ANNUAL REPORT

Activities of the President
of the National Atomic Energy Agency
and assessment of nuclear safety
and radiation protection in Poland in 2021

2021

PAA
NATIONAL
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AGENCY

ANNUAL REPORT

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WARSZAWA 2022

PAA
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AGENCJA
ATOMISTYKI

National Atomic Energy Agency

Purpose and legal basis for the publication of the Report of the President of the PAA

The report on the activities of the President of the National Atomic Energy Agency and the assessment of nuclear safety and radiation protection in the country have been prepared on the basis Article 110 Section 13 of the Act of 29 November 2000 – Atomic Law (Dz. U. of 2021, item 1941 and of 2022, item 974). In accordance with the statutory obligation, this report has been submitted to the Prime Minister.

Vision

The National Atomic Energy Agency is a modern and competent nuclear regulatory authority, which is respected and trusted by the general public, and which conducts activities significant for ensuring nuclear safety and radiation protection.

Mission

The National Atomic Energy Agency, through regulatory and supervisory activities, aims to ensure that activities involving exposure to ionizing radiation are conducted safely for the employees, society, and the environment.

Contents

Dear Readers,

We present you a report containing the evaluation of nuclear safety and radiation protection in the country in 2021. However, we must draw attention to an unprecedented situation, which has occurred at the end of February and beginning of March this year. On 24 February 2022, the aggression of Russian Federation army against Ukraine started. The military activities, including those aimed at nuclear facilities, caused anxieties all over the world and posed a number of challenges, not only for the National Atomic Energy Agency, but also for the entire international community focused on the nuclear safety and radiation protection. **It should be emphasised that the war actions in Ukraine so far have not resulted in the radiation hazard in the country. In Poland, there is no hazard now to human health and life and to the environment.** The attacks of the Russian Federation army, including the occupation of nuclear facilities, the Chernobyl Exclusion Zone and the Zaporizhzhia Nuclear Power Plant, destruction of equipment, and also the plunder of specialised laboratories, require firm condemnation. Poland and the international group of experts on nuclear safety and radiation protection many times called the aggressor to cease hostilities in the area and on site of nuclear facilities.

Since the beginning of the war, the PAA has been undertaking a number of actions, which are aimed at ensuring as good as possible supervision of radiation safety. The agency is in permanent contact with the Ukrainian nuclear regulatory authority, which on a regular basis provides messages on the situation related to nuclear facilities in Ukraine. Each reported incident is analysed in detail by the PAA experts. The National Atomic Energy Agency permanently monitors the radiation situation in the country. At the same time the Agency experts carry out actions related to the expansion and modernisation of the radiation monitoring system. Only this year the Agency plans to purchase almost 20 new stations of early detection of radioactive contamination. This has been the continuation of the work carried out for a few years. A larger number of modern stations provides an even more precise picture of the radiation situation in the country, and in a crisis situation – a better assessment and a possibility of a proper response.

Summarising the previous year, it is important to draw attention to **a high level of nuclear safety and radiation protection in Poland – this is the priority for the National Atomic Energy Agency**. Despite difficulties related to the pandemic restrictions still binding in 2021, we managed to accomplish the assigned tasks, in many cases to a larger extent than in the preceding year.

The nuclear regulatory inspectors are controlling thousands of activities, where the ionizing radiation is used, inter alia in the health preventive actions, medical diagnostics and treatment of diverse illnesses, but also in veterinary medicine, industry, services, or for the scientific research needs. **Last year, the PAA's nuclear regulatory inspectors carried out altogether 835 inspections of the aforementioned entities.** As compared with 2020 that means 370 inspections more. Within the regulatory control over nuclear facilities, in 2021 the PAA performed 18 inspections of facilities managed by the National Centre for Nuclear Research and the Radioactive Waste Management Plant.

In 2021, we issued 836 licenses to conduct exposure-related activities involving ionizing radiation. Thereby, **the number of registered activities in the country increased to 7368 (as of the end of December 2021)**.

The National Atomic Energy Agency is also carrying out its tasks in the field of drafting legal acts related to the state policy on ensuring the nuclear safety and radiation protection. Last year, based on the authorisation of the Minister of Climate and Environment, we conducted the legislative process for **14 draft implementing acts to the Atomic Law**.

The year of 2021 was another consecutive year which passed marked by the preparations to implement tasks resulting from the **Polish Nuclear Power Programme**. The PAA, apart from the Ministry of Climate and Environment and the PEJ company, is one of the three key institutions involved in this programme. The PAA's inspectors will control the process of nuclear power plants construction, starting from the design phase, throughout the construction works, the entire period of operation till the power plant decommissioning. In order to perform the entrusted tasks as well as possible, we strengthen the infrastructure and the staff potential. We are going to continue these actions in the following years as well.

Last year, the PAA experts prepared the **Strategy and policy on nuclear safety and radiation protection in the Republic of Poland**, which was adopted by the Council of Ministers in April this year. This document defines the most important objectives and directions of actions, and also presents the description of the current situation and the principles of nuclear safety and radiation protection. The main objective of the Strategy consists in ensuring the protection of people and natural environment against harmful effects of the ionizing radiation and in improving the level of nuclear safety and radiation protection in the Republic of Poland.

I hope you will find the report interesting,

Łukasz Młynarkiewicz

Dr. Łukasz Młynarkiewicz
President of the National Atomic Energy

1 National Atomic Energy Agency

Fot. PAA

Role of the President of the National Atomic Energy Agency

The President of the National Atomic Energy Agency (PAA) is the central government administration authority competent in matters of nuclear safety and radiation protection. The President's activities are regulated by the Act of 29 November 2000 – the Atomic Law and the relevant implementing acts. The President of the PAA is supervised by the minister competent in climate matters. The President of the PAA performs his tasks with the assistance of the National Atomic Energy Agency.

The scope of activities of the President of the PAA includes tasks which involve ensuring nuclear safety and radiological protection of Poland, in particular:

1) preparation of draft documents related to the national policy on nuclear safety and radiation protection, taking into account the programme of nuclear power engineering development, as well as internal and external threats;

2) exercising regulatory control and supervision over activities which cause or may cause exposure of people and the environment to ionizing radiation, including inspections conducted in this scope and the issuance of decisions on licenses and authorizations as well as other decisions stipulated by the act;

3) promulgation of technical and organizational recommendations on nuclear safety and radiation protection matters;

4) performance of tasks related to the assessment of radiation situation in the country under normal conditions and in radiation emergency situations as well as provision of the relevant information to appropriate authorities and to the general public;

5) performance of tasks resulting from the commitments of the Republic of Poland in the field of nuclear materials accountancy and control, physical protection of nuclear materials and facilities, special control of foreign trade in nuclear goods and technologies, and other commitments arising from international agreements on nuclear safety and radiation protection;

6) conducting activities related to public communication and technical and legal advice on the nuclear safety and radiation protection, including the provision of information to the public about the ionizing radiation and its impact on human health and on the environment, as well as on measures possible to apply in the case of radiation emergencies, excluding the promotion of ionizing radiation use, and, in particular, in nuclear power sector, due to the principle of independence of the nuclear regulatory authority;

7) cooperation with central and local administration authorities in matters related to nuclear safety and radiation protection, and in research on nuclear safety and radiation protection;

8) performance of tasks related to the national and civil defence as well as protection of classified information, as stipulated in separate regulations;

9) preparation of opinions on nuclear safety and radiation protection with reference to planned technical activities involving the peaceful use of atomic energy, for the needs of the central and local administration authorities;

10) cooperation with competent foreign entities and international organizations on matters covered by the Atomic Law;

11) preparation of draft legal acts on the matters stipulated by the Atomic Law and consulting them pursuant to the procedure specified in the Rules of Procedure of the Council of Ministers;

12) issuance of opinions on draft legal acts developed by authorised bodies;

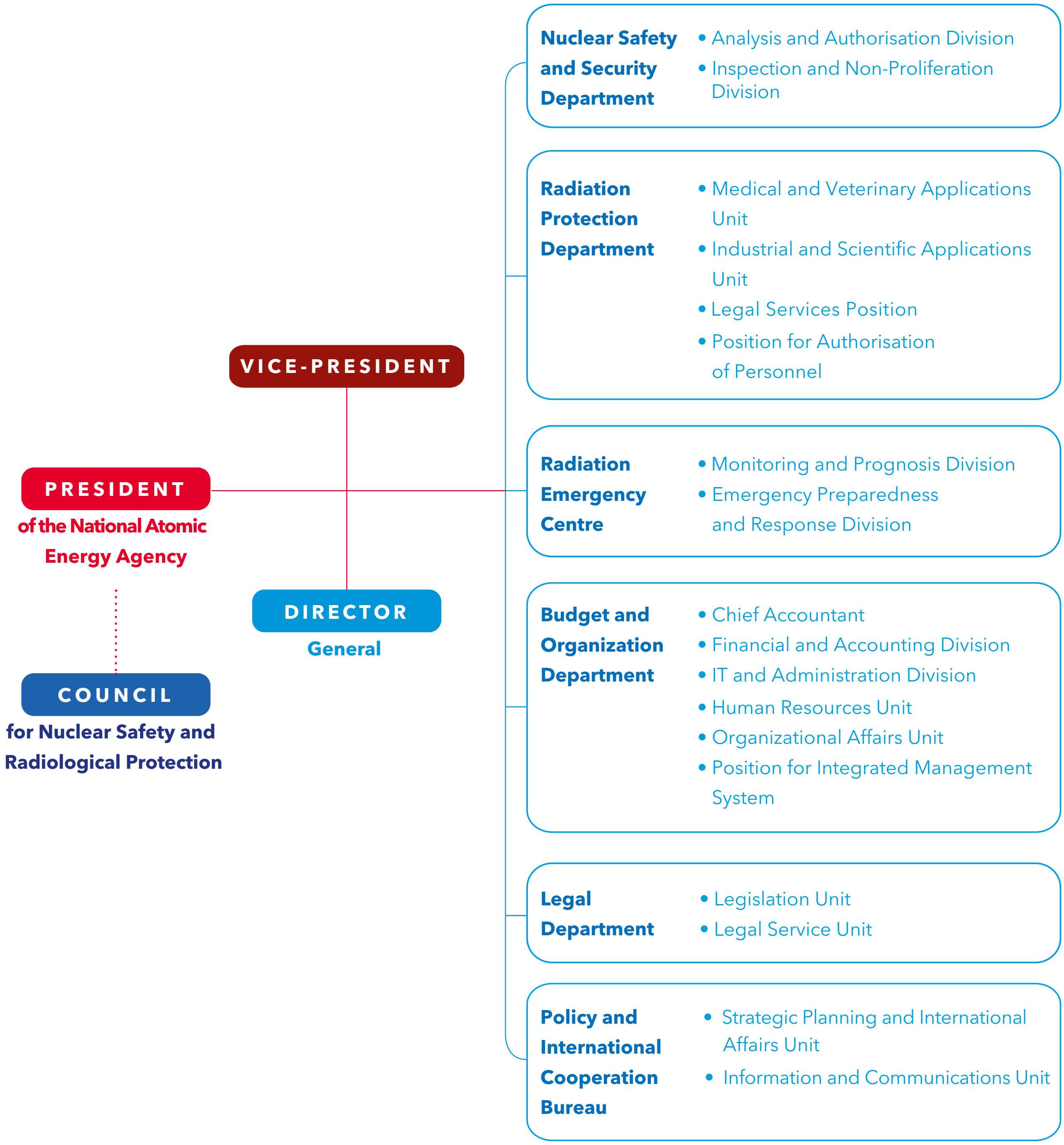
13) presentation of an annual report on the President of the PAA's activities for the preceding year and an assessment of the state of nuclear safety and radiation protection in the country for approval to the Prime Minister by 30 June of each year.

The Prime Minister may define a detailed scope of activities of the President of the National Atomic Energy Agency by way of a regulation; so far he has not exercised this right.

Organizational Structure

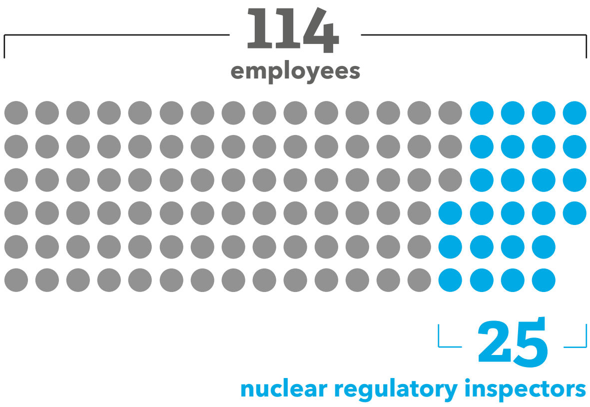
FIGURE 1.

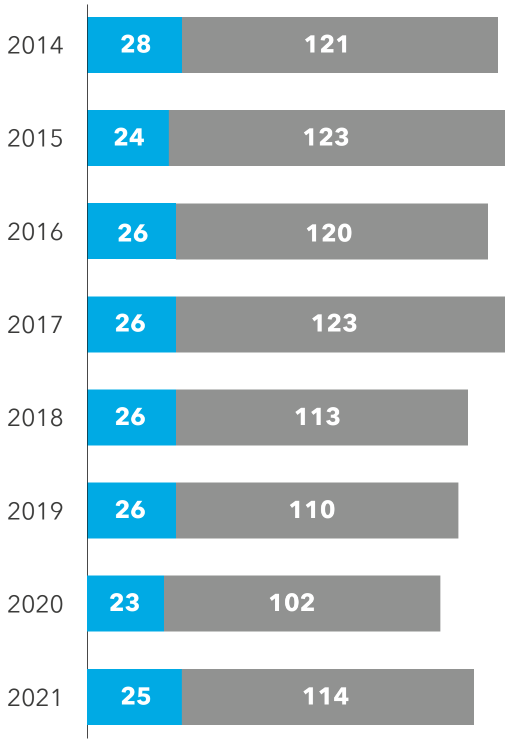
Organizational structure of the PAA (as of 31 December 2021)



Employment

As of 31 December 2021, the headcount in the PAA was 114 (FTE: 111.475). The calculation was based on the employment level without persons on unpaid and parental leaves. As of 31 December 202,1 the PAA employed 27 nuclear regulatory inspectors, including 2 on unpaid leaves.





Council for Nuclear Safety and Radiological Protection

The Council for Nuclear Safety and Radiological protection (the Council) is an advisory and consultative body for the President of the PAA. The Council is composed of the Chairman, Deputy Chairman, Secretary, and no more than seven members appointed from among specialists in nuclear safety, radiation protection, physical protection, nuclear protection safeguards, and other specialities relevant to the supervision of nuclear safety.

Tasks of the Council

- Issuing opinions on licenses for activities involving exposure to ionizing radiation in the construction, commissioning, operation, and decommissioning of nuclear facilities,
- Issuing opinions on draft legislation as well as technical and organizational recommendations,
- Launching initiatives to improve the supervision of activities related to exposure to ionizing radiation.

The 2021 Report of the Council on FY 2021 has been published in the PAA's Public Information Bulletin.

Composition of the Council

Composition of the FY 2021 Council:

Prof. **JANUSZ JANECZEK**, D.Sc,
Chairman of the Council

Prof. **ANDRZEJ G. CHMIELEWSKI**, D.Sc. Eng.
Deputy Chairman of the Council

Prof. **MAREK K. JANIAK**, D.Sc, M.D.
Member of the Council

TOMASZ NOWACKI, Ph.D.
Member of the Council

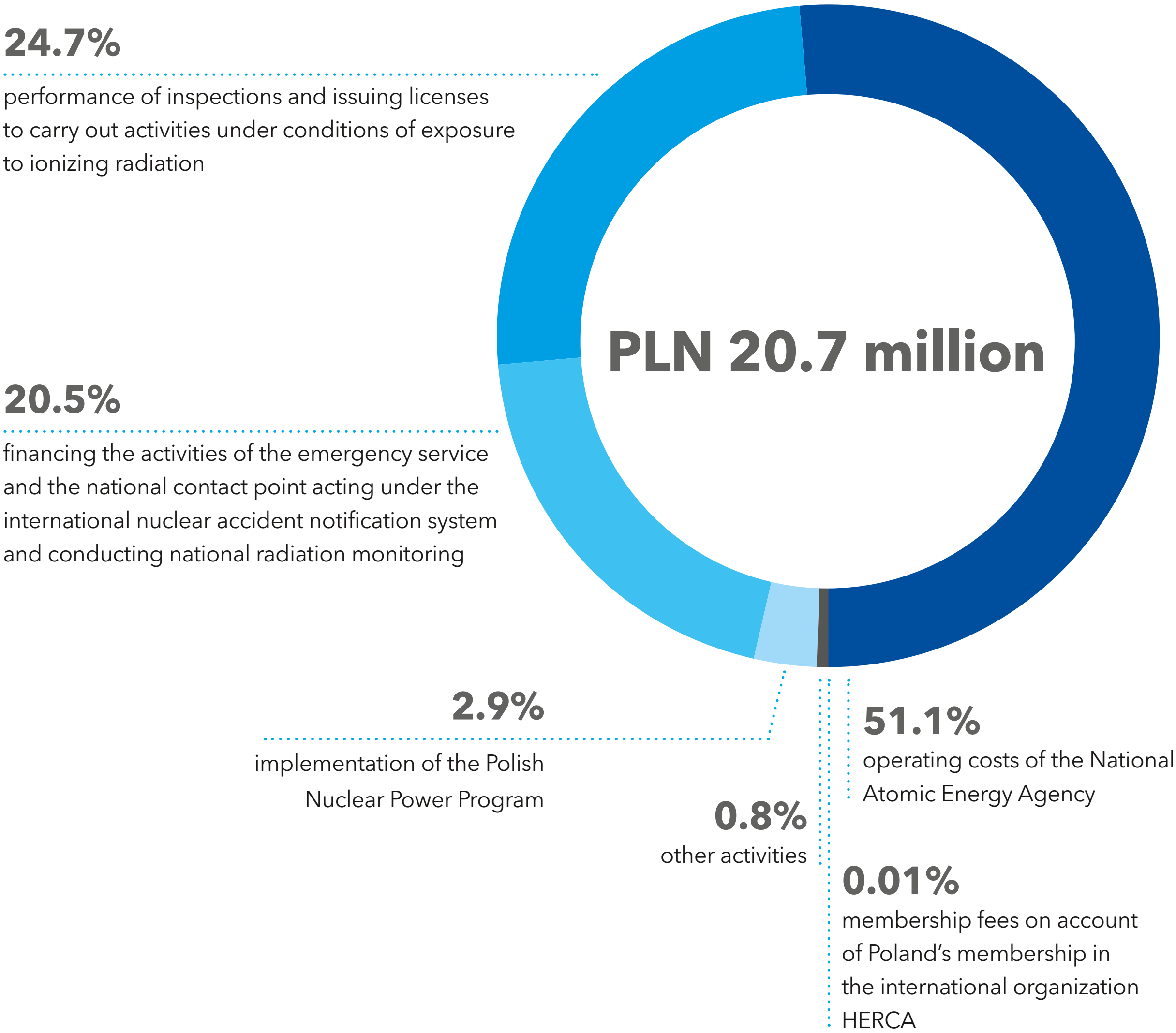
PIOTR KOŚCIŃSKI, Ph.D.
Member of the Council

Prof. **KONRAD ŚWIRSKI**, D.Sc.
Member of the Council (till 23 September 2021)

Budget

FIGURE 2.

In 2021, the budgetary expenses amounted to PLN 20.7 million, and included:



Additional information:

The budgetary expenses in 2021 amounted to PLN 20.7 million, including PLN 45,000 of budgetary expenses from European funds.

In 2021, the budget of the National Atomic Energy Agency was reduced against 2020 by the amount of membership fee in the International Atomic Energy Agency in Vienna – PLN 15,602,000.00. This fee was transferred to the part 47 – Energy (Ministry of Climate and Environment).

In 2021, the full range of tasks (as revised) planned for implementation in the substantive departments was successfully executed. The PAA's budgetary expenses were incurred in a purposeful manner and in accordance with the planned aim, based on the schedule of expenditures.

Assessment of the PAA's operations

Audits performed by the Supreme Audit Office

As a result of the audit performance in 2020 the Supreme Audit Office (NIK) positively assessed the budget spending in 2019, in section 68 – the National Atomic Energy Agency. In 2021 there was no NIK audit.

National Atomic Energy Agency and the Polish Nuclear Power Programme

On 2 October 2020, the Council of Ministers adopted resolution No 141 updating the multiannual programme named 'Polish Nuclear Power Programme' (M.P. Item 946). The Polish Nuclear Power Programme (PPEJ) is aimed at constructing in Poland from 6 to 9 GWe of installed capacity based on proven, large-scale, pressurized water reactors of generation III and III+. The schedule assumes the construction and commissioning of 2 nuclear power plants, each with 3 reactors. Poland still faces the choice of the target technology of the first nuclear power plant. On 22 December 2021, the Polskie Elektrownie Jądrowe Sp. z o.o. (PEJ, Ltd.) has informed that the seaside municipality of Choczewo was chosen as the preferred site for the construction of the first nuclear power plant in Poland. The location named 'Lubiatowo-Kopalino' was indicated based on very detailed environmental and location surveys carried out since 2017. The company PEJ will be now applying to obtain necessary administrative decisions. The start of the first reactor's construction is planned for 2026, its commissioning for 2033, and the commissioning of the last reactor in the second power plant for 2043.

The National Atomic Energy Agency is one of the main stakeholders of the PPEJ and plays the role of a regulatory authority – it is to supervise the safety and operation of nuclear facilities, perform safety inspections and assessments, issue licenses, and impose sanctions, if any.

In order to prepare for its role of a nuclear regulatory authority, the PAA plans to employ at least 55 specialists during the nearest 2 years. The newly employed persons will be performing tasks of the nuclear regulatory control, related primarily to the oversight and inspection of the construction of the first nuclear power plants in the country. In accordance with the PPEJ assumptions, the PAA is to recruit 70 new employees by 2026.

Summary

The National Atomic Energy Agency is one of the main stakeholders of the PPEJ and plays the role of a regulatory authority – it is to supervise the safety and operation of nuclear facilities, perform safety inspections and assessments, issue licenses, and impose sanctions, if any.

2 Nuclear regulatory infrastructure in Poland

Fot. NCBJ

Definition, structure, and functions of nuclear safety and radiation protection system

The system of nuclear safety and radiation protection comprises all the legal, organizational, and technical projects, which ensure the highest standards of nuclear and radiation safety of nuclear facilities and activities carried out with the use of ionizing radiation sources in Poland. The safety hazard may result from the operation of nuclear facilities both in the country and abroad, and from other activities involving the use of ionizing radiation sources. In Poland, all the issues related to the radiation protection and radiation monitoring of the environment, pursuant to the legislation in force, are examined together with the issue of nuclear safety, as well as with physical protection and safeguards of nuclear materials. Such a solution guarantees that there is one common nuclear regulatory approach and a single, common approach to aspects of nuclear safety, radiation protection, safeguards of nuclear materials and radioactive sources.

LEGAL BASIS

The system of nuclear safety and radiation protection operates in accordance with the Act of 29 November 2000 – Atomic Law and its implementing acts, as well as applicable directives and regulations of the EU Council/Euratom and international treaties and conventions, of which Poland is a cosignatory.

Nuclear regulatory authorities in Poland:

- President of the PAA,
- nuclear regulatory inspectors.

Essential elements of the nuclear safety and radiation protection system:

- supervision of activities involving nuclear materials and ionizing radiation sources, carried out through:
    - regulatory safety verification of the activities applied for and granting licenses for their performance or receiving registrations and notifications of their performance,
    - verification over the manner of such activity and application of sanctions in the case of breaching the safety rules,
    - control of the doses received by workers,
    - supervision of training of radiation protection officers (experts in nuclear safety and radiation protection, working in entities carrying out activities based on the granted licenses), workers employed on positions of significant importance for the nuclear safety and radiation protection, and workers exposed to ionizing radiation,
    - control of trade in radioactive materials,
    - keeping the register of radioactive sources, the register of their users, and a central register of individual doses, and in the case of activities involving the use of nuclear materials – keeping detailed records and accountancy for such materials, providing approvals for systems of physical protection of nuclear material, and control of the technologies applied;
- identification and assessment of the radiation situation in the country, through coordination (including standardisation) of the work performed by local stations and units, which measure the level of radiation dose rate, the contents of radionuclides in selected components of the natural environment and in drinking water, food products and fodder;
- maintaining the service prepared to identify and assess the radiation situation and to respond in the case of radiation emergencies (in cooperation with other competent authorities and services operating under the national emergency response system);
- performance of the work aimed at fulfilling Poland's commitments resulting from the membership in international organizations, and also from treaties, conventions, and international agreements on nuclear safety and radiation protection, as well as bilateral agreements on mutual assistance in the case of nuclear accidents and cooperation in the scope of nuclear safety and radiation protection with Poland's neighbouring countries, as well as for the purpose of assessing the condition of nuclear facilities, radioactive sources and waste management, and nuclear safety and radiation protection systems outside of Poland.

Nuclear regulatory tasks are performed by the President of the PAA with the assistance of nuclear regulatory inspectors and employees of the specialised organizational units of the PAA. In performing these tasks, the President of the PAA also relies on the expert support from the Members of the Council for Nuclear Safety and Radiological Protection and members of examination boards.

The supervision of the President of the PAA over the activities carried out under conditions of exposure to ionizing radiation comprises:

- Determination of the conditions required to ensure nuclear safety and radiation protection;
- Safety assessment as the basis for granting licenses and formulating their conditions, and for taking other administrative decisions;
- Issuance of licenses for the performance of exposure-related activities, consisting in:
  - production, processing, storage, transport, or use of nuclear materials, radioactive materials, or radioactive sources (excluding waste containing radioactive materials, which is not radioactive waste) and trade in such materials or sources,
  - storage, transport, processing, or disposal of radioactive waste,
  - storage, transport, and reprocessing of the spent nuclear fuel and trade in this fuel,
  - isotopic enrichment,
  - operation or closure of a uranium ore mine,
  - construction, commissioning, operation, or decommissioning of nuclear facilities,
  - construction, operation, or closure of radioactive waste repositories,
  - manufacture, installation, use, and operation of equipment containing radioactive sources or trade in such equipment,
  - commissioning or using the equipment generating ionizing radiation,
  - commissioning of laboratories, where sources of ionizing radiation are to be used, including X-ray or medical X-ray laboratories,
  - intended addition of radioactive substances in the production process of consumer products and medical devices, medical devices for in vitro diagnostics, accessories for medical devices, accessories for medical devices for in vitro diagnostics, active implantable medical devices, as defined by the Act of 20 May 2010 on Medical Devices (Dz. U. of 2021, item 1565), trade in these devices, and import to or export from the territory of the Republic of Poland of such devices or accessories, and consumer products, to which radioactive substances have been added,
  - deliberate administration of radioactive substances to people or animals for the purpose of medical or veterinary diagnostics, treatment, or research,
  - activation of the material causing an increased activity in a consumer product, which cannot be disregarded from the point of view of radiation protection,

and also receiving registrations and notifications related to the performance of such activities.

- Inspection of the aforementioned activities with regard to compliance with the criteria specified in the applicable regulations and with the requirements of the licenses granted;
- Imposition, as a result of implemented administrative proceedings, of sanctions enforcing the observation of the aforementioned requirements;
- With respect to activities involving nuclear materials and nuclear facilities, the President of the PAA's supervision also includes the approval and control of physical protection systems and performance of activities provided for in the Republic of Poland's commitments regarding nuclear materials safeguards.

The exception to the principle of the President of the PAA's supervision of activities involving ionizing radiation sources consists in the exercise of this supervision by state regional sanitary inspectors (or appropriate authorities of military sanitary inspection reporting to the Ministry of National Defence), with respect to commissioning or using X-ray equipment in medical diagnostics, interventional radiology, surface radiotherapy and radiotherapy of non-oncological diseases, as well as commissioning of medical X-ray laboratories.

Basic provisions of law on nuclear safety and radiation protection

The Atomic Law Act

The Act of 29 November 2000 – Atomic Law, effective as of 1 January 2002, introduced a uniform legal framework to ensure nuclear safety and radiation protection of workers and the general public in Poland.

The most important of its provisions are related to the granting of licenses for activities involving exposure to ionizing radiation (that is licenses issued for activities listed in the subsection 'Definition, structure and functions of the nuclear safety and radiation protection system'), receiving registrations and notifications about such activity, the duties of heads of organizational entities conducting activities involving ionizing radiation, and the powers of the President of the National Atomic Energy Agency to exercise control and supervision over such activities. The Act also specifies other tasks of the President of the PAA, including those related to the assessment of country's radiation situation and procedures in the case of radiation emergencies.

The principles and methods of procedure specified in the Act apply to *inter alia* the following issues:

- justification for undertaking activities involving exposure to ionizing radiation, its optimisation and the establishment of dose limits for workers and members of the public,
- procedure for obtaining licenses to perform such activities as well as the procedure and method of control of such activities,
- activities involving naturally occurring radioactive material,
- protection against exposure to radon in workplaces and buildings intended for habitation,
- requirements of patient's radiation protection,
- principles of human exposure to non-medical imaging,
- record keeping and control of ionizing radiation sources,
- siting, designing, construction, commissioning, operation, and decommissioning of nuclear facilities,
- accountancy and control of nuclear materials,
- physical protection of nuclear materials and nuclear facilities,
- management of high-activity sealed sources,
- radioactive waste classification and management, and spent nuclear fuel management,
- classification of workers and workplaces according to the degree of hazard involved in the work and determination of protective measures appropriate to that hazard,
- training and granting licenses of radiation protection officers and authorisations to hold positions of significant importance to ensure nuclear safety and radiation protection,
- assessment of the country's radiation situation,
- procedure in the case of radiation emergencies,
- development of a system for radiation emergency situation management,
- management of existing exposure situations,
- civil liability for nuclear damage.

