EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY

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D.3 – Radiation protection and nuclear safety

Verification under the terms of Article 35 of the Euratom Treaty

Technical Report

AUSTRIA
Vienna

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

30 September – 2 October 2020

Reference: AT 20-02

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	Vienna, Austria
DATES	30 September -2 October 2020
REFERENCE	AT 20-02
TEAM MEMBERS	Mr V. Tanner (team leader) Ms E. Diaconu
REPORT DATE	24 February 2021
SIGNATURES	

V. Tanner E. Diaconu

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Abbreviations

AGES	Austrian Agency for Health and Food Safety
BMI	Federal Ministry of the Interior
BMK	Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
BMSGPK	Federal Ministry for Social Affairs, Health, Care and Consumer Protection
CBRN	Chemical, Biological, Radiological, Nuclear
CPE	Customer Premises Equipment
EAA	Environment Agency Austria (Umweltbundesamt)
EC	European Commission
EURATOM	The European Atomic Energy Community
EURDEP	EUropean Radiological Data Exchange Platform
GM	Geiger-Müller
HPGe	High-purity Germanium
IAEA	International Atomic Energy Agency
ICP-MS	Inductively-Coupled Mass Spectrometer
LIMS	Laboratory Information Management System
LMU	Lebensmitteluntersuchungsanstalt Wien (Food Testing Institute of the City of Vienna)
LSC	Liquid Scintillation Counter
PIPS	Passivated Implanted Planar Silicon (Detector)
RADD	EC Radioactive Discharge Database
RANET	Response and Assistance Network of the IAEA
RARA	Radiation Protection, AGES Linz
REM	EC Radioactivity Environment Monitoring database
STRA	Department for Radiation Protection and Radiochemistry, AGES Wien
STRG	Radiometric Laboratory, AGES Graz
STRI	Radiometric Laboratory, AGES Innsbruck
TLD	Thermoluminescent dosimeter
ZAMG	National meteorological and geophysical service of Austria

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 Austria of its decision to conduct an Article 35 verification in a letter addressed to the Austria Permanent Representation to the European Union. The Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) 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 5 May 2020.

2.3 PROGRAMME OF THE VISIT

The Commission and the BMK discussed and agreed on a programme of verification activities in line with the Commission Communication of 4 July 2006.

The opening meeting included presentations on the Austrian automatic radiation monitoring system and other environmental radioactivity monitoring arrangements, including emergency monitoring. 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:

City of Vienna

- Josef Kneisl, Magistratsdirektion Organisation und Sicherheit, Gruppe Krisenmanagement und Sicherheit (Deputy Head)
- Mag. David Reinberger, Vienna Ombuds-Office for Environmental Protection
- DI Dr. Martin Vietauer, Professional Fire Brigade of Vienna (MA 68)

Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), Division V/8 - Radiation Protection, Untere Donaustraße 11, 1020 Vienna

- Mag. Dr. Verena Ehold (Division Head)
- Dr. Peter Hofer
- DI Nina Cernohlawek

Austrian Federal Ministry for Social Affairs, Health, Care and Consumer Protection (BMSGPK), Division VIII/C/2 - Radiation Protection, Environment and Health, Radetzkystrasse 2, 1030 Vienna

- MR Mag Manfred Ditto (Division Head)

Austrian Federal Ministry of the Interior, Department II/13 – Staatliches Krisen- und Katastrophenmanagement und Koordination Zivile Sicherheit, Herrengasse 7, 1010 Vienna

- AD Christian Krol
- AD Günter Timal

Austrian police

- Mag. Peter Weichselbaum
- Mag. Stefan Schoenhacker

Austrian Agency for Health and Food Safety (AGES), Division of Radiation Protection and Radiochemstry, Spargelfeldstraße 191, 1220 Vienna

- Dr. Christian Katzelberger
- Dr. Claudia Landstetter
- DI Florian Smecka

Environmental Agency Austria, Expert Team Radiation Warning Systems, Spittelauer Lände 5,

1090 Vienna

- Mag. Leondios Kratzwald (Head of Expert Team)

3 LEGAL FRAMEWORK FOR RADIOACTIVITY MONITORING IN AUSTRIA

Austria is a federal state, therefore a number of federal, provincial and district authorities are involved in the implementation of laws and regulations. Federal laws give the distribution of responsibilities for regulation of different facilities and activities. The federal state administration laws include also important elements of the legal framework for radiation protection.

3.1 LEGISLATIVE ACTS REGULATING ENVIRONMENTAL RADIOACTIVITY MONITORING

The nuclear and radiation safety regulatory body in Austria is formed by a system of authorities. The Austrian Radiation Protection Act 2020 §°125 allocates the responsibilities for environmental radioactivity monitoring.

3.2 LEGISLATIVE ACTS REGULATING RADIOLOGICAL SURVEILLANCE OF FOOD AND DRINKING WATER

In Austria, the following legal texts regulate the monitoring of radioactivity in food and drinking water:

- Austrian Radiation Protection Act 2020 (BGBl. I Nr. 50/2020)
- Food Safety and Consumer Act (LMSVG, Bundesgesetzblatt Nr. 13/2006)
- Austrian Drinking Water Ordinance (Bundesgesetzblatt II No. 362/2017)

3.3 LEGISLATIVE ACTS REGULATING RADIOACTIVITY MONITORING IN EMERGENCIES

In Austria, the following legal texts regulate the monitoring in emergency situations:

- Austrian Radiation Protection Act 2020 (BGBl. I Nr. 50/2020)
- Ordinance on Interventions 2020 (BGBl. II Nr. 343/2020)

3.4 INTERNATIONAL LEGISLATION AND GUIDANCE DOCUMENTS

The list below includes 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.

The Euratom and the 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
- *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
- *Environmental and Source Monitoring for Purposes of Radiation Protection*, Safety guide, IAEA Safety Standards Series No. RS-G-1.8, IAEA, Vienna, 2005
- *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
- World Health Organisation (WHO), *Guidelines on the quality of drinking water (Guidelines for drinking-water quality*, 4th ed. 2011)

4 BODIES HAVING COMPETENCE IN RADIOACTIVITY MONITORING

4.1 Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is the ministry in charge of railways, transport policy, environment and the energy sector. It has responsibilities in large-scale radiological events (NPP accidents, satellite re-entry, radiological terrorism, and off-site emergency response in Austrian nuclear facilities). It is responsible for monitoring of environmental radioactivity, feedstuffs and other products; it also provides information to the public on the monitoring results. Its main responsibilities are laid down in the Radiation Protection Act (2020).

The BMK is the contact entity for the operators of the Austrian Radiation Early Warning System and - in cooperation with the BMSGPK – for the laboratory-based radioactivity monitoring system.

The BMK is the Competent Authority for the early exchange of information in the event of a radiological emergency (Convention on Early Notification in case of nuclear accidents, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Council Decision 87/6007 Euratom and bilateral agreements).

In the event of a nuclear or radiological emergency, the BMK works in cooperation with BMSGPK for the evaluation of the situation and consequences, takes decisions on protective actions and decides on the termination of an emergency exposure situation as required by the Austrian Radiation Protection Act 2020.

The BMK is also responsible for installation and operation of emergency systems, such as decision support systems and electronic situation reporting systems, and obtaining the emergency relevant data, such as numerical weather prognoses and data from the accident country. The information to the public before and in the event of an emergency, caused by events mentioned above, are distributed by the BMK.

4.2 Federal Ministry for Social Affairs, Health, Care and Consumer Protection

The Federal Ministry for Social Affairs, Health Care and Consumer Protection (BMSGPK) is the ministry in charge of welfare policy and health care. It is responsible for monitoring of radioactivity in foodstuffs and other products, as defined in the national legislation, and for providing information to the public on these monitoring results.

In cooperation with the BMK, the BMSGPK acts as the contracting entity for the operators of the laboratory based radioactivity monitoring system (AGES).

In the event of a nuclear or radiological emergency, the BMSGPK has the responsibility, in cooperation with the BMK, of evaluating the situation and consequences and taking decisions on protective actions.

BMSGPK is also responsible for the procurement and establishment of an adequate system for pre-distribution, storage and distribution of Potassium Iodine tablets for thyroid blocking, in cooperation with the Austrian Provinces (Bundesländer).

4.3 Federal Ministry of the Interior

The Federal Ministry of the Interior (BMI) is the national contact point through the Federal Alarm Centre, according to the Convention on Early notification in case of nuclear accidents and the Council Decision on community arrangements for the early exchange of information in the event of a radiological emergency (87/600/Euratom), and other bilateral agreements. It is the call-up of the

coordination board of the Austrian National Crisis and Disaster Management with representatives of all involved federal ministries, Austrian Provinces and emergency response organisations.

The BMI intervention and radiation detection teams of the Austrian Federal Police have competences for mobile radiation monitoring (terrestrial and airborne) using sets of equipment, available in each district. The teams participate in regular national exercises and international exercises and courses organized by the Austrian Civil Protection School.

4.4 City of Vienna

The City of Vienna is a regional authority, which has some responsibilities in radiological monitoring, in particular during emergencies. It is responsible for:

- Routine drinking water monitoring under the Austrian Drinking Water Ordinance (Bundesgesetzblatt II No. 362/2017),
- Emergency sampling of environment compartments and food in the event of a large-scale emergency (e.g. contamination in Austria after a severe nuclear power plant accident), based on the Austrian wide plan for sampling and measurements in case of emergencies with large scale contamination (Probenahmeplan großraeumig, 30-1-2020),
- Emergency management for local scale radiological events, as described in the Radiation Protection Act 2020 §°123.

4.5 Austrian Agency for Health and Food Safety

The Austrian Agency for Health and Food Safety (AGES) is the national organization controlling the health and food safety. Core tasks include the protection of human, animal and plant health, food safety and food quality, as well as the protection of consumers against fraud. It is responsible for operating the laboratory-based radioactivity monitoring system. The radiological laboratories of AGES are located in Vienna, Linz, Graz and Innsbruck. The AGES has a staff of around 1500 in total, 47 of them work in the field of radiation protection (18 responsible for the measurements).

4.6 Environment Agency Austria

The Environment Agency Austria (EAA) is the expert organisation of the federal government in Austria for environmental protection and environmental control. The EAA is a state-owned limited liability company, which deals with all environmental issues and applies an interdisciplinary approach to environmental media. The Agency employs more than 500 experts from all environmentally relevant disciplines.

The EAA is the technical organisation, which operates and further develops the Austrian Radiation Warning Systems on behalf of the BMK.

4.7 Austrian Civil Protection School

The Austrian Civil Protection School provides training on all areas of civil protection and crisis management. It organises basic regular radiation protection training on two levels, specific continuous training and special training in Gamma-Aerodosimetry. The school is the European Capacity Building Centre on Emergency Preparedness and Response (CBC-EPR) of the International Atomic Energy Agency (IAEA).

5 RADIOACTIVITY MONITORING IN AUSTRIA

5.1 INTRODUCTION

Austria has a civil nuclear research program, which operates a nuclear research reactor (Triga Mark IV at the Atominstitut in Vienna) and a central radioactive waste management and interim storage facility Nuclear Engineering Seibersdorf. Austria has no nuclear power reactors, but there are several operational power reactors close to its borders (Leibstadt and Beznau in Switzerland, Isar and Gundremmingen in Germany, Bohunice and Mohovce in Slovakia, Dukovany and Temelin in the Czech Republic and Krško in Slovenia). Because of this Austria has developed a comprehensive national program for monitoring environmental radioactivity in both routine and emergency situations. The program includes both on-line and off-line monitoring.

