6.2.5 Sample storage requirements

There are specific fridges and freezers for long-term sample storage. Samples are stored and destroyed in accordance with the BIOR internal quality control procedures. According to internal procedure, samples are stored until the end of testing +5 days. In case of repeated testing storage time is 10 days. In case of positive result, sample is stored separately from other samples for 6 months after issuing of test report to client.

6.2.6 Quality assurance and control procedures

BIOR laboratory is accredited according to the LVS EN ISO/IEC 17025:2018 standard "General requirements for the competence of testing and calibration laboratories". The laboratory takes part in proficiency tests and international intercomparison exercises on regular basis (at least once in 5 years).

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 EU 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 MONITORING PROGRAMME

The verification team reviewed the structure of the environmental radioactivity monitoring programme in Latvia, with specific focus on Riga. The team noted the following:

- There is no air sampling system in Riga. Air sampling is performed periodically in Baldone (for one week each month) at 40 km distance from Riga. This periodical sampling is not sufficient to assess the radiological quality of air in the capital city Riga.
- There is no soil or terrestrial biota sampling in Riga. Soil sampling is performed in Baldone and Salaspils.
- Due to lack of funding, monitoring of marine radioactivity on the Latvian coast was discontinued in 2014.

The verification team recommends an air sampling system to be installed in Riga; the system should operate continuously and facilitate monitoring of particulate radioactivity and monitoring of gaseous radioactive Iodine in air in the event of a nuclear emergency.

The verification team recommends including sampling and analysis of radioactivity in either soil or terrestrial biota (grass) in the regular monitoring programme in Riga.

The verification team suggests continuation of the marine radiological monitoring programme (in particular radioactivity in fish and other seafood) on the Latvian territorial waters.

7.3 LEGMC LABORATORY

7.3.1 General

The verification team verified the monitoring facilities at the LEGMC radiological laboratory[4]. The radiological laboratory is a part of the ISO 17025 accredited LEGMC environmental laboratory. All the laboratory facilities are located in the same building. Altogether there are some 42 laboratory staff, 4 of which are working on the radiological laboratory.

The verification team noted that there are no pre-planned arrangements for managing radioactivity samples in an emergency situation, when the number of environmental samples increases, and the

[4] Maskavas iela 165, Latgales priekšpilsēta, Rīga

samples may contain elevated levels of activity. The LEGMC 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 analytical capacity could be increased to facilitate higher sample throughput, but there is no formalised plan for this type of situation.

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

7.3.2 Sample preparation

LEGMC laboratory staff carries out the sampling. Radiological samples arriving in the laboratory include water, food and air filters. In addition, the laboratory carries out TLD reading for personnel dose monitoring (TLDs are not used in the environment monitoring). Soil sampling is not routinely done, but equipment for this is available. Sample management is based on a LIMS system. Samples are labelled with hand-written labels.

The laboratory has the necessary equipment for sample preparation (drying ovens (2), evaporators, furnaces (3) and scales).

The verification team noted that air filters are milled to a powder form to achieve the required counting geometry. This may lead to loss of material; using a hydraulic press would be a better method.

The verification team suggests using printed bar-code labels for sample management.

The verification team suggest using a hydraulic press for preparing air filter samples for gamma counting.

7.3.3 Gamma spectroscopy

The verification team verified the LEGMC laboratory gamma spectroscopy systems. The laboratory has one Ortec and one Canberra HPGe-detector (Fig. 3). Genie2000 and GammaVision softwares are used. Efficiency calibration is based on commercial activity standards (liquid multinuclide and point source Cs-137). Air filter geometry calibration has been prepared by spiking a reference filter with a multinuclide liquid standard.

Detector system stability is controlled weekly (energy, efficiency and resolution (FWHM)).

The verification team noted that the detector systems are located in a small room, which is also used as an office. Operating LN_2-cooled HPGe-systems in a cramped office environment is not a good practise.

The verification team suggests allocating a separated laboratory room as a counting room. The room should be controlled for temperature and humidity and have sufficient space for the equipment.

Figure 3. LEGMC laboratory gamma spectroscopy systems

7.3.4 Liquid scintillation counting

The LEGMC laboratory has a Perkin-Elmer Quantulus liquid scintillation counter for Tritium, Radon and total alpha/beta counting (Fig. 4). The system is old, but functional.