In 2021, one amendment to the Act on Atomic Law took effect:

1. Pursuant to Art. 5 of the Act of 30 March 2021 on Amendment to the Act on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments, and on some other acts (Dz. U., item 784) 2 new provisions were added to the Atomic Law, with the effect as of 13 May 2021:
   1) Art. 39ia, in the following wording:
      'Art. 39ia. To a nuclear facility construction license, preceded by an environmental decision, provisions of Art. 72 Sections 6 and 6a of the Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments shall be applied';

2) Art. 55ra, in the following wording:
' Art. 55ra. To a nuclear waste repository construction license, preceded by an environmental decision, provisions of Art. 72 Sections 6 and 6a of the Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in the environmental protection and environmental impact assessments shall be applied'.

Other acts

Provisions indirectly related to the nuclear safety and radiation protection issues are also comprised in other acts, in particular:

- Act of 19 August 2011 on Transport of Dangerous Goods (Dz. U. of 2021, item 756 and of 2022, item 209),
- Act of 18 August 2011 on Maritime Safety (Dz. U. of 2022, item 515),
- Act of 21 December 2000 on Technical Inspection (Dz. U. of 2021, item 272 and 2269, and of 2022, item 727).

Implementing acts to the Atomic Law

The work on draft implementing acts to the Atomic Law was continued. They are necessary due to the adoption by the Parliament of the Act of 13 June 2019 amending the Atomic Law and the Act on fire protection (Dz. U. item 1593, and of 2020, item 284). As of 31 December 2021, the status of this work was as follows:

1. Regulations that came into force in 2021.

On 5 January 2021, the **Regulation of the Council of Ministers of 30 November 2020 amending the regulation on basic requirements related to the controlled and supervised areas** (Dz. U. item 2303) came into force. The regulation introduced the increased safety requirements in the field of dosimetric control and the protection of workers in the controlled and supervised areas.

On 21 January 2021, the **Regulation of the Council of Ministers of 30 November 2020 on the protection against ionizing radiation for outside workers exposed during work in a controlled or supervised area** (Dz. U. Item 2313) came into force.

The regulation specified detailed duties of the head of the organizational entity, external employer, and outside worker in the field of protection against ionizing radiation of outside workers exposed during work in a controlled or supervised area, taking into account protection methods used for workers of the organizational entity. In addition, the regulation indicated the information placed by the head of the organizational entity, external employer, and the authorised physician in a dosimetric passport, and also the procedure for issuing a dosimetric passport and a new template of it.

On 21 January 2021, the **Regulation of the Council of Ministers of 30 November 2020 amending the regulation on detailed conditions for safe work with ionizing radiation sources** (Dz. U. item 2300) came into force. The regulation introduced new requirements related to the performance of inspections of ionizing radiation sources and specified a new template of a register chart for high-activity sources.

On 7 February 2021, the **Regulation of the Council of Ministers of 17 December 2020 on building materials which require determining the activity concentration of radioactive potassium K-40, radium Ra-226 and thorium Th-232 isotopes, requirements to be fulfilled by these determinations, and the value of the activity concentration index which, once exceeded, requires informing proper authorities** (Dz. U. of 2021, item 33) came into force. The regulation specified requirements applicable to determinations of activity concentration of natural radioactive isotopes in building materials, the methods and frequency of sampling, and also factors, which shall be considered at the interpretation of measurement results. As compared with the previously binding regulations, the differences consist primarily in another approach to the determination of the value of activity concentration of natural radioactive isotopes in building materials. Instead of the determination of the radioactive concentration of thorium Th-228 isotope, which is a progeny and a product of decay of Th-232 isotope in a state of secular equilibrium with it, the determination of activity concentration of the thorium isotope Th-232 was introduced.

On 24 April 2021, the **Regulation of the Council of Ministers of 10 March 2021 amending the regulation on radioactive waste and spent nuclear fuel** (Dz. U. item 663) came into force. The Regulation repealed § 5 in the Regulation of the Council of Ministers of 14 December 2015 on radioactive waste and spent nuclear fuel (Dz. U. item 2267 as amended), which excluded certain waste categories from radioactive waste, which was the matter transferred to the statutory level by the Act of 13 June 2019 amending the Atomic Law Act and Act on Fire Protection.

On 7 May 2021, the **Regulation of the Council of Ministers of 10 March 2021 on cases in which the performance of exposure-related activity involving ionizing radiation originating from natural radioactive isotopes does not require a notification** (Dz. U. item 627) came into force. The regulation specified cases, where activities, in which exposure of workers to naturally existing radioactive isotopes occurs, are not covered by restrictions, despite the fact that they have been mentioned in the list of activities comprised by the obligation to make a notification, as specified in Art. 4 Section 1a of the Act of 29 November 2000 – Atomic Law.

On 9 May 2021, the **Regulation of the Council of Ministers of 5 March 2021 on radiation protection officers** (Dz. U. item 640) came into force. The regulation specified types of authorization of radiation protection officers and types of activities they are authorized to control, detailed conditions for such authorization granting, the method of examination procedure and the method of result interpretation, the organization of work of the examining committees of the examination boards, the remuneration of the members of these boards, the scopes and forms of organizing trainings, the contents of an application for a radiation protection officer authorization, and also the list of documents attached to such an application.

On 9 May 2021, the **Regulation of the Council of Ministers of 5 March 2021 on the position of significant importance for ensuring nuclear safety and radiation protection** (Dz. U. item 765) came into force. The regulation specified detailed conditions for granting authorizations to hold positions of specific speciality, the examination procedure and the method of result interpretation, the organization of work of the examining committees of examination boards, the contents of an application for granting the authorization, and also the documents attached to such an application.

On 29 June 2021, the **Regulation of the Council of Ministers of 25 May 2021 on the scope of a hazard assessment resulting from an activity involving exposure to ionizing radiation, and the form of presenting conclusions from the hazard assessment** (Dz. U. item 1059) came into force. The regulation specified:

1) the scope of a hazard assessment, which can occur in relation to various activities involving exposure to ionizing radiation, carried out by the head of the organizational entity, regional governor, or minister competent in internal affairs;
2) the form, in which the head of the organizational entity and the regional governor present conclusions from the hazard assessment.

On 12 July 2021, the **Regulation of the Council of Ministers of 25 May 2021 on the requirements for the registration of individual doses** (Dz. U. item 1053) came into force. The regulation specified requirements for the registration of individual doses, considering in particular:

1) content and method of maintaining the register of individual doses kept by the head of the organizational entity as well as the Central Dose Register, the length of the registration period, the period for keeping the data in these registers, the period for keeping the documents which are the basis for making entries in the registers, the procedure for making copies of the data contained in the registers and the period for keeping them, as well as the template of the registration card for the Central Dose Register and the template of the record card for the Central Dose Register;
2) entities to which data from the register of individual doses kept by the head of the organizational entity as well as from the Central Dose Register may be communicated, the deadlines for the communication of such data, and the content of the application for access to data from the Central Dose Register;

3) various exposures, referred to in provisions of the Act of 29 November 2000 – the Atomic Law, including results of dosimetric measurements;
4) the list of research institutes, which prior to the date of establishment of the Central Dose Register were carrying out measurements of individual doses, and the assessment of doses from internal exposure.

On 29 July 2021, the **Regulation of the Council of Ministers of 10 March 2021** on cases in which activities involving exposure to ionising radiation do not require a license, registration or notification and cases in which they may be performed on the basis of a registration or notification (Dz. U. item 796) came into force. The regulation specified cases, in which the performance of activity involving exposure to ionizing radiation is not regulated, in which it may be performed on the basis of a registration or notification, and also limit values of total activity and activity concentration of radioactive isotopes as the criteria to exempt from the requirement to obtain a license, to make a registration or notification.

On 18 August 2021, **the Regulation of the Council of Ministers of 25 May 2021 on emergency plans in the event of radiation emergencies** (Dz. U. item 1086) came into force. The regulation specified detailed contents of the on-site, regional, and national emergency plans.

On 11 September 2021, the **Regulation of the Council of Ministers of 11 August 2021 on r nuclear regulatory inspectors** (Dz. U. item 1577) came into force. The regulation, taking into account the introduction by the Act of 13 June 2019 amending the Atomic Law Act and the Act on Fire Protection of an additional category of nuclear regulatory inspectors for safeguards (authorized to perform inspections only in the field of controlling nuclear technologies and nuclear material safeguards), specified detailed conditions for apprenticeships by candidates for a nuclear regulatory inspector, the procedure of confirming the completion of these apprenticeships, the manner and procedure of conducting a qualifying examination for a nuclear regulatory inspector, detailed duties of the examination board, the amount of remuneration of the examination board, a template of a certificate of passing the examination, documents attached to an application for being appointed as a nuclear regulatory inspector.

On 24 September 2021, **the Regulation of the Council of Ministers of 11 August 2021 on indicators enabling the determination of ionizing radiation doses used when assessing exposure to ionizing radiation** (Dz. U. item 1657) came into force. The regulation specified detailed indicators enabling the determination of doses of ionizing radiation used when assessing the exposure and the manner and frequency of making exposure assessments for workers and for the public.

On 25 September 2021, the **Regulation of the Council of Ministers of 30 August 2021 on documents required when submitting an application for the issuance of a license to perform an activity related to exposure to ionizing radiation, or when registering the performance of this activity** (Dz. U. item 1667) came into force. The regulation specified the list of documents necessary to confirm by the applicant the fulfilment of nuclear safety and radiation protection conditions, required when submitting the application for a license to perform an activity related to exposure to ionizing radiation, or when registering the performance of this activity.

On 12 November 2021, the **Regulation of the Council of Ministers of 1 October 2021 on the security of radioactive sources** (Dz. U. item 1958) came into force. The regulation specified:
1) categories of radioactive sources and detailed reasons for qualifying radioactive sources into these categories;
2) the level of security for individual categories of radioactive sources;
3) organizational and technical arrangements for securing radioactive sources, the purposes of securing and the functions of securing radioactive sources;
4) the minimum contents of the plan for securing radioactive sources.

2. Draft regulations at the Legal Commission stage
Draft regulation of the Council of Ministers on the scope of radiation monitoring programme developed and implemented by the organizational units classified as hazard category I or II.

Summary

The Act of 29 November 2000 – the Atomic Law is the basic piece of legislation in the field of nuclear safety and radiation protection.

In 2021, the amendments to this act came into force, introduced by the Act of 30 March 2021 the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments, and on some other acts (Dz. U. item 784). These amendments stipulate the application of provisions of Art. 72 Sections 6 and 6a of the Act of 3 of October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments to the construction license for a nuclear facility or a nuclear waste repository, preceded by an environmental decision.

Four regulations of the Council of Ministers passed in 2020 came into force in 2021. In addition, the legislation work continued on another 13 draft implementing acts to the Atomic Law Act, of which 12 regulations of the Council of Ministers were adopted and came into force. The work on 1 draft was continued in 2022. The necessity of issuing those regulations results from the passing by the Parliament of the Act of 13 June 2019 amending the Atomic Law Act and the Act on Fire Protection (Dz. U. item 1593, and of 2020, item 284).

3 Supervision of the use of ionizing radiation sources

Fot. PAA

Tasks of the President of the PAA in terms of regulatory oversight of activities involving exposure to ionizing radiation

- granting licenses and taking other decisions concerning nuclear safety and radiation protection, following the analysis and assessment of documentation submitted by users of ionizing radiation sources,
- preparation and performance of inspections in organizational entities conducting activities involving exposure,
- maintaining a register of such units.

Users of ionizing radiation sources in Poland

The number of registered organizational units conducting activity (one or more) involving exposure to ionizing radiation, subject to supervision of the PAA President, is 4770 (as of 31 December 2021).

The number of all registered activities involving exposure to ionizing radiation is 7368 (as of 31 December 2021).

Issuing licenses and receiving registrations or notifications

Licenses issued by the President of the PAA to conduct activities involving exposure to ionizing radiation and in the field of nuclear safety and radiation protection are drafted in the Radiation Protection Department (DOR) of the PAA.

BASIS TO GRANT A LICENSE

1. Application, referred to Art. 5 Section 5 of the Act of 29 November 2000 – Atomic Law.
2. Documents specified in the Regulation of the Council of Ministers of 30 August 2021 on documents required at filing an application for a license to conduct an activity involving exposure to ionizing radiation or at the registration of such activity performance.
3. Additional information, referred to in Art. 5 Section 1b Item 3 of the Atomic Law Act, if the content of documents attached to the application is insufficient to demonstrate that the conditions required by law for carrying out exposure-related activities have been satisfied.

The issuance of a license, annex to a license, the acceptance of a registration or notification must be preceded by the analysis and assessment of documentation, which is delivered by users of ionizing radiation sources.

In particular, the following issues must be analysed: the rationale for undertaking an exposure-related activity, the proposed dose constraints, the quality assurance programme for the undertaking and the company's emergency plan for dealing with radiation emergencies.

In the cases, in which the activities with ionizing radiation sources do not require a license, decisions to accept registration of an activity involving exposure to ionizing radiation or notifications are issued. Such cases are specified in the Regulation of the Council of Ministers of 29 April 2021 on cases in which activities involving exposure to ionizing radiation do not require a license, registration or notification and cases in which they may be performed on the basis of a registration or notification (Dz. U. item 796) and in Art. 5 Section 5 of the Act of 29 November 2000 – the Atomic Law.

Regulatory inspections

Inspections in organizational entities other than those having nuclear facilities and radioactive waste disposal sites are carried out by nuclear regulatory inspectors from the Radiation Protection Department of the PAA who work in Warsaw and Katowice. The number of inspections carried out in 2021 was 835, including 11 re-inspections (the second inspection in the same year), of which 595 inspections were performed by inspectors from Warsaw, and 240 by inspectors from Katowice. Each inspection was preceded by a detailed analysis of collected documentation related to the inspected organizational entity and its activity.

FIGURE 3.

The number of licenses for conducting activities in conditions of exposure to ionizing radiation and amending annexes to licenses granted by the President of the PAA in 2008–2021

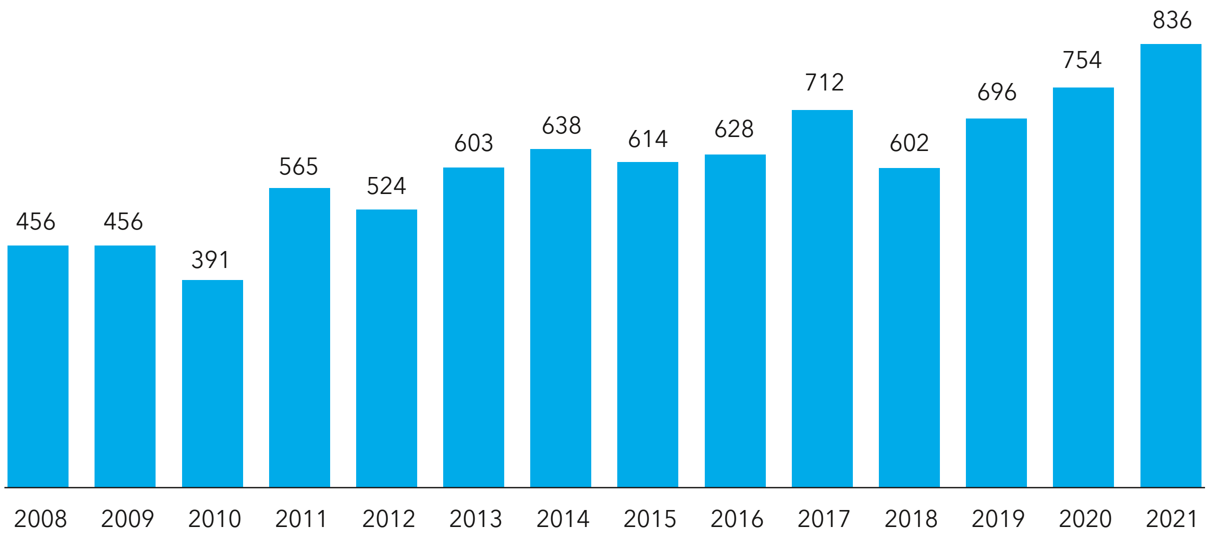


FIGURE 4.

Number of inspections carried out by the inspectors from the Radiation Protection Department of the PAA in the years 2008-2021

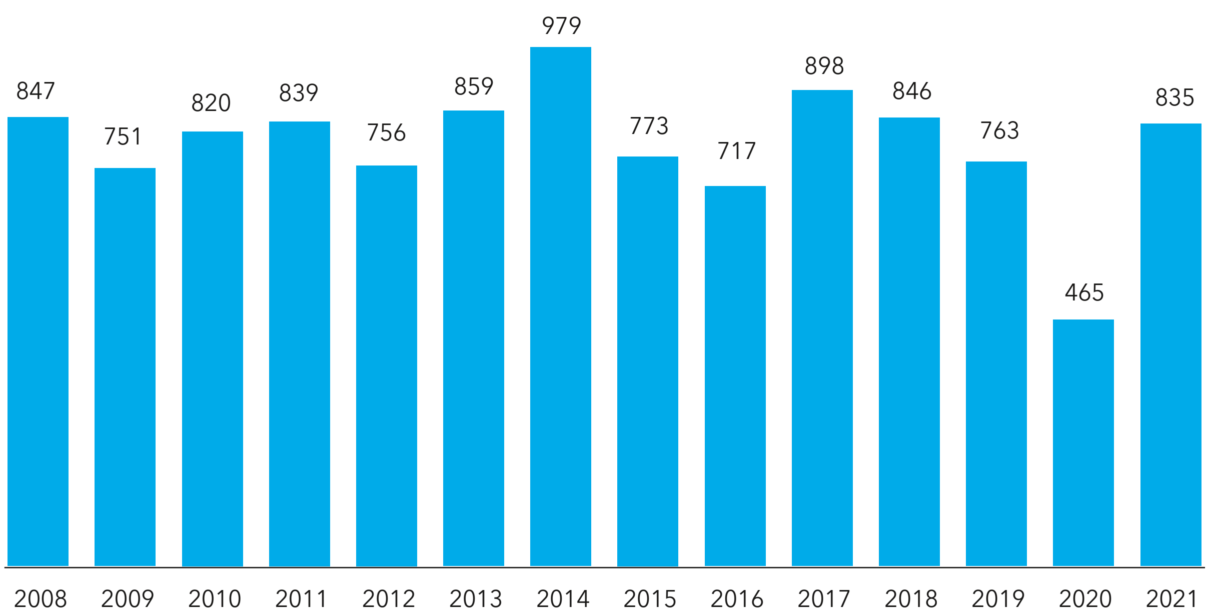


TABLE 1.

Users of ionizing radiation sources in Poland in numbers (as of 31 December 2021)

Type of activity	Symbol	Number of units	Number of activities	NUMBER OF GRANTED IN 2021: licenses	annexes	registration decisions	notifications	INSPECTIONS: Inspections no in 2021	Inspections frequency
Class I laboratory	I	2	2	0	0	0	0	0	annually
Class II laboratory	II	98	129	16	15	0	0	48	every 2 years
Class III laboratory	II	119	232	5	3	4	0	13	every 4 years
Class Z laboratory	Z	139	239	11	9	7	0	70	every 4 years
Smoke detector installer	UIC	365	367	6	4	0	0	8	every 5 years
Equipment installer	UIA	222	293	28	65	0	0	49	every 5 years
Isotope device	AKP	518	675	14	21	4	0	309	every 5 years
Manufacture of isotope sources and devices	PRO	24	28	0	0	0	0	2	every 3 years
Trade in isotope sources and devices	DYS	79	87	1	0	0	0	2	every 5 years
Accelerator	AKC	84	250	38	13	0	0	21	every 4 years
Isotope applicators	APL	39	53	2	1	0	0	30	every 2 years
Telegammatherapy	TLG	4	4	0	1	0	0	2	annually
Radiation instrument	URD	32	35	2	0	0	0	20	co 3 lata
Gammagraphic apparatus	DEF	98	100	12	10	0	0	58	every 2 years
Storage facility for isotope sources	MAG	193	227	18	6	0	0	30	every 3 years
Work with sources outside laboratory	TER	99	115	18	7	2	0	18	every 3 years
Transport of sources or waste	TRN	513	514	8	4	1	0	3	every 5 years
Chromatograph	CHR	235	291	0	0	2	0	10	every 10 years
Veterinary X-ray instrument	RTW	1556	1651	219	5	0	0	29	every 10 years
X-ray scanner	RTS	694	997	79	41	76	0	29	every 10 years
X-ray defectoscope	RTD	215	247	23	21	0	0	27	every 2 years
Other X-ray instrument	RTG	559	832	92	18	44	4	36	every 10 years
Ad hoc inspections									additionally
TOTAL:			**7368**	**592**	**244**	**140**	**4**		

Regular and ad hoc inspections

Guided by the necessity to ensure an appropriate frequency of inspections depending on the hazard created by the performed activity, the inspection cycles were established for particular groups of activities.

Ad hoc inspections are carried out in organizational entities in which activities resulting or likely to result in exposure of people and the environment to ionizing radiation may be performed without a license of the President of the PAA.

In addition, in relation to applications for a license to perform activity involving exposure to ionizing radiation, inspections were carried out by nuclear regulatory inspectors from the Radiation Protection Department (DOR).

The data on inspections carried out by nuclear regulatory inspectors from the PAA's Radiation Protection Department in 2021 are presented in Table 1.

Register of sealed radioactive sources

The obligation of keeping a register of sealed radioactive sources results from Art. 43c Section 1 of the Act of 29 November 2000 – Atomic Law.

Heads of organizational entities, which perform an activity involving the use or storage of sealed radioactive sources or devices containing such sources based on a license, submit to the President of the PAA copies of records of radioactive sources. Such documents include record sheets containing the data on sources: name of the radioactive isotope, activity level according to the source certificate, date of activity determination, certificate number and source type, type of container or name of instrument and the place of source use or storage.

The register comprises the data on 28,455 sources, including disused radioactive sources (decommissioned and handed over to the Radioactive Waste Management Plant), and also information on their movements (i.e. dates of source receipt and handing over), and related documents.

28,455

RADIOACTIVE SOURCES IN THE REGISTER OF THE PRESIDENT OF THE PAA

Data from the record sheets are entered into the register of sealed radioactive sources, which is used to verify the information on sources. The information included in the register is used for inspections of organizational entities, which perform activities involving exposure to ionizing radiation. The inspection consists in the comparison of entries in the record sheet with the scope of the issued license. The data from the register are also used to prepare information and lists within the framework of cooperation and collaboration with the government administration and local government for statistical purposes.

In Poland, sources are classified under categories, depending on the source purpose, its activity, and the radioactive isotope present:

Category 1 – sealed radioactive sources used in radioisotope thermoelectric generators (RTGs), instruments for irradiation, in particular for irradiation of tissues and blood, and in telegammatherapy instruments.

The register contains 1,686 currently used Category 1 sources.

Category 2 – comprises sealed radioactive sources used in instruments for industrial radiography (defectoscopy), and in instruments for brachytherapy HDR.

The register contains 2,711 currently used Category 2 sources.

Category 3 – comprises sealed radioactive sources used in stationary industrial meters, which contain high-activity sources, and in geophysical probes.

The register contains 7,081 currently used Category 3 sources.

The remaining sealed radioactive sources have been classified as category 4 and 5 of sealed radioactive sources.

1,686
CATEGORY 1 SOURCES

2,771
CATEGORY 2 SOURCES

7,081
CATEGORY 3 SOURCES

TABLE 2.

Selected radioactive isotopes and sources containing them, currently used (as of 31 December 2021)

	NUMBER OF SOURCES IN THE REGISTER		
Isotope	**cat. 1**	**cat. 2**	**cat. 3**
Co-60	793	1177	1518
Ir-192	414	35	3
Cs-137	82	259	2174
Se-75	363	86	3
Am-241	15	359	715
Pu-239	2	88	91
Ra-226	–	71	51
Sr-90	–	37	684
Pu-238	1	79	22
Kr-85	5	64	162
Tl-204	–	–	88
other	11	135	1570
Total	**1686**	**2711**	**7081**

Summary
In 2021, the number of organizational entities, registered in the register of organizational entities whose activities require at least registration, increased from 4,545 to 4,770, where the largest growth occurred for entities generating ionizing radiation in veterinary medicine. The number of sealed radioactive sources, used in organizational entities, registered in the register of the President of the PAA, increased by 981. A large part of them comprised sealed radioactive sources classified as Category 2 and used in defectoscopic measurements. At the same time, in 2021, there were 370 more inspections of activities involving exposure to ionizing radiation as compared to 2020.

The reason for that was the introduction of remote inspections, due to the COVID-19-related epidemiological situation in the country and the impeded possibility of conducting field inspections in the organizational units.

4 Supervision of nuclear facilities and of the National Radioactive Waste Repository

Fot. PAA

Nuclear facilities in Poland

Nuclear facilities in Poland include:

- **MARIA research reactor** – in the National Centre for Nuclear Research (NCBJ),
- **EWA research reactor** (under decommissioning) and **two spent nuclear fuel repositories** – at the Radioactive Waste Management Plant (ZUOP).

These facilities are located in Świerk near Otwock, in two organizational units. Fig. 5 presents their location.

MARIA reactor

The MARIA research reactor is the second nuclear reactor built in Poland (excluding critical assemblies ANNA, AGATA, and MARYLA); currently the only reactor operating in the country. It is a high flux pool type reactor with a nominal thermal power of 30 MW^t and a maximum core thermal neutron flux density of $3.5{\cdot}10^{18} n/(m^2{\cdot}s)$. The MARIA reactor started to operate in 1974 and it was shut-down between 1985 and 1993 for necessary upgrades, including the installation of a system for passive emergency core cooling using water from the reactor pool. From April 1999 to June 2002, a conversion of the reactor core was carried out, reducing the fuel enrichment from 80% to 36% of the U-235 isotope content (HEU fuel – High Enriched Uranium). In 2014, as part of the implementation of the international Global Threat Reduction Initiative (GTRI), the MARIA reactor was adapted to operate with low-enriched fuel (LEU – Low Enriched Uranium) with less than 20% of the U-235 isotope.

In 2021, the reactor operation schedule was adapted to:

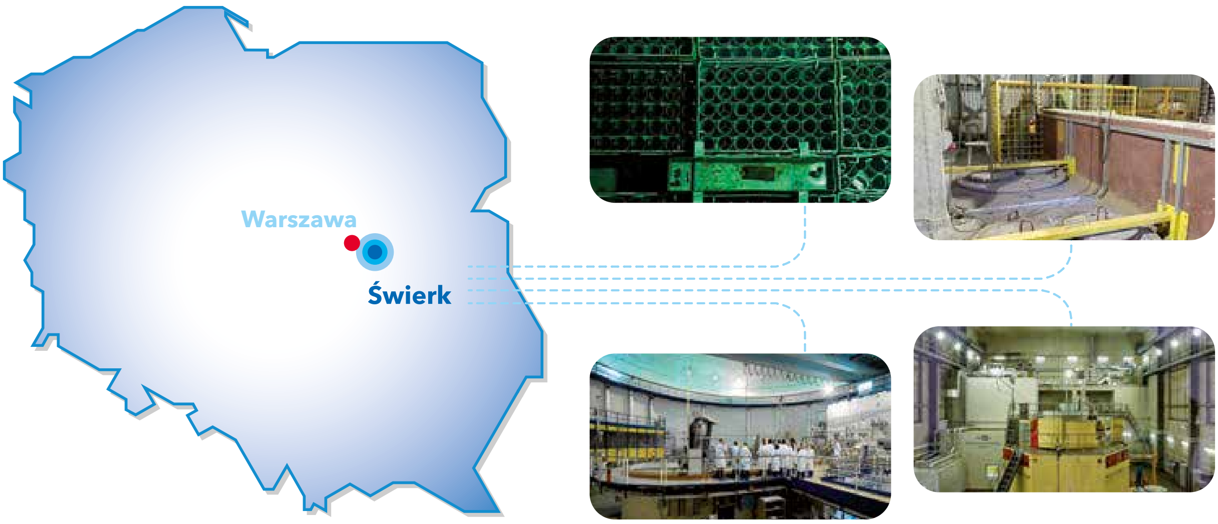
- the irradiation requirement of uranium wafers for production of Mo-99 molybdenum isotope;
- the irradiation of target materials for the Radioisotope Centre, i.e. tellurium dioxide, potassium chloride, sulphur, samarium, lutetium, cobalt, and iron, intended for the production of radioactive agents used in the nuclear medicine (Fig. 6);
- the irradiation of holmium targets, in the form of 165Ho-PLLA MS microspheres, which are used in the procedure of selective brachytherapy,
- the research work and measurements of core reactivity parameters.

In 2021, the MARIA reactor was in service for 4,048 hours operating in 30 cycles at power outputs ranging from 15 to 25 MW (Fig. 7).

In 2021, only MR-6 type fuel, with 19.7% U-235 enrichment, was used in the MARIA reactor.

FIGURE 5.

Illustrative location of the MARIA research reactor, the EWA reactor (under decommissioning) and spent nuclear fuel storage on the premises of the Nuclear Research Centre in Świerk near Otwock.



In 2021, there were 25 unscheduled reactor shutdowns. 21 of them were short-lived and did not cause the necessity of shortening the reactor's operation cycle. The most common cause of shutdowns was the failure to adapt to the changed operating conditions of one of the reactor equipment that had already been replaced with an element suitable for the new conditions. None of the unscheduled shutdowns created a hazard for the nuclear safety and radiation protection.

The following important operations were carried out in the MARIA reactor in 2021:

- Modernisation of the ventilation system in the experimental hall;
- Replacement of air furnaces in the ventilation system of the reactor hall;
- Modernisation of the transmitter for measurements of water flow intensity in the cooling system of the reactor pool;
- Modernisation of the reactor's hot cell, consisting in replacement of manipulators inside it.