5.2 NATIONAL AUTOMATIC MONITORING NETWORK

5.2.1 Overview

Austria operates a national automatic radiation monitoring network (Fig. 1). The system consists of 319 dose rate monitoring stations measuring external radiation automatically and continuously, and of 10 automatic air monitoring stations installed close to the borders, which continuously determine the concentration of radioactive nuclides in air. The organisation in charge of operating the system is the BMK through the Environment Agency Austria[4].

The monitoring stations are connected to two data centres (main in the Div. V/8 of BMK in Vienna, backup in Korneuburg, Lower Austria) via different transmission paths. The data are graphically displayed on a secure website. Due to its role as an emergency system, the functionality of the website is reduced to the most essential operations.

The measurement data is accessible to other authorities at federal and provincial level, such as the provincial warning centres. Data from 111 dose rate stations is available to the public via a website[5] and the TELETEXT system of the Austrian Broadcasting Corporation (ORF). These stations are a representative selection of locations in all district capitals, places close to the border and some high-altitude stations.

Based on bilateral arrangements measurement data are exchanged automatically with the neighbouring countries directly and via the EURDEP data platform. Austria has installed air radioactivity monitoring stations in the neighbouring countries and receives data directly from these stations too (Fig. 2).

The detector is a proportional counter tube of (BITT type NPGD02), which has the advantage of a very wide measurement range. The counter tube serves as pulse source in the low dose rate range, while in the high dose rate range it operates as a current device (integral of the current pulses). The complete equipment of the detector is housed in a waterproof aluminium tube with a wall thickness of 2 mm.

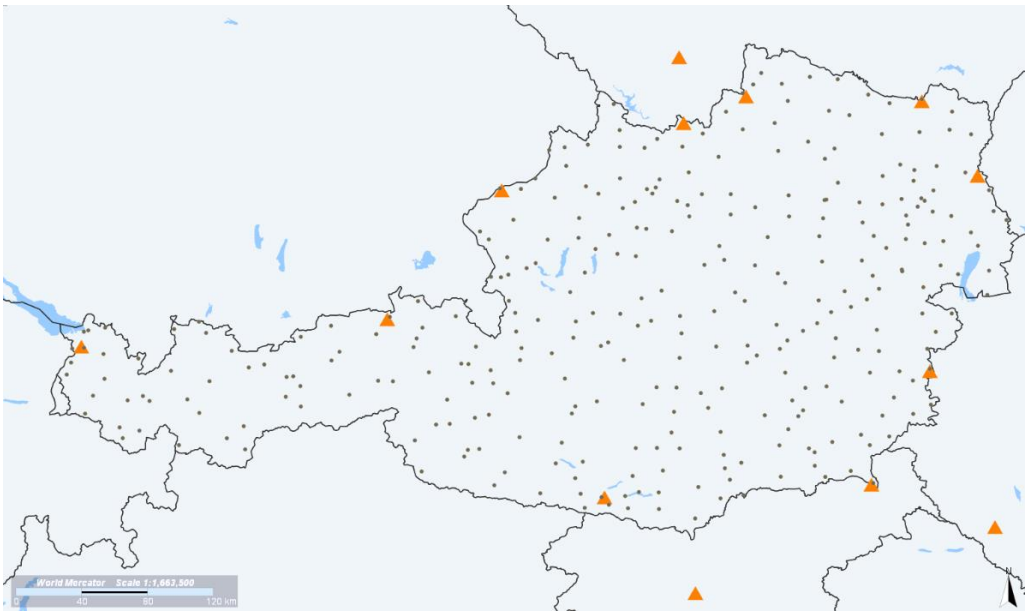
The modernization of the data loggers for all 319 measurement sites has been completed in October 2020. The new data logger is able to store 10- and 1-minute mean values. It also receives information on the state of the sensor and the power supply. This information is simplified for the transmission to the data centre(s) like “sensor OK/sensor inactive” or “mains operated/battery operated”. Each site includes a battery, which provides an uninterruptable power supply for up to 48 hours. The measurement interval is usually 10 minutes. When a certain criteria is met (rapid change of the

[4] Spittelauer Lände 5, 1090 Vienna

[5] www.bmk.gv.at/themen/klima_umwelt/strahlenschutz/fruehwarnsystem/messwerte.html

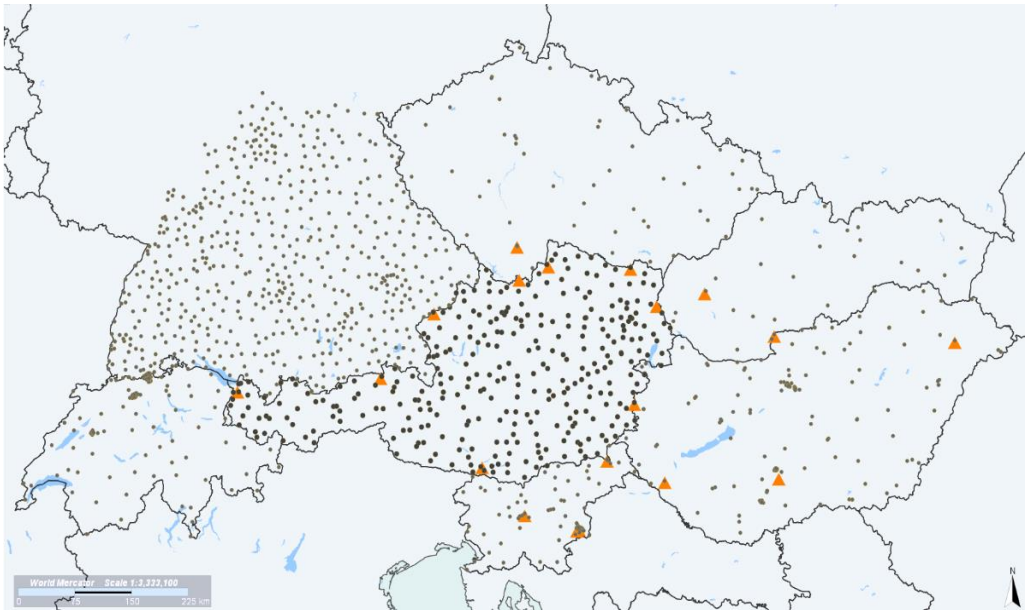
measured value), the system switches to 1-minute-mode for at least 30 minutes until the criteria is not fulfilled anymore.

Routine maintenance of each gamma site is carried out three times a year (except high altitude sites; only once per year).



Gamma dose rate sites, Air monitoring stations

Figure 1. Nationwide network of dose rate and automatic air monitoring stations



Gamma dose rate sites, Air monitoring stations

Figure 2. Map showing the automatic exchange of measurement data with neighbouring countries and the automatic air monitoring stations in the neighbouring countries

There is a 24/7 Hotline to the control centre of the network provider, situated in Vienna. The BMK has an on-call duty service. In case a measured value exceeds 300 nSv/h the alarm system in the data centre starts a routine, which notifies the on-call duty officer of the competent authority (BMK) and separately the on-call duty officer of the operational management (EAA). The information consists of

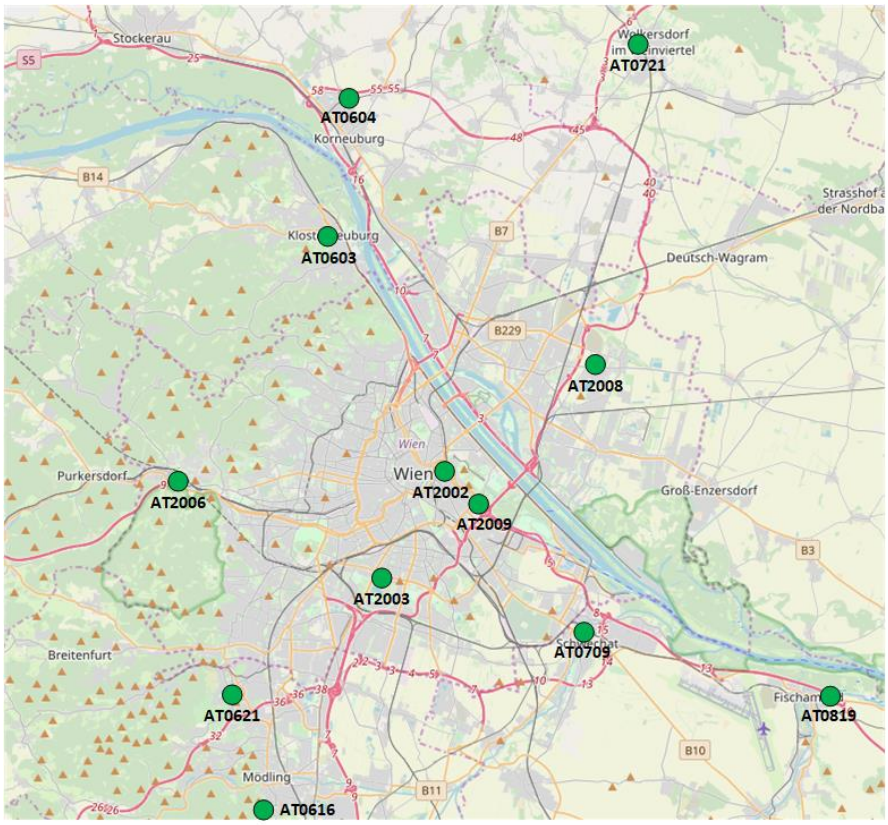
an email, a SMS and a telephone call, which must be acknowledged. If the acknowledgement does not happen after the second telephone call, the alarm system rings the second number of the group and so on.

The current data transmission network is called TuS-Infranet (telemetry and security service) and it is line-based only. No mobile communications are used. In some cases on high altitude sites (< 10 sites), a directional radio link is used to bypass impassable terrain. The CPE is a modem called SAD (Security Access Device) and has an integrated battery to provide power for up to 72 hours if necessary.

Since January 2020, the transmission network is being modernised. The new network is also line-based, but allows the possibility to use mobile communications (LTE) if no line is available. For lines the CPE is a Carrier Ethernet Device, which is directly powered over the provider line, and therefore needs no power supply on the customer side. For sites using mobile communications the CPE is a brand router, equipped with an external battery to provide power for at least 6 hours if necessary. The current local storage capacity of measured values is 1 month. With the upgrade to the new transmission network, the local storage capacity of measured values is extended to 1 year.

5.2.2 Stations in Vienna

Ambient dose rate monitoring in Vienna is carried out by the automatic radiation early warning system, which is a complete system with 5 gamma dose rate monitors in Vienna[6]. These stations are part of the national monitoring network. In the wider area of Vienna, there are six other gamma dose rate monitors[7] (Fig. 3). There are no automatic air monitoring stations in Vienna.