The verification team noted, that there is no systematic programme for controlling the performance stability of the liquid scintillation counter.

> *The verification team suggests that the LEGMC laboratory logs liquid scintillation counter performance parameters (efficiency, quenching) using control charts weekly.*

Figure 4. LEGMC laboratory liquid scintillation counter

7.3.5 Other capabilities

The verification team was informed, that currently the LEGMC laboratory has no alpha counting capability, but a new alpha spectrometer (Canberra Series 8) has been delivered and is pending installation for operational use.

The verification team was informed, that the LEGMC laboratory has an ICP-MS system (Thermo Scientific iCAP TQ), which can be used for environmental Uranium analysis, if needed. Currently there is no need to include uranium in the environment monitoring programme.

No remarks.

7.4 BIOR LABORATORY

7.4.1 General

The verification team verified the systems for monitoring radioactivity in food at the BIOR laboratory[5]. The laboratory carries out measurements of food radioactivity as a part of the national monitoring programme, but also on commercial basis. The number of annual samples is fairly low (67 samples in 2021).

The laboratory has good facilities and sufficient space for the equipment; one staff member is trained to carry out radioactivity measurements, a second member is in training. A LIMS system is available for sample management.

The verification team noted that there are no pre-planned arrangements for managing radioactivity samples in an emergency situation, when the number of food samples increases, and the samples may have higher levels of activity than in a routine situation. The BIOR laboratory has sufficient space for

[5] Lejupes iela 3, Zemgales priekšpilsēta, Rīga

storing and managing increased number of incoming (radioactive) samples in the event of an emergency, and by reducing the counting times the laboratory analytical capacity could be increased to facilitate higher sample throughput, but there is no formalised plan for this type of situation. In addition, the number of trained staff is a limiting factor.

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

The verification team suggests that the BIOR laboratory increases the number of staff trained for radioactivity measurements.

7.4.2 Sample preparation

The verification team verified the sample preparation equipment of the BIOR laboratory. This includes two furnaces and two ovens for sample ashing and drying (Fig. 5). In addition, there are calibrated scales and equipment for Sr-90 chemical separation.

No remarks.

Figure 5. Furnaces and driers at the BIOR laboratory

7.4.3 Liquid scintillating counting

The BIOR laboratory has a Perkin-Elmer Quantulus 1220 liquid scintillation counter for Sr-90 determination (Fig. 6). The system is old (2006), but functional.

The verification team noted, that there is no systematic programme for controlling the performance stability of the liquid scintillation counter.

The verification team recommends that the BIOR laboratory logs the liquid scintillation counter performance parameters (efficiency, quenching) in a long-term trend graph by performing e.g. a weekly control measurement.

Figure 6. BIOR laboratory liquid scintillation counter

7.4.4 Gamma spectroscopy

The BIOR laboratory has a Baltic Scientific HPGe gamma spectroscopy system (Fig. 7). The system is quite old (1996), but functional. The original software provided with the detector system is still used.

The verification team noted that BIOR does not have an activity standard for carrying out calibration of the HPGe-system – the original factory calibration is still being used. There is no systematic approach to monitoring system stability either.

> *The verification team recommends that BIOR acquires a multinuclide standard activity source for controlling the HPGe-detector calibration in terms of efficiency, energy and resolution (peak FWHM).*
>
> *The verification team recommends that the BIOR laboratory logs the HPGe-detector performance parameters in a long-term trend graph by performing e.g. a weekly control measurement.*
>
> *The verification team recommends renewal of the HPGe-detector system in the near future.*

Figure 7. BIOR laboratory gamma spectroscopy system

7.5 RADIATION SAFETY CENTER

7.5.1 General

The verification team verified the monitoring equipment at the Radiation Safety Center (RSC)[6]. The RSC manages the Latvian automatic radiation monitoring network and is able to carry out mobile monitoring using hand-held and carborne equipment. It has no radiological laboratory and no equipment to monitor radioactive particulate material or gaseous radioactive iodine in air in central Riga. The nearest such monitoring station is in Baldone, about 40 km from Riga.