The MARIA reactor can also be used to carry out physical research, using six horizontal ducts (H-3 to H-8). In 2021, such research was not carried out due to the fact that these ducts were shut down to prepare the experimental hall for modernisation. As part of this modernisation, it is planned to install modern research equipment acquired from another foreign research reactor.

The technological pool of MARIA reactor is currently used for storage of spent MC and MR nuclear fuel, originating from the current operation of the reactor.

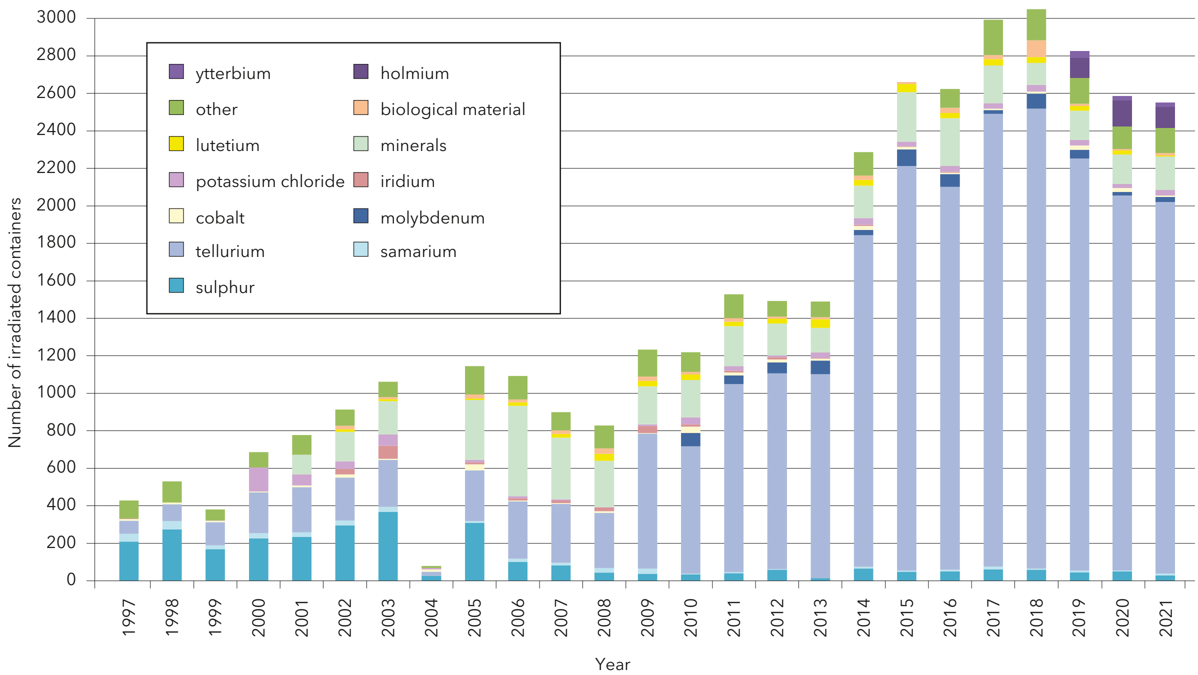
A summary of general information on reactor's operation is presented on pages 30–31.

Summary

There are four nuclear facilities in Poland, including MARIA, the only operational research reactor. During its operation, the reactor was used to irradiate target materials and to conduct material and technological research. In order to increase the level of reliability and to ensure safe working conditions, pre-planned repair, maintenance and modernisation works were carried out in the reactor.

FIGURE 6.

Materials irradiated in the MARIA reactor by 2021 (NCBJ figures)



EWA reactor under decommissioning

The EWA research reactor was in operation in the years 1958-1995. The initial thermal power of the reactor was 2 MWt and was later increased to 10 MWt.

The decommissioning process of this reactor, which started in 1997, reached the state named 'completion of phase two' in 2002. This means that the nuclear fuel and all irradiated elements of the equipment, which activity level could be important from the radiation protection point of view, were removed from the reactor. Because of that the EWA reactor does not emit radioactive substances into the environment. The building of the reactor was refurbished and it is used by the ZUOP.

The building of the former EWA reactor houses now:

- a class I isotope laboratory,
- a radiometric analysis laboratory,
- a chemical laboratory,
- a contaminated laundry room.

Summary:

The EWA reactor, which was the first nuclear reactor used in Poland, is now in the process of decommissioning. As a result of the decommissioning work performed so far, the EWA reactor is now safe for the environment, and its infrastructure may be still used for the ZUOP needs.

Spent nuclear fuel storage

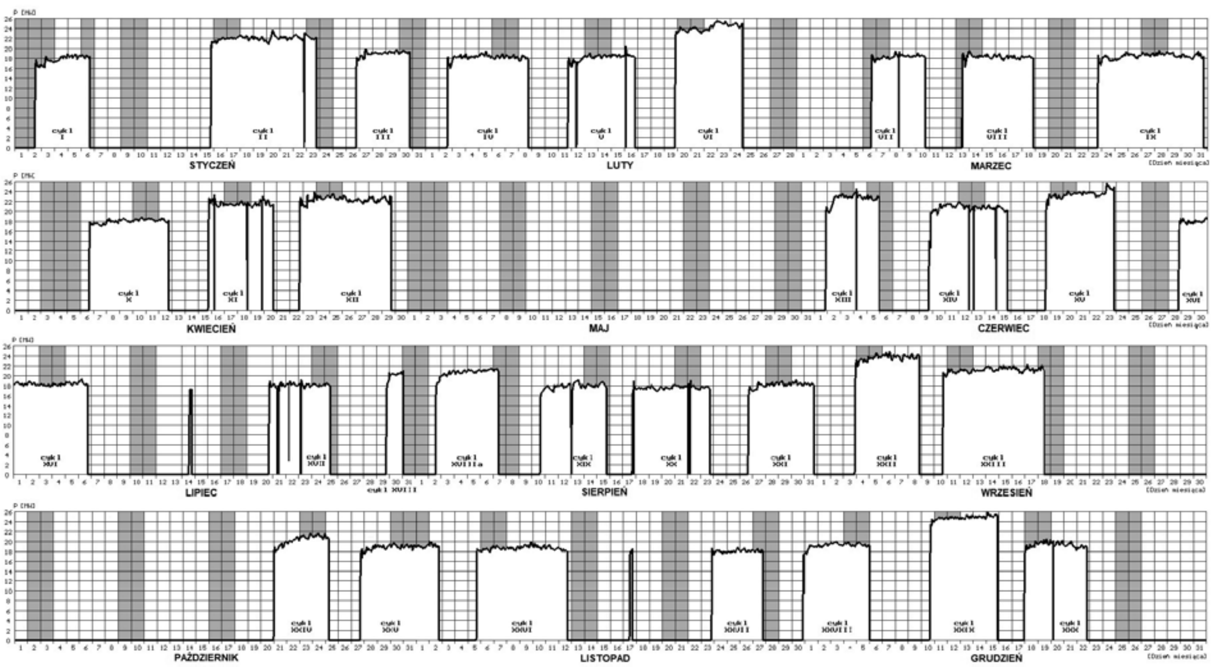
Spent nuclear fuel storage facilities, , i.e. Facility no. 19 and Facility no.19A, belonging to the ZUOP since January 2002, are also nuclear facilities. Both are wet storage facilities, i.e. they are adapted for the storage of spent nuclear fuel in the water environment.

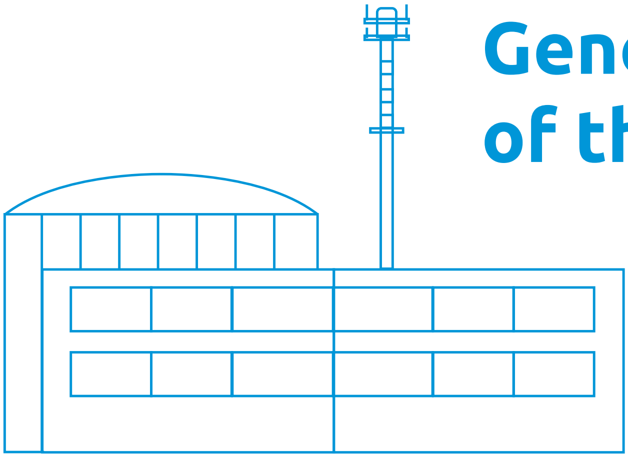
Facility No 19 was used for the storage of encapsulated low-enriched spent nuclear fuel EK-10 from the EWA reactor, which was returned to the producer country, i.e. the Russian Federation, in September 2012.

Because of that, this facility is used now as a storage site for certain radioactive waste (structural elements) from the decommissioning of the EWA reactor and from the operation of the MARIA reactor, and also spent high-activity gamma-radiation sources.

FIGURE 7.

Summary of the MARIA reactor's operation cycles in 2021 (NCBJ data), compiled and prepared by Andrzej Frydrysiak – DOM EJ2.





General information of the MARIA reactor

Number of operation cycles

I. 9 | II. 6

III. 8 | IV. 7

Time of operation at nominal power [h]

4048

I. 1201 | II. 802

III. 1156 | IV. 889

Average reactor power in cycles [MWt]

I. 18–24 | II. 18–23

III. 15–24 | IV. 17–25

15–25

Number of fuel elements in the core

20–23

about the operation per quarter in 2021

OFF

Unscheduled shutdowns

Human error	Equipment malfunction (I.)	Instrumentation errors (II.)	Short power outages
0	3	13	9

Malfunctions/defects and non-compliances found

Q 1	Q 2	Q 3	Q 4	
3	1	0	1	5

Repair and maintenance works carried out

Q 1	Q 2	Q 3	Q 4	
1	10	5	11	27

Performed tests, inspections, and checks

Q 1	Q 2	Q 3	Q 4	
24	59	44	43	170

Facility No 19A was used for storage of high-enriched spent nuclear fuel, marked with symbol WWR-SM and WWR-M2, from the operation of the EWA reactor in the years 1967-1995, and also encapsulated spent nuclear fuel of MR type from the operation of MARIA reactor in the years 1974-2005. After returning the entire spent nuclear fuel from Facility No 19A to the Russian Federation in 2010, this repository has been used as a reserve in case of a necessity for the storage of spent nuclear fuel from the MARIA reactor.

Summary:

There are two spent nuclear fuel storage facilities located at the Świerk site which are operated by the ZUOP. Currently, none of them contains spent nuclear fuel, and the Facility 19A serves as a reserve in case there is a need to store spent nuclear fuel from the MARIA reactor.

Licenses issued

The MARIA reactor is operated by the National Centre for Nuclear Research based on the license of the President of the PAA No 1/2015/Maria of 31 March 2015. This license is valid till 31 March 2025.

Other licenses issued by the President of the PAA for the operation of the MARIA reactor, which are not licenses to operate a nuclear facility, include:

- License No 1/2015/NCBJ of 3 April 2015 for the storage of nuclear material,
- License No 2/2015/NCBJ of 3 April 2015 for the storage of spent nuclear fuel.

The decommissioning of the EWA reactor and the operation of the storage facilities of spent nuclear fuel by the ZUOP are carried out on the basis of a license No 1/2002/EWA of 15 January 2002, which is valid for an indefinite period of time. No decision changing the above licenses was issued in 2021.

PAA conducted:

12

12 INSPECTIONS AT THE NATIONAL CENTRE FOR NUCLEAR RESEARCH (NCBJ)

6

6 INSPECTIONS AT THE RADIOACTIVE WASTE MANAGEMENT PLANT (ZUOP).

Regulatory inspections

In 2021, nuclear regulatory inspectors of the PAA carried out 18 inspections of nuclear safety, radiation protection, and physical protection of nuclear facilities. The conducted inspections did not show hazards for the nuclear safety and radiation protection, however, in a few cases nuclear regulatory inspectors found violations of provisions in terms of conducting day-to-day operation and breaching the terms of the license.

The inspections carried out at the NCBJ were mainly related to the MARIA reactor, and included checking and evaluating the following:

- compliance of the MARIA reactor's day-to-day operation and operating records with the terms of the license,
- security interlock system,
- reactor commissioning,
- ventilation system,
- emergency power supply,
- nuclear fuel management,
- integrated management system,
- neutron measurement instruments,
- technological control system instruments,
- circulation pumps,
- heat exchangers,
- water cleaning system,
- physical protection,
- pool cooling system.

The inspections conducted in the ZUOP were related to the following:

- condition of radiation protection of facilities operated by the ZUOP,
- solid waste pressing,
- smoke detectors dismantling,
- waste treatment in the evaporator,
- technical condition of the ZUOP facilities,
- decommissioning of the EWA nuclear facility,
- physical protection,
- state of radiation protection,
- integrated management system of the ZUOP.

During the conducted inspections 10 irregularities were found – 7 at the site of the MARIA research reactor, 3 at the ZUOP area, and 8 infringements for the MARIA reactor. In 2021, the President of the PAA issued 2 decisions ordering to remove the irregularities found during inspections in 2020 and 1 post-inspection notice related to the infringement found during the aforementioned inspections. In addition, the President of the PAA issued 1 post-inspection notice related to the infringement found in 2021.

Functioning of the coordination system for inspection and supervision of nuclear facilities

In accordance with provisions of the Act – Atomic Law, at the performance of supervision and inspection of nuclear safety and radiation protection of nuclear facilities, the nuclear regulatory authorities cooperate with other administration authorities through the **coordination system**. The cooperating authorities include the Office of Technical Inspection (UDT), the State Fire Brigades, the authorities of environmental protection, construction supervision, the State Sanitary Inspection, the State Labour Inspection, as well as the Internal Security Agency (ABW).

Summary

In 2021, the supervision of the nuclear facilities proceeded smoothly and showed no deviations from the nuclear safety status demonstrated in previous years. The operation of the most important nuclear facility, i.e. the MARIA research reactor, proceeded without significant interruptions, and performed modernisations, and other maintenance works, as well as unscheduled shutdowns, did not create a hazard to nuclear safety or radiation protection. In 2021, the PAA inspectors carried out altogether 21 inspections related to nuclear facilities at the NCBJ and ZUOP, and also at the KSOP. The inspections conducted in 2021 confirmed that there were no hazards for the nuclear safety and radiation protection of nuclear facilities operated in the country, despite several instances of non-compliance with the rules for day-to-day operation and breaches of license terms. The organizational units responsible for the operation of nuclear facilities have rectified, or are in the process of rectifying, irregularities and infringements found during inspections.

NUCLEAR POWER PLANTS IN THE NEIGHBOURING COUNTRIES

There are 9 nuclear power plants operating 22 power reactors with a total capacity of about 15.5 GWe within 300 km of the Polish borders.

SWEDEN

Oskarshamn NPP

PL — **298 km**

1 BWR-3000 unit
1450 MWe

CZECH REPUBLIC

Dukovany NPP

PL — **119 km**

4 V-213 units
500 MWe
500 MWe
500 MWe
500 MWe

CZECH REPUBLIC

Temelin NPP

PL — **192 km**

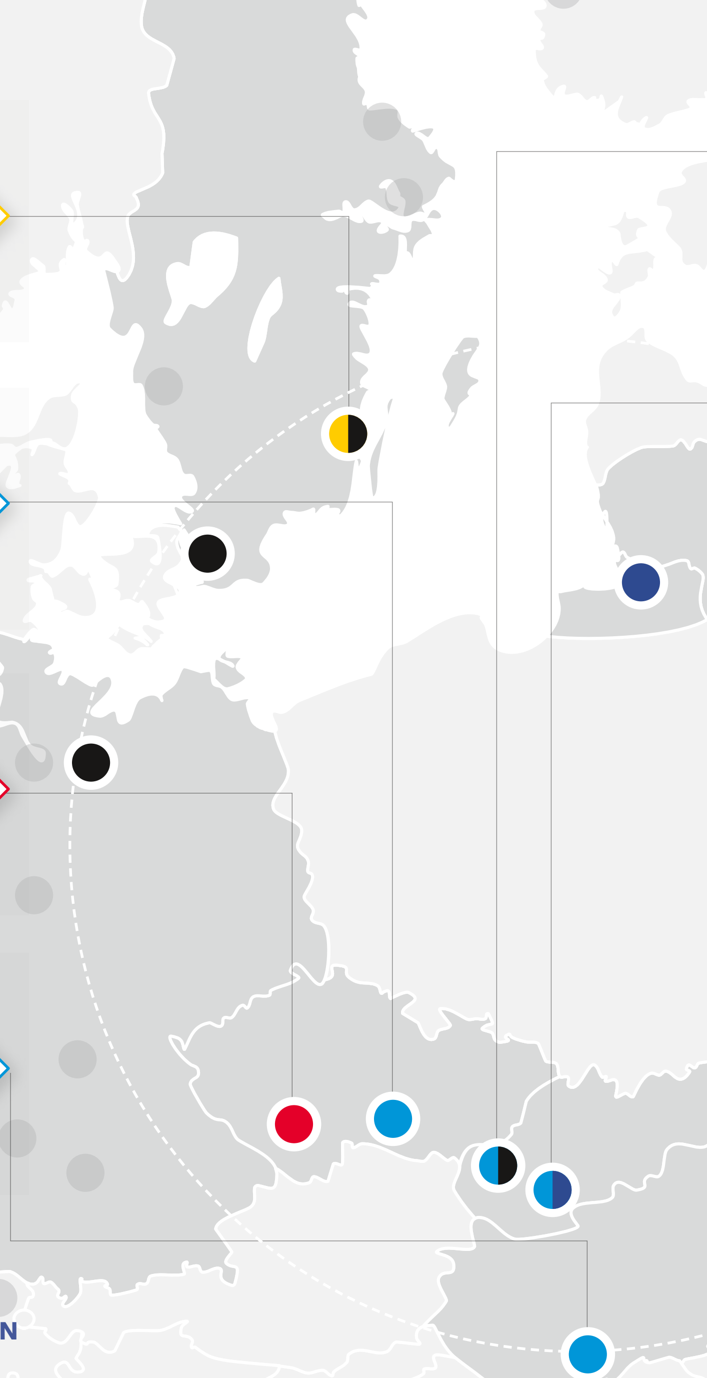
2 V-320 units
1082 MWe
1082 MWe

HUNGARY

Paks NPP

PL — **300 km**

4 V-213 units
506 MWe
506 MWe
506 MWe
506 MWe



NUCLEAR REACTORS UNDER CONSTRUCTION

2 V-213 reactors
at **Mochovce NPP**
(Slovakia)

1 V-491 reactor
at **Belarusian NPP**
(Belarus)

2 V-320 reactors
at **Khmelnytskyi NPP**
(Ukraine)

1 V-491 reactor
at **Baltic NPP**
(Russia)

CERTAIN POWER PLANTS AT A DISTANCE LARGER THAN 300 KM FROM POLAND

9 OPERATING NUCLEAR POWER PLANTS

14 V-213 REACTORS

6 V-320 REACTORS

1 V-491 REACTOR

1 BWR-3000 REACTOR

SLOVAKIA
Bohunice NPP
PL 138 km
2 V-213 units
500 MWe
500 MWe

SLOVAKIA
Mochovce NPP
PL 133 km
2 V-213 units
500 MWe
500 MWe

BELARUS
Belarusian NPP
PL 250 km
1 V-491 unit
1194 MWe

UKRAINE
Rivne NPP
PL 134 km
2 V-213 units
420 MWe
415 MWe
2 V-320 units
1000 MWe
1000 MWe

UKRAINE
Khmelnytskyi NPP
PL 184 km
2 V-320 units
1000 MWe
1000 MWe

DECOMMISSIONED POWER PLANTS

Ignalina NPP (Lithuania)
Two 1300 MWe RBMK reactors shut down in 2004 and 2009

Krümmel NPP (Germany)
One 1402 MWe BWR reactor shut down in 2011

Bohunice NPP (Slovakia)
Two 440 MWe V-213 reactors shut down in 2006 and 2008

Barseback NPP (Sweden)
Two 615 MWe BWR reactors shut down in 1999 and 2005

Oskarshamn NPP (Sweden)
Two 492 MWe and 661 MWe BWR reactors shut down in 2017 and 2016, respectively

5 Safeguards

Fot. PAA

Legal basis for safeguards

LEGAL BASIS

In the field of nuclear safeguards, Poland fulfils its commitments arising from the following international regulations:

- The Treaty establishing the European Atomic Energy Community (Euratom Treaty) of 25 March 1957. The Treaty provisions have been in force in Poland since the accession to the European Union;
- Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The NPT entered into force on 5 March 1970. In 1995, its validity was extended indefinitely. Poland ratified the NPT on 3 May 1969. The NPT came into force in Poland on 5 May 1970;
- Agreement between Poland, European Atomic Energy Community, and the International Atomic Energy Agency in relation to the implementation of Article III of the Treaty on the Non-Proliferation of Nuclear Weapons, also referred to as the Tripartite Safeguards Agreement (INFCIRC/193). The agreement has been in force in Poland since 1 March 2007;
- Additional protocol to the Tripartite Safeguards Agreement on the implementation of Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (INF-CIRC/193/Add.8). The protocol came into force on 1 March 2007;
- Commission Regulation (Euratom) No 302/2005 of 8 February 2005 on the application of Euratom safeguards (OJ L 54, 28.2.2005).

The most common agreement on nuclear safeguards concluded under the Treaty on the Non-Proliferation of Nuclear Weapons between non-nuclear weapon states and the International Atomic Energy Agency (IAEA) is based on IAEA Model Document – INFCIRC/153.

On this basis, a comprehensive agreement on nuclear material safeguards was concluded in 1972 between Poland and the International Atomic Energy Agency, as presented in the IAEA INFCIRC/179 document.

In March 2006, the so-called integrated safeguards system was introduced in Poland. That became possible after providing the IAEA with all the relevant information on nuclear material safeguards. On this basis, the IAEA stated that the nuclear materials were used in Poland exclusively for peaceful purposes. The introduction of the integrated safeguards system allowed for a significant reduction of the number of inspections carried out in Poland by the IAEA. The bilateral agreement on nuclear safeguards between Poland and the IAEA was in force till the end of February 2007.

After Poland's accession to the European Union, the agreement between Poland and the IAEA was suspended. The integrated safeguards system has been in force in Poland since 1 March 2007 under the tripartite agreement between Poland, the European Atomic Energy Community and the International Atomic Energy Agency. The President of the PAA is responsible for the implementation of this agreement.

Pursuant to the concluded trilateral agreement, the IAEA and EURATOM are entitled to conduct inspections of nuclear safeguards in Poland. Such inspections are aimed at checking the compliance of reports with the operator's documentation, identifying and checking the place of nuclear materials storage, verifying the amount and composition of nuclear materials covered by safeguards, explaining reasons for the occurrence of unaccounted-for-material, if any, and differences in the information submitted by the sender and recipient of the nuclear material. Checks are also performed before or after nuclear material is exported from or imported to Poland.

Users of nuclear materials in Poland

The tasks of the national system for nuclear material accountancy and control are performed in the PAA by the Nuclear Safety Department, which is responsible for the collection and storage of information on nuclear materials and for the conduct of controls in all material balance areas.

The national system for nuclear material accountancy and inspection is based on the structure of the so-called material balance areas (MBA). Nuclear materials are used in Poland in the following organizational entities, which are separate MBAs:

- MARIA Reactor Operations Division and related scientific laboratories of the National Centre for Nuclear Research (NCBJ) – WPLC;
- POLATOM Radioisotopes Centre at the NCBJ – **WPLD**;
- 22 medical and scientific facilities that use small amounts of nuclear materials and 86 industrial, diagnostic, and service facilities that have primarily depleted uranium shielding. All those facilities constitute a material balance area, Locations outside Facilities – **WPLE**;
- Institute for Nuclear Chemistry and Technology (IChTJ) in Warsaw – **WPLF**;
- Radioactive Waste Management Plant (ZUOP), which is responsible for spent nuclear fuel storage facilities, the shipping warehouse, and the National Radioactive Waste Repository in Różan – material balance area – **WPLG**.

There is also a WPLB material balance area defined for the partially dismantled ANNA and AGATA critical assemblies at the NCBJ. There are no nuclear materials in the area.

The reports on quantitative changes in the stock of nuclear materials in individual MBAs (the so-called Inventory Change Report) are submitted monthly to the Nuclear Material Accounting and Control System maintained by the European Commission's Nuclear Safeguards Office in Luxembourg. A copy of this information is also provided by the organizational entities to the PAA. Monthly reports on the changes in nuclear material balance in the WPLE area are prepared at the PAA, and then sent to the European Commission.

In matters concerning control over exports and imports of nuclear materials, strategic goods and dual-use technologies, the PAA cooperates with the Department of Sensitive Goods Trade and Technical Safety of the Ministry of Development, Labour, and Technology. On the basis of the opinions provided within the Tracker system by the PAA and other ministries, the Ministry of Development, Labour, and Technology issues decisions on matters related to the export and import control of nuclear materials, goods, and technologies.

The European Commission's Nuclear Safeguards Office provides copies of the reports to the International Atomic Energy Agency in Vienna.

INFOGRAPHICS

Balance of nuclear materials in Poland, kg
(as of 31 December 2021)

Plutonium **2.45 kg**

High-enriched uranium **7.31 kg**

Low-enriched uranium **501.77 kg**

Natural uranium **3,921.95 kg**

Depleted uranium **23,023.08 kg**

Thorium **276.86 kg**

Inspections of nuclear material safeguards

In 2021, the PAA's nuclear regulatory inspectors carried out, individually or jointly with the IAEA and EURATOM inspectors, 46 inspections of nuclear material safeguards in all material balance areas in Poland. EURATOM inspectors participated in 7 inspections. 3 inspections were conducted with the joint participation of IAEA, EURATOM, and PAA inspectors.

During all the inspections, the IAEA and EURATOM inspectors did not identify any significant concerns related to nuclear material safeguards.

Fulfilling the commitments arising from the Additional protocol to the Tripartite Agreement, a declaration updating information on the technical or research activities related to the nuclear fuel cycle conducted in Poland, information on non-export of goods listed in Annex II to that Protocol, and a declaration regarding users of small quantities of nuclear materials in Poland were submitted to EURATOM.

As a result of all the conducted inspections, no irregularities were found in relation to nuclear material safeguards in Poland. In particular, it was confirmed that all the nuclear materials located in Poland were used for peaceful purposes.

6 Transport of radioactive materials

Fot. MAEA

Transport of radioactive sources and waste

LEGAL BASIS

Radioactive materials are transported on the basis of the provisions of:

- Act of 29 November 2000 – the Atomic Law,
- Act of 19 August 2011 on Transport of Dangerous Goods,
- Act of 18 August 2011 on Maritime Safety,
- Act of 3 July 2002 on Aviation Law,
- Act of 15 November 1984 on Transport Law.

The Polish provisions are based on international modal regulations, such as:

- European Agreement concerning the International Carriage of Dangerous Goods by Road – **ADR** (French: L'Accord européen relatif au transport international des marchandises dangereuses par route);
- Regulations concerning the International Carriage of Dangerous Goods by Rail – **RID** (French: Réglement concernant le transport international ferroviaire des marchandises dangereuses);
- European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways – **ADN** (French: Accord européen relatif au transport international des marchandises dangereuses par voie de navigation intérieure);
- International Maritime Dangerous Goods Code – **IMDG Code**;
- Technical Instructions for the Safe Transport of Dangerous Goods by Air, International Civil Aviation Organization (**ICAO**);
- Dangerous Goods Regulations – IATA DGR, International Air Transport Association (**IATA**).

Radioactive materials are transported on the basis of the SSR-6 transport guidelines prepared by the IAEA. They constitute the basis for international organizations involved in the preparation of modal regulations or are directly implemented to the national legislation and constitute the basic legal form in the international traffic.

In line with Poland's commitments to the IAEA, the radioactive sources classified into appropriate categories are transported in accordance with the rules specified in the Code of Conduct on the Safety and Security of Radioactive Sources and the supplementary Guidance on the Import and Export of Radioactive Sources.

In the context of the transport of radioactive materials, it is particularly important to prevent all attempts of illegal (i.e. without a license or a registration) import into Poland of radioactive substances and nuclear materials. Such attempts are prevented primarily by the Border Guard (SG), which have **330 stationary radiometric devices, so-called dosimetric portal monitors**, installed at border crossings, nearly **1,400 portable signalling and measuring devices, and also 2 vehicles with a system of ionizing radiation detectors, which enable field measurements of ionizing radiation**.

As a result of the conducted inspections, due to e.g. exceeded permissible levels of ionizing radiation doses, the Border Guard did not allow further transport in seven cases. The Border Guard, as in previous years, received support in the form of equipment from the USA under the Memorandum of Understanding concluded in 2009 between the US Department of Energy (DoE) and the Minister of Interior and Administration and the Minister of Finance of the Republic of Poland on the cooperation in combating illicit trafficking of special nuclear and other radioactive materials.

In the organizational units of the Border Guard, equipped with permanent ionizing radiation monitors, delivered under the Memorandum, the software for the NCS system (National Communication System), supplied by the USA and used for the monitoring and information exchange on the current operation of dosimetric portal monitors, was partly implemented.

In total, 147 dosimetric portal monitors have been installed since 2010, the SG's organizational units were supplied with 434 portable radiometric devices and with 2 vehicles with the system of ionizing radiation detectors. Further installation of dosimetric portal monitors and the implementation of an IT system for processing and analyzing radiometric inspection data are planned.

In 2021 there were 42,442 shipments of radioactive materials and 197,593 shipments were transported by road, rail, inland waterways, sea, and air on the territory of Poland, covering a distance of 1,102,047 km. The ten most frequently transported isotopes include: Se-75, Ir-192, Cs-137, Am-241, Co-60, I-131, Lu-177, U-238, Mo-99, and Kr-85. The Radioactive Waste Management Plant also performed 6 shipments of radioactive waste to the National Radioactive Waste Repository in Różan. No accident occurred during the transport of radioactive materials and radioactive waste.

Transport of nuclear fuel

Shipments of fresh and spent nuclear fuel are licensed by the President of the PAA. In 2021, there were 4 shipments (in transit) of fresh nuclear fuel and no shipments of spent nuclear fuel on the territory of the Republic of Poland.

