NATIONAL
ATOMIC ENERGY
AGENCY

2022

ANNUAL REPORT

Activities of the President
of the National Atomic Energy Agency
and assessment of nuclear safety
and radiation protection in Poland in 2022

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WARSAW 2023

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

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 of Article 110 Section 13 of the Act of November 29, 2000 – Atomic Law (Dz. U. of 2021, item 1941, of 2022, item 974 and of 2023, item 595). In accordance with statutory obligation, this report has been submitted to the Prime Minister of Poland.

Vision

The National Atomic Energy Agency is a modern and competent nuclear regulatory authority, which is respected and trusted by the 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 performed safely for both people working with radiation, society, and the environment.

Contents

Dear Reader's

I hereby present you with the Annual Report containing an overview of the activities of the President of the National Atomic Energy Agency and an assessment of nuclear safety and radiation protection in the country in 2022.

The defining event for nuclear safety and radiation protection decision-making in 2022 was undoubtedly the Russian military aggression against Ukraine. The National Atomic Energy Agency carried out a number of forecasts and analyses of the development of the radiation situation in 2022 related to Russia's aggression against Ukrainian nuclear facilities. We also maintain constant contact with the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU). In doing so, it should be noted that repeated military actions in and around the Zaporizhzhia Nuclear Power Plant, which should never have taken place, did not pose a threat to the people of Poland. Due to the distance of the Zaporizhzhia Power Plant from the Polish borders, which is about 840 km in a straight line, the weather conditions and the fact that the reactors are currently in a state of shutdown, there is no threat to the health and life of the population or the environment in our country. Poland, together with Canada, took the initiative to condemn the Russian aggression against Ukraine and called for an end to any action against nuclear facilities on its territory. As a result of this initiative, the Board of Governors of the International Atomic Energy Agency adopted a resolution condemning the actions on Ukrainian territory on March 3, 2022. The Polish delegation attending the Board of Governors was headed by the President of the National Atomic Energy Agency and the Permanent Representative of the Republic of Poland to the United Nations Office in Vienna.

The past year has been an important one for the development of nuclear power in Poland. On November 2, 2022, the Council of Ministers adopted a resolution on the construction of large-scale nuclear power plants in the Republic of Poland. It was decided that a nuclear power plant would be built based on the US AP1000 reactor technology. The President of the National Atomic Energy Agency will supervise the safe implementation of this project. In turn, Polskie Elektrownie Jądrowe (hereinafter referred to as "PEJ"), which plays the role of investor in the nuclear programme, submitted an application to the President of the PAA in September 2022 to obtain a general opinion for the proposed scope of description of verification of the designed nuclear power plants' safety analyses. The PAA is currently working on the documentation submitted on March 13, 2023 by PEJ to obtain a general opinion for the safety classification of the systems, structures and components used in the designed nuclear power plant.

A particular challenge for the PAA is to adequately prepare personnel for the implementation of the Polish Nuclear Power Programme, as well as for new nuclear technologies and the corresponding organizational and technical solutions affecting nuclear safety and radiation protection issues. In accordance with the **Polish Nuclear Power Programme** the National Atomic Energy Agency continued to strengthen its nuclear regulatory and oversight capability in 2022, by increasing staffing, building competencies and adjusting equipment and infrastructure facilities. Furthermore, we have granted authorizations to six institutions (one of them in January 2023) confirming the high quality of the work they provide for nuclear safety. This is the first step for these entities to apply for the role of technical support organization for the PAA in the process of licensing and supervising the construction of nuclear power plants.

The National Atomic Energy Agency is continuously strengthening the country's continuous radiation monitoring. Last year, we launched 13 new permanent monitoring stations. At the end of 2022, there were 52 permanent monitoring stations (PMS) in Poland, managed by the PAA. These stations provide monitoring of ionizing radiation throughout the country 24/7. The early radioactive contamination detection system enables an ongoing assessment of the radiation situation in Poland as well as early detection of radioactive contamination in the event of a radiation emergency. Further expansion of the entire station network is planned for the coming years.

The use of ionizing radiation is gaining interest in our country. Approximately 5% of entities utilizing ionizing radiation are added each year. In 2022, the number of organizational entities registered in the register of organizational entities kept by the President of the PAA, whose activity requires at least registration, increased from 4,770 to 4,895, with the largest growth occurring for entities generating ionizing radiation in veterinary medicine.

In 2022, the aforementioned nuclear regulatory authority issued 1,701 administrative decisions on the regulation of activities related to exposure to ionizing radiation, including 17 decisions on nuclear safety. Thereby, the number of registered entities in the country increased to 7,761 (as of the end of December 2022).

In 2022, PAA inspectors conducted more than 600 inspections at organizational entities that use ionizing radiation. These are just examples of PAA's nuclear safety and radiation protection efforts, which have been a priority for the Agency for 40 years. The year 2022 was a special year for our institution – we celebrated the fortieth anniversary of PAA's establishment. On this occasion, a commemorative badge - the Badge of the Fortieth Anniversary of the Establishment of the National Atomic Energy Agency - was presented to deserving individuals in recognition of their achievements in nuclear safety and radiation protection.

In addition, an important task carried out by the PAA is to raise public awareness of the effects of ionizing radiation, including its impact on human health and the environment.

In view of the need to ensure that the public has access to reliable information, activities have been intensified at the PAA to disseminate knowledge about nuclear safety and radiation protection, including by conducting public communication activities.

Summing up the year, it should be said that the state of nuclear safety and radiation protection in Poland in 2022 was at a high level.

I hope you will find this report interesting!

President of the National Atomic Energy Agency

1 National Atomic Energy Agency

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 regulations. The President of the PAA reports to the minister competent in climate matters. The President of the PAA performs his tasks with the assistance of the National Atomic Energy Agency.

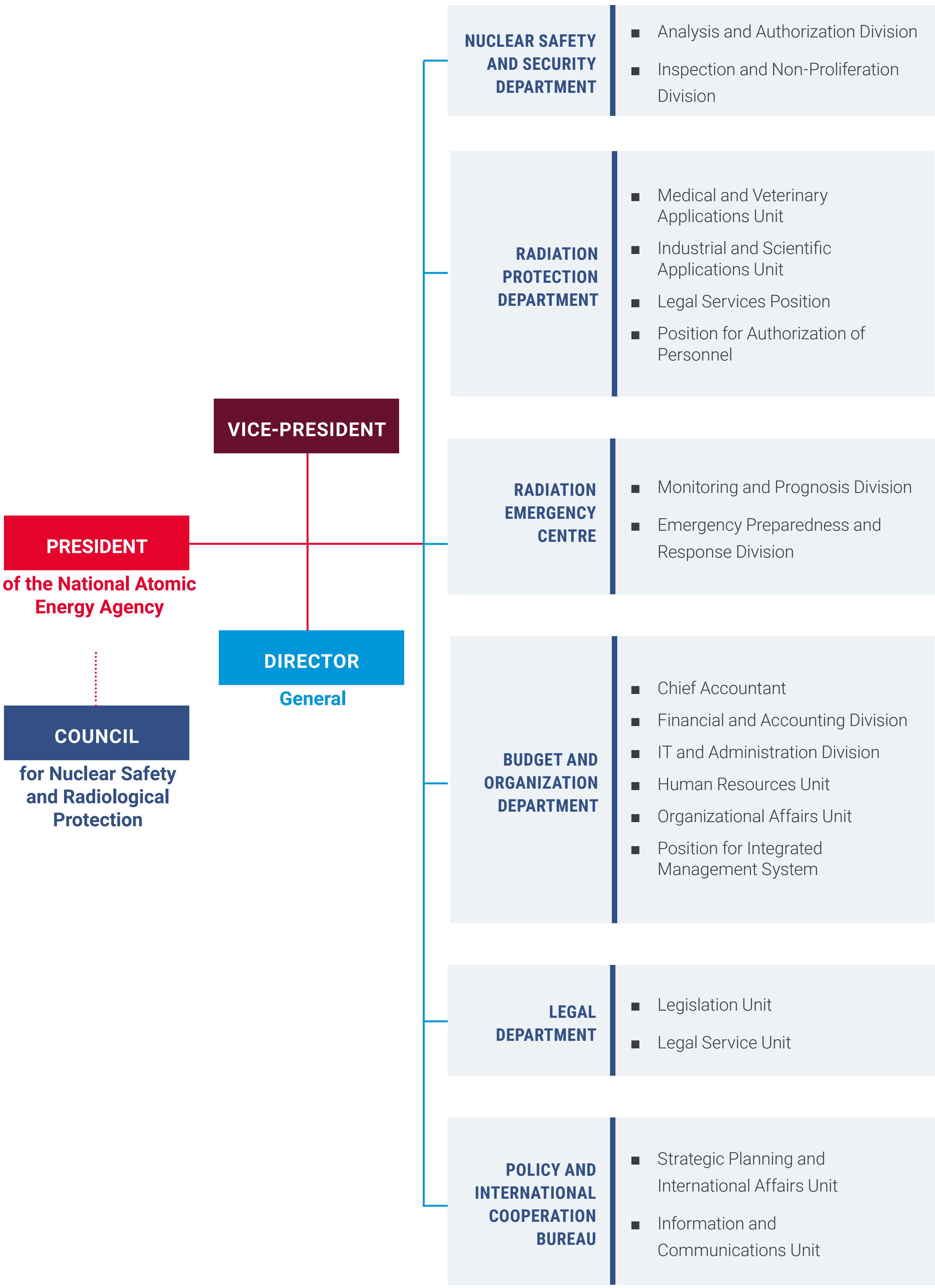
The scope of activities of the President of the PAA includes tasks which involve ensuring nuclear safety and radiation protection of Poland, in particular:

1. preparing draft of 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 and the issuance of decisions such as licenses registrations as well as other decisions specified in the act;
3. promulgating technical and organizational recommendations on nuclear safety and radiation protection matters;
4. performing 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 public;
5. performing 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 possible measures to apply in the case of radiation emergencies, excluding the promotion of ionizing radiation use, in particular, in nuclear power sector, due to the principle of independence of the nuclear regulatory authority;
7. cooperating 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. performing tasks related to the national and civil defense as well as protection of classified information, as stipulated in separate regulations;
9. preparing 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. cooperating with competent foreign entities and international organizations on matters covered by the Atomic Law Act;
11. preparing drafts of legal acts on the matters stipulated by the Atomic Law Act and consulting them pursuant to the procedure specified in the Rules of Procedure of the Council of Ministers;
12. issuing opinions on draft legal acts developed by authorized bodies;
13. presenting 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.

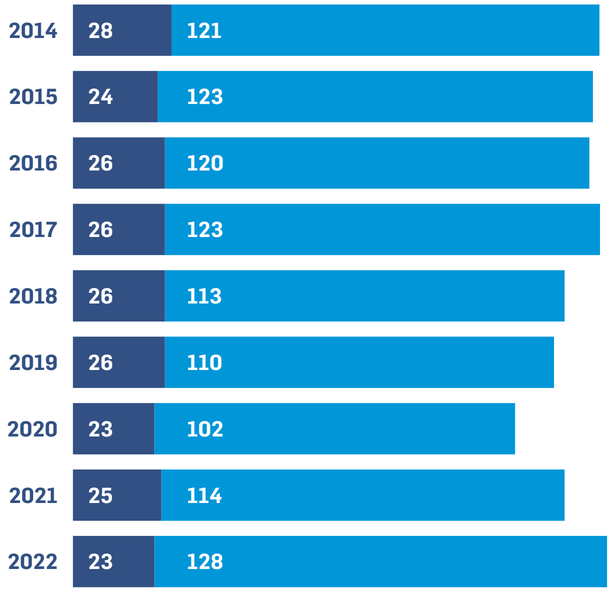
Organizational Structure

FIGURE 1.
Organizational structure of the PAA (as of December 31, 2022)

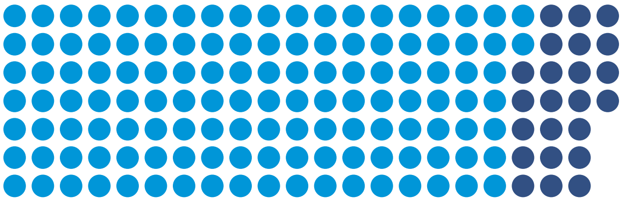


Employment

As of December 31, 2022, there were 128 PAA employees (FTE: 126.15). The calculation was based on the employment level excluding persons on unpaid and parental leaves. As of December 31, 2022, the PAA employed 23 nuclear regulatory inspectors, including 1 on unpaid leave.



128 EMPLOYEES



23 NUCLEAR REGULATORY INSPECTORS

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 material safeguards, and other specialties 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 Report of the Council for 2022 has been published in the PAA's Public Information Bulletin.