[6] Wien-Mariabrunn AT2006, Wien-Radetzkystraße AT2002, Wien-Rudolfshügel AT2003, Wien-Atominstitut AT2009 and Wien-Breitenlee AT2008

[7] Schwechat AT0709, Perchtoldsdorf AT0621, Wolkersdorf AT0721, Korneuburg AT0604, Fischamend AT0819 and Klosterneuburg AT0603

Figure 3. Radiation Early Warning System in the Vienna area

5.3 MONITORING OF RADIOACTIVITY IN THE ATMOSPHERE

5.3.1 Automatic air monitoring network

There are 10 automatic air monitoring stations, which are part of the Austrian Radiation Early Warning System located close to the borders to the neighbouring countries (Fig. 1). In addition, the measurement data of 9 air monitoring stations in the neighbouring countries are available within the system based on bilateral arrangements.

The network consists of radiological monitoring containers (BITT AMS 02) (Fig. 4). This is a fully automatic small-volume (8 m^3/h) filter system for monitoring both particulate and gaseous radioactivity. Filters are measured by the system on a continuous basis and the system is able to send an alert in the event of high values. One filter is kept in the collector position for 24 hours; a robotic arm changes the filters. There is an electrically cooled HPGe detector[8] and an alpha/beta PIPS detector for aerosol monitoring and two NaI detectors for Iodine monitoring. The container includes also monitors for temperature, wind direction and wind speed. A UPS is available to facilitate operation during short power cuts (max. 10 minutes). The container is temperature controlled and lightning protected.

Figure 4. Automatic air radioactivity monitoring container

5.3.2 Air samplers collecting particulate matter and/or Iodine

Radioactivity in air in Austria is monitored using mid-volume and high-volume air samplers, which filter large amounts of air. The filter is measured in a laboratory for particulate aerosol or gaseous Iodine radioactivity. Sample collection time is typically one week. These systems have no early warning function, but due to the large collection volume, they are extremely sensitive. The radionuclides assessed in air are Be-7, Na-22, K-40, I-131, Cs-134, Cs-137 and Pb-210. Some of the stations have also a charcoal filters for sampling radioactive Iodine. Figure 5 presents the geographical locations of the systems and Tables I and II their technical specifications. Figures 6 and 7 present two systems, the JL-900 SnowWhite and PTI-Fischer ASS-1000.

[8] Four stations of the automatic air monitoring network (Villach, Laa/Thaya, Braunau and Kufstein) are equipped with NaI detectors instead of HPGe detectors.

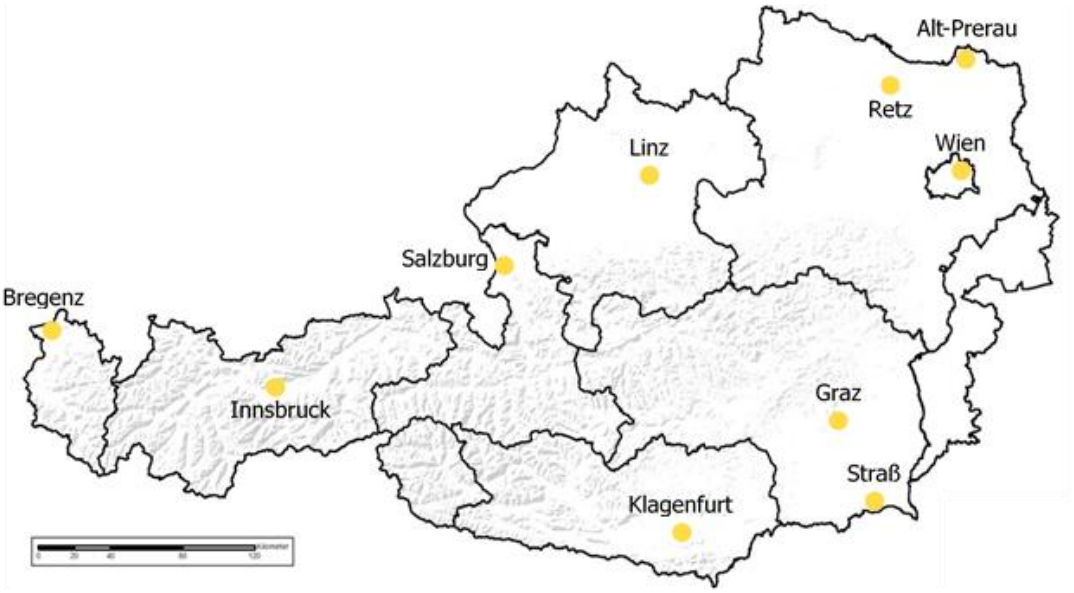


Figure 5. Locations of the air sampling devices

Table I. Air monitoring stations

Location	System type	Samples/year	Frequency	Sampling
Graz	Custom	52	7 days	AGES, STRG
Straß	Custom	52	7 days	Erzherzog-Johann-Kaserne Straße
Bregenz	Custom	52	7 days	Bauhof Bregenz
Innsbruck	Custom	52	7 days	ZAMG Wetterdienststelle Innsbruck
Linz (Iodine)	F&J DF-22	52	7 days	AGES, RARA
Linz	Custom	52	7 days	AGES, RARA
Salzburg	Custom	52	7 days	ZAMG Wetterdienststelle Salzburg
Wien (Iodine)	F&J DF-22	52	7 days	AGES, STRA
Alt-Prerau	Custom	52	7 days	Landwirtsch. Industrieges. Alt-Prerau
Klagenfurt	Custom	52	7 days	ZAMG Wetterdienststelle Klagenfurt
Retz	Custom	52	7 days	Wetterbeobachtungsstation Retz
Wien	Custom	52	7 days	AGES, STRA
Wien (high-volume)	ASS-1000	52	7 days	AGES, STRA
Innsbruck (high-volume) (installed end 2019)	JL-900 Snow White	52	7 days	AGES, STRI
Innsbruck (Iodine) (installed end 2019)	JL-900 Snow White	52	7 days	AGES, STRI

Table II. Technical specification of air samplers

Type	Manufacturer	Technical Specifications	Filter	Frequency of filter exchange	How continuous operation is ensured
90 m³/h (all locations)	Custom build Instrumentation: DIGITEL (build in 2015)	Air flow ~ 90 m³/h	Whatman GF/A 203×254 mm	7 days (in emergency shorter frequency possible)	Web interface Digital; weekly check during filter exchange
Iodine (Vienna & Linz)	F&J DF-22	Air flow ~ 4 m³/h additional information below	TE2C (Charcoal)	7 days (in emergency shorter frequency possible)	weekly check during filter exchange, in Vienna monitored power supply
high-volume Vienna	pti-fischer ASS-1000	Air flow ~ 800 m³/h	Polypropylene filter type G-3	7 days (in emergency shorter frequency possible)	weekly check during filter exchange, in Vienna monitored power supply
high-volume Innsbruck	Senya JL-900 Snow White	Air flow ~ 900 m³/h	Whatman GF/A 57 cm x 46 cm	7 days (in emergency shorter frequency possible)	remote access form lab-computer, weekly check during filter exchange
Iodine Innsbruck	Senya JL-900 Snow White	Air flow ~ 16m³/h	TEDA (Charcoal) Volume 0,5 l	7 days (in emergency shorter frequency possible)	remote access form lab-computer, weekly check during filter exchange

***** Senya JL-900 Snow White has the ability to use both filter types at the same time (one system)

Figure 6. SnowWhite high-volume air sampler

Table III. Technical specifications for Senya JL-900 Snow White

Dimensions l x h x w	1950 x 1000 (ball 1610) x 800 (ball 1070) mm
Weight	~400 kg
Cover material	GRP, glass reinforced plastics
Baseframe material	Stainless steel
Pump	Gas Ring Vacuum
Pump control	Frequency converter or soft starter
Power	9.0 - 9.2 kW standard 14.6 kW arctic
Vacuum max.	190 mbar
Voltage	3-phase 400 VAC / 50 Hz 3-phase 200 VAC / 60 Hz
Main filter flow max.	900 m^3/h, filter dependent
Particle filter size	570 x 460 mm
Particle filter types	Whatman GF/A Camfil A500G Machery-Nagel-MN 85/90 Petrianov FPP-15-1.5 3M E666,BMF20,W/1,1.6OZ PP
Display unit values	Pressure difference, Pascal Current airflow, m^3/h Total volume, m^3 Total time, hh:mm:ss
Data storage	Non-volatile memory for total volume and time over one sampling

ASS-1000

Measurement- and Power-Supply-Box
- Flow meter DPMF 95 E*
- Datalogger/Interface DATRANS 97E
- Control unit HMTS 01

Flow meter DPFM 95 E*

Datalogger/Interface DATRANS 97E
Degree of Protection IP 65

Control unit HMTS 01

Interfacekonverter TTY/RS232 - USB

* The program TransDat provides the user with a clearly represented user interface to the monitoring and data storage for the interface DATRANS 97E.

Figure 7. PTI-Fischer ASS-1000 high-volume air sampler components

5.3.3 Atmospheric deposition collectors

Atmospheric deposition is sampled using precipitation collectors, which are placed in all regions of Austria. The collectors collect both wet (snow and rainwater) and dry (atmospheric dust) deposition. Figure 8 presents the geographical locations.

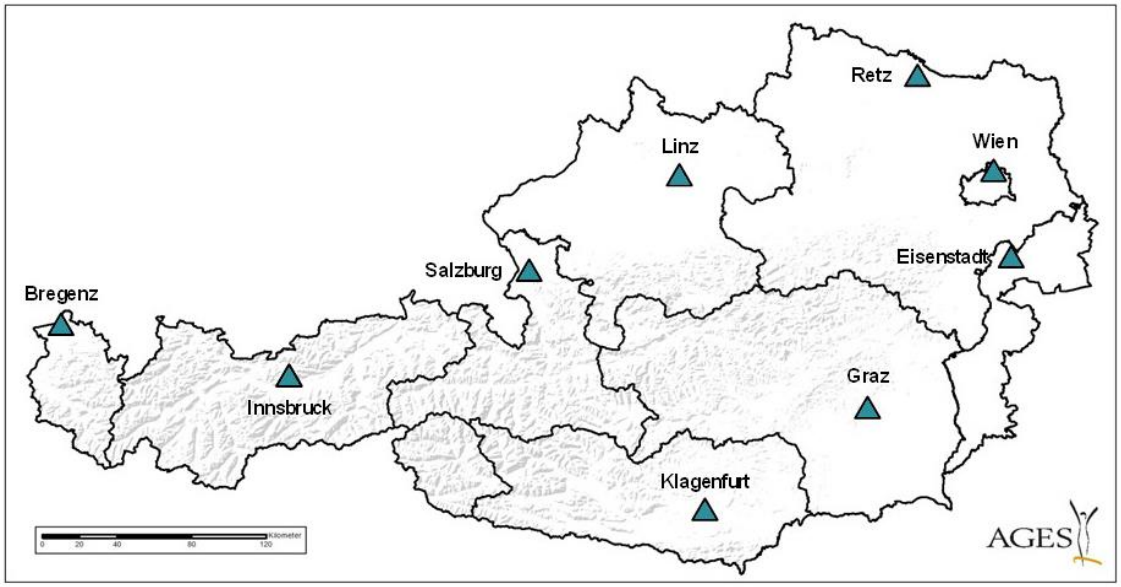


Figure 8. Locations of the precipitation collectors

The equipment is a custom-built stainless steel device (Fig. 9). The collectors have collection areas of 0.1 or 1 m². The equipment is heated to prevent the water in the collector from freezing in the cold season and to allow snow to melt in the collecting funnel. In the warm season this heater - if it does not have a thermostat - must be switched off in order to avoid unnecessary evaporation losses in the collecting container.