Fresh nuclear fuel

Since 2007, fresh nuclear fuel has been imported to Poland 9 times, including: MR fuel from the Russian Federation – twice, and MC fuel from France – 7 times, in connection with the operation of the MARIA research reactor at the National Centre for Nuclear Research in Świerk, 13 transits and 2 exports.

Spent nuclear fuel

The last export of spent nuclear fuel from the MARIA and EWA research reactors to the Russian Federation took place in 2016. Between 2007 and 2016, there were 9 such exports (8 of high-enriched and 1 of low-enriched fuel).

Summary

The Commander-in-Chief of the Border Guard and the President of the National Atomic Energy Agency, under the agreement on cooperation in the field of radiation protection, undertake to provide information to prevent illicit trafficking of radioactive materials across the state border. The Radiation Emergency Centre duty officer systematically cooperates with Border Guard officers in cases where the dosimetric portal monitor is activated, giving recommendations on further action. The shipments were carried out in accordance with regulations, no dose limits were exceeded. Materials which were not permitted to be further transported, did not create a hazard to the health and life of the public or to the environment. However, they exceeded the permissible values of radioactive concentrations specified in the Act – Atomic Law.

INFOGRAPHICS

Number of inspections conducted by Border Guard units.

	imports to	transit, export from	transfer at airports
TRANSPORT OF RADIOACTIVE SOURCES – 3,252 INSPECTIONS IN PARTICULAR:	1,037 inspections	2,718 inspections	219 inspections
TRANSPORT OF MATERIALS CONTAINING NATURAL RADIOACTIVE ISOTOPES – 29,858 INSPECTIONS (IN 102 CASES THE OBJECT DID NOT CROSS THE BORDER OF THE REPUBLIC OF POLAND) IN PARTICULAR:	14,430 inspections	15,318 inspections	8 inspections
TRANSPORT OF OTHER UNDECLARED ITEMS (E.G. ITEMS CONTAINING COMPONENTS PAINTED WITH RADIUM PAINT, CONTAMINATED CLOTHING, SCRAP METAL) – 96 INSPECTIONS (IN 3 CASES THE OBJECT DID NOT CROSS THE BORDER OF THE REPUBLIC OF POLAND) IN PARTICULAR:	33 inspections	56 inspections	4 inspections
PERSONS AFTER TREATMENT OR EXAMINATION WITH RADIOACTIVE ISOTOPES – 465 INSPECTIONS.		465 inspections	

In 2021 the units of the Border Guard conducted: 34,393 inspections

7

Radioactive waste

Fot. PAA

Management of radioactive waste

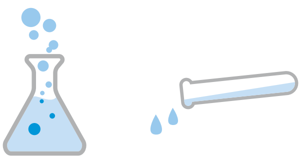
Radioactive waste is produced from activities involving radioactive sources in medicine, industry and research facilities and during the operation of a research reactor. This waste exists in a gaseous, liquid, and solid form.

INFOGRAPHICS

Radioactive waste may appear in the following states:

SOLID WASTE

includes used sealed radioactive sources, personal protection equipment contaminated with radioactive substances (rubber gloves, protective clothing, footwear), laboratory materials and equipment (glass, pieces of apparatus, lignin, cotton wool, foil), used tools and elements of technological equipment (valves, pipeline segments, parts of pumps), used sorption and filtration materials used in the process of cleaning radioactive solutions or air released from reactors and isotope laboratories (used ionites, post-precipitation sludge, filtration cartridges, etc.) The qualification of radioactive waste takes into account the radioactive concentration and the half-life of the radioactive isotopes contained in the waste.



LIQUID WASTE

consists mainly of water solutions and suspensions of radioactive substances.

GASEOUS WASTE

consists mainly of noble gases (argon, xenon, krypton) and iodine.

The following categories of radioactive waste are distinguished: low-, medium-, and high-level radioactive waste, classified into three sub-categories: transitional and short- and long-lived. Used sealed radioactive sources, which represent a separate category of radioactive waste, are classified according to their activity level into three sub-categories: low-, intermediate-, and high-level sources which may be further divided into short- and long-lived, based on the period of half-life degradation of the relevant radioactive isotopes.

> Radioactive waste containing nuclear material and spent nuclear fuel, which becomes high-level waste when a decision is made to dispose of it, are subject to specific, separate provisions for management at all stages (including storage and disposal).

Pursuant to the Atomic Law Act, all organizational entities conducting activities involving exposure to ionizing radiation must plan and conduct these activities in such a way as to prevent the generation of radioactive waste (the so-called waste minimization principle). If that is impossible, the generated radioactive waste shall be properly processed (i.e. segregation, volume reduction, solidified, and packaged) and then stored or disposed in such a way that the undertaken measures and provided barriers effectively isolate the waste from people and the environment.

Radioactive waste shall be temporarily stored in such a manner as to ensure the protection of people and the environment, under normal conditions and in radiation emergencies, for example by providing protection against spillage, dispersion or release. Specially dedicated facilities or rooms (radioactive waste storage facilities) are used for this purpose and are equipped with mechanical or gravitational ventilation and purification of the air discharged from the room.

The radioactive waste disposal is allowed only in facilities dedicated to that, i.e. repositories. In accordance with the Polish regulations, they are divided into near surface and deep geological repositories, and the nuclear safety and radiation protection licensing process, which is the responsibility of the President of the PAA, defines in detail the types of waste of each category that may be disposed at a given facility.

Radioactive waste in Poland

The Radioactive Waste Management Plant (ZUOP) is involved in the collection, transport, processing, and disposal of waste generated by users of radioactive materials in Poland.

Supervision over the safety of waste management, including supervision over the safety of waste disposal by the ZUOP is exercised by the President of the PAA.

TABLE 3.

Quantities of radioactive waste collected by the ZUOP in 2021

Waste sources	Solid waste [m³]	Liquid waste [m³]
Outside the Nuclear Centre in Świerk (medicine, industry, scientific research)	2.5	0.04
National Centre for Nuclear Research, POLATOM	7,45	0.17
National Centre for Nuclear Research+ MARIA Reactor*	3.48	46
Radioactive Waste Management Plant	1.16	10.3
Total:	**14.59**	**56.51**

* overall value of radioactive waste from the MARIA reactor and the National Centre for Nuclear Research

The ZUOP owns facilities at the site of the Nuclear Centre in Świerk, equipped with radioactive waste treatment installations.

The radioactive waste in Poland is disposed in the National Radioactive Waste Repository (KSOP), situated in Różan (Maków district). The KSOP is a near surface repository, intended for the disposal of short-lived, low- and intermediate-level radioactive waste (with a radionuclide half-life of less than 30 years). It is also used for the storage of long-lived waste, mainly alpha-radioactive materials, awaiting disposal in a deep geological repository (named otherwise geological or underground). The KSOP was established in 1961 and is the only facility of this kind in Poland.

In 2021, the ZUOP received 238 orders from 170 institutions to collect radioactive waste. Table 3 presents the quantities of collected radioactive waste (including the waste generated at the ZUOP).

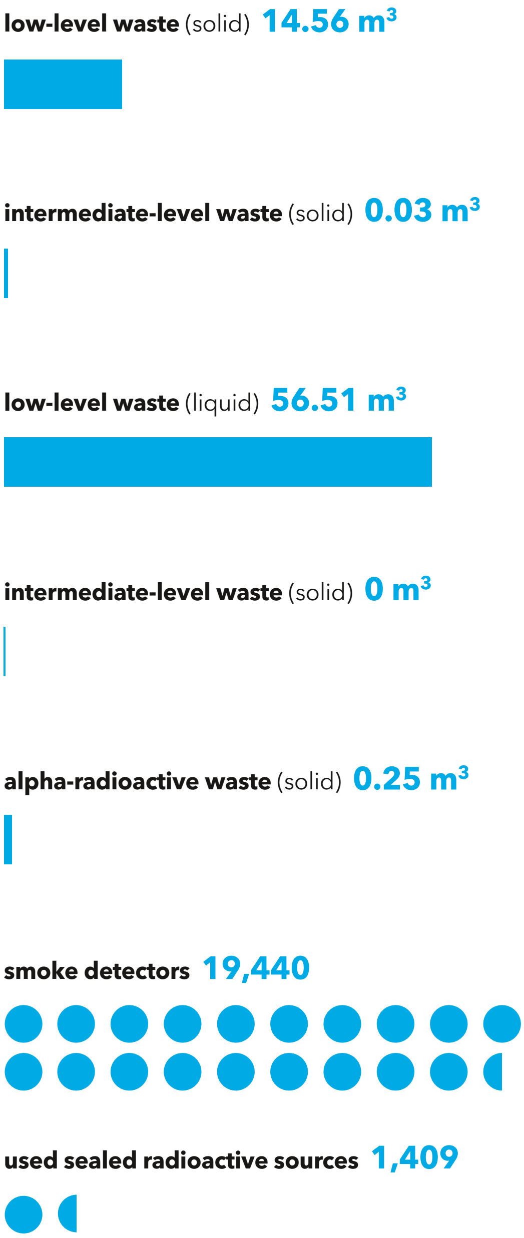
After treatment, the radioactive waste is placed in drums of 200 and 50 dm^3 capacity, and then it is handed over in the solidified form for disposal.

89 drums of 200-litre capacity with treated radioactive waste of a total activity of 1.673 TBq (figures as of 31 December 2021) were handed over to the KSOP in 2021.

Also, the waste originating from dismantling of smoke detectors is sent to the ZUOP for storage.

FIGURE 8.

The collected solid and liquid waste by type and category may be broken down as follows:



The conducted inspections of radioactive waste disposed and stored at the KSOP and ZUOP premises did not show any hazard to the public or the environment.

The management of radioactive waste at the ZUOP is carried out on the basis of licenses issued by the President of the PAA.

- License No D-14177 of 17 December 2001 for nuclear activities involving transport, processing and storage of radioactive waste collected from entities involved in nuclear activities across the country at the Świerk Nuclear Centre,
- License No 1/2002/KSOP – Różan of 15 January 2002 for the operation of the KSOP in Różan.
- License No 1/2016/ZUOP of 15 December 2016 for the performance of exposure-related activities involving the storage of radioactive waste at the Facility no 8A at the National Radioactive Waste Repository in Różan,
- License No D-19866 of 4 July 2016 for the performance of activity, referred to in Art. 4 Section 1 Item 1a of the Atomic Law Act, consisting in the storage of radioactive waste generated in a Class III isotopic laboratory operated under license number D-18527 and radioactive waste received from other entities under license number D-14177 in the Shipping Warehouse (Buildings 35A and 35B on the premises of the State-owned Radioactive Waste Management Plant in Otwock-Świerk at ul. Andrzeja Sołtana 7).

These licenses are valid indefinitely, and the two first require submitting reports (the first – annual, the second – quarterly), which are analysed by the PAA's staff. The information provided in the reports is next verified during inspections.

Nuclear regulatory inspectors from the PAA in 2021 conducted seven inspections of the management of radioactive waste at the ZUOP, including the following:

- three inspections were carried out at the KSOP, which comprised: inspection of the technical condition of KSOP facilities and of the KSOP radiation protection status, checking of radioactive waste reception, inspection resulting from the current regulatory control, changes introduced to the license, modernisations and modifications of licensed activities, checking the functioning of physical protection on the KSOP premises, and checking the implementation of recommendations, orders, and bans, as well as verifying the removal of infringements and irregularities identified during the previous regulatory inspections;

- four inspections at the ZUOP facilities at the site of the Nuclear Centre in Świerk, which were related to the performance of technological processes of radioactive waste processing, the technical condition of the ZUOP facilities and the condition of radiation protection as well as the implementation of recommendations, orders, and bans, and the verification of removal of the infringements and irregularities from previous regulatory inspections.

The conclusions and observations from the performed inspections were implemented by the management of the ZUOP on an ongoing basis, while irregularities and infringements identified by nuclear regulatory inspectors were removed in accordance with the provisions included in the inspection protocols or post-inspection notices.

Summary

The amount of radioactive waste handed over to the ZUOP in 2021 was at a level comparable to previous years.

In accordance with the report submitted by the ZUOP, in 2021 the radioactive waste was managed according to the terms of valid licenses. No radiation emergencies occurred, the presented results of environmental and radiation monitoring do not deviate from the levels recorded in the previous year and show that there was no radiation hazard to the personnel and environment.

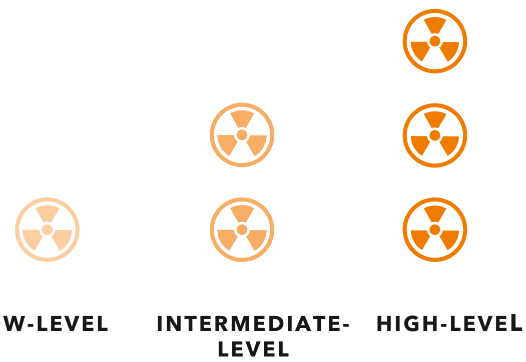
The inspections of radioactive waste disposed and stored at the KSOP and ZUOP did not show any hazard to the public and environment.

INFOGRAPHICS

Classification of radioactive waste.

RADIOACTIVE WASTE

The following categories of radioactive waste are distinguished: **low-**, **intermediate-**, and **high-level** radioactive waste, classified into three sub-categories: transitional, short- and long-lived.



- **TRANSITIONAL**
- **SHORT-LIVED**
- **LONG-LIVED**

NUCLEAR MATERIAL AND SPENT NUCLEAR FUEL

Radioactive waste containing nuclear material and spent nuclear fuel, which becomes high-level waste at the moment of taking a decision on its disposal, is subject to special separate regulations on the management at all stages (including storage and disposal).

USED SEALED RADIOACTIVE SOURCES

constituting a separate category of radioactive waste, are classified by the level of activity into three sub-categories: low-, intermediate-, and high-level waste.

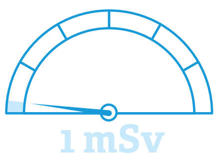
8 Radiation protection of the population and workers in Poland

Exposure of the population to ionizing radiation

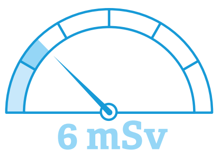
For individuals in the general population, the dose limit, expressed as an effective dose, amounts to 1 mSv per calendar year.

For occupational workers with exposure to ionizing radiation and for school students, tertiary education students, and apprentices aged 18 or older, the dose limit is 20 mSv per calendar year. In the case of workers, this dose may be exceeded up to 50 mSv per year, if such an excess is authorized by the President of the National Atomic Energy Agency or another authority competent to issue licenses or accept a registration or a notification concerning the relevant activity.

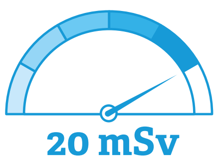
The dose limit for school students, tertiary education students and apprentices aged 16 to 18 is 6 mSv. The dose limit for the general population applies to school students, tertiary education students and apprentices under the age of 16.



for persons in the general public



for school students, tertiary education students and apprentices aged 16 to 18



for workers and school students, tertiary education students and apprentices aged 18 and older

The dose limit value consists of three elements:

- the presence of artificial radionuclides in food and the environment from nuclear explosions and radiation accidents,
- the use of consumer goods emitting radiation or containing radioactive substances,
- professional activities involving the use of ionizing radiation sources.

Human exposure to ionizing radiation results from two main sources:

- natural radiation sources – ionizing radiation emitted by radionuclides which are natural components of all elements of the environment, and the cosmic radiation;
- artificial (man-made) radiation sources – all artificial radiation sources, such as radioactive isotopes of elements and radiation generating instruments, e.g. X-ray instruments, accelerators, nuclear reactors, and other radiation devices.

Ionizing radiation is a phenomenon that has always been present in the human environment, and therefore its presence cannot (and does not have to) be eliminated, but can be limited. This results from the fact that man cannot have influence on, for example, the level of cosmic radiation, the contents of natural radionuclides in the Earth's crust, or even in his/her body. **For this reason, the established dose limit (the limit of the effective dose for the general population) takes into account only artificial radiation sources**, and excludes doses received:

- by patients as a result of the use of radiation for medical purposes;
- during radiation emergencies (i.e. when the radiation source is not under control).

LEGAL BASIS

Annex 4 to the Atomic Law Act is the basic national normative act determining this limit.

NFOGRAPHICS

The percentage of different ionizing radiation sources in the annual average effective dose.

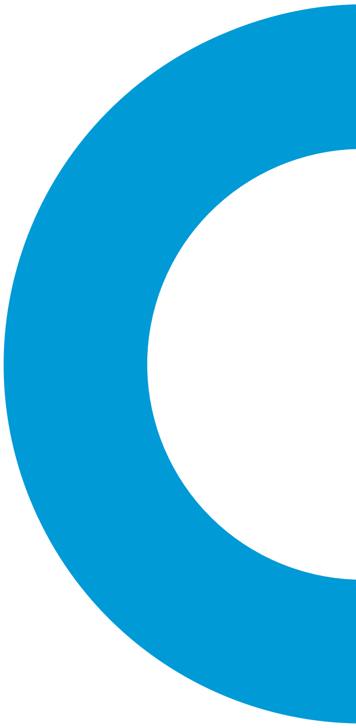
4.19 mSv

annual total effective dose of ionizing radiation received per capita Poland in 2021

NATURAL
SOURCES

64%

2.68 mSv



RADON
28.6% **1.2 mSv**

222
Rn
86

GAMMA RADIATION
19% **0.80 mSv**

COSMIC RADIATION
7.6% **0.2 mSv**

INTERNAL RADIATION
6.3% **0.26 mSv**

THORON
2.4% **0.1 mSv**

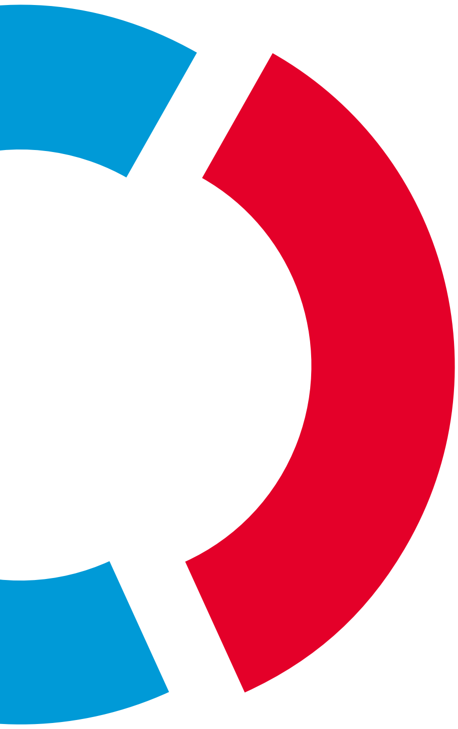
Tn

Exposure to natural sources:

- radon and products of its decay,
- cosmic radiation,
- terrestrial radiation, i.e. radiation emitted by natural radionuclides existing in the intact Earth's crust,
- natural radionuclides contained in the human body, approx. 0.001 mSv.

approx. 0.001 mSv
dose of exposure to ionizing radiation from consumer goods (e.g. TV, isotopic smoke detectors).

approx. 0.091 mSv
exposure dose from radionuclides naturally occurring in food (Ra-226, Pb-210, Po-210, and U+Th).



ARTIFICIAL
SOURCES
36%
1.51 mSv

MEDICAL DIAGNOSTICS
35.8% 1.5 mSv

This overall dose predominantly includes doses received during tests performed with the use of:
- **computed tomography 0.9 mSv**,
- **conventional radiography and fluoroscopy 0.2 mSv**.

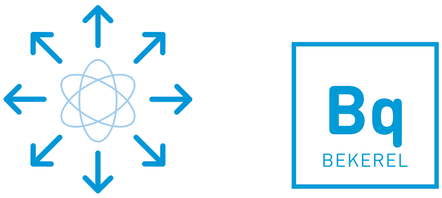
For other diagnostic examinations, the single doses are as follows:
- mammography **0.02 mSv**,
- X-ray **1.2 mSv**,
- chest radiograms **0.11 mSv**,
- spinal column and lung scans **3 mSv – 4.3 mSv**.

DEFECTS
0.1% 0.005 mSv

OTHER
0.1% 0.005 mSv

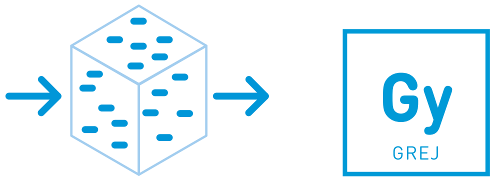
INFOGRAPHICS

Basic terms and units used in radiation protection.



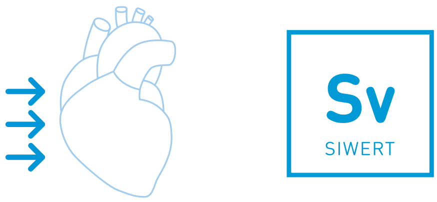
RADIOACTIVITY

Determines the number of radioactive decays in a given material per unit time.



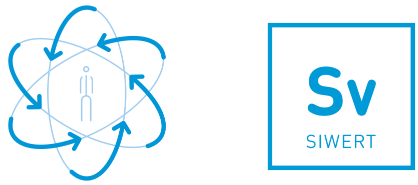
ABSORBED DOSE

Determines the average energy absorbed by the medium, through which the radiation passes.



EQUIVALENT DOSE

Determines the dose absorbed in the tissue or organ, taking into account the radiation type and energy. It allows to determine the biological effects of radiation impact on the exposed tissue.



DOSE

Illustrates the exposure of the whole body to radiation. Determines the degree of whole body exposure to radiation, even when only certain parts of the body are irradiated.

Exposure limits for individuals in the general population take into account external irradiation and internal irradiation caused by radionuclides that enter the human body by oral or inhalation routes, and are defined as:

- effective dose, illustrating the whole body exposure, and
- equivalent dose, expressing the exposure of individual body organs and tissues.

The annual total effective dose of ionizing radiation received per capita in Poland has remained at a similar level for several years. In 2021, this value, taking into account radiation from natural and artificial sources of ionizing radiation (including those used in the medical diagnostics), **was 4.19 mSv on average**.

The percentage share of this exposure to various radiation sources is shown in the infographics on pages 52-53[1].

Exposure of the general public to ionizing radiation sources

Exposure to the following natural sources constitutes **64%** of the total effective dose and amounts to approx. **2.68 mSv per year**:

1. The sources of data obtained included the Central Laboratory for Radiological Protection in Warsaw, the National Centre for Radiation Protection in Łódź, the Institute of Meteorology and Water Management in Warsaw, the Institute of Occupational Medicine in Łódź, and the Central Mining Institute in Katowice.

- radon and products of its decay,
- cosmic radiation,
- terrestrial radiation (radiation emitted by natural radionuclides existing in the intact Earth's crust),
- natural radionuclides contained in the human body.

Radon and its decay products account for the largest share of this exposure, with an average per capita dose of approx. **1.20 mSv per year**.

In **2021**, the average per capita exposure to medical radiation sources in Poland, mainly in medical diagnostics including X-ray examinations and in vivo examinations (i.e. administration of radioactive agents to patients) is estimated at **1.5 mSv**.

This dose consists primarily of doses received during examinations in which computed tomography was used (**0.9 mSv**) and conventional radiography and fluoroscopy (**0.2 mSv**). For other diagnostic tests, the doses are much smaller.

The average effective dose per X-ray examination is 1.2 mSv, and for the most frequently carried out examinations these values are as follows[2]:
- chest radiographs – approx. 0.11 mSv,
- spinal column and lung scans from 3 mSv to 4.3 mSv.

It should also be recalled that the public exposure limits do not cover exposure resulting from the therapeutic use of ionizing radiation.

Annual effective dose

National regulations set an effective annual dose limit of 1 mSv for the population. The value of the effective dose of a statistical Pole, comprised by this limit consists of three elements:
- the presence of artificial radionuclides in food and the environment from nuclear explosions and radiation accidents,
- the use of consumer goods emitting radiation or containing radioactive substances,
- professional activities involving the use of ionizing radiation sources.

The average per capita exposure to radionuclides of natural origin (Ra-226, Pb-210, Po-210 and U+Th) in food in Poland has been estimated at 0.091 mSv on the basis of measurements carried out in previous years (this constitutes **9%** of the dose limit for the population). These values were determined on the basis of measurements of radionuclide content in foodstuffs and food products constituting the basic components of an average diet, taking into account current data on the intake of its individual components. As in previous years, dairy, meat, vegetables (mainly potatoes) and cereals account for the largest share of this exposure, while mushrooms, forest fruits and game, despite their elevated caesium isotope content, do not contribute significantly to this exposure due to their relatively low consumption. Since the concentration of post-Chernobyl Sr-90 in food products is virtually unmeasurable at present, it was assumed that the dose from food products was from Cs-137 only.

The values illustrating exposure to radiation, emitted by artificial radionuclides contained in such components of the environment as soil, air, and open waters, were determined on the basis of measurements of the content of particular radionuclides in samples of environmental materials collected in various regions of the country (the results of the measurements are given in Chapter 10 'Assessment of the radiation situation in Poland'). Considering local differences in the level of Cs-137 isotope content, which is still present in soil and in food, it can be estimated that the maximum dose may be approx. 4-5 times higher than the average value, which means that the exposure due to artificial radionuclides does not exceed 5% of the dose limit.

Exposure to ionizing radiation from consumer goods **in 2021 was approx. 0.001 mSv, which is 0.1%** of the dose limit for the population.

The provided value was determined mainly on the basis of measurements of radiation emitted by cathode-ray tubes and isotope smoke detectors and gamma radi-

2. The range of variability of these values for individual examinations reaches up to two orders of magnitude and results from both the quality of the instrument and the use of maximally different examination conditions.

ation emitted by artificial radionuclides used for colouring ceramic tiles or porcelain. The calculated value also takes into account the dose from cosmic radiation received by passengers during airplane flights. In connection with the increasingly widespread use of LCD screens and monitors instead of the previously used CRTs, the dose received by a statistical Pole from these devices is systematically reduced.

The per capita exposure during occupational activity with sources of ionizing radiation (presented in more detail in Chapter 8.2 'Control of exposure to ionizing radiation') **in 2021 was approx. 0.002 mSv, which is 0.01% of the dose limit (for an occupationally exposed person)**.

In 2021, the total per capita radiation exposure to artificial sources of ionizing radiation, excluding medical exposure (and with the dominant share of exposure to Cs137, present in the environment as a result of nuclear explosions and the Chernobyl accident), in Poland was approx. **0.01 mSv, i.e. 0,1%** of the artificial radioisotope dose limit for people in the general population of 1 mSv per year, and only **0.24%** of the per capita dose from all sources of ionizing radiation.

In light of the radiation protection regulations adopted worldwide and in Poland, the radiation exposure of a statistical inhabitant of Poland in 2021, resulting from the use of artificial sources of ionizing radiation, should be considered low.

Control of exposure to ionizing radiation

Occupational exposure to artificial sources of ionizing radiation

Performance of occupational duties associated with work in nuclear facilities, radioactive waste management units, and units carrying out activities involving exposure to ionizing radiation result in radiation exposure to workers.

LEGAL BASIS

The requirements for nuclear safety, radiation protection and health protection of workers are specified in Chapter 3 of the Atomic Law Act.

In accordance with the principles of control of exposure to ionizing radiation, the primary responsibility for compliance with the requirements in this regard rests with the head of the organizational entity responsible for controlling the doses received by his or her subordinate workers.

Such controls must be conducted on the basis of the results of environmental measurements or individual dosimetry, performed by a specialised, accredited radiometric laboratory. The following accredited laboratories conducted individual dose measurements and assessments at the request of the concerned organizational entities in 2021:

- Laboratory of Individual and Environmental Dosimetry, the Henryk Niewodniczański Institute of Nuclear Physics in Krakow (IFJ),
- Department of Radiation Protection, the J. Nofer Institute of Occupational Medicine in Łódź (IMP),
- Dose Control and Calibration Department of Central Laboratory for Radiological Protection (CLOR) in Warsaw,
- Dosimetry Laboratory of the National Centre for Nuclear Research (NCBJ) in Świerk,
- for the monitoring of doses from natural radioactive isotopes received by miners working underground – Silesian Centre for Environmental Radioactivity, Central Mining Institute (GIG) in Katowice.

Provisions of the Atomic Law Act introduced the obligation to keep a register of doses and to provide individual control to category A workers exposed to ionizing radiation, i.e. those who, according to the assessment of the head of the organizational entity, may under normal working conditions be exposed to an effective dose from artificial radiation sources exceeding 6 mSv per year or to an equivalent dose exceeding 15 mSv per year for eye lenses or 150 mSv per year for skin or limbs.

The assessment of the doses for category B workers, i.e. those workers who are not classified as category A, is based on measurements performed in the working environment. At the discretion of the head of the organizational entity, workers in this category may (but are not required to) be subject to exposure monitoring with personal dose meters.

For workers, the dose limit, expressed as an effective dose, amounts to 20 mSv per calendar year. In view of the special conditions or circumstances of carrying out activities involving exposure to ionizing radiation, it may be possible to exceed this dose limit up to 50 mSv per year only with the consent of the authority competent to issue licenses or accept a notification or information referred to in Article 4 Section 1 or Section 1a of the Atomic Law Act and on the condition that the annual average effective dose in any period of five consecutive calendar years, including years in which the dose limit has been exceeded, does not exceed 20 mSv. Thus, the sum of doses received in the current year and in the previous four calendar years needs to be checked in the process of controlling the exposure of workers who work with ionizing radiation sources. This means that heads of organizational entities have to keep a record of doses of exposed workers and transfer the data on exposure of category A workers to the central register of doses kept by the President of the PAA.

The work under exposure to ionizing radiation affects tens of thousands of people. However, only a small percentage of workers routinely work with significant exposure to ionizing radiation.

For most people, dose monitoring is conducted to confirm that the use of radiation sources does not pose a threat and is not expected to cause adverse health effects. This ionizing radiation exposure group is classified as category B workers. The largest subgroup in category B is the medical staff of diagnostic X-ray laboratories.