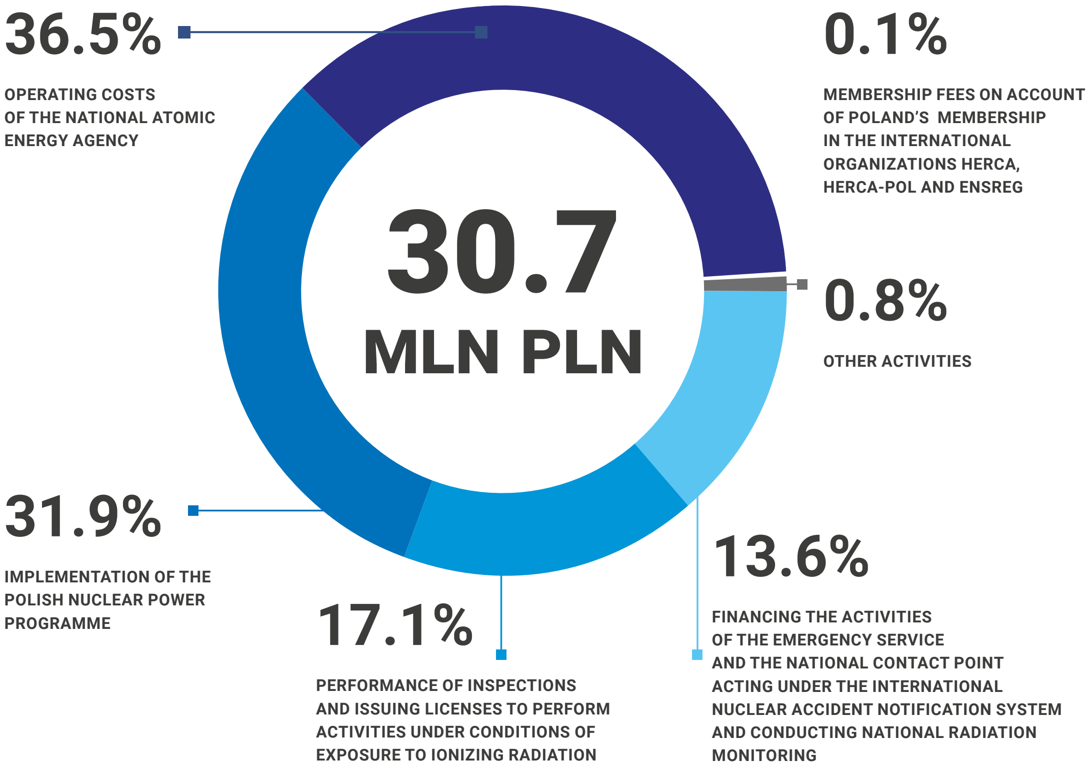
Composition of the Council

Composition of the Council in 2022:

- Prof. **JANUSZ JANECZEK**, D.Sc,
  Chairman of the Council
- Prof. **ANDRZEJ G. CHMIELEWSKI**, D.Sc. Eng.,
  Deputy Chairman of the Council
- **PIOTR KOCIŃSKI**, PhD,
  Registrar of the Council
- Prof. **MAREK K. JANIAK**, D.Sc, M.D.,
  Member of the Council
- Prof. **LESZEK KRÓLICKI**, D.Sc, M.D.,
  Member of the Council
- **TOMASZ NOWACKI**, Ph.D.,
  Member of the Council

Budget

FIGURE 2.
In 2022, the budgetary expenses amounted to PLN 30.7 million, and included:



Additional information:

The budgetary expenses in 2022 amounted to PLN 30.7 million, including PLN 123,000 of budgetary expenses from European funds.

Assessment of the PAA's operations

Judicial-administrative review of administrative decisions issued by the President of the PAA

In 2022, the aforementioned nuclear regulatory authority issued 1,701 administrative decisions on the regulation of activities related to exposure to ionizing radiation, including 17 decisions on nuclear safety. Furthermore, 5 decisions were issued to authorize laboratories and expert organizations to participate in the inspection of nuclear power plants.

No complaints to the Voivodship Administrative Court were filed against the decisions issued by the aforementioned nuclear regulatory authority.

Audits performed by the Supreme Audit Office

In the period of January-April 2023, the Supreme Audit Office conducted an audit with the purpose of assessing budget spending in 2022 in terms of legality, expediency, reliability and economy of activities undertaken by the National Atomic Energy Agency, which is the administrator of budget section 68.

The Supreme Audit Office gave a positive opinion on the PAA's state and European budget spending in 2022 in terms of expenditures and found no irregularities in terms of budget revenues. The expenses incurred were made correctly and served the PAA's statutory tasks within the framework of the envisaged state functions related to ensuring nuclear safety and radiation protection of the country. The Supreme Audit Office gave a positive opinion on the PAA's budget and financial operations reports.

National Atomic Energy Agency and the Polish Nuclear Power Programme

On October 2, 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. On November 2, 2022, the Council of Ministers adopted a resolution to construct the first nuclear power plant with an electric output of up to 3,750 MWe based on the US AP1000 reactor technology. The first nuclear power plant is to be constructed in northern Poland. Implementation of the nuclear project will take place in cooperation with the US government.

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.

The PAA is implementing an extensive training programme for the employed specialists, a highlight of which in 2022 was the participation of 7 PAA specialists in 2-3 month training internships at the U.S. Nuclear Regulatory Commission and at the construction site of new units using the AP1000 technology at the Vogtle Nuclear Power Plant in Georgia, USA. PAA also held talks in 2022 with nuclear regulatory authorities in all countries offering reactor technology to Poland (France, South Korea, the US) to develop cooperation in strengthening PAA's competencies for the nuclear programme.

In August 2022, the President of the PAA issued authorization decisions for five national scientific and expert institutions to serve as technical support organizations during the construction and operation of the nuclear power plant in Poland. All of the authorized institutions have qualified personnel and technical facilities that will allow them to impartially and reliably conduct specialized analyses and expert's opinions related to the assessment of the nuclear power plant license application and its inspection.

In September 2022, the company Polskie Elektrownie Jądrowe (PEJ) submitted an application to the President of the National Atomic Energy Agency to obtain a general opinion of the President of the PAA on the description of the verification of safety analyses for the planned nuclear power plants. During the process of obtaining a license for the construction of a nuclear power plant, its investor is required not only to submit analyses confirming the safety of the designed nuclear facility, but also to provide independent verification of the analyses conducted. Based on the application submitted by the PEJ, the President of the PAA will assess the proposed scope and details of the verification description, taking into account both national and international nuclear safety requirements.

The expansion of the national radiation monitoring system also continued last year, with the addition of 13 new early radiation detection stations to the network, bringing the number of stations in the national system to 52. It is expected that by the time the first nuclear power plant is operational, the national radiation monitoring system will have included 145 stations.

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. PAA

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 performed 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 November 29, 2000 – the 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 issuing licenses for performing such activities or accepting registrations and notifications of performing exposure-related activities,
  - verification of the manner of the performance 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 performing 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 dose register, 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 standardization) of the work performed by local 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; 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 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 neighboring 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 specialized organizational entities 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.

The supervision of the President of the PAA of the activities performed 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, involving:
  - 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 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 use of 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,
  - intentional addition of radioactive substances in the manufacturing process of consumer products and trade in such products,
  - intentional addition of radioactive substances in the manufacturing process of medical devices, medical device equipment and product groups with no intended medical use, within the meaning of Regulation (EU) 2017/745 of the European Parliament and of the Council of April 5, 2017 on medical devices, amendments to the Directive 2001/83/EC, Regulation (EC) No. 178/2002 and Regulation (EC) No. 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC (EU OJ L 117 of 05.05.2017, p. 1, as amended) and trade in these devices, equipment or products,
  - intentional addition of radioactive substances in the manufacturing process of in vitro diagnostic medical devices and in vitro diagnostic medical device equipment, within the meaning of Regulation (EU) 2017/746 of the European Parliament and of the Council of April 5, 2017 on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU (EU OJ L 117 of 05.05.2017, p. 176, as amended) and trade in such devices or equipment,

- 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 regard to activity with nuclear materials and nuclear facilities, the supervision of the President of the PAA also includes approval and control of physical protection systems and performance of activities provided for in the Republic of Poland's commitments with regard to nuclear material safeguards.

An exception to the principle of the President of the PAA's supervision of activities involving ionizing radiation sources is the exercise of such supervision by state voivodeship sanitary inspectors (or the relevant authorities of the military sanitary inspection reporting to the Minister of National Defense), in relation to the commissioning or use of X-ray devices for medical diagnostics, interventional radiology, surface radiotherapy and radiotherapy of non-oncological diseases, as well as the commissioning of medical X-ray laboratories.

Basic provisions of law on nuclear safety and radiation protection

The Atomic Law Act

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

As of May 26, 2022, amendments to the Atomic Law Act made by the Act of April 7, 2022 on medical devices (Dz. U. item 974) came into force, adjusting the nomenclature used in the provisions of Article 4 Section 1 Item 1 Letter b, Article 33zd Section 1 Items 2 and 4, Article 33zd Section 1 Items 2 and 3 of the Atomic Law Act, and in Section 3 Item 3 and in Section 4 Item 5 of Annex no. 5 to the Atomic Law Act to the terminology used in the aforementioned act.

Other acts

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

- Act of August 19, 2011 on transport of dangerous goods (Dz. U. of 2022, item 2147),
- Act of August 18, 2011 on maritime safety (Dz. U. of 2022, items 515, 1604, 2185 and 2687, and of 2023, item 261),
- Act of December 21, 2000 on technical inspection (Dz. U. of 2022, item 1514 and of 2023, items 553, 683 and 919),
- Act of August 5, 2022 on transport of dangerous goods by air (Dz. U. item 1715).

Implementing acts to the Atomic Law Act

The work on draft implementing acts to the Atomic Law Act, which had to be issued due to the adoption by the Parliament of the Act of June 13, 2019 amending the Atomic Law Act and the Act on fire protection (Dz. U. item 1593, and of 2020, item 284) was concluded in 2022.

On November 21, 2022, the Regulation of the Council of Ministers of August 9, 2022, on environmental radiation monitoring programme developed and implemented by organizational entities included in category I or II of hazards came into force (Dz. U. item 2058). Provisions of the regulation are applicable to organizational entities performing activities involving exposure to ionizing radiation classified in hazard category I or II, according to Annex No. 5 to the Atomic Law Act. The development and implementation of an environmental radiation monitoring programme by the head of the organizational entity is necessary to ensure continuous control of the level of environmental impact of exposure-related activities, including regular assessment of the exposure of members of the public in accordance with the applicable provisions.

Summary

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

In 2022, the amendment to the Act introduced by the Act of April 7, 2022 on medical devices (Dz. U. item 974) came into force, adjusting the nomenclature used in the provisions of Article 4 Section 1 Item 1 Letter b, Article 33zd Section 1 Items 2 and 4, Article 33zd Section 1 Items 2 and 3 of the Atomic Law Act, and in Section 3 Item 3 and in Section 4 Item 5 of Annex no. 5 to the Atomic Law Act to the terminology used in the aforementioned act.

In 2022, there was continued work that resulted in the adoption of the Regulation of the Council of Ministers of August 9, 2022, on the scope of the environmental radiation monitoring programme developed and implemented by the organizational entities included in category I or II of hazards (Dz. U. item 2058).

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,
- preparing and performing inspections in organizational entities performing exposure-related activities,
- maintaining a register of such entities.

Users of ionizing radiation sources in Poland

The number of registered organizational entities performing activity (one or more) involving exposure to ionizing radiation, subject to oversight of the PAA President, is 4,895 (as of December 31, 2022).

4,895

The number of all registered activities involving exposure to ionizing radiation is 7,761 (as of December 31, 2022).

7,761

Issuing licenses and receiving registrations or notifications

Licenses issued by the President of the PAA to perform activities involving exposure to ionizing radiation, except for activities on nuclear facilities and radioactive waste repositories, are drafted in the Radiation Protection Department (DOR) of the PAA.

BASIS TO GRANT A LICENSE

Application, referred to Article 5 Section 5 of the Act of November 29, 2000 – the Atomic Law. Documents specified in the Regulation of the Council of Ministers of August 30, 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. Additional information, referred to in Article 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 performing exposure-related activities have been satisfied.

The issuance of a license, amendment 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 analyzed: the rationale for undertaking an exposure-related activity, the proposed dose constraints, the quality assurance programme for the undertaking and the on-site 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 conducted on the basis of a registration or notification (Dz. U. of 2021, item 796) and in Article 4 Section 5 of the Act of November 29, 2000 – Atomic Law.