> *The verification team recommends that the RSC, in cooperation with the LEGMC, implements a mobile or fixed capability for monitoring particulate radioactivity and gaseous radioactive iodine in air in Riga.*

7.5.2 Automatic radiation dose rate monitoring network

The verification team verified the fixed and mobile automatic dose rate monitors at the at the RSC office in Riga (Fig. 8 and 9). These stations are technically identical. They are Envinet RAMS-01 stations, equipped with a NaI detector, yes/no precipitation sensor, and a back-up battery for 72 hours. The stations have no local data display, so a laptop PC is needed for local data retrieval in the event of a communication network malfunction. Each station has a quarterly maintenance schedule by a contractor. The maintenance does not include 'live' testing with a standard radiation source.

Additionally, the verification team verified the operation of the network via the website used to collect and display data form the network stations. Data is received on 10-minute intervals; the data includes also radiation energy spectra.

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6 Rūpniecības iela 23, Rīga

The team visited the fixed automatic dose rate monitor LV0016 at Rupniecibas street in Riga (Fig. 8). Additionally, the RSC has one mobile monitoring station, which can be deployed anywhere in Latvia.

Radiation dose rate data is made available to the public at the SES website[7] in a table form; for a map display, a link to the EURDEP gamma dose rates simple map[8] is included.

The team noted that the data from the river monitoring station Daugava (LV0023) is received in the EURDEP system without identification that it is a water monitoring station. This leads to a situation where the data is presented as ambient dose rate on the EURDEP map.

When looking at photographs of the network stations, the verification team noted that some of the stations are installed very close to a building wall. This is not an optimal choice for a radiation monitoring device.

The verification team recommends that the RSC remove the Daugava water monitoring station (LV0023) from the Latvia EURDEP files.

The verification team suggests making on-line dose rate data available to the public at the SES website also on a map display, in addition to table form.

The verification team suggests including an operation test with a standard radiation source in the routine dose rate station maintenance.

The verification team suggests a review of the physical placement of the automatic dose rate monitoring stations. If possible, the monitoring probe should be placed on an open location free of obstructing elements.

Figure 8. Automatic dose rate monitor at the RSC office

Figure 9. Mobile automatic dose rate monitor

[7] https://www.vvd.gov.lv/lv/radiacijas-limenis-latvija

[8] https://remap.jrc.ec.europa.eu/Consent/Simple.aspx

7.5.3 Mobile radiation monitoring equipment

The verification team verified the availability of the following mobile radiation monitoring equipment at the RSC:

- Envinet MONA system for monitoring radiation dose rate and radiation spectrum (Fig. 11). The system can be installed in a car. It has two large NaI detectors and a GPS system, allowing geographical mapping of the data. A source tracking demo was presented to the verification team.
- Portable HPGe detector ORTEC for mobile gamma spectroscopy (Fig. 10)
- identiFINDER 2 ULK-NGH with neutron-gamma detector, identiFINDER 2 R400 HM5 and identiFINDER 2 ULK-NG (Fig. 15)
- Contamination monitor Berthold LB 124 SCINT (Fig. 13)
- Contamination monitor Canberra RadiaGem 2000, which includes gamma detector SG-2R, alfa/beta detector SAB 100, alfa/beta/gamma detector SABG-15+, telescopic gamma detector and audio-R (Fig. 12)
- Radon monitor AlphaE and AlphaGUARD from Bertin technologies
- X-ray and gamma radiation dosimeter ATOMTEX AT1123 (Fig. 14)
- Personal radiation detectors Rad Eye PRD4 and Rad Eye PRD-ER from Thermo Scientific (Fig. 16)
- Radiometer FH 40 G-L 10. Detector can be added to the telescopic stem. (Fig. 17)
- Radiometer/spectrometer Inspector 1000 with neutron detector (Fig. 18)

Figure 10. ORTEC mobile HPGe detector

Figure 11. RSC mobile radiation surveillance system (Envinet MONA)

The verification team was informed, that altogether eight RSC staff members have been trained to operate the mobile equipment. In addition, the verification team was informed that in Latvia there is basic radiation dose rate monitoring capability in each fire brigade, typically one hand-held detector in each fire truck.

The verification team noted that the RSC has no mobile capability to carry out monitoring of particulate radioactivity or gaseous radioactive iodine in air.