From the collected samples, 50 ml are taken for H-3 measurement with the LSC. The rest of the sample is evaporated and used for gamma spectrometric measurement. If the sample is less than 5 l, the sample goes for direct gamma measurement. The gamma emitters assessed are H-3, Be-7, K-40, I-131, Cs-134 and Cs-137.

The precipitation collector in Linz is used for dry analyses only in emergencies. The type of the equipment is a cascade impactor - Digital/ Tisch Environmentel Inc, with an airflow of 34 m³/h:

- Aerosol sampler:
  Manufacturer: Digitel Elektronik GmbH
  Model: DH-77
- Cascade impactor
  Manufacturer: Tisch Environmental Inc.
  Modell: TE-236
  Particle cut-off (approx.): >10 µm, 4-10 µm, 2-4 µm, 1-2 µm, 0.7-1.3 µm, 0.4-0.7 µm, <0.4 µm.
  Airflow: 30 m³/h (STP)
- Filters
  Glass fibre 150 mm 227/1/60 Ederol
  Glass fibre TE-230-GF

The radionuclides monitored with this device depend on the type of emergency.

Figure 9. Left: Cascade impactor - Digital/ Tisch Environmental Inc.; Right: Large dry/wet deposition collector

Table IV. Atmospheric deposition collectors

Location	Samples/year	Frequency	Sampling
Graz	12	Monthly	AGES, STRG
Bregenz	12	Monthly	ZAMG, Bregenz
Innsbruck	12	Monthly	ZAMG, Innsbruck
Linz	12	Monthly	AGES, RARA
Salzburg	12	Monthly	ZAMG, Salzburg
Eisenstadt	12	Monthly	BEWAG, Eisenstadt
Klagenfurt	12	Monthly	ZAMG, Klagenfurt
Retz	12	Monthly	ZAMG Retz
Wien	12	Monthly	AGES, STRA

5.4 MONITORING OF RADIOACTIVITY IN WATER

5.4.1 Surface water

Surface water is analysed by AGES in locations presented in Fig. 10 (some samples are taken by AGES and others are taken from other institutes or offices and sent to the AGES laboratories). Sample quantity is 25 litres. H-3 measurement (LSC) and gamma spectroscopy is performed. Gross alpha/beta, H-3, Be-7, Cs-134, Cs-137, I-131 and K-40 are assessed.

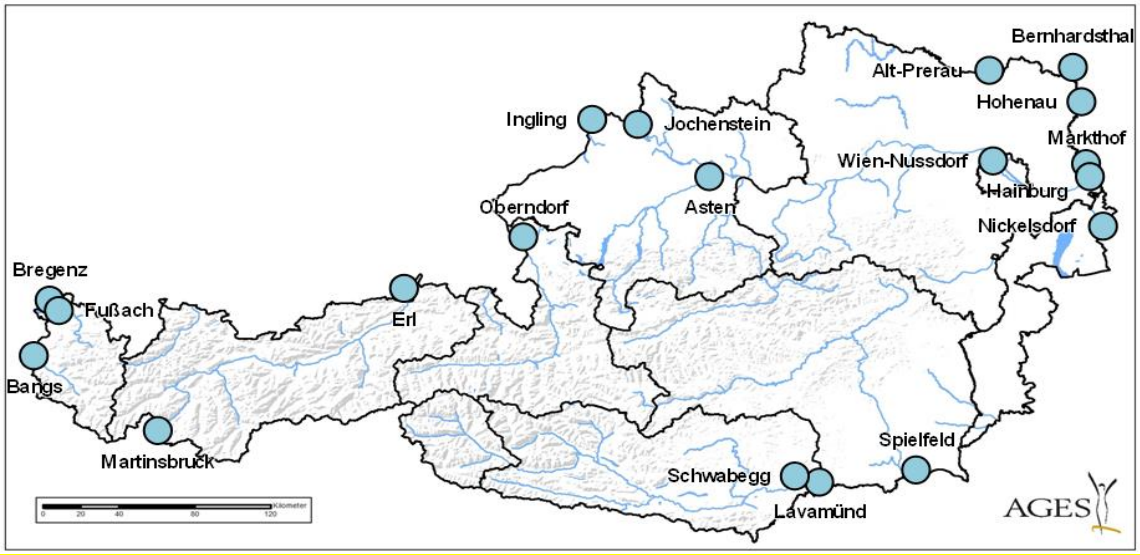


Figure 10. Surface water sampling locations

Table V. Surface water sampling location data

Location	Samples/year	Frequency	Sampling
Mur/Spielfeld (cont.)	12	Monthly	Amt der Steiermärkischen LR
Mur/Spielfeld	12	Monthly	Amt der Steiermärkischen LR
Bodensee/Bregenz	6	every 2nd month	Umweltinstitut Vorarlberg
Inn/Erl	12	Monthly	CTUA Innsbruck
Inn/Martinsbruck	12	Monthly	AGES, STRI
Rhein/Bangs	6	every 2nd month	Umweltinstitut Vorarlberg
Rhein/Fußach	12	Monthly	Fa. Böhler Analytik
Donau/Aschach	12	Monthly	AGES, RARA
Donau/Jochenstein	12	Monthly	AGES, RARA
Drau/Schwabegg (kont.)	12	Monthly	AGES, RARA
Drau/Schwabegg	12	Monthly	AGES, RARA
Inn/Ingling	12	Monthly	AGES, RARA
Lavant/Lavamünd	12	Monthly	AGES, RARA
Salzach/Oberndorf	12	Monthly	AGES, RARA
Donau/Jochenstein	4	every 3rd month	Wasserwirtschaftsamt Passau/Deggendorf
March/Hohenau (STRA)	52	7 days	AGES, STRA
Donau/Hainburg	12	Monthly	Synlab, Seeböckgasse 32b
Donau/Nussdorf	12	Monthly	Synlab, Seeböckgasse 32b
Leitha/Nickelsdorf	12	Monthly	GBA Gesellschaft für Bioanalytik mbH, Deutschland
March/Hohenau	12	Monthly	Synlab, Seeböckgasse 32b
March/Markthof	12	Monthly	Synlab, Seeböckgasse 32b
Thaya/Alt-Prerau	12	Monthly	Synlab, Seeböckgasse 32b
Thaya/Bernhardsthal	12	Monthly	Synlab, Seeböckgasse 32b

5.4.2 Ground water

Ground water is sampled from 315 sample locations all over the country, in particular around the nuclear installations (Nuclear Engineering Seibersdorf and the TRIGA Mark-II reactor in Vienna). Two 1 litre bottles are completely filled and cooled for transport (samples from nuclear installations are not cooled).

Sampling is not annual, but project based. The latest measurement project for ground water took place in the years 2008 - 2009 (500 different sample locations); the next measurement project will start in 2020.

Sample analysis are done at the AGES laboratories. Radionuclides that are assessed are H-3, Pb-210, Po-210, Rn-222, Ra-226, Ra-228 & U-238. Near the nuclear installations, the radionuclides tested are Gross alpha/beta and a larger library of gamma nuclides[9].

5.4.3 Drinking water

The analyses of the drinking water are done in the laboratories of the AGES, in fixed sampling locations, under the national monitoring programme (Table VI). Every working day 1 litre of tap water is taken into a 25 l container (Graz, Linz, Innsbruck and Wien) and approximately 4 ml into a 0.1 l container (Bregenz, Eisenstadt, Klagenfurt, St. Pölten, Salzburg) to create composite samples. All of the samples are analysed for H-3 and Gross α+β. The samples from Graz, Linz, Innsbruck and Wien are also analysed for gamma nuclides after evaporation (Cs-134, Cs-137, I-131 and K-40). Additionally the samples from Wien are analysed for Ra-228, Ra-226, Pb-210 and Po-210 (LSC). Sr-90 is analysed in a mixed sample of three months at the location Wien.

Table VI. Drinking water sampling

Location	Samples/year	Frequency	Sampling
Graz	12	Monthly	AGES, STRG (Vienna)
Innsbruck	12	Monthly	AGES, STRI (Innsbruck)
Linz	12	Monthly	AGES, RARA (Linz)
Bregenz	12	Monthly	Inst. f. Umwelt- u. Lebensmittelsicherheit
Eisenstadt	12	Monthly	Amt d. Burgenländischen LR
Klagenfurt	12	Monthly	LUA, Klagenfurt
St. Pölten	12	Monthly	Magistrat St.Pölten
Salzburg	12	Monthly	AGES, ILMU Salzburg
Wien	12	monthly	AGES, STRA (Graz)
Wien 3 month mixed sample	4	every 3rd month	AGES, STRA

Additionally, around 100 samples are collected each year from water suppliers. The analyses are performed according to the Austrian Drinking Water Ordinance (BGBl. II Nr. 362/2017). There is also a project, run by the small water suppliers, on the measurements of Pb-210 and Po-210 in water.

The competent authority for food monitoring (BMSGPK) determines the sampling locations for regular monitoring between the well and the consumer. The sampling procedure is in accordance with the Austrian national norm[10]. The Austrian Drinking Water Ordinance requires the monitoring of

[9] Ac-228, Ag-108m, Ag-110m, Am-241, Ba-133, Be-7, Bi-214, Br-82, Co-57, Co-60, Cr-51, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, Fe-59, H-3, Hg-203, I-125, I-131, Ir-192, K-40, Mn-54, Nb-95, Pa-233, Pb-210, Pb-214, Ra-226, Ru-103, Ru-106, Sb-124, Sb-125, Sc-46, Se-75, Sn-113, Sr-85, Ta-182, Y-88, Zn-65, Zr-95, I-133 and I-124.

[10] ÖNORM ISO 5667-5 „Wasserbeschaffenheit – Probenahme, Anleitung zur Probenahme von Trinkwasser aus Aufbereitungsanlagen und Rohrnetzsystemen“ and ÖNORM EN ISO 5667-3 „Wasserbeschaffenheit — Probenahme, Konservierung und Handhabung von Wasserproben“

Tritium and effective dose (parametric values 100 Bq/l and 0.10 mSv/year). In the effective dose estimation all natural and non-natural radionuclides excluding Tritium, Kalium-40, Radon und Radon decay products have to be taken into account. This is in accordance with the norm ÖNORM S 5251[11].

5.5 MONITORING OF RADIOACTIVITY IN SOIL AND SEDIMENTS

Soil is sampled on 637 locations in Austria (Fig. 11). 14 of these sampling locations are fixed locations (near border; in every province at least one location except Vienna) with a sampling frequency of once a year. In addition also once a year soil is sampled at alternating 70-100 locations out of the remaining 623 locations . Analysis is carried out by the AGES laboratories. The radionuclides assessed are Cs-134, Cs-134 and I-131.