Regulatory inspections

Inspections in organizational entities other than those having nuclear facilities and radioactive waste repositories are carried out by nuclear regulatory inspectors from the Radiation Protection Department of the PAA working in Warsaw and Katowice. The number of inspections carried out in 2022 was 615, including 8 re-inspections (second inspection in the same year), of which 427 inspections were carried out by inspectors from Warsaw, and 188 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 performing activities in conditions of exposure to ionizing radiation and amendments to licenses granted by the President of the PAA in 2008-2022

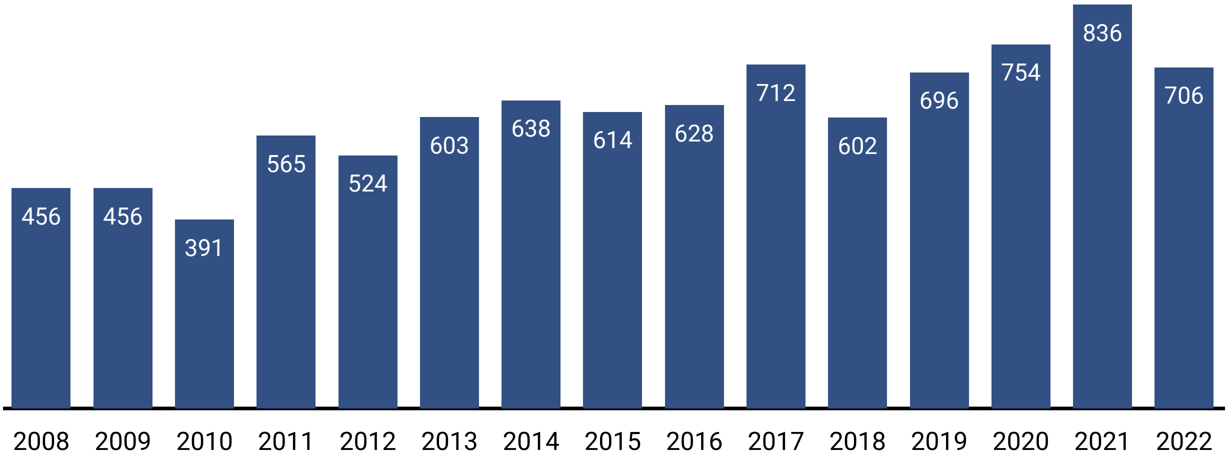


FIGURE 4.
Number of inspections carried out by the inspectors from the Radiation Protection Department of the PAA in the years 2008-2022

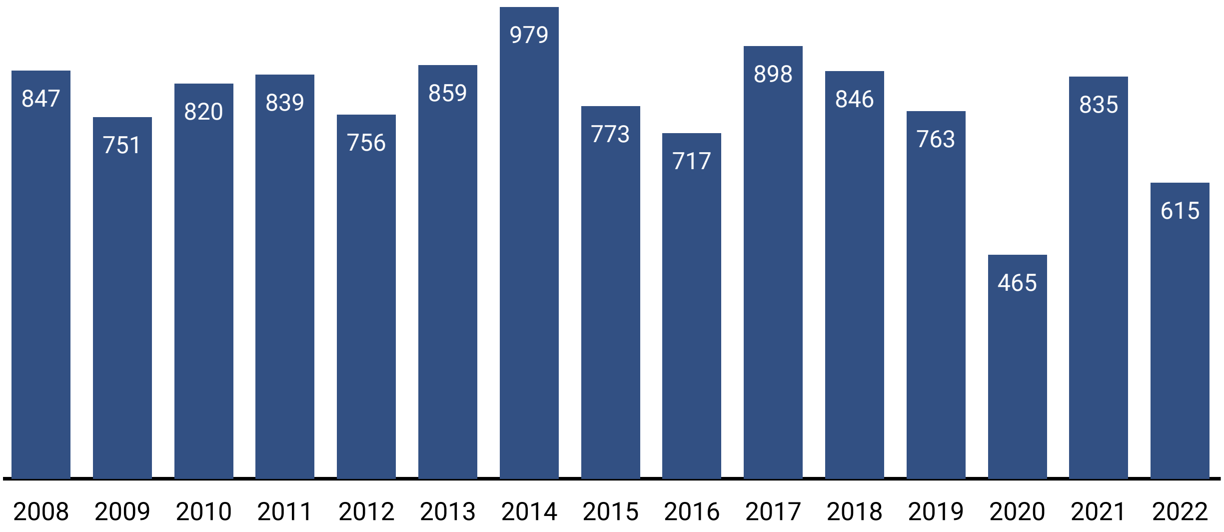


TABLE 1.
Users of ionizing radiation sources in Poland in numbers (as of December 31, 2022)

TYPE OF ACTIVITY	SYMBOL	NUMBER OF UNITS	NUMBER OF ACTIVITIES	NUMBER OF GRANTED IN 2022				INSPECTIONS	
				LICENSES	ANNEXES	REGISTRATION ACCEPTANCE DECISIONS	NOTIFICATIONS	INSPECTIONS IN 2022	INSPECTIONS FREQUENCY
Class I laboratory	I	2	2	0	0	0	0	0	annually
Class II laboratory	II	95	129	5	12	0	0	29	every 2 years
Class III laboratory	II	116	230	0	5	5	0	13	every 4 years
Class Z laboratory	Z	148	258	20	7	7	0	39	every 4 years
Smoke detector installer	UIC	334	338	6	3	0	0	49	every 5 years
Device installer	UIA	238	328	43	94	0	0	32	every 5 years
Isotope device	AKP	503	678	1	11	37	0	59	every 5 years
Manufacture of isotope sources and devices	PRO	24	30	2	3	0	0	2	every 3 years
Trade in isotope sources and devices	DYS	80	86	5	5	0	0	2	every 5 years
Accelerator	AKC	82	261	21	8	0	0	22	every 4 years
Isotope applicators	APL	39	52	18	8	0	0	22	every 2 years
Telegammatherapy	TLG	4	4	1	1	0	0	1	annually
Radiation instrument	URD	31	33	0	0	0	0	13	every 3 years
Gammagraphic apparatus	DEF	96	97	4	10	0	0	16	every 2 years
Storage facility for isotope sources	MAG	187	235	20	9	0	0	17	every 3 years
Work with sources outside laboratory	TER	102	123	12	7	0	0	8	every 3 years
Transport of sources or waste	TRN	503	513	3	5	0	0	4	every 5 years
Chromatograph	CHR	233	288	0	0	2	0	7	every 10 years
Veterinary X-ray instrument	RTW	1661	1826	226	9	0	0	70	every 10 years
X-ray scanner	RTS	751	1105	13	22	235	0	41	every 10 years
X-ray defectoscope	RTD	217	260	17	18	0	0	66	every 2 years
Other X-ray instrument	RTG	583	885	36	16	78	0	90	every 10 years
Ad-hoc inspections								13	additionally
			7761	**453**	**253**	**364**	**0**		

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.

Additional 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 an activity related to 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 2022 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 November 29, 2000 – the 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 29,183 sources, including used 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.

29,183

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 1,486 currently used Category 1 sources.

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

The register contains 3,095 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 6,692 currently used Category 3 sources.

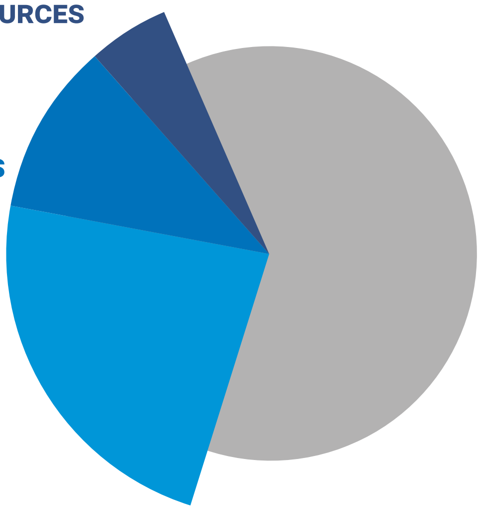


TABLE 2.
Selected radioactive isotopes and sources containing them, currently used (as of December 31, 2022)

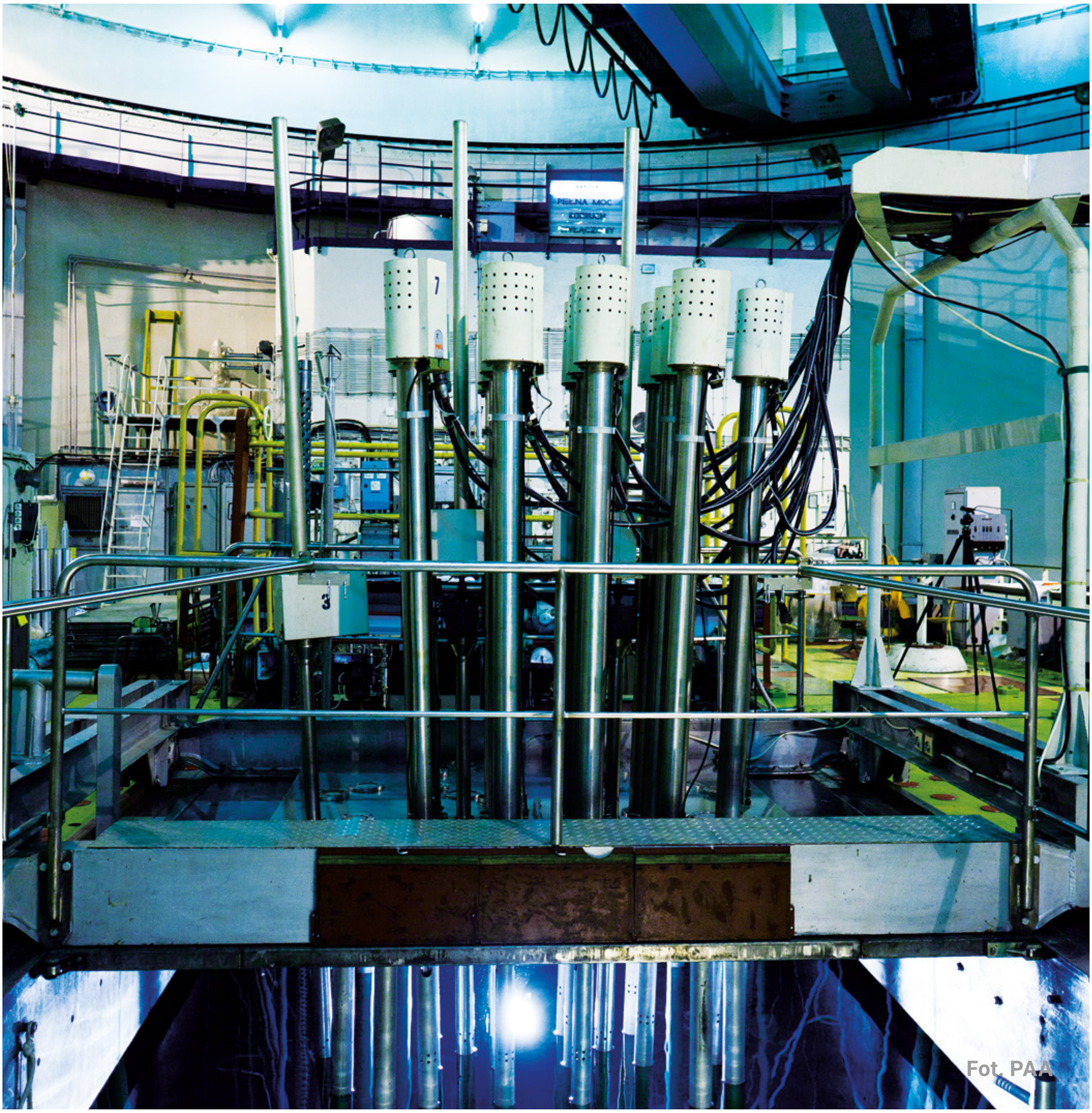
	NUMBER OF SOURCES IN THE REGISTER		
ISOTOPE	**CAT. 1**	**CAT. 2**	**CAT. 3**
Co-60	790	1,114	1,447
Ir-192	325	668	2
Cs-137	77	260	2,086
Se-75	261	241	3
Am-241	14	345	666
Pu-239	2	88	91
Co-57	3	33	231
Sr-90	–	37	624
Ni-63	-	8	247
Kr-85	5	61	146
Th-232	–	5	261
other	9	235	888
TOTAL	**1,486**	**3,095**	**6,692**

Summary

In 2022, the number of organizational entities, registered in the register of organizational entities whose activities require at least registration, increased from 4,770 to 4,895, 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 728. A large part of them comprised sealed radioactive sources classified as Category 2 and used in defectoscopic measurements. At the same time, in 2022, there were 220 more inspections of activities involving exposure to ionizing radiation as compared to 2021.

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 entities.

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



Fot. PAA

Nuclear facilities in Poland

The nuclear facilities in Poland are as follows:

- **MARIA research reactor** at the National Centre for Nuclear Research (NCBJ),
- **EWA research reactor** (under decommissioning) and **wo spent fuel storage facilities** at the Radioactive Waste Management Plant (ZUOP).