More than 2,000 people who are subject to individual dose measurements are classified annually as category A workers.

Sub-section summary:
Two categories of workers, i.e. categories A and B, are introduced in order to adapt the way the risk of workers in organizational entities is assessed to its expected level, depending on the magnitude of the risk. The assessment of workers' exposure is carried out on the basis of the results of environmental measurements or individual dosimetry. The Atomic Law Act defines the dose limit, which is expressed as an effective dose and equals 20 mSv in a calendar year for workers and only in exceptional situations may be exceeded up to 50 mSv per year on condition that the average annual effective dose in any period of five consecutive calendar years, including years in which the dose limit was exceeded, may not exceed 20 mSv. In Poland, 95% of workers exposed to ionizing radiation are category B workers.

Central Dose Register of the President of the PAA

LEGAL BASIS

Detailed information on the procedure for recording, reporting, and registering individual doses is provided in the Regulation of the Council of Ministers of 25 May 2021 on requirements for the registration of individual doses (Dz. U. item 1953).

The data on doses for workers classified by heads of individual units as category A workers are collected in the central dose register of the President of the PAA. Workers from this ionizing radiation risk category are required to undergo measurement of effective doses to the whole body and/or to a specific, most exposed part of the body (e.g. hands).

INFOGRAPHICS

Statistics of individual annual effective doses of workers assigned to category A for exposure to ionizing radiation in 2021.

NUMBER OF WORKERS*	RECEIVED ANNUAL EFFECTIVE DOSE [mSv]
1504	< 6
52	6 ÷ 15
1	15 ÷ 20
2	20 ÷ 50
0	>50,0

* According to registrations submitted to the central register of doses by 30 April 2022.

Exceptionally, in cases of exposure to contamination by dispersive radioactive substances called open sources, an assessment of the internal contamination committed dose is performed.

Since the creation of the Central Dose Register , i.e. from 2002 to 30 April 2022, a total of 6,992 individuals were registered. Over the past four years, the data for 3,120 of those registered were updated. In 2021, the data of 1,623 people were updated.

As a result of the proper radiation protection, 1,820 category A individuals received effective doses not exceeding 6 mSv per year (the lower limit of exposure assumed for Category A workers), and doses above 6 mSv were received by 55 individuals with only two cases measured exceeding an annual dose of 20 mSv (the dose limit that can be received over a calendar year from routine work with ionizing radiation). In cases where the dose limit was exceeded, working conditions and causes of radiation exposure were analysed in detail.

Summary data for 2021 on exposures of category A workers reported to the Central Dose Register by individual organizational units is provided in the infographics on page 58.

These data show that in the group of Category A workers, the percentage of persons who did not exceed the lower limit specified for this exposure category, that is 6 mSv per year, was 96.4% in 2021, and the percentage of workers who did not exceed the limit of 20 mSv/year was 100%.

Summary

In 2021, the value of effective dose limit, 20 mSv per year, was not exceeded. However, three cases of exceeded dose limit for the eye lens were recorded. This issue was related to surgeons performing procedures under X-rays, lasting many hours, especially during operations on major blood arteries and on the heart. A new annual limit dose for the eye lens, 20 mSv per year, has been effective since the implementation of the new directive 2013/59/Euratom. This condition is so restrictive that exceeding it is quite common in interventional surgery, but appropriate dosimeters for the measurement of equivalent dose in eye lenses are still rarely used. Such a dose risks a post-radiation deterministic effect in the form of lens opacity or cataracts.

All the cases of exceeded annual dose limit per the eye lens were subject to detailed special investigations, carried out by nuclear regulatory inspectors.

Exposure to radon

Radon (Rn) is a radioactive noble gas which naturally exists in the environment. It is present in various activity concentrations in every building and dwelling, depending on the geological structure of the ground, on which the building is founded. Materials used for the construction also matter. Radon gets inside together with the air sucked from the ground by cracks in foundations, building's walls, sewer manholes, leaks around sewer pipes, from building materials, etc.

In nature, the most common isotope found is radon-222 (designated Rn-222), which makes up about 80% of all isotopes and is also considered the most dangerous to the environment. Its short-lived products of decay account for approx. 30% of the ionizing radiation dose received by inhabitants of Poland from natural sources.

Radon does not directly affect our body. However, its short-lived progeny can enter our respiratory system as dust and undergo radioactive decay there. Thus, they may increase the risk of lung cancer.

Pursuant to the Atomic Law Act the reference level for the average annual activity concentration of radon in indoor workplaces and in rooms intended for human habitation amounts to 300 Bq/m^3.

The provisions of the Act of 13 June 2019 amending the Atomic Law Act and the Act on Fire Protection came into force in 2019, and introduced a number of changes also in the field of protection against exposure to radon, including the following:

- establishment of reference levels for annual average concentration of radon in the air,
- introduction of an obligation to measure radon concentrations or the potential alpha energy concentration of short-lived radon decay products in workplaces located at ground or basement level and in workplaces related to groundwater remediation in areas where annual average concentration of radon in the air in a significant number of buildings may exceed the reference level,
- introduction of an obligation to provide, at the buyer's or tenant's request, information on the value of annual average concentrations of radioactive radon in the air in a building, premises or room,
- imposition on the President of the National Atomic Energy Agency of an obligation to monitor measures preventing radon ingress into new buildings and to carry out information campaigns in this regard.

Summary

Radon can pass from the ground into a building, which means that the risk of radon exposure can occur in residences, workplaces, and mixed-use buildings. The provisions of the Atomic Law Act introduced by the Act of 13 June 2019 amending the Atomic Law Act and the Act on fire protection changed the guidelines for protection from exposure to radon.

Control of exposure in mining industry to natural sources of ionizing radiation

Contrary to radiation hazards from artificial radioactive isotopes and radiation emitting devices, the radiation hazard in the mining industry (coal mining and mining of other natural resources) are primarily posed by an increased level of ionizing radiation in mines, caused by natural radioactivity. Sources of this hazard include:

- radon and products of its decay in mine air (one of the main hazard sources, next to external gamma radiation),
- gamma radiation emitted by natural radioactive isotopes (mainly radium), contained in the rock mass, (primary, short-lived decay products of radon in the air, source of hazard),
- mine waters (and sediments from these waters) with an increased content of radium isotopes.

The first two aforementioned factors apply practically to all miners working underground, while radiation hazard from mine waters and sediments occurs in specific cases and affects a limited number of workers.

This means that when making the calculations necessary to classify the workings into individual classes of radiation hazard, from the dose resulting from the natural background on the surface for the assumed operation time should be subtracted from the dose calculated on the basis of measurements. Table 4 presents limit values for occupational hazard indicators for both classes of radiation-prone workings. The suggested values result from the developed and implemented model for the calculation of loading doses, caused by specific working conditions in underground mines.

The following factors of radiation hazard are examined:

- concentration of potential energy of alpha short-lived products of radon decay in the air of mine workings,
- dose rate of gamma radiation at the place of work in excavation mining,
- radium concentration in mine waters,
- radium concentration in sediments precipitated from mine waters.

The assessment of miners' exposure to natural radiation sources is performed by the Central Mining Institute (GIG) in Katowice. In underground mines, in radiation-prone workings, special methods of work organization have been introduced to prevent exceeding the dose limit of 20 mSv.

Table 5 shows the number of mines in which (on the basis of determined exceedances of values of particular radiation hazard factors) there may be workings classified as class A and B radiation hazard.

It should be emphasized that the classification of a particular category of radiation-prone workings is made by the heads of relevant mines on the basis of the sum of effective doses for all radiation risk factors in real working time. Therefore, the number of workings included in particular radiation hazard categories is actually lower.

LEGAL BASIS

In terms of radiation hazards, in addition to implementing acts to the Atomic Law Act, in 2021 the implementing acts to the Act of 9 June 2011 on the Geological and Mining Law (Dz. U. of 2021 item 1420 and 2269) were in force:

- Regulation of the Minister of Energy of 23 November 2016 on requirements for underground mining facilities operations (Dz. U. of 2017, item 1118, as amended),
- Regulation of the Minister of Environment of 29 January 2013 on natural hazards in mining facilities (Dz. U. of 2021, item 1617), which defined workings as:
    - class A, located in controlled areas within the meaning of the Atomic Law Act, in which the working environment creates the potential for the worker to be exposed to an annual effective dose exceeding 6 mSv,
    - class B, located in supervised areas within the meaning of the Atomic Law Act, in which the working environment creates the potential for exposure to an annual effective dose higher than 1mSv, but not exceeding 6 mSv.

Total employment in hard coal mines, according to the State Mining Authority (WUG) figures as of 31 December 2021, was: 79,800 persons.

In addition, the percentage of people working in workings belonging to particular hazard classes was estimated. The result of this evaluation is shown in Figure 9.

The process of analysis considered the number of mines with radiation-prone workings, type of working, hazard source, and the number of mining personnel working there. Based on the information collected by the State Mining Authority, the share of miners working in potentially radiation-prone workings was determined. This in particular applies to sites that may have waters and sed-

TABLE 4.
Limit values of working hazard indicators for both classes of radiation-prone workings (GIG)

Hazard indicator	Class A*	Class B*
Concentration of potential energy α of short-lived products of radon decay (Cα), μJ/m³	Cα > 2.5	0.5 < Cα ≤ 2.5
Kerma power of γ radiation (K), μGy/h	K > 3.1	0.6 < K ≤ 3.1
Specific activity of radium isotopes in sediments (C^{RaO}), kBq/kg	C_{RaO} > 120	20 < C_{RaO} ≤ 120

* The provided values correspond to doses of 1 mSv or 6 mSv, under the additional assumption that there is no cumulative effect from individual hazard sources and that the annual operating time is 1,800 hours.

iments with elevated radium isotope concentrations, elevated alpha potential energy concentrations, and higher than average gamma dose powers.

In 2021, the Central Mining Institute performed 3,567 measurements of the concentration of potential alpha energy of short-lived radon decay products, 853 measurements of exposure to external gamma radiation in underground mines and 611 analyses of the radioactivity of mine waters collected in underground workings of hard coal mines, and 134 analyses of radionuclide concentration in samples of sediments precipitating from mine waters.

In 2021 the measurements of individual doses of gamma radiation were performed in five coal mines. In the remaining mines no such measurements were carried out. Controlled persons, 68 in total, were employed mainly in the disposal of radioactive mine water sediments or worked in places where such sediments could accumulate. In two hard coal mines, the annual dose, estimated from the results of individual dose measurements, exceeded 1 mSv (taking uncertainty into account) but was less than 6 mSv (category B). In 2021, in one case, the dose exceeded 6 mSv (category A).

On the basis of the carried out control of radiation hazards, it was stated that under unfavourable conditions (lack of appropriate ventilation) it may occur in almost every mine working. The hazard assessment performed by the GIG for hard coal mines has shown that in one mine class A workings were active (hazard applies to 0.4% of the total number of employed miners), and in two mines – class B workings (hazard applies to 1.6% of the total number of employed miners). Mining workings with a slightly increased natural radiation background (but below the level corresponding to class B) employ 7.7% of the total number of employed miners, while 90.3% of miners work in non-hazardous workings.

The assessed value of the miner's potential (maximum) dose in 2021 was 27.7 mSv, taking into account the measurement uncertainty and assuming that the annual working time is 1,800 hours, and the background – 0.1 μGy/h.

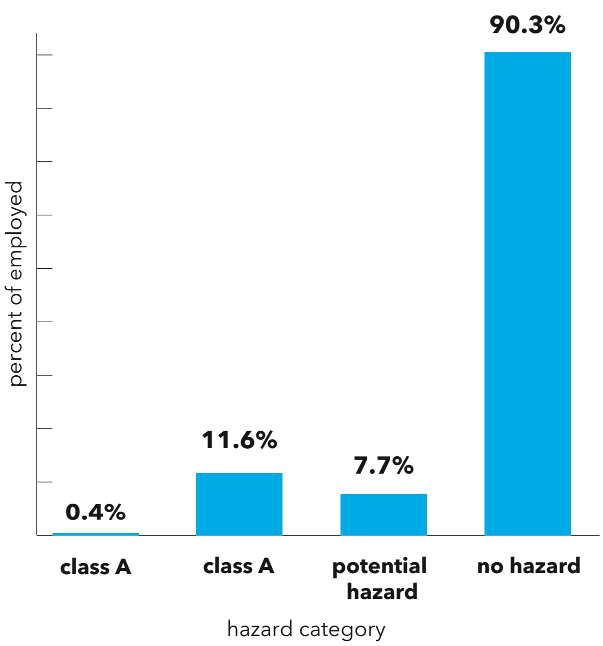
TABLE 5.

Number of hard coal mines with radiation-prone workings (GIG)

Hazard class	A	B
Number of mines	1	2
Hazard from short-lived products of radon decay	–	1
γ radiation hazard	1	2
External γ radiation (individual dosimetry)	2	1

FIGURE 9.

Percentage of hard coal miners employed in workings included in particular radiation hazard classes. Employment as of 31 December 2021 – overall 79,800 persons.



With a realistic operating time assumption of 750 hours, the maximum dose is about 10.8 mSv.The Silesian Centre for Environmental Radioactivity of the Central Mining Institute, has available precise information about the working time in individual workings only for calculating effective loading doses. For the remaining radiation hazard factors, the hazard magnitude was analysed making certain assumptions: nominal working time of 1,800 hours and frequently reported working time in water galleries of 750 hours. Estimates made on the basis of such values may therefore deviate significantly from the actual situation.

In 2021, the maximum annual additional effective dose, related to each hazard source, was:

- for short-lived products of radon decay E_{α} = 2,1 mSv (assuming that the annual working time is 1,800 hours),
- for environmental measurements of gamma radiation E_{α} = 10,8 mSv (assuming that the annual working time in water galleries of 750 hours),
- and, expressed as effective loading dose, E_{Ra} = 0,76 mSv for penetration of radium isotopes (for the declared working time equal to 213 hours per year).

Pursuant to the requirements of the Atomic Law Act concerning controlled and supervised areas, category B (supervised area) underground workings should be reclassified to category A (controlled area) in cases where there is a possibility of contamination spreading, e.g. during the work related to removal of sediments or sewage.

The analysis of the measurement results against the data from recent years has shown that class B workings, which include positions where the dose exceeds 1 mSv, are the most common in underground mines (with the assumed working times for individual hazard factors). Workings which should be classified as class A radiation hazards, i.e. those where the dose received by miners could exceed 6 mSv, occur only occasionally.

In 2021, the main reasons for the existence of increased effective doses for miners included the exposure to external gamma radiation and to the short-lived products of radon decay.

The 20 mSv per year dose was not exceeded in any mine. This is the dose limit for persons whose occupational activity is related to the radiation hazard.

Sub-section summary:

- In 2021, the number of workings classified as class B in terms of radiation hazard was twice as high as that of class A workings. On the basis of the obtained data, it is possible to conclude that last year, for class B workings, the hazard of gamma radiation prevailed.
- Last year, in 2021, individual doses of gamma radiation were measured in five hard coal mines.
- In two hard coal mines the annual dose, estimated based on the results of individual dose measurements, exceeded 1 mSv (taking into account uncertainty), but is was lower than 6 mSv (category B). In 2021, the dose of 6 mSv was exceeded in one case (category A). However, the 20 mSv per year dose was not exceeded in any mine.

Granting of personal licenses in the area of nuclear safety and radiation protection

In nuclear facilities and in other units where exposure to ionizing radiation occurs, individuals with authorization granted by the President of the PAA are employed on positions with a given specialization. The prerequisite for obtaining the authorization consists in, inter alia, the completion of a training course for individuals applying for a radiation protection officer authorization or an authorization to hold a position of significant importance for ensuring nuclear safety and radiation protection within the scope adjusted to the type or specialization of the required authorization, and passing the examination before the examination board of the President of the PAA.

LEGAL BASIS

Art. 7 Sections 3 and 10, and Art. 12 Section 1 of the Act of 29 November 2000 – Atomic Law; Regulation of the Council of Ministers of 5 March 2021 on positions of significant importance for ensuring nuclear safety and radiation protection, and Regulation of the Council of Ministers of 5 March 2021 on radiation protection officers.

The required training courses are conducted by organizational entities authorised to conduct such activities by the President of the PAA, which provide lecturers and appropriate technical facilities to conduct practical exercises, on the basis of training programmes developed for each entity and consistent with the type of training approved by the President of the PAA. In 2021, the training courses were attended by 611 persons in total. Table 6 provides the information on entities that delivered such training in 2021.

Two examination boards were working in 2021, appointed by the President of the PAA, based on Art. 71 Section 1 and Art. 12a Section 6 of the Atomic Law Act:

- examination board competent to grant a radiation protection officer authorization (IOR),
- examination board competent to grant authorizations enabling to employ on a position of significant importance for nuclear safety and radiation protection.

In 2021, due to COVID-19 counter-pandemic constraints, the training courses and examinations for a radiation protection officer authorization and an authorization to hold a position of significant importance for ensuring nuclear safety and radiation protection were carried out in accordance with the sanitary regime, which translated into a smaller number of individuals participating in the training and examinations. Nevertheless, 42 examinations were carried out (13 for IOR authorization, 28 for an authorization to hold a position of significant importance for ensuring nuclear safety and radiation protection), which were attended by 776 persons in total.

The process of issuing decisions granting the authorization in question depended on the number of submitted applications to grant such an authorization. At the same time, to ensure continuity of fulfilment of the duties of radiation protection officer, and the performance of work by persons employed on positions of significant importance for ensuring nuclear safety and radiation protection, pursuant to Art. 15zzzzn of the Act of 2 March 2020 on special solutions related to prevention, counteraction and combatting of COVID-19, and other infectious diseases and crisis situations caused thereby (Dz. U. of 2021, item 2095, as amended) a radiation protection officer authorization and an authorization to hold a position of significant importance for ensuring nuclear safety and radiation protection that expire within 30 days after the end of the epidemic emergency or outbreak of disease remain valid for further 18 months from the date of expiry during an epidemic emergency or an outbreak of disease.

TABLE 6.

Entities providing training in 2021 for persons applying for a radiation protection officer authorization and for a position of significant importance for ensuring nuclear safety and radiation protection

Authorization type	Entity name	Number of delivered courses	Number of training participants	Number of granted authorizations*
Radiation protection officer	Central Laboratory for Radiological Protection	3	51	37
	War Studies University	1	8	
Position of significant importance for ensuring nuclear safety and radiation protection	Association of Radiation Protection Officers	10	221	411
	Central Laboratory for Radiological Protection	7	116	
	National Research Institute of Oncology (Krakow Branch)	1	29	
	National Centre for Nuclear Research	9	186	

* Also includes individuals who received training prior to 2021 or were eligible to take the exam without attending training

INFOGRAPHICS

Number of persons authorized as radiation protection officers and entitled to hold a position of significant importance for ensuring nuclear safety and radiation protection

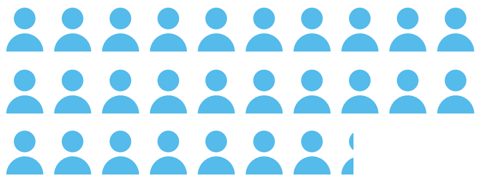
In total, a radiation inspector officer authorization and an authorization to hold positions significant for ensuring nuclear safety and radiation protection were granted to

448 persons

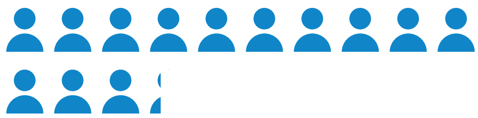
As a result of passing the examination and meeting other authorization requirements, 36 persons obtained a radiation protection officer authorization, whereas 308 persons obtained an authorization for positions of significant importance for nuclear safety and radiation protection, including:

408 persons

274 persons
authorized as non-medical accelerator operators



134 persons
authorized as: medical accelerator and teleradiotherapy equipment operators and/or operators of brachytherapy equipment containing radioactive sources



3 persons

In addition, 3 persons obtained the authorization to hold a positions of significant importance for ensuring nuclear safety and radiation protection in the organizational entity performing activities consisting in the construction, commissioning, operation, or decommissioning of a nuclear facility in the field of: research reactor operator

9 National radiation monitoring

Fot. PAA

In Poland, there is continuous monitoring of gamma dose rate and measurements of radioactive isotope content in the environment and in food products. The monitoring system operates 24 hours a day, 7 days a week, and allows to follow on an on-going basis the radiation situation in the country, and to detect early the potential threats.

Two types of monitoring are distinguished:

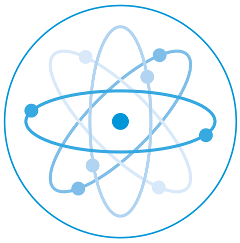
- nationwide – to obtain data needed to assess the radiation situation throughout the country under normal conditions and in emergency situations. It serves as a basis for a study of long-term changes in the radiation situation of the environment and food products;
- local – allows to obtain data from areas where activities are (or were) conducted that may cause a local increase of radiation exposure of the population (this applies to the Nuclear Centre in Świerk, National Radioactive Waste Repository in Różan, and areas of former uranium ore mining and processing facilities in Kowary).

Measurements made as part of the monitoring are carried out by:

- **measurement stations**, forming the early warning network for radioactive contamination;
- **measurement facilities**, measuring the radioactive contamination of the environment and foodstuffs;
- **services of entities operating nuclear facilities and nuclear regulatory authorities** conducting local monitoring.

The PAA's Radiation Emergency Centre (CEZAR) is responsible for coordination of the network of measurement stations and facilities.

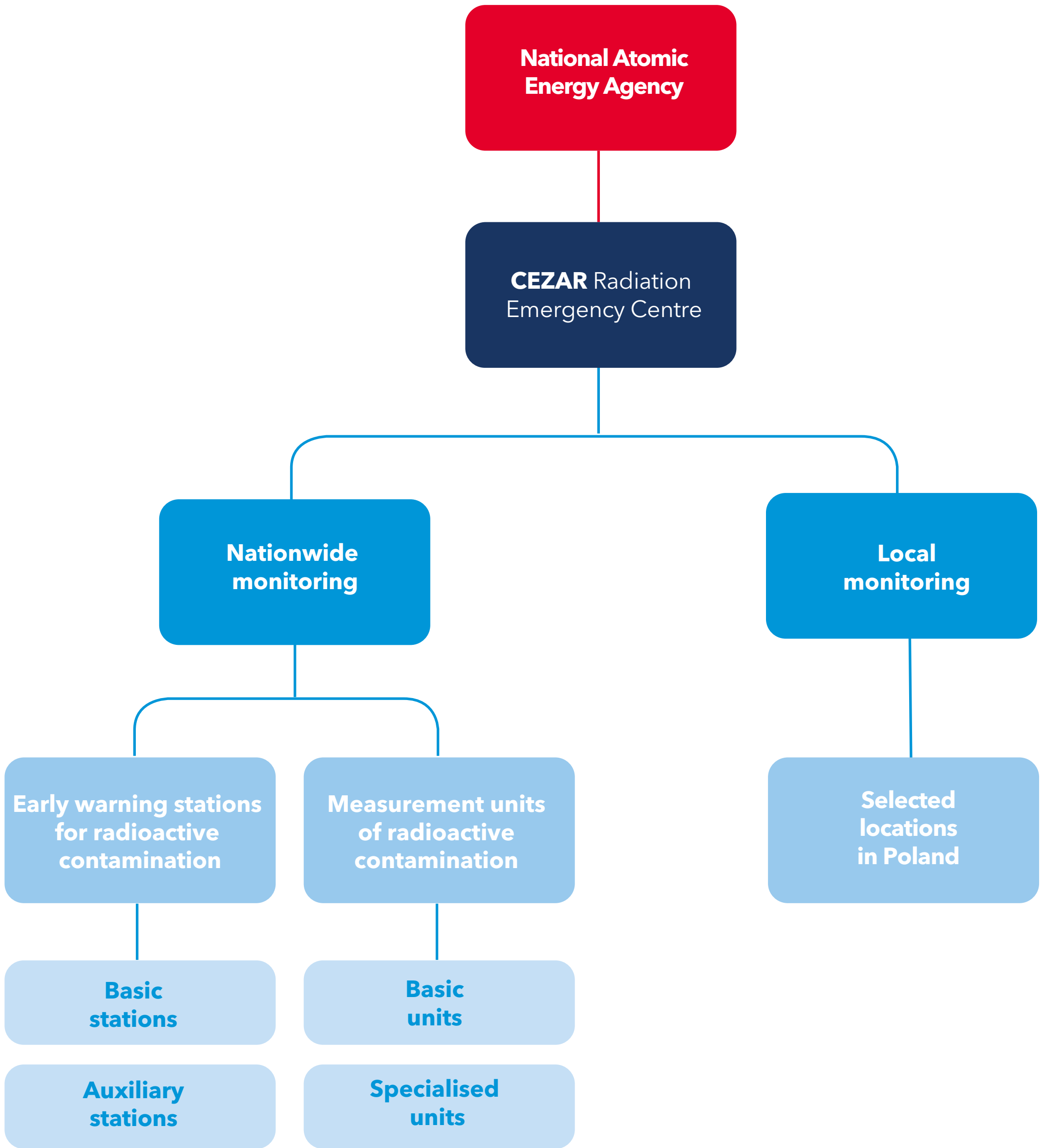
Fig. 10 presents a general diagram of this system structure.



In Poland, there is continuous monitoring of gamma dose rate and measurements of radioactive isotope content in the environment and in food products. The monitoring system operates 24 hours a day, 7 days a week, and allows to follow on an on-going basis the radiation situation in the country, and to detect early the potential threats.

FIGURE 10.

System of radiation monitoring in Poland



The results of radiation monitoring are the basis for the evaluation of Poland's radiation situation published regularly by the President of the PAA:

- at the gov.pl/paa/sytuacja-radiacyjna website – the gamma radiation dose rate,
- in quarterly notices published in Monitor Polski (the Official Gazette of the Government of the Republic of Poland) – the gamma dose rate and the Cs-137 isotope content in the air and milk,
- in the annual report of the President of the PAA – a full scope of measurement results.

In the case of emergency situations, the frequency of information is determined on an individual basis. The information presented is the basis for assessing the radiation risk for the population and for conducting intervention actions, if required by the situation.

Nationwide monitoring

Early warning stations for radioactive contamination

The task of stations of the early warning system is to enable an ongoing assessment of the radiation situation in Poland as well as early detection of radioactive contamination in the event of a radiation emergency. This system consists of so-called basic and auxiliary stations (see infographics on page 70).

Basic stations:

- **39 automatic Permanent Monitoring Stations (PMS)** owned by the PAA and operating under the international systems of the EU and Baltic States (Council of the Baltic Sea States), conducting ongoing measurements of:
  - the ambient dose equivalent rate H*(10) and the gamma-ray spectrum of radiation caused by the presence of radioactive elements in the air and on the ground,
  - basic weather parameters (precipitation and ambient temperature), which allows to verify the correctness of readings of radiometric devices in variable weather conditions.

Since 2016, the PAA has been expanding the network of PMS stations. In 2021, a total of 8 new stations were installed and put into operation, including four old stations replaced with new ones (Toruń, Wrocław, Koszalin, and Szczecin). Further expansion of the entire station network is planned for the coming years.

- **12 ASS-500 stations** owned by the Central Laboratory for Radiological Protection, which perform:
  - continuous collection of atmospheric aerosols on filters,
  - spectrometric determination of individual radioisotopes in weekly samples.
- **9 IMiGW stations**, owned by the Institute of Meteorology and Water Management, which perform:
  - continuous measurement of gamma dose rate,
  - continuous measurement of alpha activity of atmospheric aerosols from natural isotopes and alpha and beta activity of these aerosols due to isotopes of artificial origin (7 stations),
  - measurement of total beta activity in daily and monthly samples of total fallout,
  - determination of Cs-137 (spectrometrically) and Sr-90 (radiochemically) content in combined monthly samples of total fallout from all 9 stations (once a month).

Auxiliary stations:

- **13 measuring stations** owned by the Ministry of National Defence (MON), which perform continuous measurements of gamma dose rate, recorded automatically in the Centre of Contamination Analysis (COAS).

Units conducting measurements of radioactive contamination of the environment and foodstuffs

It is a network of units which perform measurements of radioactive contamination content in samples of environmental materials, foodstuffs and animal feed, using laboratory methods. The network includes:

- 27 basic facilities, operating in Sanitary and Epidemiological stations, performing:
  - determination of total beta activity in samples of milk and food products (once a quarter),
  - determination of the content Cs-137 and Sr-90 in selected agricultural and food products (twice a year on average),
- specialised units, which perform more extensive contamination analyses of environmental samples.

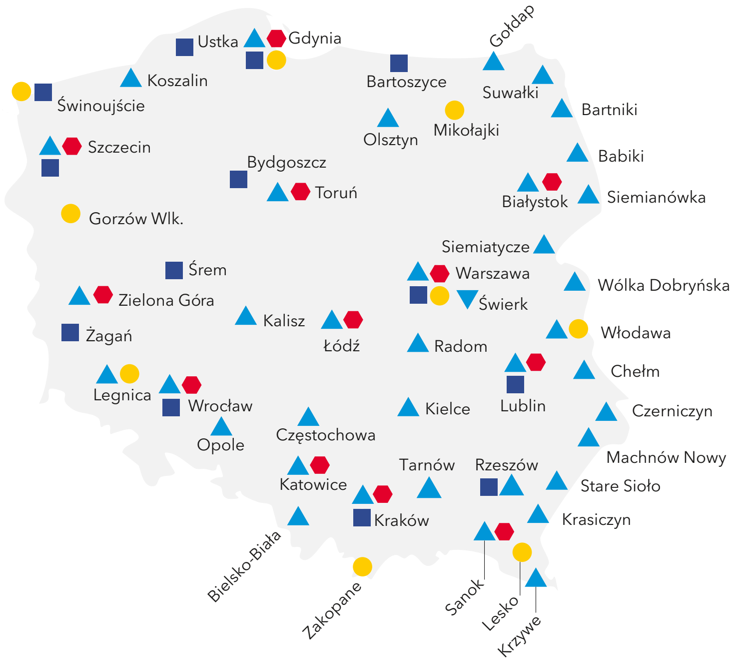
The infographics on page 71 presents the distribution of basic measurement facilities.