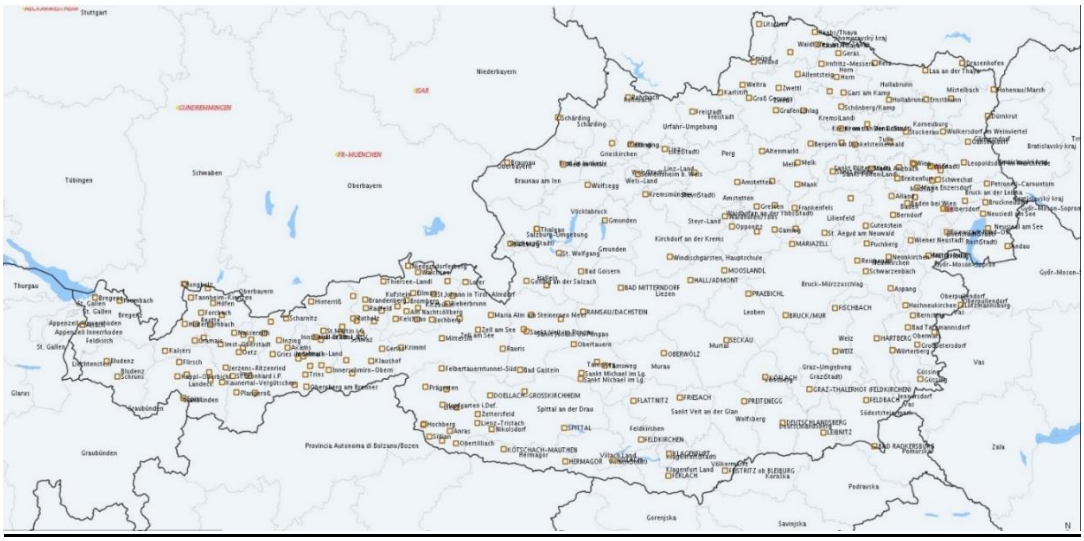


Figure 11. Sampling locations of soil

The sampling locations for sediments include rivers around the Seibersdorf site, a river close to the TRIGA Mark-II Reactor in Vienna and for four samples the Danube river (Fig. 12). The samples are collected once a year at the Seibersdorf site and four times per year at the TRIGA Mark-II Reactor. The sample weight is 250 - 500 g; they are assessed for several gamma nuclides[12]. Samples from the Danube are collected every month.

[11] ÖNORM S 5251 "Bestimmung und Bewertung der Gesamtdosis durch Radionuklide im Trinkwasser"

[12] Ag-108m, Ag-110m, Am-241, Ba-133, Be-7, Br-82, Co-57, Co-60, Cr-51, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, Fe-59, Hg-203, I-123, I-125, I-131, I-133, Ir-192, K-40, Mn-54, Nb-95, Pb-210, Ru-103, Ru-106, Sb-124, Sb-125, Sc-46, Se-75, Sn-113, Sr-85, Ta-182, Y-88, Zn-65, Zr-95

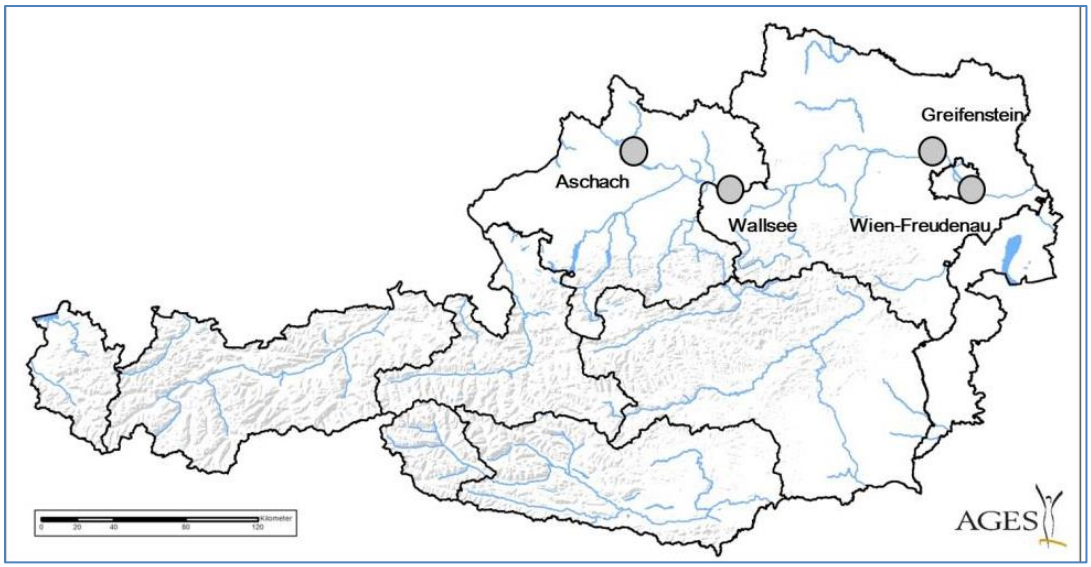


Figure 12. Sampling locations of sediments at the Danube

5.6 MONITORING OF RADIOACTIVITY IN TERRESTRIAL BIOTA

The national monitoring programme includes monitoring of pasture; the sampling locations are the same as for soil and sediments (Fig. 11). About 100 samples per year are collected during emergency exercises (with different provinces every year) and analysed by gamma spectroscopy. The radionuclides assessed are Cs-134, Cs-134 and I-131. Samples are taken from 9 fixed locations in Carinthia as well as from the 14 fixed soil sampling locations (mentioned above) and analysed once a year.

In addition, mushrooms are occasionally monitored from market samples. Typically, there are about 20 mushroom samples analysed per year. Eight samples of different kinds of grain are sampled and analysed once a year.

5.7 MONITORING OF RADIOACTIVITY IN FOOD, FOODSTUFFS AND FEEDING STUFF

5.7.1 Milk

Milk is sampled by taking samples of fresh milk at diaries (Table VII). Cs-134, Cs-137, I-131, K-40, Sr-90 are assessed. Direct gamma spectroscopy is performed on a 3-litre Marinelli sample. In addition, a 0.5 kg mixed composite sample (1 year) is prepared for Sr-90 measurement using a liquid scintillation counter.

In addition, three litres of milk are bought in the supermarket in Vienna once every month and analysed for gamma emitters (Cs-134, Cs-137, I-131, K-40) and Sr-90.

Table VII. Milk sampling locations

Location	Samples/year	Frequency	Sampling
Admont	6	every 2nd month	Ennstal Milch KG, M-ST-04
Aflenz	6	every 2nd month	Obersteirische Molkerei reg.Gen.m.b.H.
Bleiburg	6	every 2nd month	Berglandmilch reg.Gen.m.b.H.
Eibiswald	6	every 2nd month	Stainzer Molkerei Gen., M-ST-6
Kötschach-Mautern	6	every 2nd month	Kärntnermilch
Spittal a/d Drau	6	every 2nd month	Kärntermilch
Obersaifen	6	every 2nd month	Berglandmilch reg.Gen.m.b.H.
Reichenfels	6	every 2nd month	Berglandmilch reg.Gen.m.b.H.
Deutschlandsberg	6	every 2nd month	Stainzer Molkerei Gen., M-ST-6
Feldkirch	6	every 2nd month	Vorarlberg Milch
Kals	6	every 2nd month	Tirol Milch

Location	Samples/year	Frequency	Sampling
Möggers	6	every 2nd month	Bantel
Pinswang	12	every 2nd month	Wildberg Käsewerk
Schwoich	6	every 2nd month	Tirol Milch
Telfs	6	every 2nd month	Tirol Milch
Waidring	6	every 2nd month	Tirol Milch
Zell am Ziller	6	every 2nd month	SG Zillertal-Mitte
Ampflwang	6	every 2nd month	Molkerei Gmunden (M-O-21)
Ebensee	6	every 2nd month	Molkerei Gmunden (M-O-21)
Elixhausen	6	every 2nd month	Käsereigenossenschaft Elixhausen
St.Johann im Pongau	6	every 2nd month	Alpenmilch Salzburg GmbH.
Feldkirchen	6	every 2nd month	Bergland Feldkirchen (M-O-13)
Freistadt	6	every 2nd month	Molkerei Gmunden (M-O-21)
Maishofen	6	every 2nd month	Pinzgau Milch Prod GmbH. Maishofen
Mittersill	6	every 2nd month	Pinzgau Milch Prod GmbH. Maishofen
Oberes Mühlviertel	6	every 2nd month	Bergland Feldkirchen (M-O-13)
Pruggern	6	every 2nd month	Ennstal Milch KG, M-ST-04
Reichraming	6	every 2nd month	Bergland Garsten (M-O-18)
Reichraming	6	every 2nd month	Forster Bauer
Schardenberg	6	every 2nd month	Bergland Taufkirchen/Pram
Wien	12	monthly	AGES, STRA
Horitschon	6	every 2nd month	NÖM
Oberwart	6	every 2nd month	NÖM
Reichenau	6	every 2nd month	NÖM
Traunstein	6	every 2nd month	NÖM
Ulmerfeld	6	every 2nd month	Berglandmilch
Ampflwang (yearly mixed Sample)	1	1 year	AGES, RARA
Kötschach-Mautern (yearly mixed S.)	1	1 year	AGES, STRG
Feldkirchen (yearly mixed Sample)	1	1 year	AGES, RARA
Mittersill (yearly mixed Sample)	1	1 year	AGES, STRG
Möggers (yearly mixed Sample)	1	1 year	AGES, STRI
Oberwart (yearly mixed Sample)	1	1 year	AGES, STRA
Pruggern (yearly mixed Sample)	1	1 year	AGES, STRG
Traunstein (yearly mixed Sample)	1	1 year	AGES, STRA
Waidring (yearly mixed Sample)	1	1 year	AGES, STRI

5.7.2 Mixed diet

Mixed diet is sampled at public canteens and cafeterias (Table VIII). In the AGES laboratories, the sample is homogenized, weighted and filled into a suitable geometry. Direct gamma spectroscopy is performed to assess Cs-134, Cs-137, I-131 and K-40. After the gamma measurement, a 0.5 kg aliquot is kept for a quarterly composite sample, which is then ashed and measured by LSC to assess Sr-90.

Table VIII. Mixed diet sampling locations

Location	samples/year	frequency	sampling
Graz	12	monthly	Magistrat Graz, Zentralküche
Vienna	12	monthly	AGES, STRA
Mixed S. Graz	4	every 3rd month	AGES, STRG
Mixed S. Vienna	4	every 3rd month	AGES, STRA

5.7.3 Foodstuffs

Table IX presents the monitored individual foodstuffs. The collected sample is homogenized and filled into a suitable geometry, weighted and measured by direct gamma spectroscopy to assess Cs-134, Cs-137, I-131 and K-40. No samples of individual foodstuffs from the Vienna area are included in the monitoring program.

Table IX. Foodstuffs sampling

Type	Samples/year	frequency	sampling
Cattle	~50	1 year	AGES, STRG
	~50	1 year	AGES, STRA
Game animals	~50	1 year	AGES, STRG
	~50	1 year	AGES, STRA
Other foodstuff*	110	1 year	LMU (Lebensmitteluntersuchungsanstalt Wien - Food Testing Institute of the City of Vienna)

* Schnitzel, squid, tuna, prawn, lettuce…

5.7.4 Feeding stuffs

Various feeding stuffs are collected from different locations in Austria for radioactivity monitoring (alpine pasture, feed lime, corn forage, wheat forage, meadow hay, rapeseed meal, feed salt, crushed oats, etc.). Around 100 random samples per year are measured at the AGES Linz laboratory. Cs-134, Cs-137, I-131 and K-40 are assessed. No samples of individual feeding stuffs from the Vienna area are included in the monitoring program.