These facilities are located in Świerk near Otwock, in two separate organizational entities. 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 MWt and a maximum core thermal neutron flux density of 3.5·/I018n/(m2s). The MARIA reactor started to operate in 1974 and 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 2022, the reactor operation schedule was adapted to:

- the irradiation requirement of uranium targets for production of Mo-99 molybdenum isotope;
- the irradiation of target materials for the Radioisotope Centre, i.e. tellurium dioxide, potassium chloride, sulfur, samarium, lutetium, cobalt, and iron, intended for the production of radioactive materials 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;
- irradiation of various target materials for research purposes, conducted by NCBJ or the Institute of Chemistry and Nuclear Technology in Warsaw;
- the research work and measurements of core reactivity parameters

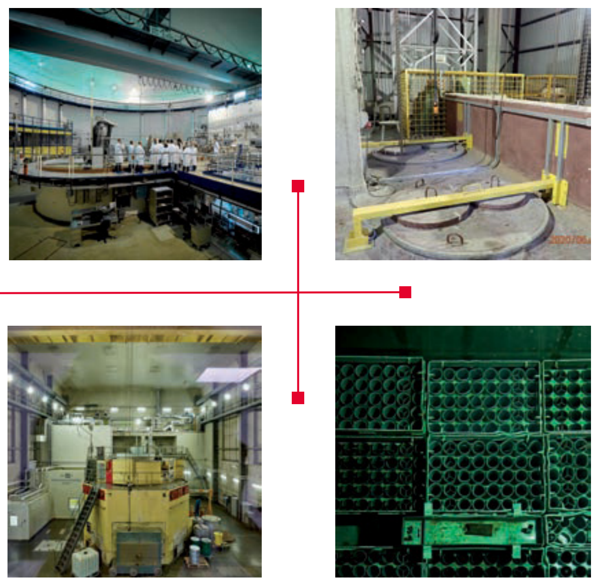


FIGURE 5.
Illustrative location of the MARIA research reactor, the EWA reactor (under decommissioning) and spent nuclear fuel storage on the premises of the Nuclear Research Centre in Świerk near Otwock.

In 2022, the MARIA reactor was in service for 3,382 hours operating in 26 cycles at power outputs ranging from 18 to 25 MW (Fig. 7). In 2022, only MR-6 type fuel, with 19.7% U-235 isotope enrichment, was used in the MARIA reactor and an MR-2 type fuel component was introduced into the reactor core to irradiate the materials inside the fuel component.

There were 3 unscheduled reactor shutdowns in 2022, including 2 that necessitated shortened reactor's operation cycles, which is a significant improvement over 2021 (25 unscheduled shutdowns). In 2022, the reactor was shut down due to a short-lived power outage on the external power grid and increased releases of fission products from fuel. None of the unscheduled shutdowns created a hazard for nuclear safety and radiation protection.

During the period from September 5, 2022 to December 31, 2022, the MARIA reactor was shut down for necessary modernization and repair work. This work is expected to be completed in the first half of 2023. In 2022, the following important operations began at the MARIA reactor:

- Modernization of main electrical switchboards with replacement of power cables;
- Modernization of the reactor control room with a visualization system;
- Modernization of liquid radioactive waste tanks;
- Modernization of the aerosol measurement system in Building B of the reactor facility;
- Modernization of the transmitter for measurements of water flow intensity in the cooling system of the reactor pool;
- Modernization of the water level measurement system in the reactor pool and storage pool;
- Experimental building renovation.

The MARIA reactor can also be used to carry out physical research, using six horizontal ducts (H-3 to H-8). In 2022, such research was not carried out due to the fact that these ducts were shut down to prepare the experimental hall for modernization. As part of this modernization, it is planned to install modern research equipment acquired from another foreign research reactor.

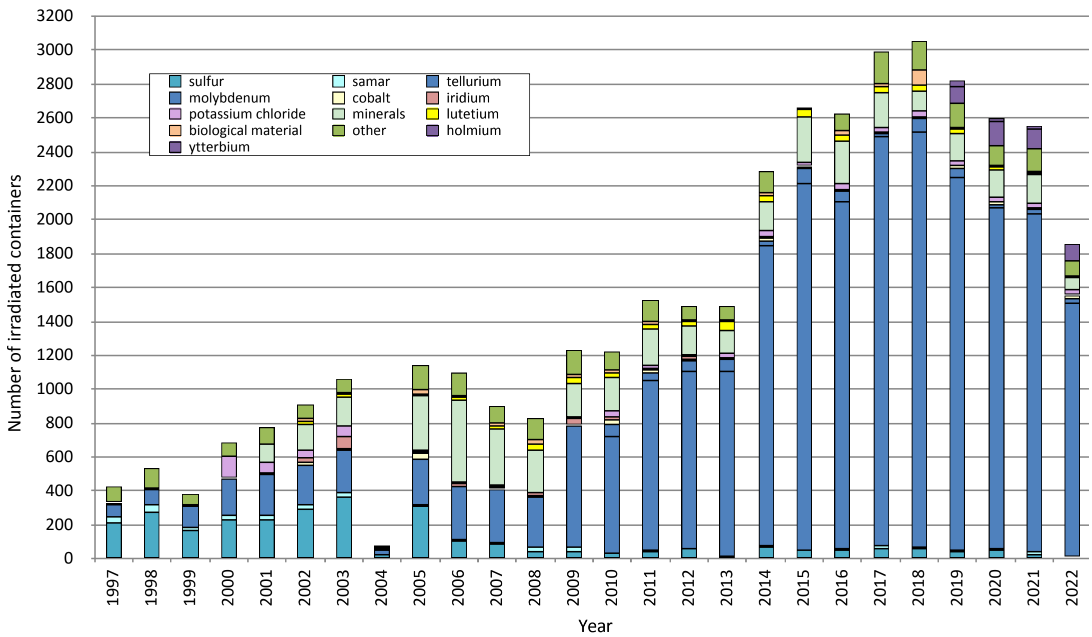
The technological pool of MARIA reactor is currently used for storage of spent MC and MR nuclear fuel, originating from the current operation of the reactor.

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 modernization works were carried out in the reactor.

FIGURE 6.
Materials irradiated in the MARIA reactor by 2022 (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 components, whose 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 ZUOP.

The building of the former EWA reactor houses now:

- a Class I isotope laboratory,
- a radiometric analysis laboratory,
- a chemical laboratory,
- a contaminated clothing laundry.

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 ZUOP needs.

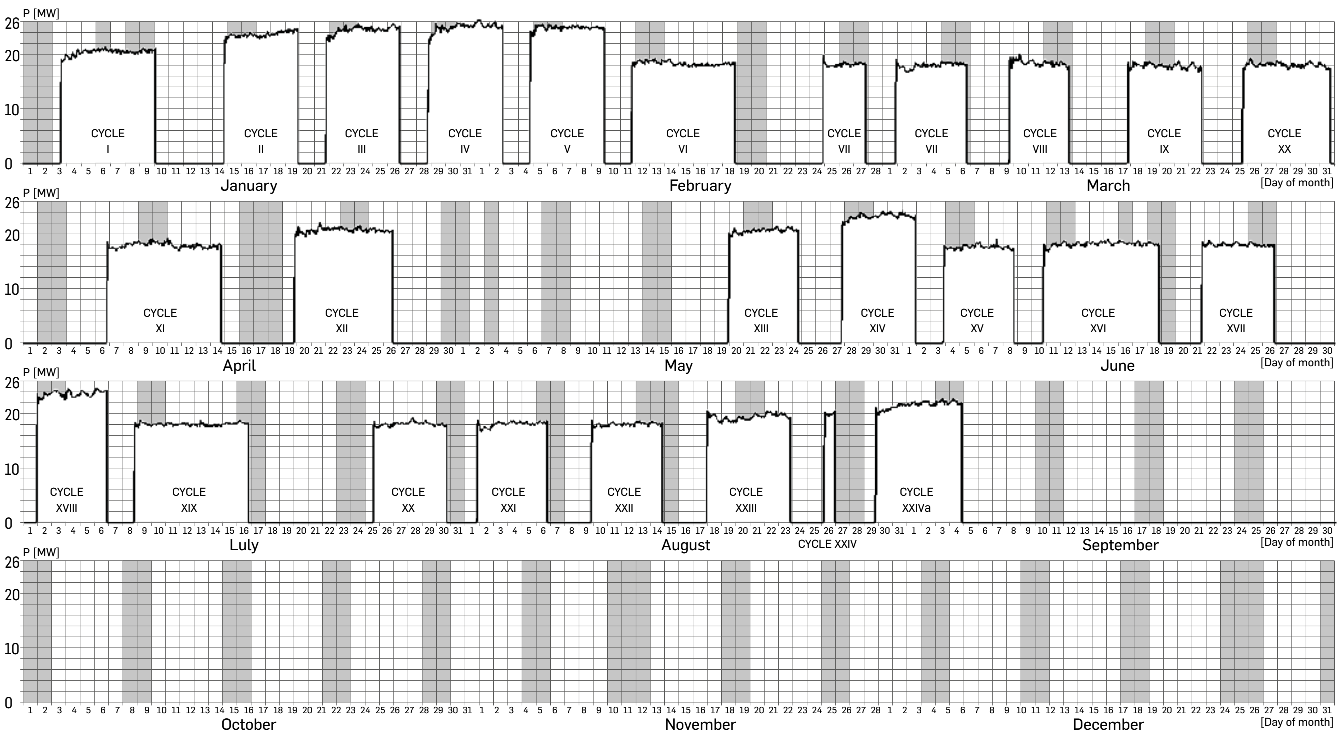
Spent nuclear fuel storage facilities

Spent nuclear fuel storage facilities also constitute nuclear facilities, including facilities no. 19 and 19A, which belong to ZUOP from January 2002. Both are wet storage facilities, i.e. they are adapted for the storage of spent nuclear fuel in the water environment.

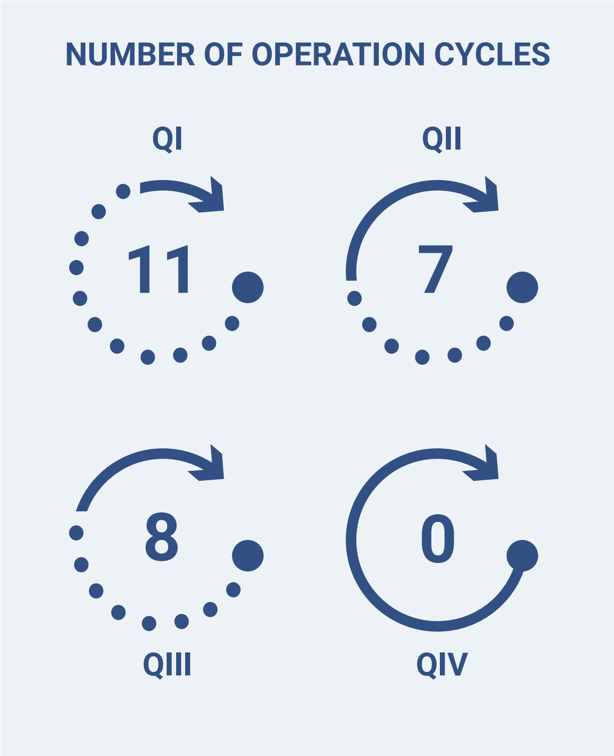
Storage facility no. 19 was used for the storage of encapsulated low-enriched spent nuclear fuel EK-10 from the EWA reactor, which was returned to the producer country, i.e. the Russian Federation, in September 2012.

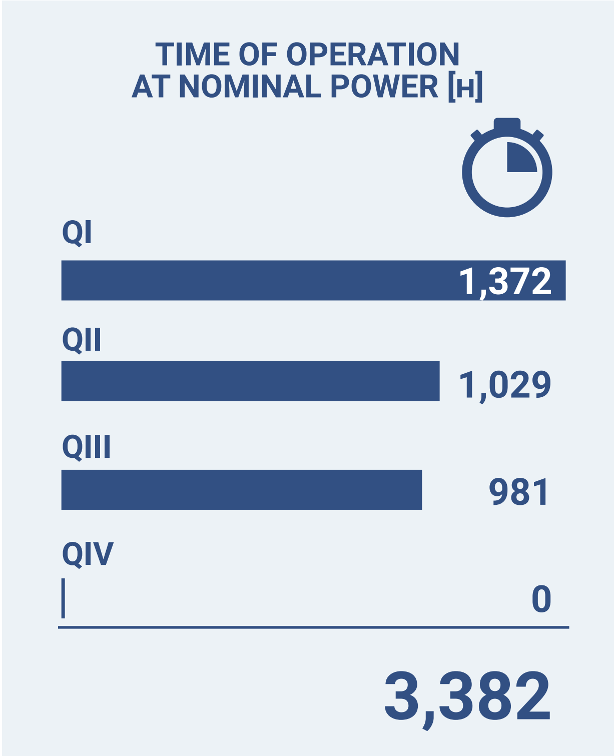
The facility is currently used as a storage site for certain radioactive waste (structures) from the decommissioning of the EWA reactor and from the operation of the MARIA reactor, and also spent high-activity gamma-radiation sources.