Nationwide monitoring
of radiation situation

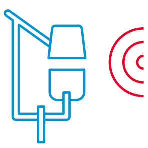
Number of measuring stations

▲ PMS stations	37
▼ PMS stations without spectrometry	2
⬢ ASS-500 stations	12
● IMiGW stations	9
■ MON stations	13

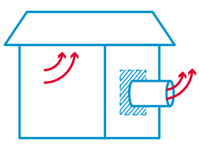
– the number of PMS and ASS-500 stations at the end of 2021



▲ **PMS stations** - - - - - PMS Stations – Permanent Monitoring System (PMS) stations provide 24/7 monitoring of ionizing radiation levels throughout the country. With spectrometric measurements (gamma-ray spectrum), they help detect isotopes of artificial origin in the environment.

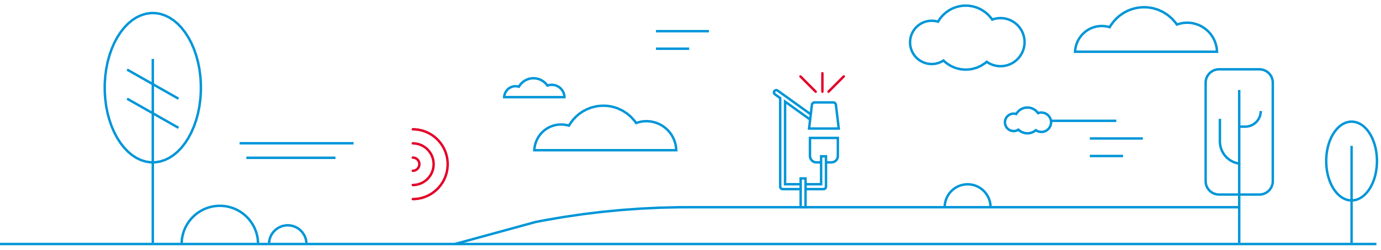


⬢ **ASS-500 stations** - - - ASS-500 stations - The high-performance ASS-500 atmospheric aerosol sampling stations are designed for radioactive air pollution control. The station pumps the air through a special filter at an average rate of approx. 500 m^3/h. Aerosols are collected on the filter and subject to a detailed laboratory analysis that can detect even trace amounts of radioisotopes present in the air. In a normal situation, the filter is replaced once per week.

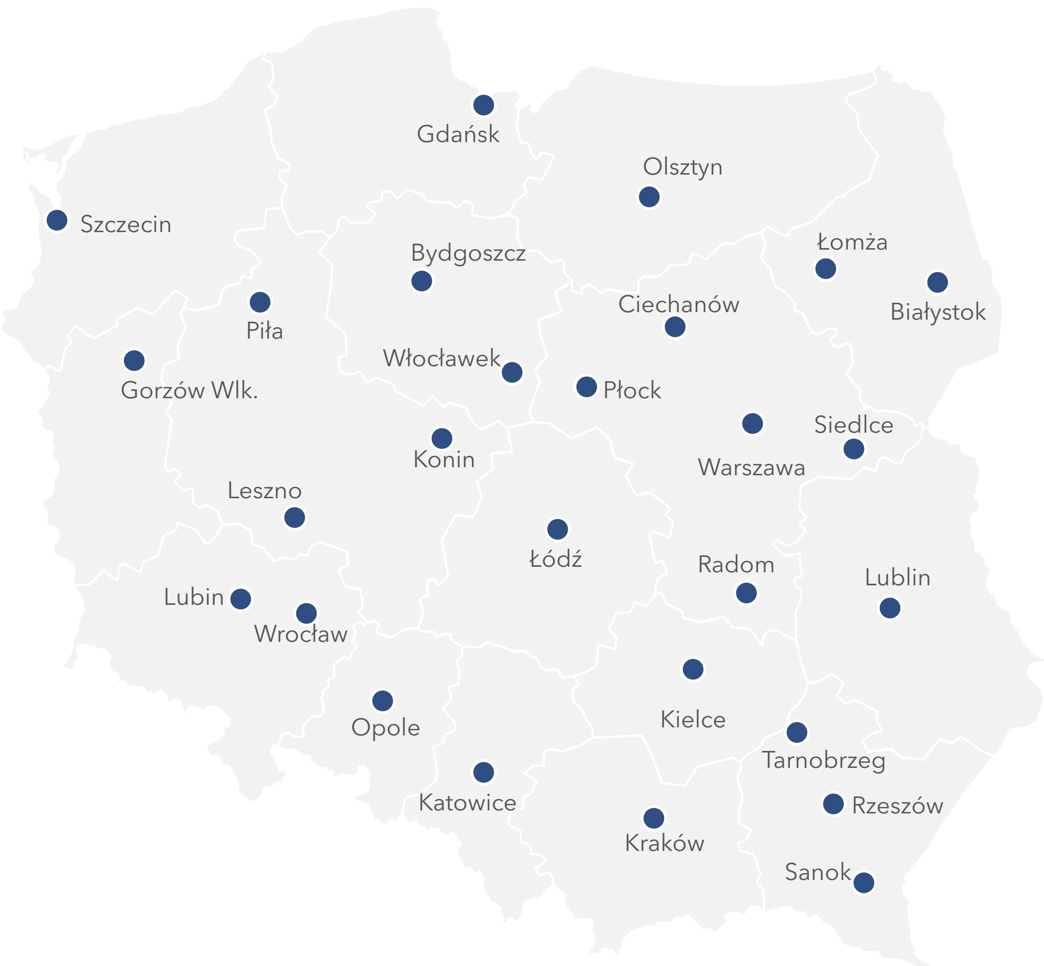


● **IMiGW stations** - - - - Stations of the Institute of Meteorology and Water Management (IMiGW) perform measurements of dose rate and activity of atmospheric aerosols and total fallout.

■ **MON stations** - - - - - Stations of the Ministry of National Defence perform the gamma dose rate measurements (auxiliary stations).



Basic units operating in Sanitary and Epidemiological Stations – conduct measurements of the presence of radioisotopes in agricultural and food products.



The current results of monitoring of the ionizing radiation dose rate may be found at:
https://www.gov.pl/paa/sytuacja-radiacyjna for Poland
https://remap.jrc.ec.europa.eu/Advanced.aspx for Europe

Local monitoring

TABLE 7.

Measurements of radioactive isotopes on-site and in the surroundings of the Nuclear Centre in Świerk.

Type of measurement and sample	Monitored isotopes	On-site	Surround-ing area
Air (aerosols)	spectrum γ	●	●
Drainage waters	total α total β γ spectrum Sr-90 H-3	●	
Tap water	total β	●	
River waters (Świder, Vistula)	total β γ spectrum		●
Well waters	total β γ spectrum		●
Total fallout	total β γ spectrum	●	
Process water	total α, β total γ γ spectrum Sr-90 HTO	●	
Sanitary wastewater	total γ total β γ spectrum Sr-90 total β	●	●
Wastewater from treatment plant	total α, β toal γ γ spectrum Sr-90 HTO	●	
Milk	γ spectrum		●
Cereals	γ spectrum		●
Grasses	γ spectrum	●	●
Soils	γ spectrum	●	●
Sludge	γ spectrum Sr-90	●	●

Summary

The data obtained in 2021 and in previous years confirm that there is no negative impact of the operation of the Nuclear Centre in Świerk or the KSOP on the natural environment, and the radioactivity of wastewater and drainage and rainwater discharged from the site of the Nuclear Centre in Świerk in 2021 was much lower than the applicable limits.

Nuclear Centre in Świerk

The radiation monitoring of the environment and the radiological supervision over the premises of the National Centre for Nuclear Research (NCBJ) in Otwock-Świerk is performed by the NCBJ Dosimetry Measurements Laboratory. It is carried out as follows:

- in on-line mode (measurements every 2 minutes) – covers gamma radiation fields at the gates of the facility and at selected points of the area, and radioactive concentrations of media released to the environment (sanitary wastewater);
- in off-line mode (in accordance with the measurement schedule) – conducted on site and in the surrounding area of the Centre. The NCBJ Dosimetry Measurements Laboratory measured the content of the radioactive isotopes listed in Table 7.

In addition, gamma radiation measurements were also conducted for selected locations in and around the site using thermoluminescent dosimeters (TLD) to determine annual dose rates.

At the request of the President of the PAA, independent monitoring is carried out to include:

- measurements of natural and artificial radioisotopes in:
  - water from the nearby Świder river,
  - water from the wastewater treatment plant in Otwock,
  - well water,
  - soil,
  - grass,
- gamma dose rate measurements at five selected locations,
- gamma radioisotope measurements in atmospheric aerosols,
- measurements of gaseous iodine isotopes,
- measurements of radioactive noble gases.

National Radioactive Waste Repository

The radiation monitoring of the environment of the KSOP premises and its surroundings is performed by the operator (ZUOP) in accordance with license requirements.

In 2021, the on-site monitoring comprised:

- measurements of radioactive substances in tap water and groundwater (measurement of beta and tritium activity),
- measurements of radioactive substances in atmospheric aerosols (spectrometric analysis of filters),
- measurements of radioactive substances in soil and grass (spectrometric analysis),
- measurements of photon background using thermoluminescent detectors.

Monitoring of the KSOP surroundings comprised:

- measurement of radionuclide concentrations in tap water, surface water (Narew river), groundwater (water intake from piezometers and wells) and spring water for total beta and tritium activity,
- ambient dose equivalent measurements using thermoluminescent detectors (1 point) and gamma dose rate measurements (4 points),
- measurements of radioactive substances in soil and grass,
- dose rate measurement,
- measurements of photon background using thermoluminescent detectors.

In addition, measurements ordered by the President of the PAA are carried out in the vicinity of the repository. The range of the measurements in 2021 was as follows:

- measurements of radioactive substances in spring water (measurement of gamma spectrum, measurement of total caesium (Cs-137 and Cs-134) concentration, measurement of tritium and Sr-90 concentration);
- measurement of radioactive substances in groundwater (piezometers; measurement of total beta activity, of potassium K-40 and tritium concentration);
- measurements of gamma-isotope concentrations in soil and grass;
- artificial gamma radioisotope measurements in atmospheric aerosols;
- the gamma dose rate measurements at five fixed locations.

The most important results of measurements and the data illustrating the radiation situation on the premises and in the surroundings of the Nuclear Centre in Świerk and KSOP are presented in Chapter 10 'Assessment of the radiation situation in Poland'.

Former uranium ore mining and processing sites

A Radiation Monitoring Programme for Areas Degraded by Mining and Processing of Uranium Ores has been carried out in former uranium ore mining sites since 1998. The following works were performed under this programme in 2021:

- measurements of alpha and beta radioactive isotope content in drinking water (public drinking water intakes) in the area of the Union of Karkonosze Municipalities and the city of Jelenia Góra and in surface and underground waters (outflows from underground workings);
- determination of radon concentration in water from public intakes, in water supplying residential premises, and in surface and underground waters (outflows from underground workings).

The results of the measurements are presented in Chapter 10 'Assessment of the radiation situation in Poland'.

International exchange of radiation monitoring data

The National Atomic Energy Agency participates in the international exchange of radiation monitoring data. The PAA's Radiation Emergency Centre, within the framework of implementing the provisions of Article 36 of the EURATOM Treaty, prepares and publishes the data on radiation monitoring carried out in Poland, and also receives and analyses the data on the radiation situation in other countries. It also participates in the data exchange within the Council of the Baltic Sea States.

The European Union measurement data exchange system based on routine radiation monitoring of the environment, deployed in the European Union's Member States.

The system includes the data on the dose rate, air contamination, contamination of drinking water, surface water, milk and food (diet). The data is transferred once a year by the PAA's Radiation Emergency Centre to the Joint Research Centre (JRC) located in Ispra, Italy.

The exchange of data from early warning stations for radioactive contamination within the European Union's system, European Radiological Data Exchange Platform (EURDEP), involves the automatic data exchange from early warning stations for radioactive contamination. The results of gamma dose rate measurements are mainly published. Many countries also publish measurements of atmospheric aerosol activity and other measurements relevant to assessing the radiation situation, which are available in automatic mode. The current radiation situation in Europe is published on an ongoing basis on the EURDEP map.

Poland transmits the following measurement results on an hourly basis:

- gamma does rate (PMS and IMiGW stations),
- total alpha and beta activity from artificial radionuclides in atmospheric aerosols (IMiGW stations).

Exchange of data from early warning stations operating under the system of the Council of the Baltic Sea States

The scope and format of data provided by Poland within the exchange within the Council of the Baltic Sea States (CBSS), i.e. the regional exchange, is the same as in the European Union's EURDEP system. Due to the limitation of the Council's activities in the area of nuclear safety and radiation protection (see Chapter 11), it is considered to stop the measurement data exchange within the CBSS and to focus primarily on the data exchange within the European Union.

Radiation emergencies

Principles of proceeding

A radiation emergency, as defined in the Atomic Law Act, is an abnormal situation or event associated with a source of ionizing radiation requiring urgent intervention to mitigate serious adverse effects on human health, safety, quality of life, property or the environment or to reduce the risks that could lead to such consequences. Radiation emergencies are classified by the extent of the effects:

- limited to the area of organizational entity ('on-site' emergencies),
- extending beyond the organizational entity ('regional' emergencies),
- extending beyond the territory of the province or with cross-border effects ('national' emergencies).

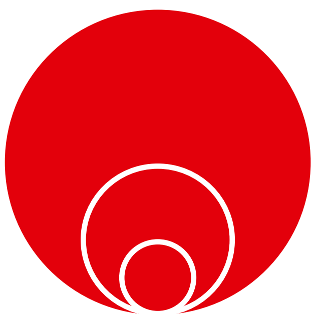
The National Atomic Energy Agency plays an informative and consultative role in the assessment of dose and contamination levels and other expertise and activities performed at the scene of an emergency. In addition, it disseminates information on radiation hazards to communities affected by the incident and to international organisations and neighbouring countries. The above procedure is also applied in the situation of detecting illicit trafficking in radioactive substances (including attempts to illegally transport them across the state border).

INFOGRAPHICS

Classification of radiation emergencies

On-site emergencies
Remedial actions managed by the **head of an organizational entity** in the on-site emergency response plan.

Regional emergencies
Remedial actions managed **by the regional governor in cooperation with the state regional sanitary inspector** in accordance with the regional emergency response plan.



National emergencies
Remedial actions managed by **the minister competent in internal affairs** with the assistance of the President of the PAA.

The President of the PAA manages a dosimetry team which can perform on-site measurements of the dose rate and of radioactive contamination, identify contaminants and abandoned radioactive substances, and secure the area around the emergency site.

The PAA's Radiation Emergency Centre (CEZAR) fulfils a number of functions, such as: emergency service of the President of the PAA[3], National Contact Point (NPC) for the International Atomic Energy Agency (USIE system – Unified System for Information Exchange in Incidents and Emergencies), for the European Commission (ECURIE system – European Community Urgent Radiological Information Exchange), for the Council of the Baltic Sea States system, NATO and countries connected with Poland by bilateral agreements, including in terms of notification and cooperation in the case of a radiation emergency, and is on duty 7 days a week, 24 hours a day. The Centre performs the assessment of country's radiation situation on a regular basis, and, in the case of a radiation emergency, uses computer decision support systems (RODOS and RASCAL).

Radiation emergencies in Poland

The Dosimetry Team managed by the President of the PAA was dispatched twice to support local services in situations which were not radiation emergencies within the meaning of the Atomic Law Act. The departures involved the assistance in identifying a radioisotope at a utility company and on a sea-coast border crossing.

On-duty CEZAR officers provided 646 consultations (not related to the elimination of radiation emergencies and their consequences), and most of them (584 cases) were addressed to Border Guard Posts, in connection with the detection of elevated radiation levels. The consultations concerned transit transport, exports or imports for domestic customers of ceramic materials, minerals, charcoal, chamotte bricks, propane-butane, electronic and mechanical components, chemicals, radioactive sources (500 cases in total), as well as border crossing by persons subject to diagnostics or treatment with the use

3. Together with the Central Laboratory for Radiological Protection (based on an agreement concluded by the President of the PAA and the CLOR).

of radiopharmaceutical products (84 cases). In addition, on-duty CEZAR officers provided 62 consultations to other institutions or individuals.

In addition, on-duty CEZAR officers received 8,824 notifications in total (e.g. reports on the radiometric control, messages provided by the official information exchange channels at the international level).

No radiation emergency was registered in Poland in 2021.

Radiation emergencies outside the country

The National Contact Point did not receive any notification of an event that was classified at level 3 or higher on the seven-point INES scale through the USIE System.

On the other hand, 27 reports on incidents related to ionizing radiation sources or nuclear facilities, mainly unplanned exposures of workers to ionizing radiation, were received. Moreover, the National Contact Point received several dozen messages of an organizational and technical nature or else related to the international drills being conducted.

No radiation emergency registered abroad in 2021 caused a threat to people and the environment in Poland

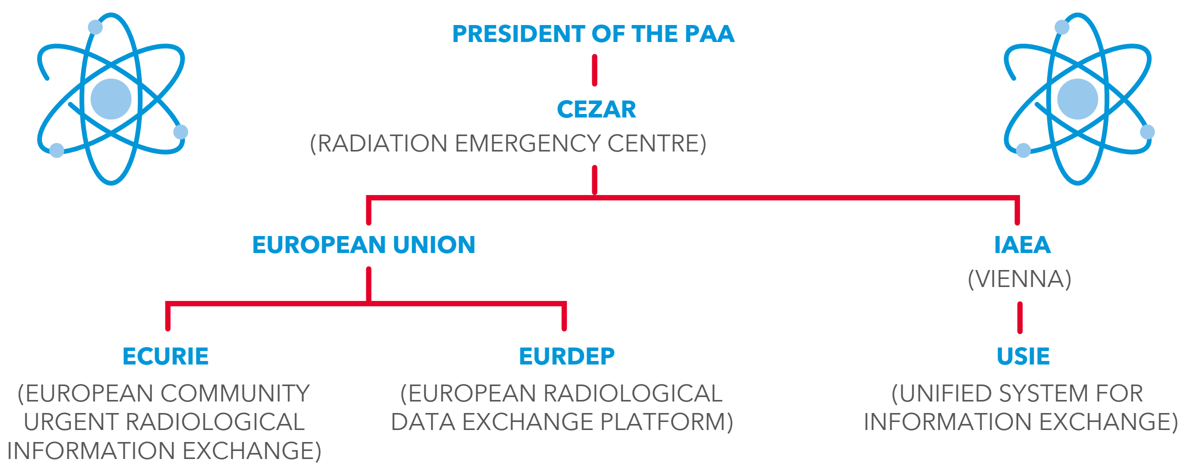
Summary

No radiation emergency was registered in Poland in 2021, and the emergencies registered worldwide did not affect the health and life of people and the environment in Poland.

Situations which are not radiation emergencies did not pose a threat to the health or life of the population or to the environment. These were incidents detected by dosimetric portal monitors operated by the Border Guard or located at the entrances to enterprises dealing with metal trade or municipal waste management.

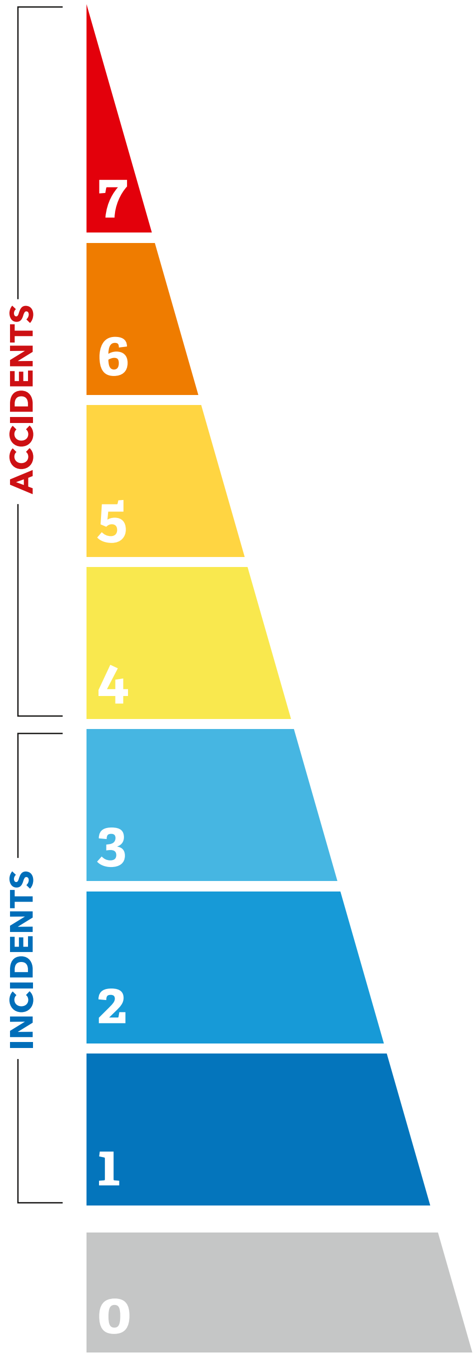
The National Contact Point, operating at the Radiation Emergency Centre, despite the ongoing pandemic, was working without disturbances, 24 hours a day, 7 days a week.

INTERNATIONAL NOTIFICATION AND INFORMATION EXCHANGE SYSTEMS



INFOGRAPHICS

INES SCALE



7 MAJOR ACCIDENT

Fukushima, Japan 2011

Release of large amounts of radioactive substances into the environment

Chernobyl, USSR 1986

Release of large amounts of radioactive substances into the environment

6 SERIOUS ACCIDENT

Kyshtym, USSR 1957

Release of substantial amounts of radioactive substances into the environment after an explosion of high-level radioactive waste in a storage facility

5 ACCIDENT WITH WIDER CONSEQUENCES

Goiania, Brazil 1987

Death of 4 persons due to contact with an abandoned high-level radioactive source

Three Mile Island NPP, USA 1979

Severe damage to the reactor core

4 ACCIDENT WITH LOCAL CONSEQUENCES

Stamboliyski, Bulgaria 2011

Exposure of 4 workers of the radiation plant to high doses of ionizing radiation

New Delhi, India 2010

Irradiation of a person due to contact with radioactive substance in the scrap

3 SERIOUS INCIDENT

Fleurus, Belgium 2008

Release of radioactive iodine into the environment from the production plant

Lima, Peru 2012

Irradiation of an industrial radiography worker

2 INCIDENT

Laguna-Verde-2 NPP, Mexico 2011

Automatic reactor shutdown due to the increased pressure in the reactor pressure vessel

Paris, France 2013

Exceeded annual radiation dose limit

1 ANOMALY

Rajasthan-5 NPP, India 2012

Exceeded dose application limits by 2 workers of the nuclear power plant

Olkiluoto-1 NPP, Finland 2008

Quick stop of main circulation pumps with simultaneous disconnection of the flywheel at reactor shutdown

0 DEVIATIONS

No effect on radiation safety

INES SCALE

The International Nuclear and Radiological Event Scale is used to illustrate the impact of events related to ionizing radiation on safety. Events are classified on levels from 0 (no effect on safety, below the scale) to 7 (most serious nuclear accident). It was introduced for use in 1990 and it is updated and developed on a regular basis. The scale is widely used by member states of the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency (OECD NEA).

10 Assessment of the radiation situation in Poland

Radioactivity in the environment

The level of gamma radiation in Poland and in the surroundings of the National Centre for Nuclear Research and the National Radioactive Waste Repository in 2021 did not differ from the previous year's level.

Concentrations of natural radionuclides in the environment have remained at similar levels over the past several years. On the other hand, the concentration of artificial isotopes (mainly Cs-137), of which the Chernobyl accident and earlier nuclear weapon tests were the source, is gradually decreasing, in accordance with the natural process of radioactive decay. The detected radionuclide content does not pose a radiation hazard to people and the environment in Poland.

Gamma dose rate

The level of gamma radiation in Poland and in the surroundings of the Nuclear Centre in Świerk and the KSOP in 2021 did not differ from the previous year's level. The variation in gamma dose rate (even for the same locality) is due to the local geological conditions that determine the level of terrestrial radiation.

The values of ambient dose equivalent rate, taking into consideration the cosmic radiation and radiation originating from radionuclides contained in the ground (terrestrial component), presented in Table 8, show that in 2021 in Poland its average daily values ranged from 40 to 135 nSv/h, with an annual average of 80 nSv/h.

In the surroundings of the Nuclear Centre in Świerk, the values of ambient dose equivalent rate ranged from 76 to 93 nGy/h (on average 85 nGy/h), and in the KSOP surroundings – from 87 to 131 nGy/h (on average 106 nGy/h).

These values do not substantially differ from the dose rate measurement results obtained in other regions of the country.

TABLE 8.

Dose rate obtained from early warning stations for radioactive contamination in 2021 (PAA)

Stations*	Place (location)	Range of average daily dose rate [nSv/h]	Annual average [nSv/h]
PMS	Babiki	49-119	82
	Bartniki	57-108	80
	Białystok	54-103	71
	Bielsko Biała	75-119	91
	Chełm	45-86	57
	Czerniczyn	58-105	86
	Częstochowa	55-84	62
	Gdynia	100-113	105
	Gołdap	53-80	66
	Kalisz**	61-78	67
	Katowice	74-118	87
	Kielce	79-108	90
	Koszalin	68-98	86
	Kraków	111-135	119
	Krasiczyn	57-102	80
	Krzywe***	65-105	79
	Legnica	66-93	78
	Łódź	84-101	90
	Lublin	90-119	101
	Machnów Nowy	43-79	61
	Olsztyn	44-84	55
	Opole	58-95	69
	Radom	48-83	56
	Rzeszów	66-112	88
	Sanok	62-115	88
	Siemianówka	40-89	53
	Siemiatycze	52-85	62
	Stare Sioło	45-87	64
	Suwałki	64-103	84
	Szczecin	49-100	78
	Tarnów	64-103	77
	Toruń	47-99	71
	Warszawa	87-111	91
	Włodawa	44-82	56
	Wólka Dobryńska	52-89	65
	Wrocław	73-95	82
	Zielona Góra	83-103	89
IMiGW	Gdynia	79-94	85
	Gorzów	63-115	81
	Legnica	81-111	96
	Lesko	78-129	107
	Mikołajki	78-119	97
	Świnoujście	64-96	77
	Warszawa	71-109	79
	Włodawa	68-98	79
	Zakopane	82-133	109

* Station symbols defined in chapter 'National radiation monitoring'
** Station installed on 9 September 2021,
*** Station installed on 12 November 2021

Atmospheric aerosols

In 2021, the artificial radioactivity of ground-level aerosols, determined from the measurements made at 12 early warning stations for detection of radioactive contamination (ASS-500), has primarily shown, as in the last few years, the presence of trace amounts of Cs-137 radionuclide. Its average concentrations during that period ranged from less than 0.08 to 7.30 μBq/m^3 (on average 0.44 μBq/m^3). Average concentrations of I-131 radionuclide in this period ranged from less than 0.09 to less than 4.58 μBq/m^3 (on average 0.70 μBq/m^3), whereas the mean values of concentrations of naturally occurring radionuclide Be-7 amounted to a few thousand μBq/m^3.

Figures 11 and 12 present the average annual concentrations of Cs-137 in atmospheric aerosols in the years 2011-2021 for the entire Poland and Warsaw, respectively.

Measurements of the radioactive isotope concentration in the air in a weekly cycle were also carried out on-site of the Nuclear Research Centre in Świerk and its surroundings (Wólka Mlądzka) and at the KSOP site. The results of the measurements in 2021 at the NCBJ site are presented in Table 9, while the average annual concentration of Cs-137 isotope in the air at the KSOP site in 2021 was below the detection limit.

FIGURE 11.

Average annual concentration of Cs-137 in aerosols in Poland in the years 2011-2021 (μBq/m^3; PAA, CLOR data)

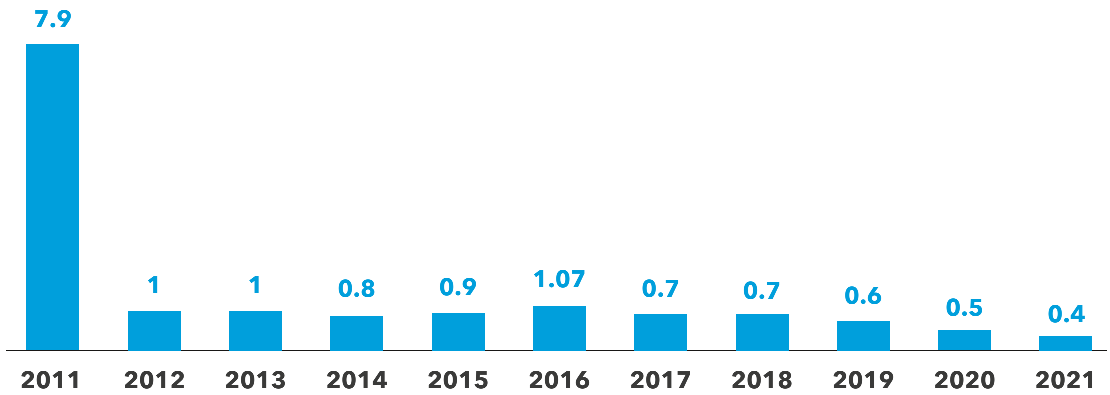


FIGURE 12.