> *The verification team suggests acquiring a mobile air sampler with possibility to install an activated carbon cartridge for monitoring radioactivity in air in the event of an emergency.*

Figure 12. Contamination monitor Canberra RadiaGem 2000

Figure 13. Contamination monitor Berthold LB 124 SCINT

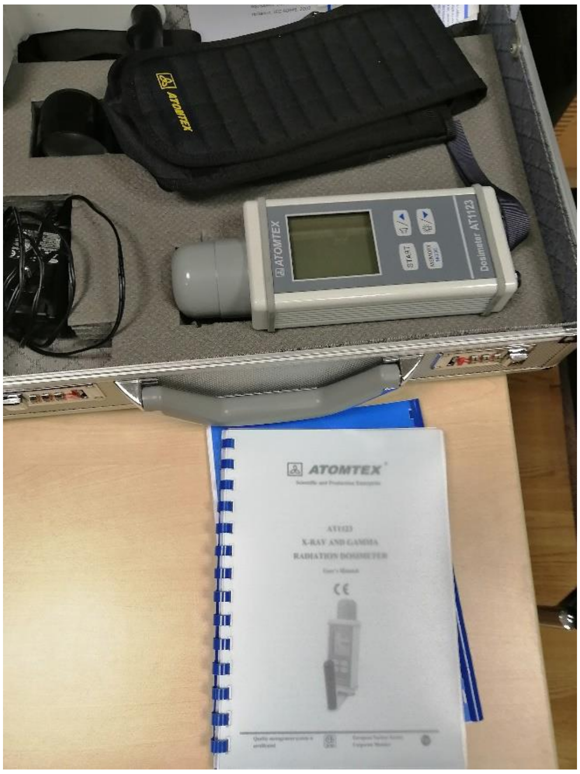

Figure 14. X-ray and gamma radiation dosimeter ATOMTEX AT1123

Figure 15.
Left - identiFINDER 2 ULK-NG
Middle - identiFINDER 2 R400 HM5
Right - identiFINDER 2 ULK-NGH

Figure 16. Personal radiation detectors

Figure 17. Radiometer FH 40 G-L 10

Figure 18. Radiometer/spectrometer Inspector 1000

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) The Commission ascertained that the existing facilities needed to carry out continuous monitoring of levels of radioactivity in air, water and soil in Riga are in operation and running.

The verification activities found that the current facilities in operation in Riga to carry out continuous monitoring of levels of radioactivity in air, water and soil in Riga are partially inadequate, in particular since there is no continuous monitoring of radioactivity in air.

(2) The Commission ascertained that the existing facilities to carry out monitoring of levels of radioactivity in the air, water and soil in the event of a radiological emergency affecting Riga are continuously available.

The verification activities found that the current facilities to carry out monitoring of levels of radioactivity in the air, water and soil in the event of a radiological emergency in Riga are partially inadequate, since the relevant analytical laboratories are not prepared for a radiological emergency.

(3) Recommendations and suggestions have been formulated. They concern in particular monitoring of radioactivity in air in Riga, renewal of laboratory equipment, laboratory and field equipment maintenance, and laboratory arrangements in the event of an emergency.

(4) The team’s recommendations are set out in the ‘Main Conclusions’ document addressed to the Latvian competent authority through Latvia Permanent Representative to the European Union.

(5) The Commission services kindly request the Latvian 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 Latvia.

(6) 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 LATVIA (RIGA)

11 – 13 OCTOBER 2022

<u>Tuesday 11 October</u>

14.00 **Opening meeting**

(Ministry of Environmental Protection and Regional Development, Peldu iela 25, Riga)

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

Overview of radioactivity monitoring arrangements in Latvia and in Riga

- 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

<u>Wednesday 12 October</u>

09:00 **Radiological laboratory capabilities in Riga (LEGMC)**

(LEGMC laboratory, Maskavas iela 165, Riga)

- Laboratory introduction
- Laboratory equipment
- Sampling equipment
- Mobile monitoring equipment

14:00 **Radiological laboratory capabilities in Riga (BIOR)**

(BIOR laboratory, 3 Lejupes Street, Riga)

- Food radioactivity monitoring
- Radiological laboratory

<u>Thursday 13 October</u>

09:00 **Radioactivity monitoring systems in Riga**
(Radiation Safety Center RSC, Rūpniecības iela 23, Rīga)
- Radiation dose rate monitoring
- Mobile/emergency monitoring systems

14:00 **Review of Latvia data on the Commission Art. 35 database**

15.00 **Closing meeting**
(Radiation Safety Center RSC, Rūpniecības iela 23, Rīga)