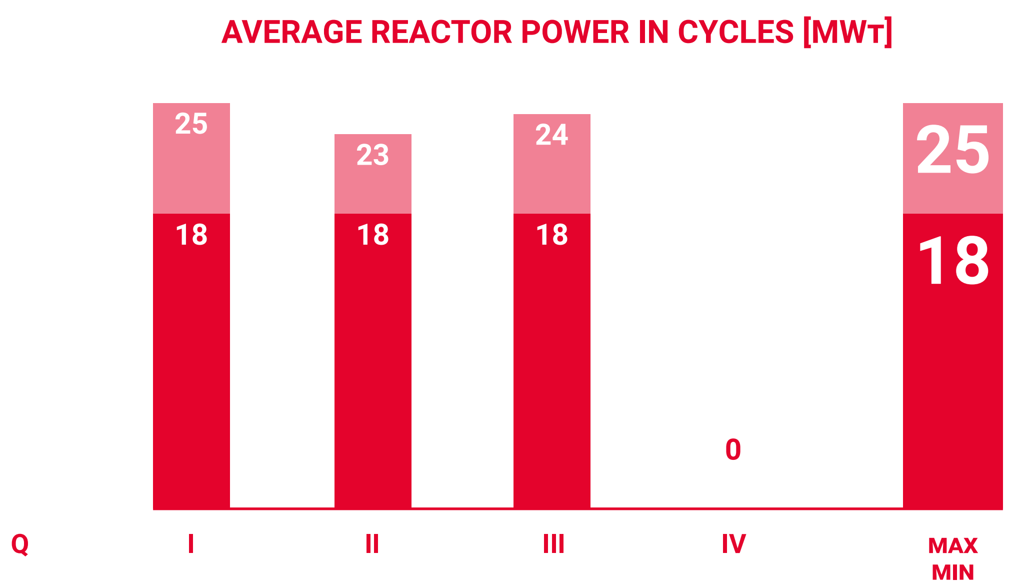
FIGURE 7.
Summary of the MARIA reactor's operation cycles in 2022 (NCBJ data), compiled and prepared by Andrzej Frydrysiak – DOM EJ2

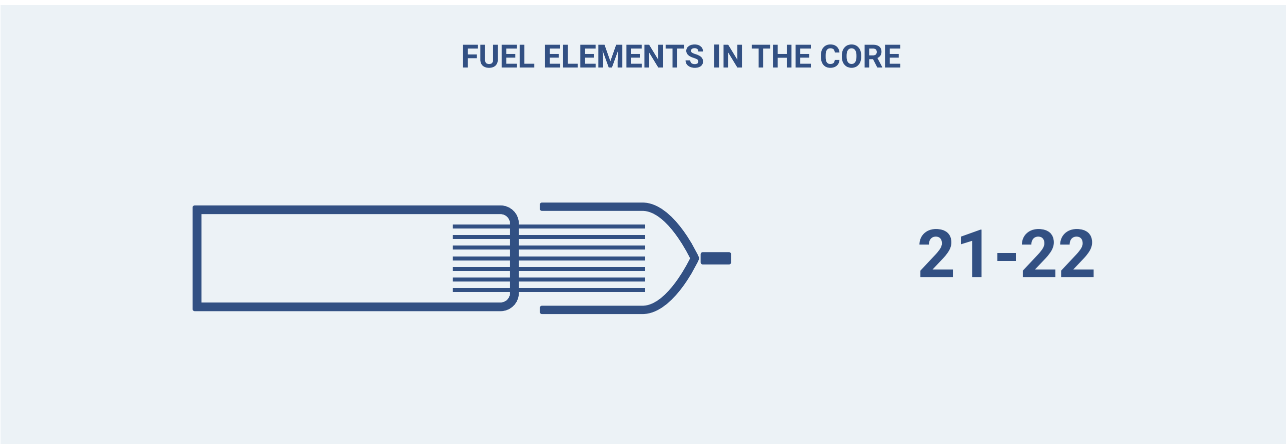


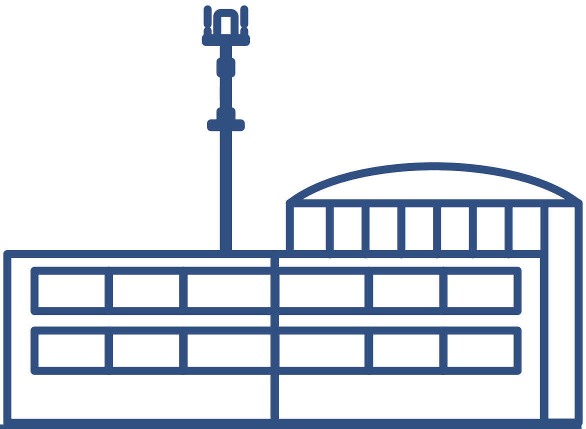
General information on the MARIA reactor's operation in specific quarters of 2022











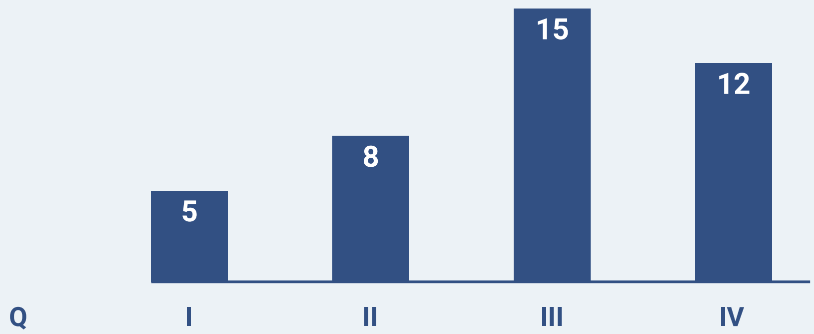
UNSCHEDULED SHUTDOWNS

0	2	0	1
HUMAN ERROR	EQUIPMENT MALFUNCTIONS	INSTRUMENTATION ERRORS	SHORT-LIVED POWER OUTAGE

MALFUNCTIONS/DEFECTS AND NON-COMPLIANCES FOUND

Q I	Q II	Q III	Q IV	TOTAL
0	1	1	0	2

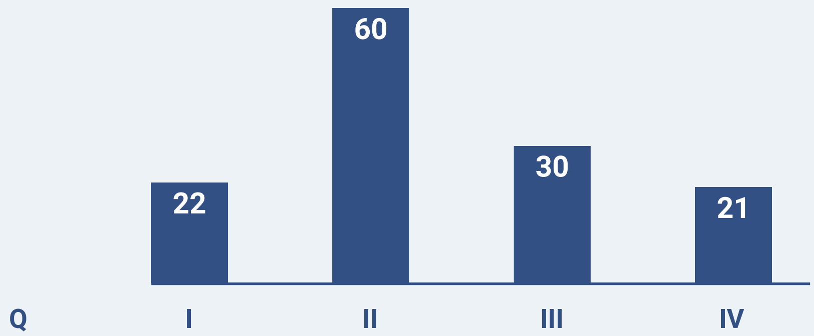
REPAIR AND MAINTENANCE WORKS



40

TOTAL IN 2022

PERFORMED TESTS, INSPECTIONS AND CHECKS



133

TOTAL IN 2022

Storage facility no. 19A was used for storage of high-enriched spent nuclear fuel, marked with symbols 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 Storage facility no. 19A to the Russian Federation in 2010, this storage facility 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 ZUOP. Currently, none of them contains spent nuclear fuel, and the Storage facility no. 19A serves as a reserve in case there is a need to store spent nuclear fuel from the MARIA reactor.

PAA carried out:

9 INSPECTIONS AT NCBJ
(NATIONAL CENTRE FOR NUCLEAR RESEARCH)

3 INSPECTIONS AT ZUOP
(RADIOACTIVE WASTE MANAGEMENT PLANT)

4 INSPECTIONS AT KSOP
(NATIONAL RADIOACTIVE WASTE REPOSITORY)

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 March 31, 2015. This license is valid till March 31, 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 April 3, 2015 for the storage of nuclear material,
- License no. 2/2015/NCBJ of April 3, 2015 for the storage of spent nuclear fuel.

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

Regulatory inspections

In 2022, nuclear regulatory inspectors of the PAA carried out 16 inspections of nuclear safety, radiation protection, and physical protection of nuclear facilities and KSOP. 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 assessing the following:

- compliance of the MARIA reactor's day-to-day operation and operating records with the terms of the license,
- neutron automation system,
- dosimetry monitoring system,
- reactor commissioning,
- ventilation system,
- electrical power supply system,
- nuclear fuel management,

- technological control system instruments,
- physical protection,
- radiation emergency management system,
- radiation protection,
- fuel cooling system.

The inspections conducted in ZUOP (3) and KSOP (4) were related to the following:

- decommissioning of the EWA nuclear facility,
- physical protection,
- technical condition of spent nuclear fuel storage facilities,
- radiation emergency management system,
- radiation protection,
- collection of radioactive waste at the KSOP,
- changes to the license, modernization, modification,
- joint radioactive materials accountancy

24 deficiencies were identified during the inspections – among others, 10 at the NCBJ, 5 at ZUOP and 8 at KSOP. In 2022, the President of the PAA issued 2 decisions ordering to rectify the deficiencies found during inspections in 2021 and 2 post-inspection notices related to the infringement found during the aforementioned inspections. The President of the PAA also issues 3 post-inspection notice on infringements identified in 2022.

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

In accordance with provisions of the Atomic Law Act, when carrying out the 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 Service, 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 2022, 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 modernizations, and other maintenance works, as well as unscheduled shutdowns, did not create a hazard to nuclear safety or radiation protection. In 2022, the PAA inspectors carried out a total of 16 inspections related to nuclear facilities and the KSOP. The inspections carried out in 2022 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 breach of license terms. The organizational entities responsible for the operation of nuclear facilities have rectified, or are in the process of rectifying, deficiencies and infringements found during inspections.

Nuclear power plants in neighboring 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

CZECHIA

Dukovany NPP

PL — 119 KM

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

CZECHIA

Temelin NPP

PL — 192 KM

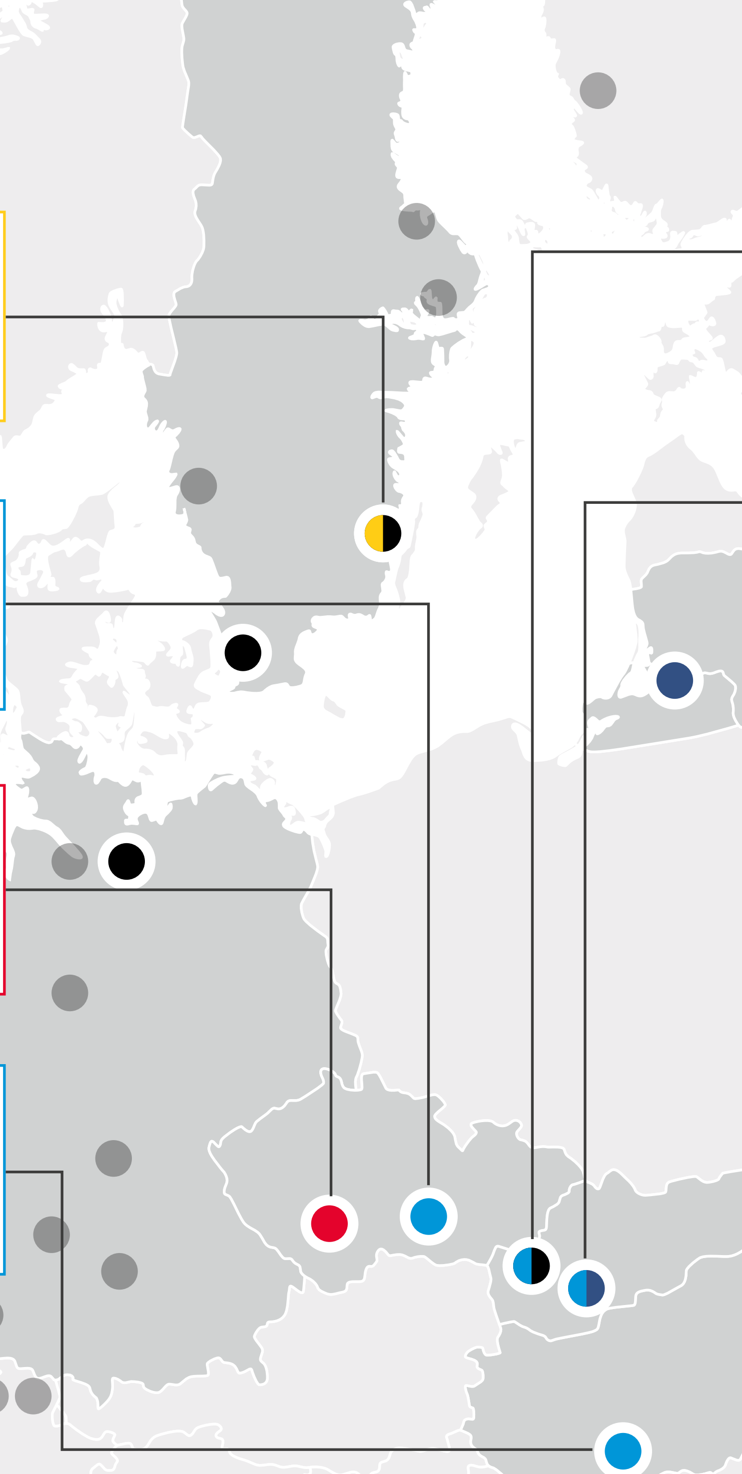
2 V-320 units
1082 MWe
1082 MWe

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 the **Mochovce NPP** (Slovakia)