Average annual concentration of Cs-137 in aerosols in Warsaw in the years 2011-2021 (μBq/m^3; PAA, CLOR data)

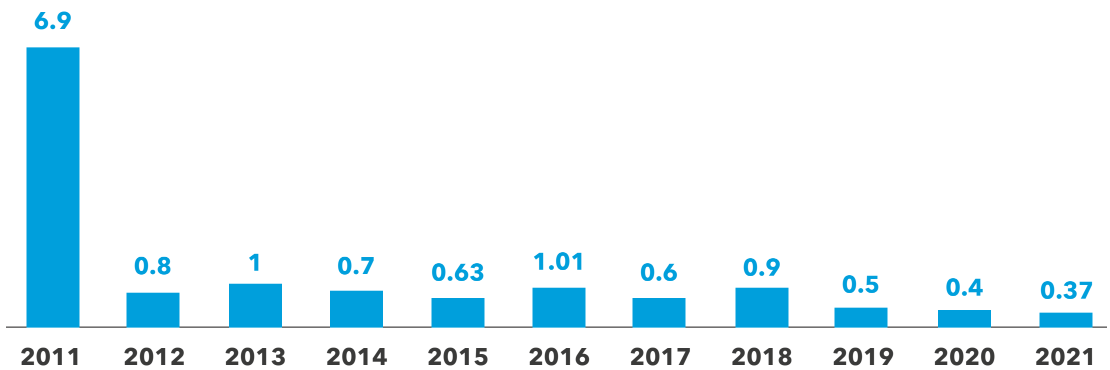


TABLE 9.

Summary of weekly measurement results of radionuclide concentrations in atmospheric aerosols at the Świerk site in 2021 (μBq/m³; PAA, NCBJ data)

	Be-7 [μBq/m³]	K-40 [μBq/m³]	I-131 [μBq/m³]	Cs-137 [μBq/m³]
Average	3,248	22.96	2.29	1.49
Minimum	910	12.00	0.75	0.49
Maximum	7,050	62.00	8.1	4.5

TABLE 10.

Mean Cs-137 and Sr-90 activity and mean beta activity in total annual fallout in Poland in 2008-2021 (Chief Inspectorate of Environmental Protection (GIOŚ), measurements performed by IMiGW)

Year	Activity [Bq/m²]		Beta activity [kBq/m²]
	Cs-137	Sr-90	
2008	0.5	0.1	0.3
2009	0.5	0.1	0.33
2010	0.4	0.1	0.33
2011	1.1	0.2	0.34
2012	0.3	0.1	0.32
2013	0.3	0.2	0.31
2014	0.5	0.1	0.32
2015	0.6	0.1	0.31
2016	0.5	0.1	0.31
2017	0.3	0.2	0.32
2018	0.4	0.1	0.33
2019	0.3	0.2	0.31
2020	0.2	0.1	0.31
2021	0.3	0.1	0.31

Total fallout

Total fallout is the dust contaminated with isotopes of radioactive elements that are deposited on the earth's surface due to the gravitational field and precipitation.

Results of measurements presented in Table 10 show that the contents of artificial radionuclides Sr-90 and Cs-137 in the annual total fallout in 2021 were at the level observed in the previous years.

TABLE 11.

Concentrations of Cs-137 and Sr-90 radionuclides in river and lake waters in Poland in 2021 [mBq/dm^3] (GIOŚ, CLOR measurements)

		Vistula, Bug and Narew rivers	Odra and Warta rivers	Lakes
Sr-90	Range	1.90-3.67	2.31-6.38	1.12-8.47
	On average	2.81	3.67	2.51
Cs-137	Range	0.95-4.29	1.81-4.31	1.22-10.15
	On average	2.81	3.10	2.96

Waters and bottom sediments

The radioactivity of waters and bottom sediments was defined based on determinations of selected artificial and natural radionuclides in samples collected at fixed sampling points

Open waters

Concentrations of caesium Cs-137 and strontium Sr-90 remain at the previous year's levels and at levels observed in other European countries.

In 2021, in surface waters of the southern part of the Baltic Sea, the radioactive concentrations were determined for Cs-137, Ra-226, and K-40 isotopes (CLOR measurements). The average concentrations of those isotopes remain at the following levels: for Cs-137 – 17.1 Bq/m^3 in surface layer waters and 16.2 Bq/m^3 in bottom waters, for Ra-226 – 2.48 Bq/m^3, and for K-40 on average a few thousand Bq/m^3 and do not differ from the previous years' results.

The last measurement cycle of radionuclide concentrations in in river and lake water samples was completed in 2021. Table 11 presents the measurement results.

The total Cs-134 and Cs-137 contents in open water samples, taken in 2021 from sampling points located near the Nuclear Centre in Świerk, were on average:

- the Świder River: 4.38 mBq/dm^3 (upstream from the Centre) and 3.99 mBq/dm^3 (downstream from the Centre),
- waters from the wastewater treatment plant in Otwock discharged to the Vistula River: 9.53 mBq/dm^3.

The Sr-90 concentrations in bulk samples of the river water taken from the surroundings of the National Centre for Nuclear Research in Świerk was 4.33 and 4.74 mBq/dm^3.

The tritium concentration in open water samples taken in 2021 from sampling points located near the Nuclear Centre in Świerk was on average:

- the Świder River 1.2 mBq/dm^3 (upstream from the Centre) and 1.4 mBq/dm^3 (downstream from the Centre),
- waters from the wastewater treatment plant in Otwock discharged to the Vistula River: 2.6 Bq/dm^3.

Ground waters – local monitoring

The results of measurements of radioactive isotope concentrations in waters conducted as part of the local monitoring in 2021 do not substantially differ from the previous years' results.

Nuclear Centre in Świerk:

In 2021, the average concentrations of radioactive caesium and strontium isotopes in well waters of the farms situated in the Świerk Centre surroundings were 5.93 mBq/dm^3 for caesium isotopes (Cs-134, Cs-137) and 19.31 mBq/dm^3 for Sr-90. The concentration of tritium (H-3) was also determined and averaged 1.80 mBq/dm^3.

National Radioactive Waste Repository (KSOP) in Różan

Concentrations of radioactive isotopes Cs-137 and Cs-134 in spring waters in the vicinity of the National Radioactive Waste Repository in Różan averaged 10.01 mBq/dm^3.

In 2021, tritium concentrations were also investigated in groundwater in the vicinity of KSOP in Różan, and averaged less than 2.43 Bq/dm^3.

Former uranium ore mining and processing sites

The WHO 'Guidelines for drinking water quality', Vol. 1 Recommendations. Geneva, 1993 (item 4.1.3, p. 115), introducing so-called reference levels for drinking water, were used for the interpretation of measurement results. They state that, in principle, the total alpha activity of drinking water should not exceed 100 mBq/dm^3, while the beta activity should not exceed 1,000 mBq/dm^3. It should be noted that these levels are indicative only – if exceeded, identification of the radionuclides is recommended.

Alpha and beta activity measurements were conducted for 55 water samples in former uranium ore mining sites with the following results:

- public intakes of drinking water:
  - total alpha activity:
    – from 2.4 to 121.6 mBq/dm^3,
  - total beta activity:
    – from 25,0 to 303.8 mBq/dm^3.
- waters flowing from mine workings (drifts, rivers, ponds, springs, wells):
  - total alpha activity:
    – from 7,5 to 547.2 mBq/dm^3,
  - total beta activity:
    – from 36,9 to 3,013.5 mBq/dm^3.

The radon concentrations in water from public intakes and domestic wells in the localities comprised by the Union of Karkonosze Municipalities ranged from 0.8 to 500.6 Bq/dm^3. The radon concentrations in waters flowing form mining facilities, which featured the highest total alpha and beta radioactivity, had the highest value of 288.2 Bq/dm^3 in water flowing from drift No 17 of the 'Pogórze' mine.

Requirements applicable to the quality of water intended for human consumption, in terms of radioactive substances, were specified in the Regulation of the Minister of Health of 7 December 2017 on the quality of water intended for human consumption (Dz. U. item 2294). The parametric value, established as 100 Bq/l of radon activity concentration, determines the content of radioactive substances in water above which it is necessary to assess whether the presence of radioactive substances poses a risk to human health that requires action and, if necessary, to take remedial action to improve the water quality to a level compatible with the requirements for the protection of human health against radiation.

Bottom sediments

The last measurement cycle of radionuclide concentrations in samples of dry matter of bottom sediments in rivers and lakes was completed in 2021. Radionuclide concentrations in dry matter samples of bottom sediments in rivers and lakes in 2021 and in the Baltic Sea in 2021 remained at the levels observed in previous years. Tables 12 and 13 present the measurement results.

TABLE 12.

Caesium and plutonium radionuclide concentrations in bottom sediments in the Polish rivers and lakes in 2021 [Bq/kg of dry matter] (GIOŚ, CLOR measurements)

		Vistula. Bug and Narew rivers	Odra and Warta rivers	Lakes
PU-239, 240	Range	0.004-0.065	0.003-0.059	0.004-0.017
	On average	0.018	0.003	0.009
Cs-137	Range	0.32-6.01	0.58-8.05	1.28-6.47
	On average	2.28	2.12	2.84

TABLE 13.

Concentrations of artificial radionuclides Cs-137, Pu-238, Pu-239, 240, and Sr-90, and natural radionuclide K-40 in the bottom sediments of the southern part of the Baltic Sea in 2021 (PAA, CLOR data)

Isotope		Layer thickness 0-19 mm
Cs-137	Bq/m^2	231.00
Pu-238	Bq/m^2	0.09
Pu-239, 240	Bq/m^2	3.25
K-40	Bq/m^2	3,308.00
Sr-90	Bq/m^2	178.00

Soil

The monitoring of radioactive isotope concentrations in the soil is performed in a 2-year measurement cycle. The sampling is performed in 254 fixed sampling points across the whole country. Soil samples are collected from the surface layer, 10 cm thick, and, additionally, 10 samples – from a layer 25 cm thick.

264 soil samples were taken in 2020 for concentration determinations of Cs-137 and natural radionuclides: Ra-226, Ac-228, and K-40.

Average Cs-137, Cs-134 concentration in soil

The conducted studies show that the average concentration of Cs-137 isotope in the surface layer of soil in Poland ranges from <0.1 kBq/m^2 to 13.35 kBq/m^2, and amounts on average to 1.13 kBq/m^2.

For comparison, the average values of surface contamination in Świerk and KSOP in Różan in 2021 were 6.82 Bq/kg and 13.82 Bq/kg, respectively. The deposition of Cs-134 isotope in soil samples varied during the period of monitoring in accordance with half-life time and this isotope is not present in measurable amounts in Polish soils.

The average deposition of Cs-137 isotope in individual regions is presented in Table 14, while the average concentrations of natural radioactive isotopes in the soil in 2020, in Table 15.

Fig. 13 presents the average Cs-137 deposition in the soil for the entire Poland in individual years 1988-2021.

TABLE 14.
Average, minimum, and maximum values of Cs-137 radionuclide deposition in soil samples taken in individual regions and in Poland for soil samples collected in autumn 2020 (GIOŚ, CLOR measurements)

Region	**Cs-137 concentration** [kBq/m^2]		
	Average value	**Range**	
		Minimum	Maximum
Lower Silesian	1.91 ± 0.70	0.25	16.27
Kuyavian-Pomeranian	0.45 ± 0.05	0.27	0.71
Lublin	0.81 ± 0.22	0.20	3.29
Lubuskie	0.39 ± 0.10	<0.01	0.73
Łódź	0.58 ± 0.13	0.08	1.25
Lesser Poland	1.52 ± 0.21	0.27	6.15
Mazovian	1.47 ± 0.33	0.29	5.42
Opole	2.78 ± 0.50	0.32	5.37
Podkarpackie	0.58 ± 0.06	0.23	1.13
Podlaskie	0.77 ± 0.08	0.41	1.04
Pomeranian	0.64 ± 0.07	0.25	1.40
Silesian	1.60 ± 0.25	0.38	4.09
Świętokrzyskie	1.01 ± 0.18	0.42	2.20
Warmian-Masurian	0.72 ± 0.13	0.17	1.53
Greater Poland	0.45 ± 0.04	0.22	0.80
West Pomeranian	0.38 ± 0.07	0.13	0.82
Poland	**1.13 ± 0.10**	**<0.01**	**16.27**

FIGURE 13.

Average Cs-137 deposition in Poland in the years 1988-2020 (PAA based on the data provided by GIOŚ, CLOR measurements)

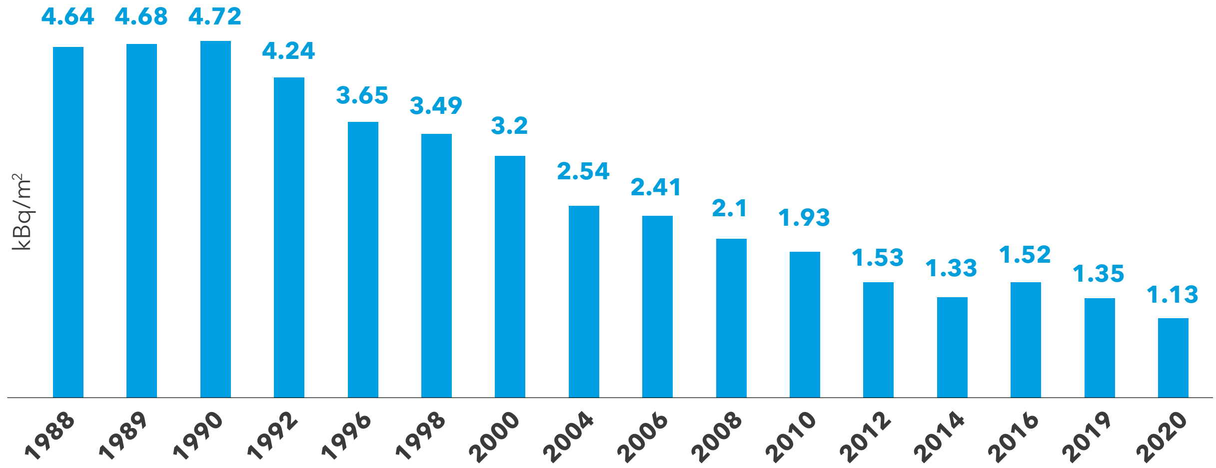


TABLE 15.

Average concentrations of natural radioactive isotopes in the soil in 2020

	Ra-226	Ac-228	K-40
Range	4.0 ÷ 126.3 Bq/kg	2.5 ÷ 93.6 Bq/kg	46.0 ÷ 906.0 Bq/kg
On average	27.6 Bq/kg	21.2 Bq/kg	369 Bq/kg

TABLE 16.

Average, minimum, and maximum values of natural isotope concentrations in soil samples collected in individual regions in October 2021 (GIOŚ, CLOR measurements)

Region	Concentration [Bq/kg]								
	Ac-228			K-40			Ra-226		
	Average value	Min.	Max.	Average value	Min.	Max.	Average value	Min.	Max.
Lower Silesian	32.6 ± 3.7	6.2	93.6	493 ± 42	169	906	44.8 ± 5.8	8.2	126.3
Kuyavian-Pomeranian	14.7 ± 1.6	9.4	21.1	369 ± 36	217	521	19.0 ± 1.6	10.9	25.4
Lublin	16.7 ± 2.5	7.2	39.8	314 ± 36	166	654	21.3 ± 2.4	12.4	37.8
Lubuskie	11.9 ± 2.0	6.7	20.3	291± 40	184	451	15.4 ± 2.9	7.5	24.7
Łódź	11.6 ± 0.8	6.8	15.7	274 ± 17	165	344	14.3 ± 1.1	9.9	21.6
Lesser Poland	30.3 ±1.1	9.2	54.5	437 ± 17	182	692	40.5 ± 2.5	12.6	126.0
Mazovian	12.4 ± 1.2	6.1	24.5	291 ± 23	157	524	15.4 ± 1.3	6.8	26.9
Opole	26.3 ± 3.1	10.2	42.4	437 ± 38	215	591	31.5 ± 3.6	13.4	45.7
Podkarpackie	28.5 ± 2.2	3.5	40.2	419 ± 28	105	604	36.1 ± 2.8	5.3	60.3
Podlaskie	16.8 ± 2.8	2.5	25.4	407 ± 66	46	523	19.6 ± 2.5	9.2	30.5
Pomeranian	12.9 ± 1.4	2.9	24.9	296 ± 21	155	537	19.7 ± 2.7	4.0	55.7
Silesian	24.0 ± 2.3	7.3	42.1	354 ± 26	138	545	28.5 ± 2.2	10.5	48.4
Świętokrzyskie	17.1 ± 2.2	9.0	29.4	272 ± 37	111	464	22.9 ±2.2	13.6	33.7
Warmian-Masurian	14.0 ± 1.5	7.8	22.8	358 ± 29	191	542	18.7 ± 1.6	11.1	25.5
Greater Poland	11.7.0 ± 0.8	5.4	17.0	290 ±12	183	391	14.3 ± 0.8	7.3	19.6
West Pomeranian	14.1 ±2.6	3.5	29.0	314 ± 40	152	540	17.5 ± 3.0	4.9	33.0
Poland	**21.2**	**2.5**	**93.6**	**369**	**46**	**906**	**27.6**	**4.0**	**126.3**

Radioactivity of basic foodstuffs and other food products

Measurements of radioactive contamination in agricultural and food products are performed by sanitary and epidemiological stations.

The activity of radioactive isotopes in foodstuffs and food products should be compared to the values laid down in Commission Implementing Regulation (EU) No 2020/1158. The document states that the concentration of Cs-137 must not exceed 370 Bq/kg in milk and milk products and 600 Bq/kg in all other foodstuffs and food products. Currently, the concentration of Cs-134 in foodstuffs and food products is below 1‰ of Cs-137 activity. For this reason Cs-134 was neglected in further considerations.

The data presented in this sub-section come from the results of measurements carried out by institutions measuring radioactive contamination (sanitary and epidemiological stations) provided to the PAA.

Milk

The concentration of radioactive isotopes in milk is a significant indicator for the assessment of oral radiation exposure.

In 2021, Cs-137 concentrations in liquid (fresh) milk ranged from 0.17 to 5.69 Bq/dm^3 and averaged approx. 0.63 Bq/dm^3, see infographics on pages 90-91.

Meat, poultry, fish, and eggs

The results of the 2021 measurements of Cs-137 activity in different types of meat from farmed animals (beef, pork), as well as in poultry meat, fish and eggs were as follows (range and average annual concentration of Cs-137):

- livestock meat – from 0.25 to 7.09, on average 1.10 Bq/kg,
- poultry – from 0.25 to 4.5 Bq/kg, on average 0.80 Bq/kg,
- fish – from 0.17 to 12.87 Bq/kg, on average 0.74 Bq/kg,
- eggs – from 0.10 to 1.59 Bq/kg, on average 0.69 Bq/kg.

The temporal distribution of Cs-137 activity between 2011 and 2020 in different types of livestock meat (beef, pork), as well as in poultry meat and eggs and fish is presented in the infographics on pages 90–91. The data obtained indicate that in 2021, the average activity of the caesium isotope in meat, poultry, fish and eggs was at the same level as in the previous year.

Vegetables, fruit, cereals, feed, and mushrooms

The results of artificial radioactivity measurements in vegetables and fruit made in 2021 show that the concentration of Cs-137 isotope in vegetables ranged between 0.34 and 1.20 Bq/kg, on average 0.64 Bq/kg, and in fruit between 0.11 and 5.13 Bq/kg, on average 0.97 Bq/kg (see infographics on pages 90-91). In long-term comparisons, the 2021 results were at the 1985 level, and several times lower than in 1986.

Cs-137 activity in cereals in 2021 ranged between 0.21 and 1.90 Bq/kg (on average 0.64 Bq/kg) and were similar to the values observed in 1985.

Cs-137 activity in feed in 2021 ranged from 0.25 to 0.74 Bq/kg (on average 0.50 Bq/kg).

The average activity of Cs-137 isotope in grass in the surroundings of the Nuclear Centre Świerk and KSOP (referred to dry matter) in 2021 ranged from 2.34 to 4.37 Bq/kg (on average 2.32 Bq/kg) for the Nuclear Centre Świerk and from <0.21 to 0.41 Bq/kg (on average 0.30 Bq/kg) for the KSOP.

The average caesium activity in the primary fresh mushroom species in 2021 did not differ from the values in previous years. It should be emphasised that in 1985, i.e. before the Chernobyl accident, Cs-137 activity in mushrooms were also much higher than in other food products. At that time this radionuclide came from the period of nuclear weapon testing (this is confirmed by the analysis of the isotope ratio of Cs-134 and Cs-137 in 1986).

Summary

The results of monitoring programs conducted in Poland in 2021 show that both the environment, food, and drinking water are safe for the general population.

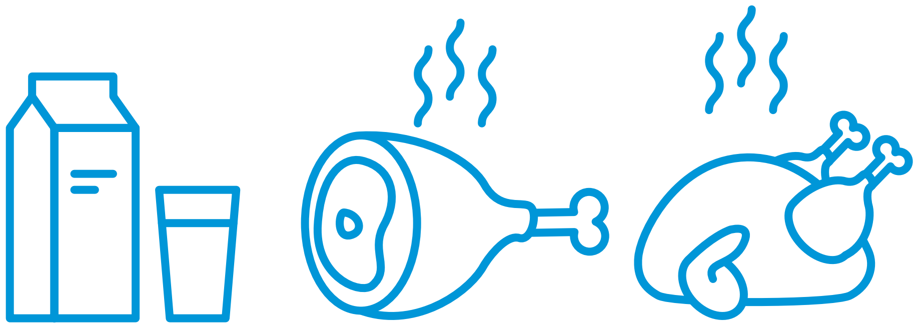
The contamination with Cs-137 isotope generated as a result of the Chernobyl accident generally mostly remains at a very low level with no significant impact on human health. Higher concentrations of Cs-137 can be observed in forest products, which also do not have a significant impact on human health, and the results of the sampled food from forest areas did not exceed the limits for consumption in 2020.

FOOD RADIOACTIVITY

The activity of radioactive isotopes in foods and food products should be compared to the values laid down in Commission Implementing Regulation (EU) 2020/1158.

370 Bq/kg

maximum total allowable dose isotope concentrations of Cs-137 and Cs-134 in milk, milk products, and infant formulae.



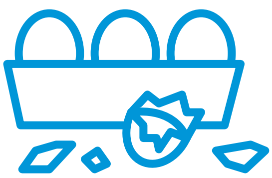
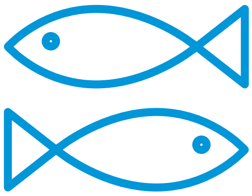
average concentration Cs-137	MILK	MEAT	POULTRY
2021	**0.63 Bq/dm³**	**1.10 Bq/kg**	**0.80 Bq/kg**
2020	0.63	0.87	0.50
2019	0.41	1.11	0.52
2018	0.52	1.09	0.47
2017	0.46	0.89	0.50
2016	0.40	0.63	0.54
2015	0.50	0.77	0.60
2014	0.50	0.83	0.73
2013	0.60	0.95	0.90
2012	0.60	0.90	0.70
2011	0.49	0.64	0.60
2010	0.48	0.83	0.58
2008	0.60	0.85	0.52
2009	0.60	0.70	0.52
2007	0.70	0.64	0.67

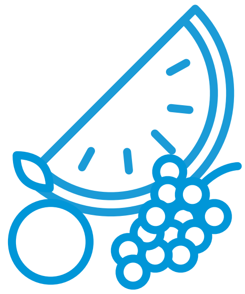
600 Bq/kg

maximum total allowable dose of concentrations of Cs-137 and Cs-134 isotopes in all other foodstuffs and food products.

Cs-137

the provided measurement results took into account only the concentrations of Cs-137, because the concentrations of Cs-134 is less than 1% of their total activity.



EGGS	FISH	VEGETABLES	FRUIT
0.69Bq/kg	**0.74 Bq/kg**	**0.64 Bq/kg**	**0.97 Bq/kg**
0.55	0.77	0.93	1.69
0.56	0.67	0.48	0.31
0.57	0.85	0.40	0.75
0.49	0.61	0.42	0.38
0.42	0.77	0.39	0.33
0.40	0.77	0.41	0.27
0.45	0.86	0.46	0.50
0.60	1.10	0.50	0.60
0.50	1.00	0.50	0.40
0.45	1.00	0.49	0.40
0.43	1.00	0.47	0.35
0.42	0.70	0.45	0.37
0.39	0.84	0.54	0.28
0.43	0.96	0.46	0.25

Data: Sanitary and epidemiological stations

11 International cooperation

Fot. IAEA

International cooperation of Poland in the field of nuclear safety and radiation protection is a statutory task of the President of the PAA. This task is performed in close cooperation with the Minister of Foreign Affairs, Minister of Energy and Environment, and other ministers (heads of central offices), in accordance with their respective competencies.

The international cooperation conducted by the PAA is aimed at supporting the implementation of the nuclear supervision mission, i.e. ensuring nuclear safety and radiation protection of the country.

This objective is achieved by the PAA's participation in the development of international legislation and international standards, through the exchange of information on nuclear safety with neighbouring countries, and through the development of its own competence and the implementation of good practices as a result of the exchange of experience and knowledge with foreign partners. International cooperation is carried out through the participation of the PAA's representatives in the work of international organizations and associations, and also by bilateral cooperation.

Multilateral cooperation

In 2021, the President of the PAA was involved in the performance of tasks resulting from multilateral cooperation of Poland within:

- European Atomic Energy Community (EURATOM),
- International Atomic Energy Agency (IAEA),
- Organisation for Economic Co-operation and Development Nuclear Energy Agency (OECD NEA)
- Western European Nuclear Regulators' Association (WENRA),
- Meetings of the Heads of the European Radiation Protection Competent Authorities (HERCA),
- Council of the Baltic Sea States (CBSS),
- European Nuclear Security Regulators Association (ENSRA),
- European Safeguards Research and Development Association (ESARDA).

Cooperation with international organizations

European Atomic Energy Community (EURATOM)

In 2021, the PAA's involvement, resulting from Poland's membership in the EURATOM, focused mainly on the work carried out in two groups within the European Nuclear Safety Regulators Group (ENSREG). The Group includes top management representatives from the national nuclear regulatory authorities of each Member State and a representative from the European Commission who holds advisory powers of the European Commission.

At the plenary meetings of ENSREG in July and November 2021, Poland was represented by the President of the PAA, Dr. Łukasz Młynarkiewicz, and Vice-President of the PAA, Mr. Andrzej Głowacki. During the meetings, issues related to the planned Second Topical Peer Review were discussed. The meetings were also devoted to the performance of safety analyses for nuclear power plants, so-called stress tests, in the countries outside the European Union.

International Atomic Energy Agency (IAEA)

Alongside the Ministry of Foreign Affairs, the PAA is the leading institution in the cooperation with the IAEA. The Ministry of Climate and Environment is the second important national institution involved in the cooperation with the IAEA, responsible for the development of energy sector in Poland.

The main activities related to Poland's membership in the IAEA include:

- coordination of national institutions' cooperation with the IAEA,
- participation in the development of the IAEA international safety standards,
- participation in the annual IAEA General Conference, the most important statutory body of the IAEA,
- implementation of own projects in cooperation with the IAEA.

Cooperation on establishing IAEA safety standards

One of the important elements of cooperation within the IAEA is the establishment of the IAEA Safety Standards for the peaceful use of nuclear energy. The work on these standards is carried out with the participation of the PAA's experts within the following six committees:

- Nuclear Safety Standards Committees (NUSSC);
- Radiation Safety Standards Committee (RASSC);
- Waste Safety Standards Committee (WASSC);
- Transport Safety Standards Committee (TRANSSC);
- Nuclear Security Guidance Committee (NSGC);
- Emergency Preparedness and Response Standards Committee (EPReSC).

IAEA General Conference

The General Conference is the highest statutory body of the IAEA. It is composed of representatives of the 173 (as of 1 March 2022) Member States of the Agency. The General Conference is held annually to consider and approve of the Agency's programme and budget, and to make decisions and resolutions on matters brought before it by the Board of Governors, Director General or Member States.

The 65th General Conference of the International Atomic Energy Agency was held on 20-24 September 2021.

In accordance with safety requirements due to the COVID-19 pandemic, the number of participants in national delegations was limited. Polish delegation was headed by Mr. Michał Kurtyka, Minister for Climate and Environment (virtual participation in the conference), and Dr. Łukasz Młynarkiewicz who was the Deputy Head and, at the same time, represented the National Atomic Energy Agency. Apart from the President of the PAA, Poland was represented at the conference room by Ambassador Dominika Krois, Permanent Representative of the Republic of Poland to the United Nations Office and the International Organizations in Vienna[5].

The Polish delegation voted in favour of the resolution setting the membership fee for the regular budget of the IAEA in 2022 (Poland's contribution: EUR 2,575,122 and USD 412,238).

Poland, represented by Ambassador Dominika Krois, is a member of the IAEA Board of Governors for the 2020-2022 term. Her first deputy is Dr. Łukasz Młynarkiewicz, President of the PAA, the second deputy – Mr. Adam Guibourgé-Czetwertyński.

During the General Conference, as part of its efforts to strengthen nuclear safety in the global dimension, the PAA delegation, headed by the President of the PAA, Dr. Łukasz Młynarkiewicz, held bilateral meetings with representatives of partner nuclear regulatory authorities:

- delegation of the U.S. Nuclear Regulatory Commission (US NRC) headed by Mr. Christopher T. Hanson, NRC Commission Chairman;
- delegation of the Canadian Nuclear Safety Commission (CNSC) headed by Ms. Rumina Velshi, President of the Commission;
- delegation of the Finnish Radiation and Nuclear Safety Authority (STUK), headed by Mr. Petteri Tiippana, the Director General;
- delegation of the Slovak Nuclear Regulatory Authority (UJD SR0, headed by Ms. Marta Žiaková, Chairperson of the UJD SR.