5.8 LABORATORIES PARTICIPATING ON THE ENVIRONMENTAL RADIOACTIVITY MONITORING PROGRAMME

5.8.1 Austrian Agency for Health and Food Safety

The Austrian Agency for Health and Food Safety, (AGES, Österreichische Agentur für Gesundheit und Ernährungssicherheit GmbH)[13] is the only laboratory involved in the national environmental radioactivity monitoring programme, including the radiological surveillance of foodstuffs and feeding stuffs. AGES is responsible for measurement of air, water, soil, foodstuffs and feeding stuffs. It has radiological laboratories in Vienna, Linz, Graz and Innsbruck (Fig. 13). The laboratories are staffed and equipped to carry out all sampling and analysis required by the national monitoring programme, there are no outsourced measurements. The AGES laboratories are accredited according to ISO 17025. They participate in several intercomparison exercises and proficiency tests annually (Annex 2). The sampling and analysis procedures are outlined below.

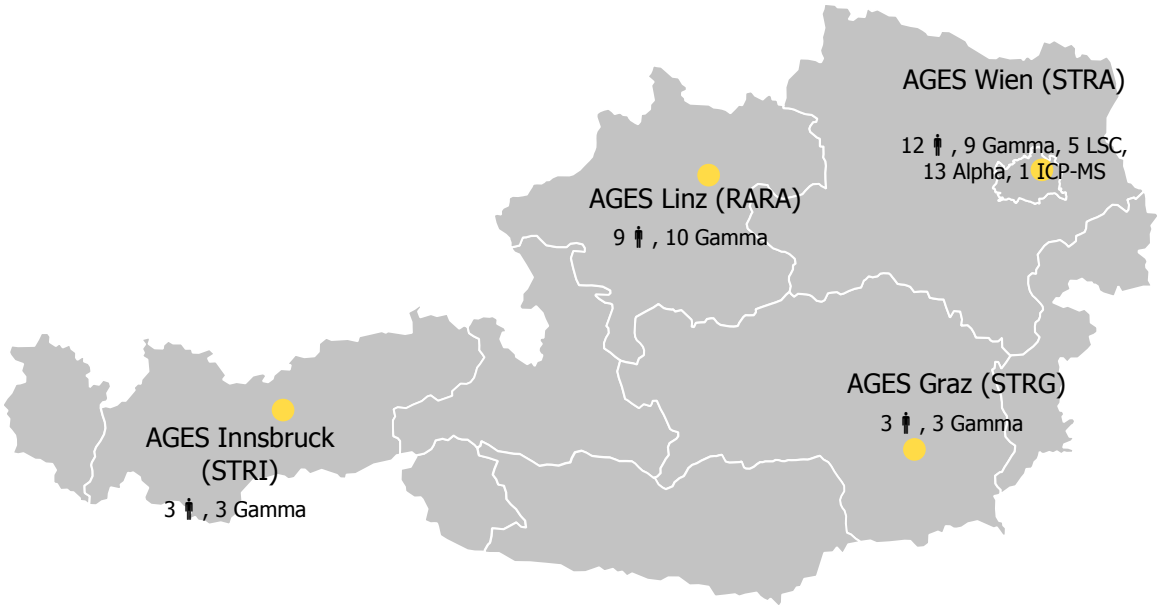


Figure 13. AGES radiological laboratories (locations, equipment, personnel)

[13] Spargelfeldstraße 191, 1220 Wien

Sample reception

Every sample is sent to the laboratory with an accompanying ticket; in the laboratory each sample is identified with a number sticker. At the reception, all samples are checked to make sure the containers and packing are intact. If a broken parcel is discovered, the laboratory informs the provider and a new sample is requested.

Sample preparation

The laboratories have sample preparation rooms, where incoming samples are registered in a LIMS database. All samples are assigned a unique sample code for traceability in the analysis and reporting chain.

Milk samples are split into two aliquots: one for Sr-90 analysis and one for gamma spectrometry. The wet weight is noted. The samples are assumed to be homogenous in its content of radionuclides. The aliquot for gamma spectrometry is transferred to a Marinelli geometry and stored in a fridge until measurement. The aliquot for Sr-90 analysis is dried in a drying oven and ashed before radiochemical separation is done.

All water samples are pH adjusted to around 1 with concentrated HNO_3 acid.

Mixed food samples are homogenized with a standard food processor for about 5 min. One aliquot is taken for Sr-90 analysis and stored and dried in a drying oven until the radiochemical separation starts. For gamma analysis, one Marinelli beaker is filled and stored in a refrigerator until the sample is measured.

Equipment

The AGES laboratories are equipped with the following counting equipment

- 25 HPGe gamma spectroscopy systems
- 5 Liquid scintillation counters
- 13 Alpha spectroscopy systems
- 1 ICP-MS

In addition, the laboratories have equipment for sampling, sample preparation (mills, grinders, etc.), storage (refrigerators, freezers) and chemical separation. There are also several portable radiation monitoring devices for mobile monitoring in the event of an emergency.

Sample storage requirements

If unusual nuclides or elevated activity levels are detected, the sample is kept for at least 1 year. Air, surface water and deposition samples are kept for 10 years. Otherwise, the samples are disposed after analysis.

5.9 EMERGENCY MONITORING

5.9.1 Austrian police

In Austria, mobile radiation measurements are performed by special units of the Austrian Police (also called BMI Intervention and radiation detection teams), which include around 500 persons all over Austria. In the Vienna region, the numbers of specially trained Police officers are 36 (Vienna), 126 (Lower Austria) and 36 (Burgenland).

The teams can intervene in source search (contamination and sealed sources), dose rate measurements (cordoning off at given values, identifying places of highest dose rate), contamination control and nuclide identification (with the CBRN Special Unit – GKO).

Dose rate measurements are done with the dose rate meter “SSM-1”, an Austrian product from the 1990s, which is widely used by Police, Military and other first responder organizations. For higher precision, a combination of up to four plastic scintillator probes can be used to determine elevated

levels of radiation. In addition to dose rate monitoring, the Austrian Police can perform radionuclide identification using handheld devices (MKC A-03, RADEAGLE) and specific measurements of surface contamination (Berthold LB 124 Scint).

Airborne monitoring is performed by specially trained officers using Police helicopters**.** The equipment consists of four plastic scintillator probes; their signals are combined to achieve a reasonable level of detection. All over Austria, 10 such systems are in place, four of those are located in the Vienna region.

Marine monitoring on the Danube is performed using Police boats. A portal monitor (YANTAR) can be placed on a Police boat, thus providing a possibility to do gamma and neutron measurements on the Danube, for example next to cargo ships.

The equipment used by teams consist of

- Detection equipment:
  - Alarm dose meter Thermo EPD
  - Contamination probe SSM1-02
  - Scintillator probe SSM1-12 Aspect
  - Dose rate meter SSM-1
  - Contamination probe TMB-3
  - Alarm dose meter Graetz EDW-150
- Personal Protective Equipment:
  - One-way protective suit
  - Full face mask with P3 filter
  - FFP3 masks
  - Safety boots
  - Chemical resistant gloves
  - Thermoluminescent dose meter (TLD)
- Special equipment:
  - Gamma Aeroradiometry system in each Provincial Police Directorate and at the Civil Protection School
  - Gamma spectrometer (RADEAGLE) and Radionuclide sensitive contamination probes (LB-124 Scint) on five places across Austria
  - there is one portal monitor YANTAR at the Civil Protection School

5.9.2 AGES

The Austrian Agency for Health and Food Safety (AGES) has dedicated emergency workers at the locations in Wien and Linz. These intervention teams can carry out terrestrial monitoring using the following mobile equipment:

AGES Wien:

- In-situ-gamma-detector (Canberra)
- Dose rate monitor (Automess 6150AD + 6150AD-b/E)
- Nuclide-identification device (RADEAGLE)
- Portable contamination monitors for alpha- and beta/gamma measurement (e.g. BERTHOLD - LB 124 SCINT)
- Neutron dose rate monitor (BERTHOLD - LB 123-N)
- Alarm dose meter

AGES Linz:

- In-situ-gamma-detector (Canberra)
- Dose rate monitor (Automess 6150AD + 6150AD-b/E)
- Nuclide-identification device (RADEAGLE)

- Portable contamination monitors for alpha- and beta/gamma measurement (e.g. BERTHOLD - LB 124 SCINT)
- Alarm dose meter

In addition, the locations Graz and Innsbruck have the following equipment:

- Dose rate monitor
- Portable contamination monitors for alpha- and beta/gamma measurement
- Alarm dose meter

5.9.3 Fire brigades

The fire brigades in Austria are quipped to carry out basic radiation monitoring on accident areas. Typically, the first responder group equipment includes the following:

- Dose rate monitor (Automess 6150 AD-2)
- Electrical dosimeters with alarm (Automess ADOS-F)
- TLDs for each staff member

For radiological assessment, the Fire Brigades have also CBRN measurement vehicles containing the following measurement instruments:

- 1 Gamma-Spectrometer (NaI)
- 4 different types of dose rate meters (10 nSv/h - 10 Sv/h)
- 3 different types of contamination probes (alpha, beta, gamma)
- 1 portal monitor (gamma and neutron)
- 30 tactical dose meters Automess ADOS-F (one for each person in the tactical unit)
- 30 personal dose meters TLD (one for each person in the tactical unit

The fire brigades have been trained to carry out radiological assessment, dose and dose rate measurements, contamination control, basic radionuclide detection, sampling and decontamination.

5.10 INFORMATION FOR THE GENERAL PUBLIC

5.10.1 BMK

Information about the national environmental radioactivity monitoring program is provided by the BMK at the Austrian Government website[14]. At this website, the BMK presents the monitoring programs together with the selected main results and interpretations. This includes text and figures, sometimes based on processed data such as mean values etc. The on-line local dose rate data (hourly mean values) for 111 stations of the Austrian automatic radiation monitoring network are available on the website.

The information on routine monitoring includes the following:

- Report on environmental radioactivity monitoring (every 2 years) in cooperation with AGES and BMSGPK
- Report on the Austrian radiation early warning system (every 2 years)
- On-line measurement values from around 111 dose rate monitoring stations of the radiation early warning system, comments in case of abnormal measurement values

The information on radiological emergency preparedness includes the following:

- Relevant documents of emergency plans at federal level
- Austrian Catalogue of Protective Actions, updated periodically
- Emergency management system in Austria, protective actions for agriculture, etc.

[14] http://www.strahlenschutz.gv.at

In the event of a radiological emergency, the public will be informed via the homepage of the BMK, press releases (APA), Twitter and Facebook messages and announcements by the Austrian broadcasting system (radio and TV). A siren warning system is available for alerting the public.

5.10.2 AGES

The AGES maintains a public information website[15]. In addition, it provides information to the REM database and prepares a report on the environmental radiation every other year.