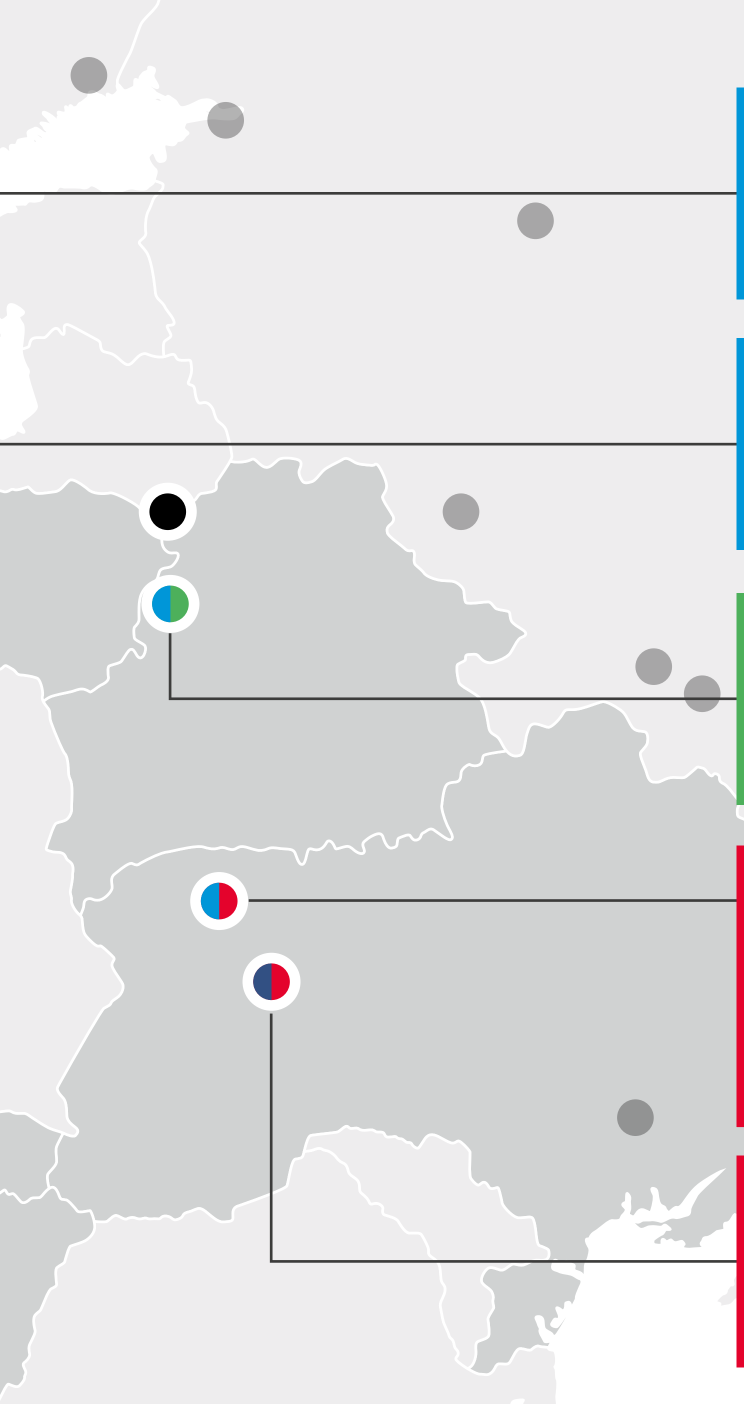
1 V-491 reactor at the **Belarusian NPP** (Belarus)

1 V-320 reactor at the **Khmelnytskyi NPP** (Ukraine)

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

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

9	14	6	1	1
OPERATING NUCLEAR POWER PLANTS	V-213 REACTORS	V-320 REACTORS	V-491 REACTOR	BWR-3000 REACTOR



SLOVAKIA

Bohunice NPP

138 KM

2 V-213 units
500 MWe
500 MWe

SLOVAKIA

Mochovce NPP

133 KM

2 V-213 units
500 MWe
500 MWe

BELARUS

Belarusian NPP

250 KM

1 V-491 unit
1194 MWe

UKRAINE

Rivne NPP

134 KM

2 V-213 units
500 MWe
500 MWe
2 V-213 units
500 MWe
500 MWe

UKRAINE

Khmelnitsky NPP

184 KM

2 V-320 units
1000 MWe
1000 MWe

DECOMMISSIONED POWER PLANTS

Ignalina NPP (Lithuania)
Two 1,300 MWe RBMK reactors shut down in 2004 and 2009

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

Krummel NPP (Germany)
One 1,402 MWe BWR reactor shut down in 2011

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

5

Safeguards

Fot. NCBJ

Legal basis for nuclear material safeguards

LEGAL BASIS

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

- The Treaty establishing the European Atomic Energy Community (Euratom Treaty) of March 25, 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 March 5, 1970. In 1995, its validity was extended indefinitely. Poland ratified the NPT on May 3, 1969. The NPT came into force in Poland on May 5, 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 March 1, 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 March 1, 2007;
- Commission Regulation (Euratom) no. 302/2005 of February 8, 2005 on the application of Euratom safeguards (EU OJ L 54, February 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 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 until 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 March 1, 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 into 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 and Security Department, which is responsible for the collection and storage of information on nuclear materials and for the performance of controls in all material balance areas.

The national system for nuclear material accountancy and control is based on the structure of the so-called material balance areas (MBAs). 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 87 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 December 31, 2022)

- **Plutonium 2.45 kg**
- **High-enriched uranium 6.97 kg**
- **Low-enriched uranium 503.57 kg**
- **Natural uranium 3,921.95 kg**
- **Depleted uranium 23,679.53 kg**
- **Thorium 276.72 kg**

Inspections of nuclear material safeguards

In 2022, the PAA's nuclear regulatory inspectors carried out, individually or jointly with the IAEA and EURATOM inspectors, 28 inspections of nuclear material safeguards in all material balance areas in Poland. EURATOM inspectors took part in 13 inspections, 2 of which 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.

The inspections of nuclear material safeguards confirmed that all 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 November 29, 2000 – the Atomic Law,
- Act of August 19, 2011 on Transport of Dangerous Goods,
- Act of August 18, 2011 on Maritime Safety,
- Act of July 3, 2002 – the Aviation Law,
- Act of August 5, 2022 on Transport of Dangerous Goods by Air,
- Act of November 15, 1984 – the 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: Règlement 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 terms 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 382 stationary radiometric devices, so-called dosimetric portal monitors, installed at border crossings, nearly 1,500 portable signaling 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 inspections carried out, 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 nuclear and other radioactive materials. In total, 156 dosimetric portal monitors have been installed since 2010, the

SG's organizational entities were supplied with 700 portable radiometric devices and with 2 vehicles with the system of ionizing radiation detectors. Further installation of dosimetric portal monitors at one of the road border crossings on Poland's eastern border is planned.

Transport of nuclear fuel

Shipments of fresh and spent nuclear fuel are subject to license issued by the President of the PAA. In 2022, one shipment (in transit) of fresh nuclear fuel and no shipments of spent nuclear fuel took place on the territory of the Republic of Poland.

Fresh nuclear fuel

Since 2007, fresh nuclear fuel has been imported into Poland 9 times, including: MR type fuel from the Russian Federation – twice, and MC type fuel from France – 7 times, in connection with the operation of the MARIA research reactor at the National Centre for Nuclear Research in Świerk, 14 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).

In 2022 there were 29,450 shipments of radioactive materials and 70,751 packages were transported by road, rail, inland waterways, sea, and air on the territory of Poland, covering a distance of 6,678,863 km. The ten most frequently transported isotopes included: Se-75, Ir-192, Cs-137, Am-241, Co-60, I-131, U-238, Mo-99, Kr-85, Sr-90.

The Radioactive Waste Management Plant also performed 10 shipments of radioactive waste to the National Radioactive Waste Repository in Różan. No accident occurred during the transport of radioactive materials and radioactive waste.

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 when a dosimetric portal monitor is activated, and gives recommendations on further action. The shipments were carried out in accordance with regulations, and 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 Atomic Law Act.

INFOGRAPHICS

Number of inspections carried out by Border Guard units..

	imports into Poland	transit, export from Poland	at airports
TRANSPORT OF RADIOACTIVE SOURCES – 4,272 INSPECTIONS, IN PARTICULAR:	**1,058** inspections	**3,039** inspections	**167** inspections
TRANSPORT OF MATERIALS CONTAINING NATURAL RADIOACTIVE ISOTOPES – 23,718 INSPECTIONS, (IN 155 CASES, THE ITEM DID NOT CROSS POLAND'S BORDER) IN PARTICULAR:	**11,702** inspections	**11,849** inspections	**12** inspections
TRANSPORT OF OTHER UNDECLARED ITEMS (E.G. ITEMS CONTAINING COMPONENTS PAINTED WITH RADIUM PAINT, CONTAMINATED CLOTHING, SCRAP METAL) – 89 INSPECTIONS (IN 3 CASES, THE ITEM DID NOT CROSS POLAND'S BORDER) IN PARTICULAR:	**49** inspections	**35** inspections	**3** inspections

PERSONS AFTER TREATMENT OR EXAMINATION WITH RADIOACTIVE ISOTOPES – 967 INSPECTIONS.

967 inspections

IN 2022, BORDER GUARD UNITS CARRIED OUT: **29,110 inspections**

7 Radioactive waste

Fot. PAA

Radioactive waste management

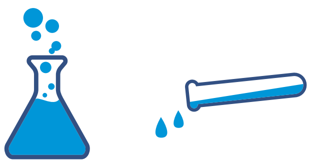
Radioactive waste is produced from activities involving radioactive sources in medicine, industry and research facilities and during the operation of a research reactor. This waste exists in a gaseous, liquid, and solid form.

Radioactive waste may appear in the following states:

SOLID WASTE

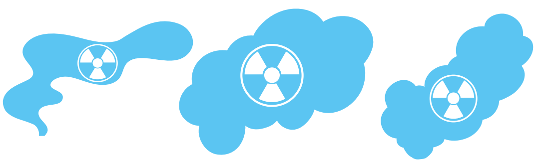
includes used sealed radioactive sources, personal protective equipment contaminated with radioactive substances (rubber gloves, protective clothing, footwear), laboratory materials and equipment (glass, pieces of apparatus, lignin, cotton wool, foil), used tools and elements of technological equipment (valves, duct 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-, intermediate-, and high-level radioactive waste, classified into three subcategories: 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 performing activities involving exposure to ionizing radiation must plan and perform 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. segregated, reduced in volume, 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 disposal facilities, 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 waste management safety, including supervision over waste disposal safety performed by ZUOP is exercised by the President of the PAA.

ZUOP owns facilities at the site of the Nuclear Centre in Świerk and is equipped with radioactive waste treatment installations. The radioactive waste in Poland is disposed at the National Radioactive Waste Repository (KSOP), situated in Różan (Maków district). KSOP is a near surface disposal facility, 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 disposal facility (named otherwise geological or underground). KSOP was established in 1961 and is the only facility of this kind in Poland.

In 2022, ZUOP received 259 orders from 176 institutions to collect radioactive waste. Table 3 presents the quantities of collected radioactive waste (including the waste generated at ZUOP).

After treatment, the radioactive waste is placed in drums of 200 and 50 dm3 capacity, and then it is handed over in solidified form for disposal.

128 drums of 200-litre capacity with treated radioactive waste and 5 pieces of atypical and large-diameter drums of a total activity of 7.4 GBq (figures as of December 31, 2022) were handed over to KSOP in 2022.