5. Speech by the Head of the Polish Delegation, Mr. Michał Kurtyka https://www.iaea.org/sites/default/files/20/09/poland-gc64.pdf

The PAA also held a number of consultations with international partners:

- at the meeting with the delegation of OECD Nuclear Energy Agency (OECD NEA), headed by Mr. William D. Magwood, Director General (NEA OECD);
- at a meeting (remote) of the Regulatory Cooperation Forum (RCF). The forum was established on the basis of the IAEA initiative to support countries planning or developing nuclear power sector by countries with advanced nuclear power technologies;
- at a meeting with Ms. Eve Külli Kala, Director of Technical Cooperation Division for Europe (TCEU) and Jing Zhang from the Department of the Technical Cooperation (TC) of the International Atomic Energy Agency. The National Atomic Energy Agency, as the leading institution for Poland's cooperation with the IAEA, is coordinating the participation of national institutions in the Technical Cooperation Programme.

The Board of Governors held six meetings in 2021 (February, March, May, June, September, and November) raising topics related to the draft budget and work plan of the IAEA for the years 2022-2023, the Technical Cooperation Programme (TCP) for the years 2022-2023, or spending funds assigned for the assistance in the fight against the COVID-19 pandemic.

The Board of Governors also addressed the issue related to efforts to return to the Joint Comprehensive Plan of Action (JCPOA) with Iran, including steps leading to the lifting of sanctions. The work of the Board of Governors included also reports on the implementation of safeguards and provisions under the Nuclear Non-Proliferation Treaty (NPT), in particular, in relation to Syria, Iran, and the Democratic People's Republic of Korea.

Through its membership in the Board, Poland gained a direct influence on the activities of the International Atomic Energy Agency, including IAEA's recommendations on the safe use of nuclear energy and the Agency's non-proliferation and nuclear safeguards activities.

The Board of Governors is composed of 35 Member States. In addition to the annual General Conference, it is one of the two bodies of the International Atomic Energy Agency responsible for the direction of its activities.

The Board analyses and submits to the General Conference recommendations on financial statements, programme tasks, and the IAEA budget. It considers applications for the membership in the Agency, approves of the IAEA Safety Standards and agreements in the field of nuclear safeguards.

Last time Poland was represented at the Board of Governors in the years 2012-2014.

Expert cooperation under the auspices of the IAEA

The Technical Cooperation Programme is an important instrument of the IAEA, and Poland has for many years participated in the Programme with a dual role: as a net contributor to the Programme and as a beneficiary of expert cooperation with the IAEA and its Member States. For many years, Polish institutions have participated in national and regional IAEA technical cooperation projects.

In 2021, the PAA coordinated the participation of national expert and research organizations in 200 meetings, training courses, and conferences organised by the IAEA. Because of the pandemic, many events were cancelled or postponed. Only selected training courses were organised in a remote form.

Polish institutions actively use the IAEA's expert support and Technical Cooperation Programme, to implement projects important for the development of Polish science, medicine, power sectors, and to ensure nuclear safety and radiation protection in the country. The IAEA offers support in developing competencies, advice from international experts, and assistance in the purchase of necessary equipment.

Four national organizations implement cooperation projects for the years 2020-2021. The National Centre for Radiological Protection in Health Care is preparing a new project for the years 2022-2023 in the field of medicine. The Ministry of Climate and Environment will continue the project aimed at expanding the nuclear power infrastructure, while the PAA will focus on further development of the competencies indispensable for the effective performance of its nuclear regulatory role.

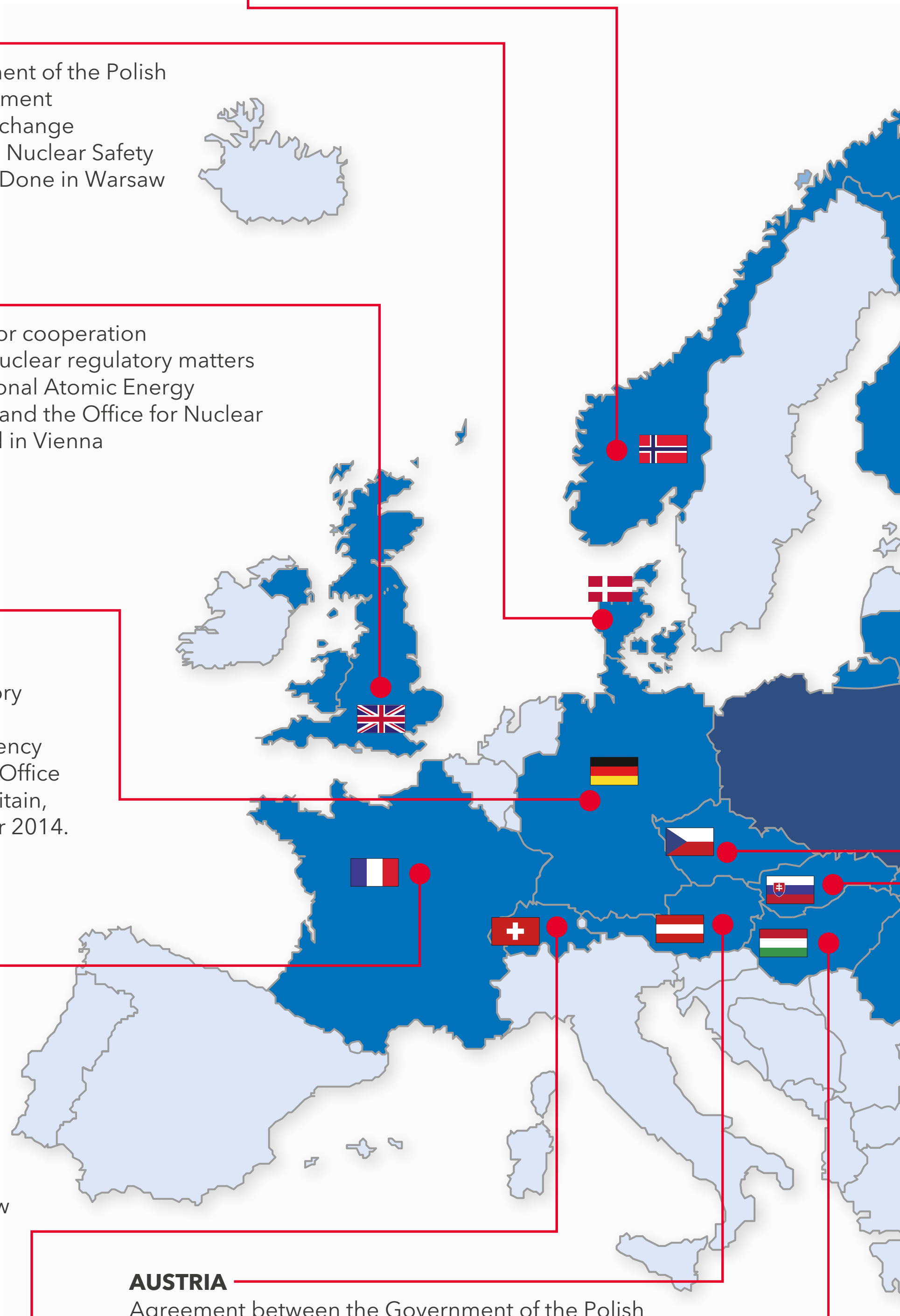
Bilateral agreements concluded by Poland within the areas of activity of the National Atomic Energy Agency in Europe

NORWAY
Agreement between the Government of the Polish People's Republic and the Government of the Kingdom of Norway on Early Notification of Nuclear Accidents and Cooperation in Nuclear Safety and Protection Against Radiation. Done in Oslo on 15 November 1989.

DENMARK
Agreement between the Government of the Polish People's Republic and the Government of the Kingdom of Denmark on Exchange of Information and Cooperation in Nuclear Safety and Protection Against Radiation. Done in Warsaw on 22 December 1987.

UNITED KINGDOM
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Office for Nuclear Regulation of Great Britain, signed in Vienna on 24 September 2014.

GERMANY
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Office for Nuclear Regulation of Great Britain, signed in Vienna on 24 September 2014.



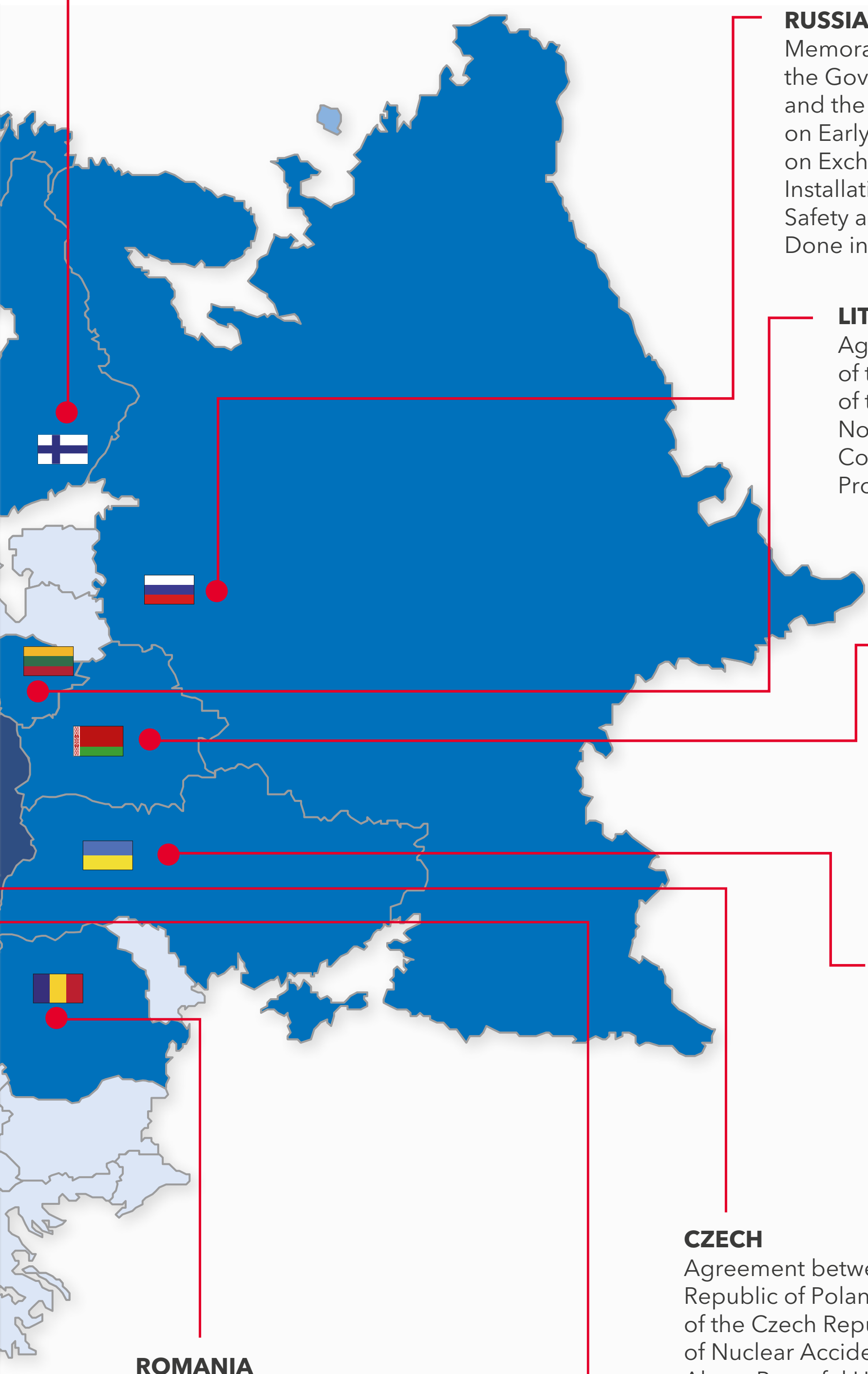
FRANCE
Agreement concluded between the President of the National Atomic Energy Agency of the Republic of Poland and the Office of the Nuclear Safety of the Republic of France on the exchange of technical information and cooperation in the field of nuclear safety, signed in Warsaw on 14 June 2012 and in Paris on 26 of June 2012.

AUSTRIA
Agreement between the Government of the Polish People's Republic and the Government of the Republic of Austria on Information Exchange and Cooperation in Nuclear Safety and Protection Against Radiation. Done in Vienna on 15 December 1989.

SWITZERLAND
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Swiss Federal Nuclear Safety Inspectorate ENSI, signed in Vienna on 26 September 2016 (only in English).

HUNGARY
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Hungarian Atomic Energy Authority, signed in Vienna on 19 September 2017 (only in English).

FINLAND
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Radiation and Nuclear Safety Authority of Finland, signed in Vienna on 19 September 2017 (only in English).



RUSSIA
Memorandum of Understanding between the Government of the Republic of Poland and the Government of the Russian Federation on Early Notification of Nuclear Accident, on Exchange of Information About Nuclear Installations and on Cooperation in Nuclear Safety and Radiation Protection. Done in Warsaw on 18 February 1995.

LITHUANIA
Agreement between the Government of the Republic of Poland and the Government of the Republic of Lithuania on Early Notification of Nuclear Accident and on Cooperation in Nuclear Safety and Radiation Protection. Done in Warsaw on 02 June 1995.

BELARUS
Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on Early Notification of Nuclear Accident and on Cooperation in Radiation Safety. Done in Minsk on 26 October 1994.

UKRAINE
Agreement between the Government of the Republic of Poland and the Government of Ukraine on Early Notification of Nuclear Accident, on Exchange of Information and on Cooperation in Nuclear Safety and Radiation Protection. Done in Kiev on 24 May 1993.

CZECH
Agreement between the Government of the Republic of Poland and the Government of the Czech Republic on Early Notification of Nuclear Accident and on Exchange of Information About Peaceful Use of Nuclear Energy, Nuclear Safety and Radiation Protection. Done in Vienna on 27 September 2005

ROMANIA
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the National Commission for Nuclear Activities Control of Romania, signed in Vienna on 25 September 2014.

SLOVAKIA
Agreement between the Government of the Republic of Poland and the Government of the Republic of Slovakia on early warning of nuclear accidents, on sharing information and on cooperation in the field of nuclear safety and radiation protection. Done in Bratislava on 17 September 1996.

Cooperation with the Regulatory Cooperation Forum (RCF)

The Regulatory Cooperation Forum (RCF) was established to ensure that the countries with developed nuclear power programs support the countries planning or developing nuclear power.

The PAA's cooperation with the RCF has resulted in projects that significantly contribute to the efforts made in preparation for the implementation of the Polish Nuclear Power Programme. With the support of the Forum, the PAA is implementing an OJT (On-the-Job Training) project aimed at providing direct experience in nuclear regulation in terms of the siting, construction, commissioning and operation of nuclear power plants. Under the project, the PAA's employees completed internships in various foreign nuclear regulatory authorities.

On 8– 12 March and 30 November– 2 December 2021, the President of the PAA, Dr. Łukasz Młynarkiewicz, and Vice-President of the PAA, Andrzej Głowacki, participated in the meetings of the international Regulatory Cooperation Forum. Because of the COVID-19 pandemic, the three-day meetings were held remotely. During the meetings, the recipient members of the RCF presented the current state of preparations for nuclear regulatory tasks in relation to nuclear power plants under construction or planned. The President of the PAA spoke about the tasks resulting from the Polish Nuclear Power Programme, the update of which was published in October this year, and the state of preparations of the PAA to carry out the tasks resulting from the Programme. The provider members presented activities implemented in the area of experience sharing, good practices, and expert support.

Organisation for Economic Co-operation and Development Nuclear Energy Agency (OECD NEA)

The activities of the NAE are based on the cooperation of national experts in 7 committees and in subordinate working groups. Poland became a member of the NAE in 2010 and has since actively participated in the working groups. The leading national institution for the NAE is the Ministry of Climate and Environment. The PAA is involved in the work of NAE committees and working groups on nuclear safety, nuclear regulation, nuclear legislation, and new reactors.

In May and December 2021, the President of the PAA, Dr. Łukasz Młynarkiewicz, participated in the meetings of the Committee on Nuclear Regulatory Activities (CNRA). Because of the COVID-19 pandemic, the two-day meetings were held remotely. The meetings were devoted to the update of the strategy of the Committee and the analysis of its structure and operations to enable the effective performance of its tasks. The activities of individual working groups of the Committee were discussed.

Cooperation within associations and other forms of multilateral cooperation

Western European Nuclear Regulators' Association (WENRA)

In 2021, WENRA work areas included activities within working groups dedicated to the harmonisation of reference levels for nuclear power plants and research reactors and a working group dedicated to radioactive waste.

On 13–14 April and 14–15 October 2021, the President of the PAA, Dr. Łukasz Młynarkiewicz, attended remotely the WENRA plenary meetings. The issues related to the current activities of the Association were discussed as well as the strategy of its future actions. Apart from the nuclear safety issues, the technical specification for the Second Topical Peer Review was also addressed.

Heads of the European Radiological Protection Competent Authorities (HERCA)

Representatives of Poland participate in the plenary work of the heads of regulatory authorities and in the HERCA working groups, which are involved in such issues as radiation protection in medicine, veterinary medicine, industry, or preparedness for radiation emergencies.

On 23–24 June and 1–2 December 2021, the President of the PAA, Dr. Łukasz Młynarkiewicz, and Vice-President of the PAA, Mr. Andrzej Głowacki, took part in the meetings of the Heads of the European Radiological Protection Competent Authorities (HERCA). During the meetings, the heads of radiation protection authorities from 32 European countries discussed the current and planned activities of the organization.

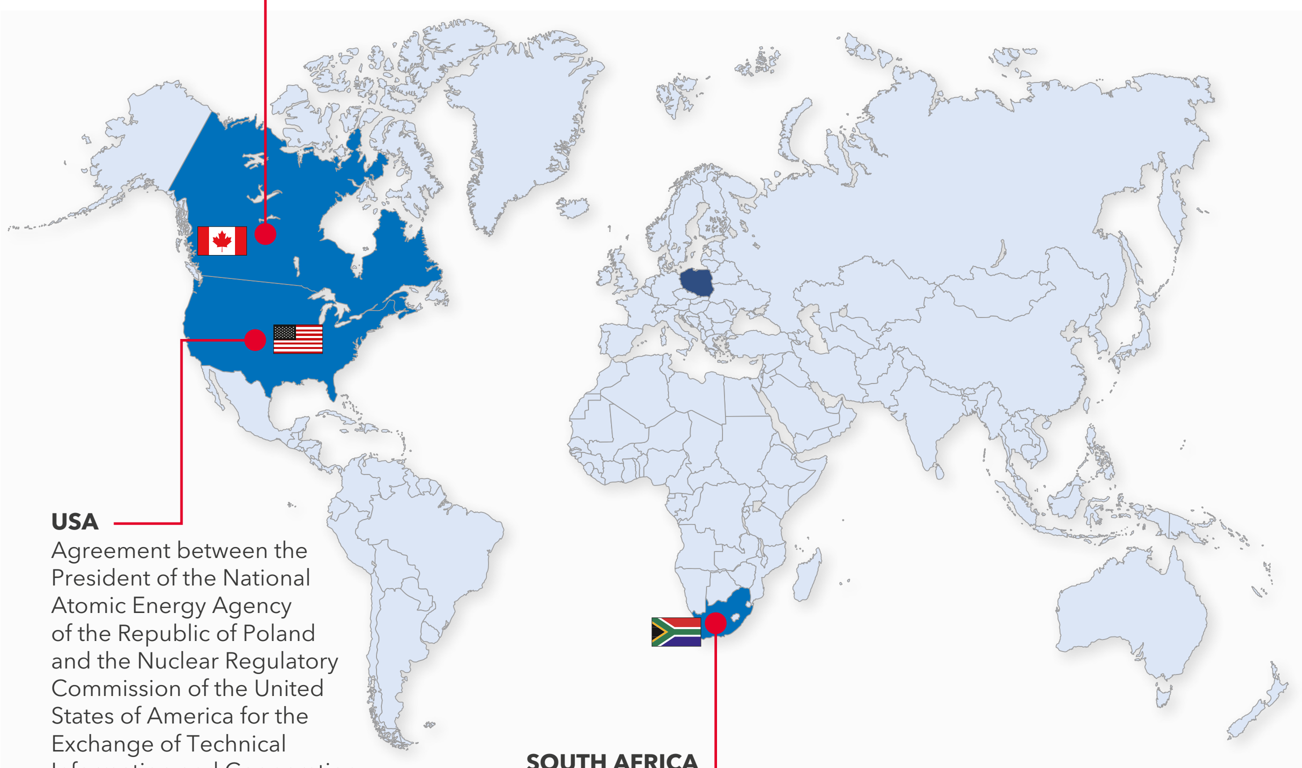
The tasks implemented by the individual working groups were discussed. In addition, a new HERCA Strategy was approved. It assumes ten strategic objectives divided into three main areas: cooperation, effectiveness, and stakeholders. This document is aimed at sharing, both internally and with parties cooperating with HERCA, its vision, mission, and main challenges for the coming years.

Council of the Baltic Sea States (CBSS)

The CBSS is a political forum for intergovernmental cooperation among countries of the Baltic Sea Region. The Council's objective consists in developing cooperation and trust among Member States. The Presidency of the Council is held by successive Member States. Norway assumed the Presidency of the Council in 2021.

As part of the Council's work, on 1 June 2021, the 'Vilnius Declaration II – the vision of the Baltic Sea Region by 2030' was adopted. It confirms the will to make the region one of most sustainable, affluent, innovative, and competitive areas of the world.

Bilateral agreements concluded by Poland within the areas of National Atomic Energy Agency activities outside Europe



In recent years, the issues related to nuclear safety and radiation protection were marginalized in the Council. The Expert Group on Nuclear and Radiation Safety (EGNRS), of which the PAA was a member, suspended its activities. The last activity of the Council in this field was the seminar 'Baltic Sea Region: acting together against nuclear risk', which took place remotely in November 2020. It was attended by Polish representatives from the PAA and from the National Headquarters of the State Fire Service.

European Nuclear Security Regulators Association (ENSRA)
Authorities from 16 EU countries are currently participating in ENSRA, including the PAA (since 2012). The basic goals of the Association are the exchange of information on physical protection of nuclear materials and facilities, and the promotion of a unified approach to physical protection in the EU Member States.

European Safeguards Research and Development Association (ESARDA)
The PAA has been a member of the European Safeguards Research and Development Association (ESARDA) since 2009. This organization is a forum for the exchange of information, knowledge, and experience, for the popularisation of continuous development and improvement in nuclear material safeguards, related to the fulfilment of commitments under the Nuclear Non-Proliferation Treaty and related international agreements. The organization cooperates with the IAEA, the US Institute of Nuclear Materials Management (INMM), and the laboratories of the Joint Research Centre (JRC) of the European Commission. It brings together scientific institutes, universities, industrial companies, experts, and state administration authorities responsible for nuclear safeguards in the European Union's Member States. The organization has a Steering Committee, whose meetings are attended by representatives of all member organizations.

Bilateral cooperation

Poland has concluded agreements on the cooperation and information exchange on nuclear safety, protection against radiation, and nuclear accidents with all neighbouring countries. The President of the PAA is responsible for the implementation of these agreements.

In 2021, the PAA continued cooperation with foreign partners, experienced in the oversight of large nuclear facilities. The PAA implemented a bilateral cooperation programme:

- on 23 February 2021, a remote meeting was held with Mr. Christopher T. Hanson, Chairman of the U.S. Nuclear Regulatory Commission (US NRC);
- on 22 April 2021, a meeting was held with Dr. Grzegorz Rzentkowski, Director of the IAEA Division of Nuclear Installation Safety;
- on 16 June 2021, a remote meeting was held with Mr. Bernard Doroszczuk, Commission Chairman of the French Nuclear Safety Authority (ASN);
- on 1 July 2021, a meeting was held with Mr. Petteri Tiippana, the Director General of the Finnish Radiation and Nuclear Safety Authority (STUK);
- on 9 July 2021, a meeting was held with representatives of the French Institute for Radiation Protection and Safety (IRSN);
- on 4-6 November 2021, a meeting was held with the delegation of the U.S. Nuclear Regulatory Commission (US NRC), headed by Mr. Christopher T. Hanson, Chairman of the US NRC;
- on 2 December 2021, a meeting was held with Mr. Igor Sirc, Director of Slovenian Nuclear Safety Administration (SNSA).

The bilateral cooperation with the US NRC also allowed to organise in 2021 remote consultation meetings with the US NRC experts. The consultations revolved around the following issues:

- the effective management of assessment of the documentation attached to the application for a nuclear facility construction license,
- the regulatory control over the quality assurance of the process of the construction of a nuclear power plant.

As part of the bilateral cooperation with the USA, the President of the PAA, Dr. Łukasz Młynarkiewicz, Vice-President of the PAA, Mr. Andrzej Głowacki, and the PAA experts met representatives of the company Polskie Elektrownie Jądrowe (PEJ) and an American operator, Southern Nuclear. Specialists discussed, inter alia, the construction licensing process of nuclear power plants. Southern Nuclear has a wealth of experience in that respect. The American entity is a nuclear power plant operator, including two newly constructed AP1000 reactors in Vogtle 3 and 4 nuclear power plants. Southern Nuclear has also been managing for years the Farley and Hatch nuclear power plants, and previously constructed two units of Vogtle power plant.

Conclusions

- The active actions of Poland in the Board of Governors are the greatest success on the international arena. Ambassador Dominika Krois, Permanent Representative of the Republic of Poland to the United Nations Office and the International Organisations in Vienna, represents Poland on the IAEA Board of Governors for the 2020–2022 term. Her first deputy is Dr. Łukasz Młynarkiewicz, President of the PAA, the second deputy is Adam Guibourgé-Czetwertyński, Undersecretary of State in the Ministry of Climate and Environment, and the third deputy is Arkadiusz Michoński, Deputy Permanent Representative of the Republic of Poland to the Office of the United Nations and the International Organisations in Vienna.
- The PAA participates in all remote meetings organised by associations and other forms of multilateral cooperation. The PAA's representatives actively participated in working and expert groups focussing on nuclear safety, nuclear regulatory competence building, nuclear law and new reactors.
- The COVID-19 pandemic substantially reduced the possibility of holding bilateral meetings, but this did not affect the excellent relations with partner nuclear regulatory authorities. Continuous exchange of information is one of the main assumptions of bilateral relations.
- The exchange of experience and good practices in the field of safe conduct of the licensing process by the US NRC allowed the PAA to prepare more effectively for activities resulting from the implementation of tasks provided for in the Polish Nuclear Power Programme.

List of abbreviations

- **ADN** – European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways
- **ADR** – L'Accord européen relatif au transport international des marchandises dangereuses par route – European Agreement Concerning the International Carriage of Dangerous Goods by Road
- **ASN** – Autorité de sûreté nucléaire – French Nuclear Safety Authority
- **ASS-500** – Aerosol Sampling Station – basic detection stations of radioactive air contamination, used for measurements of radioactive contamination in atmospheric aerosols
- **BSS** – Basic Safety Standards
- **CEZAR PAA** – Radiation Emergency Centre
- **CLOR** – Central Laboratory for Radiological Protection
- **COAS** – Centre for Contamination Analysis
- **DBJ PAA** – Nuclear Safety Department of the National Atomic Energy Agency
- **DoE** – U.S. Department of Energy
- **DOR PAA** – Radiation Protection Department of the National Atomic Energy Agency
- **ECURIE** – European Community Urgent Radiological Information Exchange
- **ENSRA** – European Nuclear Security Regulators Association
- **ENSREG** – European Nuclear Safety Regulators' Group
- **ESARDA** – European Safeguards Research and Development Association
- **EURATOM** – European Atomic Energy Community
- **EURDEP** – European Radiological Data Exchange Platform – System for data exchange from early warning stations for radioactive contamination
- **GIG** – Central Mining Institute
- **GIOŚ** – Chief Inspectorate of Environmental Protection
- **GTRI** – Global Threat Reduction Initiative
- **HERCA** – Heads of the European Radiation protection Competent Authorities
- **HEU** – Highly Enriched Uranium
- **IAEA** – International Atomic Energy Agency
- **IAEA Safety Standards** – International IAEA Safety Standards
- **IATA** – DGR International Air Transport Association Dangerous Goods Regulation
- **ICAO** – International Civil Aviation Organization
- **IChTJ** – Institute of Nuclear Chemistry and Technology
- **IMDG Code** – International Maritime Dangerous Goods Code
- **IMiGW** – Institute of Meteorology and Water Management
- **INES** – International Nuclear and Radiological Event Scale

- **IOR** – radiation protection inspector
- **IRSN** – L'Institut de Radioprotection et de Sûreté Nucléaire – French Institute of Radiation Protection and Nuclear Safety
- **JRC** – European Commission's Joint Research Centre
- **KG** – General Conference IAEA
- **KPK** – National Contact Point
- **KSOP** – National Radioactive Waste Repository
- **LEU** – Low Enriched Uranium
- **MON** – Ministry of National Defence
- **NCBJ** – National Centre for Nuclear Research
- **NEA OECD** – Nuclear Energy Agency of the Organization for Economic Co-operation and Development
- **NIK** – Supreme Audit Office
- **NUSSC** – Nuclear Safety Standards Committee
- **PAA** – National Atomic Energy Agency
- **PMS** – Permanent Monitoring Station – basic stations for early detection of radioactive contamination for dose rate measurement of ionizing radiation
- **POLATOM** – POLATOM Radioisotope Centre
- **PPEJ** – Polish Nuclear Power Programme
- **RASSC** – Radiation Safety Standards Committee
- **RCF** – Regulatory Cooperation Forum
- **RID** – Réglement concernant le transport international ferroviaire des marchandises dangereuses – Regulations Concerning the International Carriage of Dangerous Goods by Rail
- **CBSS** – Council of the Baltic Sea States
- **TLD** – thermoluminescent dosimeters
- **TRANSSC** – Transport Safety Standards Committee
- **UDT** – Office of Technical Inspection
- **USIE** – Unified System for Information Exchange in Incidents and Emergencies
- **WASSC** – Waste Safety Standards Committee
- **WENRA** – Western European Nuclear Regulators Association
- **WHO** – World Health Organization
- **ZUOP** – Radioactive Waste Management Plant

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