5.10.3 BMSGPK

The BMSGPK webpage[16] provides information on potassium iodine tablets and food radioactivity monitoring (routine monitoring, monitoring of foodstuff imported from Japan, monitoring of game and mushrooms from the forest).

5.10.4 BMI

The BMI webpage[17] contains some information on radiation protection. In the event of an emergency, the BMI is prepared to open a call centre, if requested by the BMK.

[15] www.ages.at/themen/strahlenschutz

[16] www.sozialministerium.at/Themen/Gesundheit/Strahlenschutz.html

[17] www.bmi.gv.at/204/Download/start.aspx

6 VERIFICATIONS

6.1 INTRODUCTION

Verification activities were carried out in accordance with the agreed programme. This chapter summarises the verifications carried out the 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.

6.2 FEDERAL MINISTRY FOR CLIMATE ACTION, ENVIRONMENT, ENERGY, MOBILITY, INNOVATION AND TECHNOLOGY

6.2.1 Monitoring network data centre

The network servers of the Austrian automatic radiation monitoring network are located in the basement of the BMK ministry building[18]. Physical protection of the servers is ensured by a locked gage and a fire protection system. There is also a UPS and a diesel generator available for electrical back-up.

No remarks.

6.2.2 Monitoring facilities at the Wien-Atominstitut

The verification team visited the reactor facility of the Atominstitut in Vienna[19]. The facility has a Triga Mark 2 nuclear research reactor.

In front of the reactor building there is one monitoring station of the national automatic dose rate network (station AT2009) (Fig. 13). The system is identical with the other 318 dose rate monitors in the Austrian network. This probe (Bitt technology RS03/A232) is on a grass field close to the building wall inside the fenced facility area. The electronics unit of the station is located inside the reactor facility building. This includes the communication modem, a local data display and a battery for 24h independent operation. The probe is 23 years old; the expected lifetime is 35 years. Control measurements are carried out three times each year. On three-year intervals, all network probes are taken to the service company for a full recalibration.

In addition to the national network monitoring station, there is also the reactor facility radiological environment monitoring equipment, which includes a dose rate monitor, 4 TLDs and 4 wells (5 m deep) for ground water sampling (Fig. 14). Data from these systems is not part of the national monitoring data, but serves for reactor facility environment monitoring.

[18] Untere Donaustraße 11, 1020 Vienna

[19] Schüttelstraße 115, 1020 Vienna

No remarks.

Figure 13. Dose rate detector AT2009 and its electronics unit at the Vienna Atominstitut

Figure 14. Atominstitut site dose rate monitor and a TLD environmental dosimeter

6.2.3 Monitoring facilities at Wien-Breitenlee

The verification team visited the monitoring station located at the AGES laboratory area in Breitenlee (Fig. 15). The station consists of the following equipment:

- Station AT2008 of the automatic dose rate monitoring network (BITT RS03/A232)
- Small-volume air sampler for iodine monitoring (F&J Products pump with a charcoal cartridge and a flow meter)
- Large atmospheric deposition collector (wet and dry deposition)
- Medium-volume air sampler
- High-volume air sampler (800 m^3/h) (Fig. 16)

The equipment are located inside the fenced laboratory area. There is no back-up power supply at this station.

No remarks.

Figure 15. Atmospheric sampling equipment at the AGES laboratory site (from left: small-volume iodine sampler, large deposition sampler, medium-volume air sampler and a high-volume air sampler)

Figure 16. High-volume air sampler filter with heaters

6.2.4 Monitoring facilities at Zwerndorf

The verification team visited the automatic monitoring station located at the Zwerndorf village outside Vienna close to the border with Slovakia. This is a standard monitoring station of the automatic monitoring network. The equipment is located at a fenced area next to a waterworks pumping station. At the same site, there are also equipment of the Austrian meteorological service.

The site equipment includes a station of the automatic dose rate monitoring network (BITT RS03/A232) and a radiological monitoring container BITT AMS 02 (Fig. 17). The container belongs to the automatic air monitoring network (see section 5.3.1). This is a fully automatic small-volume (8 m^3/h) filter system for monitoring both particulate and gaseous radioactivity. Filters are measured by the system on a continuous basis and the system is able to send an alert in the event of high values. One filter is kept in the collector position for 24 hours; a robotic arm changes the filters. There is an electrically cooled HPGe detector[20] and an alpha/beta PIPS detector for aerosol monitoring and two NaI detectors for Iodine monitoring. The container includes also monitors for temperature, wind direction and wind speed. A UPS is available to facilitate operation during short power cuts (max. 10 minutes). The container is temperature controlled and lightning protected.

> *The verification team commends the sophisticated approach to automatic air radioactivity monitoring in Austria.*

[20] Four stations of the automatic air monitoring network (Villach, Laa/Thaya, Braunau and Kufstein) are equipped with NaI detectors instead of HPGe detectors.

Figure 17. BITT AMS02 radiological monitoring container

6.3 Austrian Agency for Health and Food Safety

The verification team visited the Austrian Agency for Health and Food Safety (AGES)[21], Division of Radiation Protection and Radiochemistry. AGES is a state-owned company with 6 business units and around 1500 staff. One of the units works on radiation protection, employing 47 staff members (18 of them responsible for the measurements). It has radio-analytical laboratories in Innsbruck, Linz, Graz and Vienna.

The AGES presented to the verification team its radio-analytical laboratory in Vienna and the mobile equipment available for monitoring in emergency situations.

6.3.1 Radio-analytical laboratory

The radio-analytical laboratory of the AGES Vienna is well equipped. The environmental radioactivity monitoring programme includes monitoring of air, atmospheric deposition, surface water, ground water and waste water. There are automatic samplers for air and river water. In addition, the AGES laboratory monitors food, milk, mixed diet and drinking water. Incoming samples are recorded in the sample database RAMSES and labelled using QR-codes.

The laboratory has ISO17025 accredited measurement methods using HPGe-gamma spectrometry, liquid scintillation counting, alpha spectroscopy and inductively coupled mass spectroscopy (ICP-MS). The counting equipment consists of the following:

- HPGe-detectors (Canberra, 25 in total, 10 in Vienna)
- Alpha-spectrometers (Canberra 7401, 13 in total, all in Vienna)
- Liquid scintillation counters (Quantulus, 5 in total, all in Vienna + one portable HIDEX)
- ICP-MS (Thermo Scientific iCAP TQ, 1 in Vienna)

Gamma spectroscopy systems are calibrated using standard sources; also mathematical efficiency calibration programme (Canberra ISOCS) is available. Quality control of HPGe-detector calibration stability is carried out monthly, but it does not include control of detector resolution (FWHM).

[21] Spargelfeldstraße 191, 1220 Vienna

The laboratory facilities of the AGES consists of separate rooms for sample receipt, storage, preparation (evaporation, chemical separation, etc.) and counting. If elevated radioactivity levels are found, a report is prepared to the ministry immediately. Regular reporting is carried out every 2nd year. In addition, the AGES reports monitoring results to the EU REM database.

In the event of an emergency, special procedures are available for sample handling in order to avoid contamination or elevated radiation background in the laboratories.

In addition to the regular monitoring programme the AGES laboratory participates in emergency exercises and has carried out several specific monitoring projects, for example on ground water, wild boar, imported food and river Danube sediments.

The verification team suggests including trend control of HPGe-detector resolution stability (FWHM width of the ^{60}Co-peak at 1332 keV) in the monthly quality controls.

6.3.2 Emergency monitoring capabilities

The AGES has four laboratories, which can carry out radiation monitoring in the event of an emergency. It has developed large-scale emergency procedures for monitoring. Each laboratory takes part in emergency exercises every other year.

Altogether some 600 environmental samples can be measured daily during an emergency. In addition to their standard laboratory equipment, the laboratories are equipped with pre-prepared boxes of field monitoring equipment, which are normally operated by two persons. The mobile equipment (Figure 18) consists of the following:

- Portable NaI gamma detector + other dose rate monitors
- Radionuclide identifier + neutron detector (RADEAGLE system)
- Contamination detection equipment
- Neutron detector (Berthold)

The AGES Vienna laboratory is equipped also with a portable liquid scintillation counter (HIDEX Triathler) and a medium-volume (80 m^3/h) portable air sampler (Figure 19).

No remarks.

Figure 18. AGES portable gamma and neutron radiation monitoring equipment

Figure 19. AGES portable liquid scintillation counter and air sampler

6.4 FEDERAL MINISTRY OF THE INTERIOR

6.4.1 Organisation of monitoring in Austria

The verification team was briefed on the organisation of the Austrian civil protection and police to carry out radiation monitoring. Radiation protection training (courses on three levels) is provided by the Austrian Civil Protection School according to the Austrian standard ÖNORM S 5207. The school trains the Austrian RANET teams; it is one of the capacity building centres for EPR designated by the IAEA. Altogether, some 550 members of the police and civil protection staff have received radiation protection training.

The police services in Austria are equipped with some 400 radiation detection sets, which consist of a dose rate monitor, alarming personal dosimeters and a contamination probe. In addition, the sets include personal protective equipment. Some sets have also nuclide identification capability (portable gamma spectroscopy system Ortec RADEAGLE). With this equipment, the radiation protection teams of the police and civil protection can carry out source search operations (without source recovery capability)[22], dose rate mapping, area cordoning and contamination control.

> *The verification team commends the extent and quality of the radiation monitoring training and operational arrangements of the police and civil protection services.*

6.4.2 Terrestrial monitoring capabilities of the Austrian police in Vienna

The verification team verified the radiation monitoring equipment of the Austrian police CBRN unit in Vienna. The unit is equipped with a radiation monitoring set described in section 6.4.1, including the RADEAGLE system for nuclide identification (Fig. 21). The equipment is kept available among other CBRN equipment in a van without police markings (Fig. 20). The Austrian police has five such units, which means that they can reach any part of the country in less than two hours.

[22] Source recovery operations are carried out by the Mobile Intervention Team of the Nuclear Engineering Seibersdorf.

No remarks.

Figure 20. Austrian police CBRN unit van

Figure 21. Radiation monitoring equipment of the Austrian police CBRN unit

6.4.3 Airborne monitoring capabilities of the Austrian police in Vienna

The verification team visited the Austrian police airborne unit[23], which is equipped with helicopters (Fig. 22). The gamma aeroradiometry system (Fig. 23) can be installed in the helicopter in order to carry out source search or geographical mapping of gamma radiation dose rate. The monitoring is not nuclide-specific. The aircraft are equipped with GPS mapping software and ground-distance altimeters to maintain the exact distance to the ground (80 meters) during these operations. The airborne units participate in regular monitoring exercises. There is one gamma aeroradiometry system available in each district (9) and one at the Austrian Civil Protection School.

No remarks.

Figure 22. Austrian police helicopter

[23] Meidlinger Kaserne, Ruckergasse 62, 1120 Vienna

Figure 23. Radiation dose rate monitoring equipment installed in the police helicopter

7 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 Vienna 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 Vienna 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 air, water and soil in the event of a radiological emergency in Vienna are adequate. The Commission ascertained that these facilities are continuously available.

(4) One suggestion concerning monitoring of detector stability in the radiological laboratories has been formulated. Notwithstanding this remark, the verified parts of the monitoring system for environmental radioactivity in Vienna are in conformity with the provisions laid down under Article 35 of the Euratom Treaty.