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

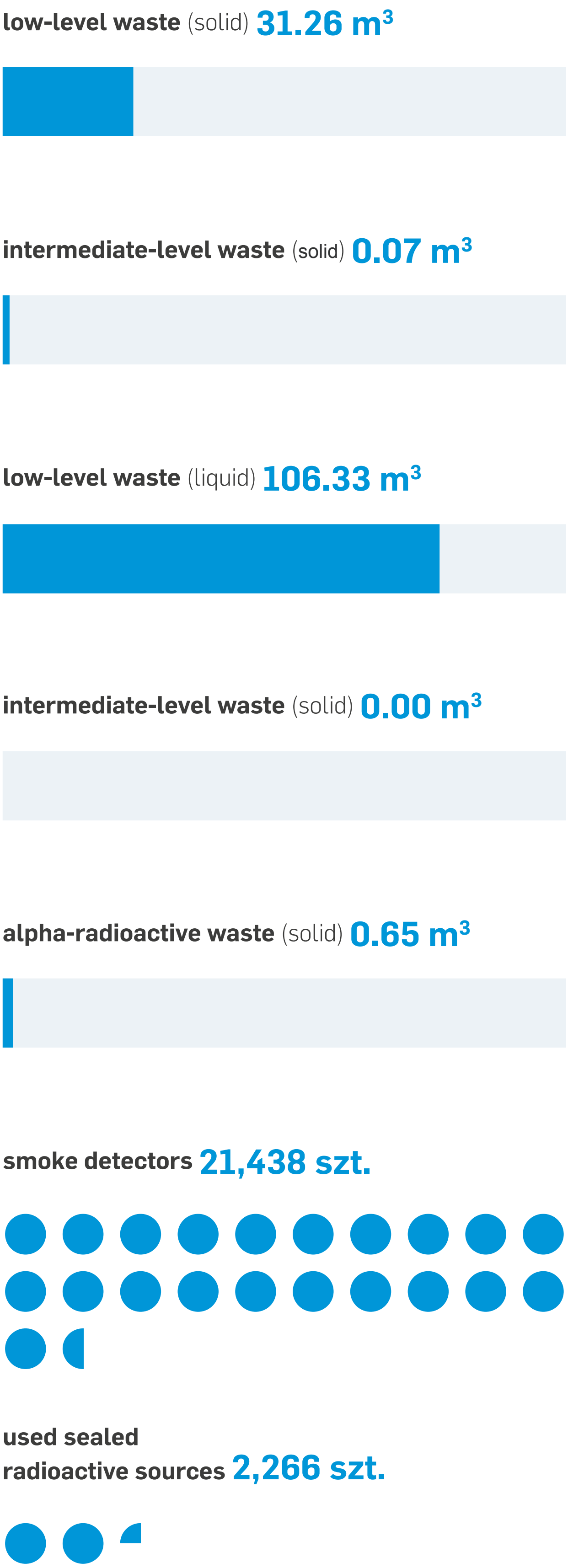
TABLE 3.

Quantities of radioactive waste collected by ZUOP in 2022.

WASTE SOURCES	SOLID WASTE [m^3]	LIQUID WASTE [m^3]
Outside the Nuclear Centre in Świerk (medicine, industry, scientific research)	10.06	0.39
National Centre for Nuclear Research, POLATOM	16.16	0.84
National Centre for Nuclear Research + MARIA Reactor*	2.97	33.86
Radioactive Waste Management Plant	2.14	71.24
Total:	**31.33**	**106.33**

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

FIGURE 8.
The collected solid and liquid waste by type and category may be broken down as follows:



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

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

- License no. D-14177 of December 17, 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 January 15, 2002 for the operation of the KSOP in Różan,
- License no. 1/2016/ZUOP of December 15, 2016 for the performance of exposure-related activities involving the storage of radioactive waste at the Storage Facility no. 8A at the National Radioactive Waste Repository in Różan,
- License no. D-19866 of July 4, 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 National Radioactive Waste Management Plant in Otwock-Świerk).

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

Nuclear regulatory inspectors from the PAA in 2022 conducted three inspections of the radioactive waste management at ZUOP, including the following:

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

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

Summary

The amount of radioactive waste handed over to ZUOP in 2022 was at a level comparable to previous years.

In accordance with the report submitted by ZUOP, in 2022 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 KSOP and ZUOP did not show any hazard to the public and environment.


Fot. PAA

INFOGRAPHICS
Classification of radioactive waste.

RADIOACTIVE WASTE

The following categories of radioactive waste are distinguished:

low-level waste

intermediate-level waste

and **high-level waste**

classified in three sub-categories:

transitional

short-lived

and **long-lived**

NUCLEAR MATERIAL AND SPENT NUCLEAR FUEL

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).

USED SEALED RADIOACTIVE SOURCES

constituting an additional 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

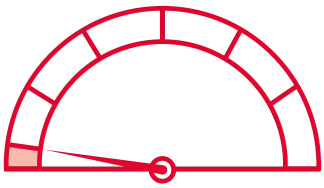
Fot. PAA

Exposure of the population to ionizing radiation

For members of the public, the dose limit, expressed as an effective dose, amounts to 1 mSv per calendar year.

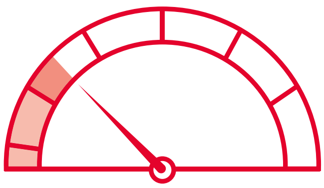
For occupational workers with exposure to ionizing radiation and for school students, tertiary education students, and apprentices aged 18 or older, the dose limit is 20 mSv per calendar year. In the case of workers, this dose may be exceeded up to 50 mSv per year, if such an excess is authorized by 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 population applies to school students, tertiary education students and apprentices under the age of 16.



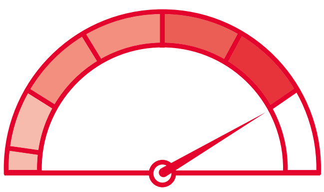
1 mSv

for members of the public



6 mSv

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



20 mSv

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 devices, 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 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.

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INFOGRAPHICS

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

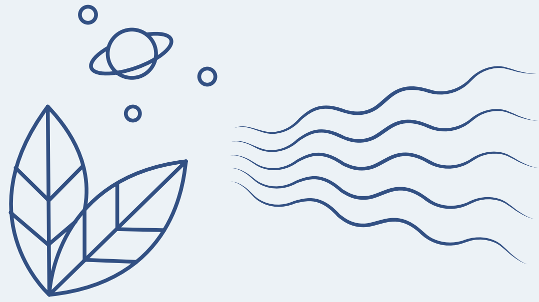
4.39 mSv

annual total effective dose of ionizing radiation received per capita in Poland in 2022

NATURAL SOURCES

58.76%

2.58 mSv



222
Rn
86

RADON

27.6% 1.20 mSv

GAMMA RADIATION

15.83% 0.70 mSv

COSMIC RADIATION

7.29% 0.32 mSv

INTERNAL RADIATION

6% 0.26 mSv

Tn

THORON

2.28% 0.10 mSv

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

exposure dose to ionizing radiation from consumer goods (e.g. TV, isotope smoke detectors).

approx. 0.092 mSv

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

ARTIFICIAL SOURCES

41.24%

1.51 mSv

MEDICAL DIAGNOSTICS

41.02% **1.80 mSv**

This overall dose predominantly includes doses received during tests performed with the use of:
computer tomography **1.40 mSv,**
conventinal radiography and fluoroscopy **0.20 mSv.**

For other diagnostic examinations, the single doses are as follows:
mammography **0.02 mSv,**
X-ray **1.20 mSv,**
chest radiograms **0.11 mSv,**
spinal column and lung scans **3 mSv – 4.30 mSv**.

DEFECTS

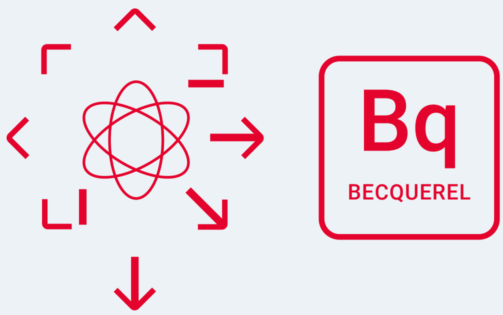
0.1% **0.005 mSv**

OTHER

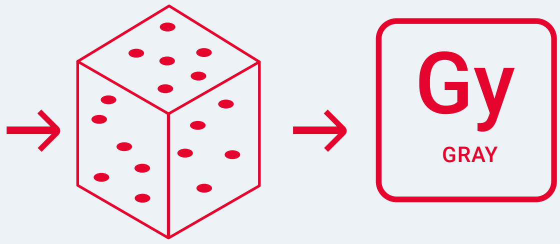
0.1% **0.005 mSv**

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 members of the public 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:

- deffective 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 2022, this value, taking into account radiation from natural and artificial sources of ionizing radiation (including those used in the medical diagnostics), was 4.39 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 population to ionizing radiation sources

Exposure to the following natural sources constitutes 58.76% of the total effective dose and amounts to approx. **2.58 mSv per year:**

- radonu i produktów jego rozpadu,
- promieniowania kosmicznego,

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.

- 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 2022, 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 1.80 mSv.

This dose consists primarily of doses received during examinations in which computed tomography was used (1.40 mSv) and conventional radiography and fluoroscopy (0.20 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 performed examinations these values are as follows[2]:

- chest radiographs – approx. 0.11 mSv,
- spinal column and lung scans from 3 mSv to 4.30 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 per capita effective dose , 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 fruit and game, despite their elevated cesium 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 2022 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 radiation emitted by artificial radionuclides used or coloring 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 per capita dose received from these devices is systematically reduced.

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.

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”)

amounted to approx. 0.002 mSv in 2022, constituting 0.01% of the dose limit (for an occupationally exposed person).

In 2022, 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 members of the public of 1 mSv per year, and only 0.22% of the per capita dose from all sources of ionizing radiation.

In light of the radiation protection regulations adopted worldwide and in Poland, the per capita radiation exposure in Poland in 2022, resulting from the use of artificial sources of ionizing radiation, is 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 entities, and entities performing 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 carried out on the basis of the results of environmental measurements or individual dosimetry, performed by a specialized, accredited radiometric laboratory. The following accredited laboratories conducted individual dose measurements and assessments at the request of the concerned organizational entities in 2022:

- 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 performing 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. 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 dose register 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 group in category B is the medical staff of diagnostic X-ray laboratories.

Approximately 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 in which 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 to 20 mSv in a calendar year for workers and only in exceptional situations may be exceeded up to 50 mSv per year if earlier approved by the authority competent to issue a license, receive a registration or notification set out in Article 4 Section 1 or 1a of the Atomic Law Act. 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 May 25, 2021 on requirements for the registration of individual doses (Dz. U. item 1053).

The data on doses for workers classified by heads of individual entities 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). Exceptionally, in cases of exposure to contamination by dispersive radioactive substances called open sources, an assessment of the internal contamination committed dose is performed.

INFOGRAPHICS

Statistics of individual annual effective doses of workers assigned to category A for exposure to ionizing radiation in 2022.

NUMBER OF WORKERS	RECEIVED ANNUAL EFFECTIVE DOSE [mSv]
1,516	<6
73	6 ÷ 15
4	15 ÷ 20
1	20 ÷ 50
0	>50,0

* According to registrations submitted to the Central Dose Register by April 30, 2023.

Since the creation of the Central Dose Register, i.e. from 2002 to April 30, 2023, a total of 7,749 individuals were registered. Over the past four years, the data for 2,975 of those registered were updated. In 2022, the data of 1,630 people were updated. As a result of the proper radiation protection, 1,516 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 78 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 Summary data for 2022 on exposures of category A workers reported to the Central Dose Register by individual organizational entities 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 95.1% in 2022, and the percentage of workers who did not exceed the limit of 20 mSv/year was 99.9%.

Summary

A single case of exceeding the effective dose limit (20 mSv per year) was recorded. One case of exceeded dose limit for the eye lens was also recorded. The problem involved a surgical radiologist. A new annual dose limit for the eye lens, 20 mSv per year, has been effective since the implementation of the new directive 2013/59/Euratom. Exceeding this dose poses the risk of a post-radiation deterministic effect in the form of lens opacity or cataracts.

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/m3.

The provisions of the Act of June 13, 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 concentrations 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 June 13, 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 excavations.

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

WSKAŹNIK ZAGROŻENIA	KLASA A*	KLASA B*
Potential energy concentration a of short-lived radon decay products ($C\alpha$), µJ/m^3	$C\alpha > 2.5$	$0,5 < C\alpha \leq 2.5$
Radiation kerma γ (K), µGy/h	$K > 3.1$	$0,6 < K \leq 3.1$
Specific activity of radium isotopes in sediments (C_{RaO}), kBq/kg	$C_{RaO} > 120$	$20 < C_{RaO} \leq 120$

* The values provided 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.

The suggested values result from the developed and implemented model for the calculation of committed 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 excavations,
- dose rate of gamma radiation at the place of work in excavation mining,
- radium concentrations in mine waters,
- radium concentrations 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 excavations (featuring possibility of obtaining an annual effective dose exceeding 1 mSv), special methods of work organization have been introduced to prevent exceeding the dose limit of 20 mSv.

Table 5 shows the number of mines which (on the basis of determined exceedances of values of particular radiation hazard factors) may feature excavations classified as class A and B radiation hazard. It should be emphasized that the classification of a particular category of radiation-prone excavations 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 excavations included in particular radiation hazard categories is actually lower.

LEGAL BASIS

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

- Regulation of the Minister of Energy of November 23, 2016 on requirements for underground mining facilities (Dz. U. of 2017, item 1118, as amended),
- Regulation of the Minister of Environment of January 29, 2013 on natural hazards in mines (Dz. U. of 2021, item 1617), which defined excavations 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 December 31, 2022, was: 75,470 persons.