(5) The Commission services kindly request that the Austrian authorities keep them informed of any significant changes in the set-up of the monitoring systems.

(6) The team's conclusions are set out in the 'Main Conclusions' document addressed to the Austrian competent authority through the Austria Permanent Representative to the European Union.

(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 AUSTRIA (VIENNA)

30 SEPTEMBER – 2 OCTOBER 2020

Wednesday 30 September

09.30 **Opening meeting**
Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Sektion V – Abfallwirtschaft, Chemiepolitik und Umwelttechnologie
V/8 – Abteilung Strahlenschutz *(Untere Donaustraße 11, 1020 Vienna)*

- Welcome address
- European Commission Art. 35 verification programme introduction
- Discussion on past verifications in Austria by the Commission
- Overview of radioactivity monitoring arrangements in Austria
- Overview of radioactivity monitoring arrangements in Vienna
- Verification planning

11.00 **Overview of radioactivity monitoring arrangements in Austria and in Vienna**
Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Sektion V – Abfallwirtschaft, Chemiepolitik und Umwelttechnologie
V/8 – Abteilung Strahlenschutz *(Untere Donaustraße 11, 1020 Vienna)*

- 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 **Radiation Warning Systems**
Environment Agency Austria (EAA, Umweltbundesamt GmbH, Team Radiation Warning Systems
(Untere Donaustraße 11, 1020 Vienna)

- Presentation “Team Radiation Warning Systems”
- Presentation/verification visit the data centre at the BMK

15.00 **Verification of selected monitoring facilities in Vienna and surroundings**
Visit of locations of the early warning systems

- Wien-Atominstitut AT2009

Thursday 1 October

09.00 **Austrian Agency for Health and Food Safety (AGES)**
Radioactivity laboratory in Vienna (STRA)
(*Spargelfeldstraße 191, 1220 Wien*)
Analytical program

- Air
- Water
- Soil
- Atmospheric deposition
- Food stuff and feeding stuff
- Mixed diet

Emergency preparedness (sampling plan, capabilities und responsibilities of AGES in emergencies)
Verification of the monitoring station at the AGES site

- Air samplers
- Dry/we deposition collectors
- Dose rate monitor

Laboratory facilities AGES Vienna

15.00 **Verification of a station of the Austrian AMS system (Zwerndorf, AMS-0003)**

Friday 2 October

09.00 **Verification of mobile emergency teams of the Austrian police (BMI)**
Federal Ministry of the Interior, Department II/13 – Staatliches Krisen- und Katastrophenmanagement und Koordination Zivile Sicherheit
(*Meidlinger Kaserne, Ruckergasse 62, 1120 Wien)*

- Emergency radioactivity monitoring systems (presentation)
- Car monitoring team
- Aerial monitoring

13.00 **Closing meeting**
Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Sektion V – Abfallwirtschaft, Chemiepolitik und Umwelttechnologie
V/8 – Abteilung Strahlenschutz
(Untere Donaustraße 11, 1020 Vienna)

ANNEX 2

AGES LABORATORY COMPARISON EXERCISES AND PROFICIENCY TESTS 2015 – 2020

Organizer	ID	Date	Nuclides
EU-RL	Cs-137 Luftfilter	22.01.2015	Cs-137
IAEA Reference Materials Group, Chemistry Unit; Agency´s Laboratories Seibersdorf, A-2444 Seibersdorf, AQCS@iaea.org, und A-1400 Wien, Wagramer Strasse 5, P.O.Box 100,Tel.: 01-2600 28226, Fax: 01-2600 728 226, E	IAEA-TEL-2015-03	01.06.2015	K-40,Ac-228,Bi-214, Pb-210, Pb-212, Pb-214, Ra-226,Tl-208, U-235, Cs-134, Cs-137, Na-22, Zn-65, U-238, U-234, Pu-Isotopes, Sr-90, gross beta
Bundesamt für Strahlenschutz	RV 2/2015	01.10.2015	H-3, Am-241, Sr-90, gross alpha
bfg Bundesanstalt für Gewässerkunde	Tritium in Wasser 2016	29.02.2016	H-3
EU-RL	Cs-137 Luftfilter	26.02.2016	Cs-137, Cs-134, I-131
IAEA Reference Materials Group, Chemistry Unit; Agency´s Laboratories Seibersdorf, A-2444 Seibersdorf, AQCS@iaea.org, und A-1400 Wien, Wagramer Strasse 5, P.O.Box 100,Tel.: 01-2600 28226, Fax: 01-2600 728 226, E	IAEA-TEL-2016-03	30.05.2016	gamma, gross alpha+beta, Sr-90
BFS	RV 4/2016	01.06.2016	Rn-222, Ra-226, Ra-228, Pb-210, Po-210, U-238, U-235, U-234,gross alpha
Uni Regensburg	K-RISK Phantomwand 2015	24.11.2015	Cs-137, Eu-152
Bundesamt für Strahlenschutz	BfS-RV-2016-H-3/C-14	18.10.2016	H-3, C-14
Bundesamt für Strahlenschutz	BfS-RV-2016-Po-210	18.10.2016	Po-210
IAEA Reference Materials Group, Chemistry Unit; Agency´s Laboratories Seibersdorf, A-2444 Seibersdorf, AQCS@iaea.org, und A-1400 Wien, Wagramer Strasse 5, P.O.Box 100,Tel.: 01-2600 28226, Fax: 01-2600 728 226, E	IAEA-TEL-2017-03	29.05.2017	gamma (+ nat.), H-3, Sr-90,
Europ commission, JRC, Geel	Proficiency Test on I-131, Cs-134 and Cs-137 activity measurements in maize powder	02.06.2017	I-131, Cs-134, Cs-137, (K-40)
IAEA	IAEA Convex-3-2017	14.06.2017	Ba-133, Cs-134, Cs-137,
BFS	RV 2/2017	03.10.2017	U-238, U-235, U-234, gross alpha, Am-241, Cm-244, Pu-238, Pu-239/240, Sr89, Sr-90, H-3
BFS	BfS-RV-2017-Am/Cm/Pu	13.10.2017	Am-241, Cm-244, Pu-240
BEV – Physikalisch-technischer Prüfdienst, Arltgasse 35, A-1160 Wien	BEV-2017-01 NORM	11.05.2017	gamma artificial, K-40, Ra-226, Ra-228
Uni Regensburg	K-RISK Phantomwand 2017	24.11.2017	Co-60, Eu-152

Organizer	ID	Date	Nuclides
IAEA Reference Materials Group, Chemistry Unit; Agency´s Laboratories Seibersdorf, A-2444 Seibersdorf, AQCS@iaea.org, und A-1400 Wien, Wagramer Strasse 5, P.O.Box 100,Tel.: 01-2600 28226, Fax: 01-2600 728 226, E	IAEA-TEL-2018-03	12.06.2018	gamma nat.+artificial , Sr-90, Sr-89, Po-210, Am-241
Bundesamt für Strahlenschutz	Ringversuch Trinkwasser RV 4/2018	21.06.2018	gross alpha, U-238,U-234,Ra-226, Ra-228, Po-210
Bundesamt für Strahlenschutz	Urin	10.09.2018	Am-241, Cm-244
Bundesamt für Strahlenschutz	reales Wasser, Modellwasser RV 1/2018	16.10.2018	Co-60, Cs-134, CS-137, Ba-133, Eu-152, Am-241
Bundesamt für Strahlenschutz	Modellwasser RV 1/2018	16.10.2018	Co-57, Co-60, Cd-109, Cs-134, Cs-137, Eu-152, Am-241
European Commission (EC), Directorat General (DG), Joint Research Centre (JRC), Institute for Reference Materials and Measurement (IRMM), Retieseweg 111, B-2440 Geel, Belgium, Tel.: +32-14-571 882 • Fax: +32-14-584 273 •	EC-JRC-REM 2018 radon-in-water	18.10.2018	Rn-222
Max Rubner-Institut (MRI), Hermann-Weigmann-Straße D-24103 Kiel1	Rohmilch	14.05.2019	K-40, I-131, Ba-133, Cs-134, Cs-137, Sr-89, Sr-90
IAEA Ref. Materials Group, Agency´s Lab., A-2444 Seibersdorf, AQCS@iaea.org, + A-1400 Wien, Wagramer Str. 5, P.O.Box 100, T.: 01-2600 28226	IAEA-TEL-2019-03	22.05.2019	Sample 1&2: gamma nat.+artificial, Sr-90, Ra-224, Ra-226, Ra-228, gross alpha, gross beta, QC-Probe=sample 3: IAEA-SOLL Mn-54 Cs-134 Cs-137 Pb-210 Ra-226 Ra-228 Sr-90 Sample 4 (shrimp): gamma nat.+ Cs-137,Po-210,Pb-210,Ra-224,-226,-228, U-234,-235,-238, gross alpha, gross beta Sample 5-7: gamma, gross beta
Max Rubner-Institut (MRI), Hermann-Weigmann-Straße D-24103 Kiel1	Rohmilch	04.06.2019	K-40, I-131, Ba-133, Cs-134, Cs-137
Bundesamt für Strahlenschutz (BfS) Berlin	BfS Vergleichsprüfung für Trinkwasser RV4/2019	09.08.2019	Rn-222
Bundesamt für Strahlenschutz (BfS) Berlin	BfS Vergleichsprüfung für Trinkwasser RV4/2019	19.08.2019	Ra-226, Pb-210, Uranium, gross alpha
IAEA Ref. Materials Group, Agency´s Lab., A-2444 Seibersdorf, AQCS@iaea.org, + A-1400 Wien, Wagramer Str. 5, P.O.Box 100, T.: 01-2600 28226	IAEA-TEL-2019-03	18.10.2019	Sample 4 (shrimp): gamma nat..+ Cs-137,Pb-210,Ra-224,-226,-228, U-234,-235,-238

Organizer	ID	Date	Nuclides
IAEA Ref. Materials Group, Agency´s Lab., A-2444 Seibersdorf, AQCS@iaea.org, + A-1400 Wien, Wagramer Str. 5, P.O.Box 100, T.: 01-2600 28226	IAEA-TEL-2019-03	15.07.2019	Sample 1&2: gamma nat.+artificial. Ra-224, Ra-226, Ra-228 QC-Probe=s3: IAEA-SOLL in Bq/kg Mn-54 13.8 Cs-134 5.03 Cs-137 27.6 Ra-226 9.1 Ra-228 26.8 Sample 4 (shrimp): gamma nat.+ Cs-137, Pb-210, Ra-224,-226,-228, U-234,-235,-238 Sample 5-7: gamma
Bundesamt für Strahlenschutz (BfS) Berlin	Ringversuch zur Bestimmung von Alpha- und Betastrahlern in Wasser 2019	01.01.2020	H-3 Sr-89 Sr-90 U-234, U-235, U-238 Pu-238, Pu-238/-240 Am-241 Cm-244 gross alpha, gross beta
European Commission (EC), Directorat General (DG), Joint Research Centre (JRC), Institute for Reference Materials and Measurement (IRMM), Retieseweg 111, B-2440 Geel, Belgium, Tel.: +32-14-571 882 • Fax: +32-14-584 273 •	EC-JRC-REM 2018 radon-in-water	16.01.2020	gross alpha, gross beta