Furthermore, the percentage of people working in excavations 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 excavations, type of working, hazard source, and the number of mining personnel working there. The hazard assessment performed by the Central Mining Institute for hard coal mines has shown that in one mine class A excavations were active (hazard applies to 0.4% of the total number of employed miners), and in nine mines – class B excavations (hazard applies to 2.5% of the total number of employed miners). Mining excavations with a slightly increased natural radiation background (but below the level corresponding to class B) employ 8% of the total number of employed miners, while 89% of miners work in non-hazardous excavations. This in particular applies to sites that may have waters and sediments with elevated radium isotope concentrations, elevated alpha potential energy concentrations, and higher than average gamma dose rates.

In 2022, the Central Mining Institute carried out 3,684 measurements of the concentrations of potential alpha energy of short-lived radon decay products, 867 measurements of exposure to external gamma radiation in underground mines and 544 analyses of the radioactivity of mine waters collected in underground excavations of hard coal mines and 129 analyses of the concentrations of radioactive nuclides in samples of sediment deposited from underground water.

In 2022, the measurements of individual doses of gamma radiation were carried out in seven hard coal mines. In the remaining mines no such measurements were carried out. Controlled persons, 97 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 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 2022, the dose did not exceed 6 mSv (category A) at all (assuming the declared working time).

Based on the control of radiation hazards carried out, it was stated that under unfavorable conditions (lack of appropriate ventilation) it may occur in almost every mine working. The assessed value of the miner's potential (maximum) dose in 2022 was 69.36 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. With a realistic assumption of the working time

of 750 hours, the maximum dose is approx. 10.8 mSv.

The Silesian Centre for Environmental Radioactivity of the Central Mining Institute, has available precise information about the working time in individual excavations only for calculating effective committed doses. For the remaining radiation hazard factors, the hazard magnitude was analyzed making certain assumptions: nominal working time of 1,800 hours and frequently reported working time in mine waterways of 750 hours. Estimates made on the basis of such values may therefore deviate significantly from the actual situation.

In 2022, the maximum annual additional effective dose, related to each hazard source, was:

- for short-lived radon decay products E_α = 2.7 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 mine waterways of 750 hours),
- and, expressed as effective loading dose, E_{Ra} = 10.06 mSv for penetration of radium isotopes (for the declared working time equal to 1,125 hours per year).

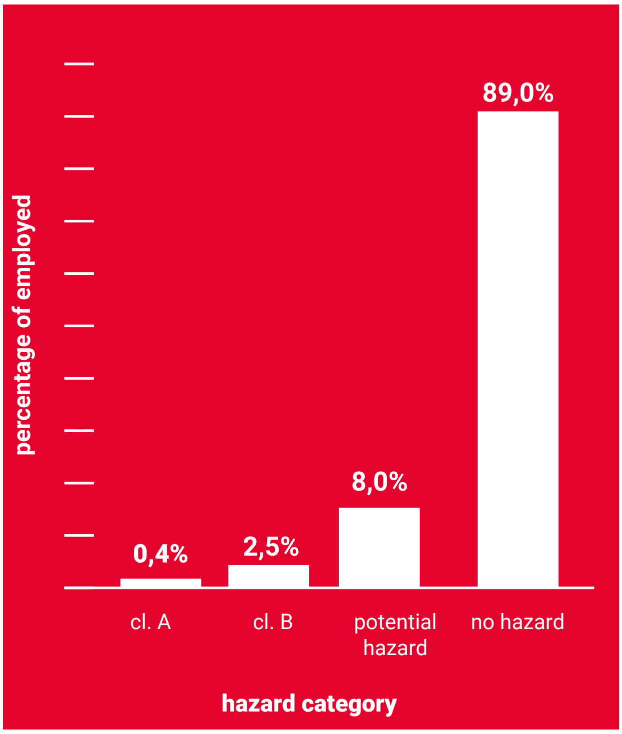
Pursuant to the requirements of the Atomic Law Act, concerning controlled and supervised areas, category B (supervised area) underground excavations should be reclassified to category A (controlled area) in cases where there is a possibility of contamination spreading, during the work related to removal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

TABLE 5.
Number of hard coal mines with radiation-prone excavations (GIG)

HAZARD CLASS	A	B
Number of mines	1	9
Hazard from short-lived products of radon	-	3
Decay γ radiation hazard	1	4
External γ radiation (individual dosimetry)	-	2

FIGURE 9.

Percentage of hard coal miners employed in excavations included in particular radiation hazard classes. Employment as of December 31, 2022 – 75,470 persons



The analysis of the measurement results against the data from recent years has shown that class B excavations, 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). Excavations 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 2022, 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 2022, 10 mines had excavations classified as Class A and B radiation hazards.
- Last year, in 2022, individual doses of gamma radiation were measured in two 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 was lower than 6 mSv (category B). The dose did not however exceed 6 mSv at all.

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

In nuclear facilities and in other entities 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

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

WThe required training courses are conducted by organizational entities authorized 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 2022, the training courses were attended by 727 persons in total. Table 6 provides the information on entities that delivered such training in 2022.

Two examination boards were working in 2022, appointed by the President of the PAA, based on Article 7[1] Section 1 and Article 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 2022, due to COVID-19 counter-pandemic constraints, 41 examinations were carried out (10 for IOR authorization, 31 for an authorization to hold a position of significant importance for ensuring nuclear safety and radiation protection), which were attended by 985 persons in total. Compared to 2021, the number of people taking training and exams was higher.

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 the 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 Article 15zzzzn of the Act of March 2, 2020 on special solutions related to prevention, counteraction and combating 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 2022 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 TRAININGS CONDUCTED	NUMBER OF TRAINING PARTICIPANTS	NUMBER OF GRANTED AUTHORIZATIONS*
Radiation protection officer	Central Laboratory for Radiation Protection	5	120	72
Position of significant importance for ensuring nuclear safety and radiation protection	Association of Radiation Protection Officers	12	266	435
	Central Laboratory for Radiation Protection	8	103	
	National Oncology Institute (Krakow Branch)	1	27	
	National Oncology Institute (Gliwice Branch)	2	49	
	Henryk Niewodniczański Institute of Nuclear Physics	1	23	
	National Centre for Nuclear Research	9	139	

* Also includes individuals who received training prior to 2022 or were eligible to take the exam without attending a training

INFOGRAPHICS

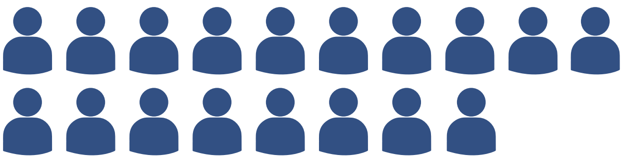
Number of persons authorized as radiation protection officers and entitled to hold a position of significant importance for ensuring nuclear safety and radiation protection.

507 persons

obtained the radiation inspector officer authorization and authorization to hold positions significant for ensuring nuclear safety and radiation protection.

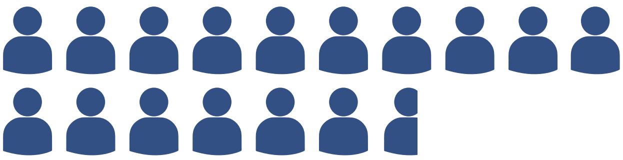
426 persons

As a result of passing the examination and meeting other authorization requirements, 72 persons obtained a radiation protection officer authorization, whereas 426 persons obtained an authorization for positions of significant importance for nuclear safety and radiation protection, including:



175 persons

authorized as non-medical accelerator operators



167 persons

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

84 persons

authorized as operators of brachytherapy equipment containing radioactive sources

9 persons

Furthermore, **9 persons** obtained the authorization to hold positions of significant importance for ensuring nuclear safety and radiation protection in the organizational entity performing activities involving the construction, commissioning, operation, or decommissioning of a nuclear facility in the field of: **research reactor operator – 2 persons, research reactor dosimetrist - 2 persons, senior research reactor dosimetrist - 1 person, deputy director for nuclear safety and radiation protection at an organizational entity with a research reactor - 1 person, specialist for nuclear material accountancy - 2 persons, manager of a radioactive waste repository - 1 person.**

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:

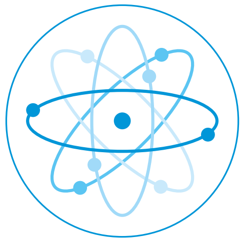
- **nationwide** – to obtain data needed to assess the radiation situation throughout the country under normal conditions and in emergency situations. It serves as a basis for a study of long-term changes in the radiation situation of the environment and food products;
- **local** – allows to obtain data from areas where activities are (or were) performed 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.

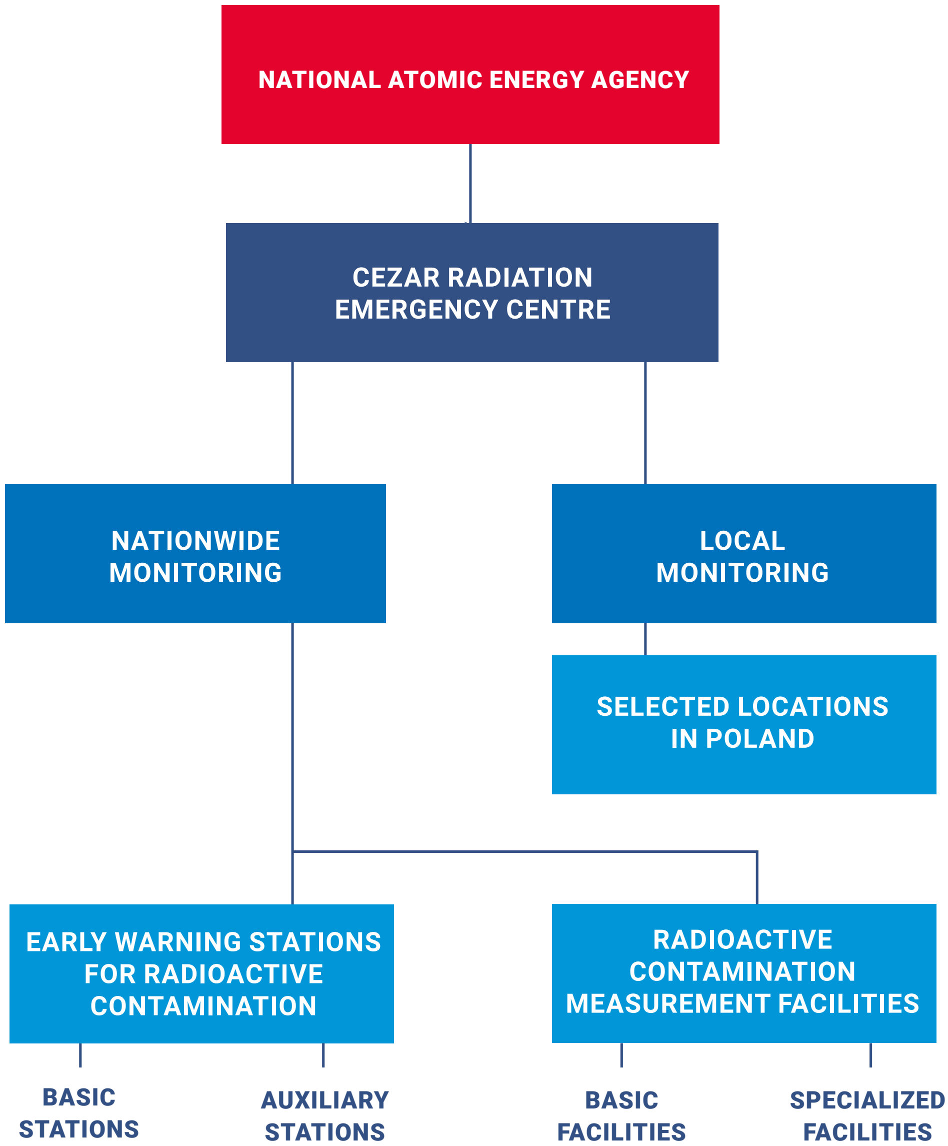
Fig. 10 presents a general diagram of this system structure.



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 website https://monitoring.paa.gov.pl/maps-portal/ – 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 implementing intervention measures, 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:

- **2 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. A total of 13 new stations were installed and put into operation in 2022 (2 stations were also installed in 2022 and put into operation in 2023 - Krasnystaw, Horodyszcze). Further expansion of the entire station network is planned for the coming years.

- **ASS-500 stations** owned by the Central Laboratory for Radiological Protection, which carry out:
  - continuous collection of atmospheric aerosols on filters,
  - spectrometric determination of individual radioisotopes in half-weekly samples (the frequency of determinations has been increased compared to previous years due to potential threats caused by the situation in Ukraine).
- **9 IMiGW stations**, owned by the Institute of Meteorology and Water Management, which carry out:
  - 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:

- 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).

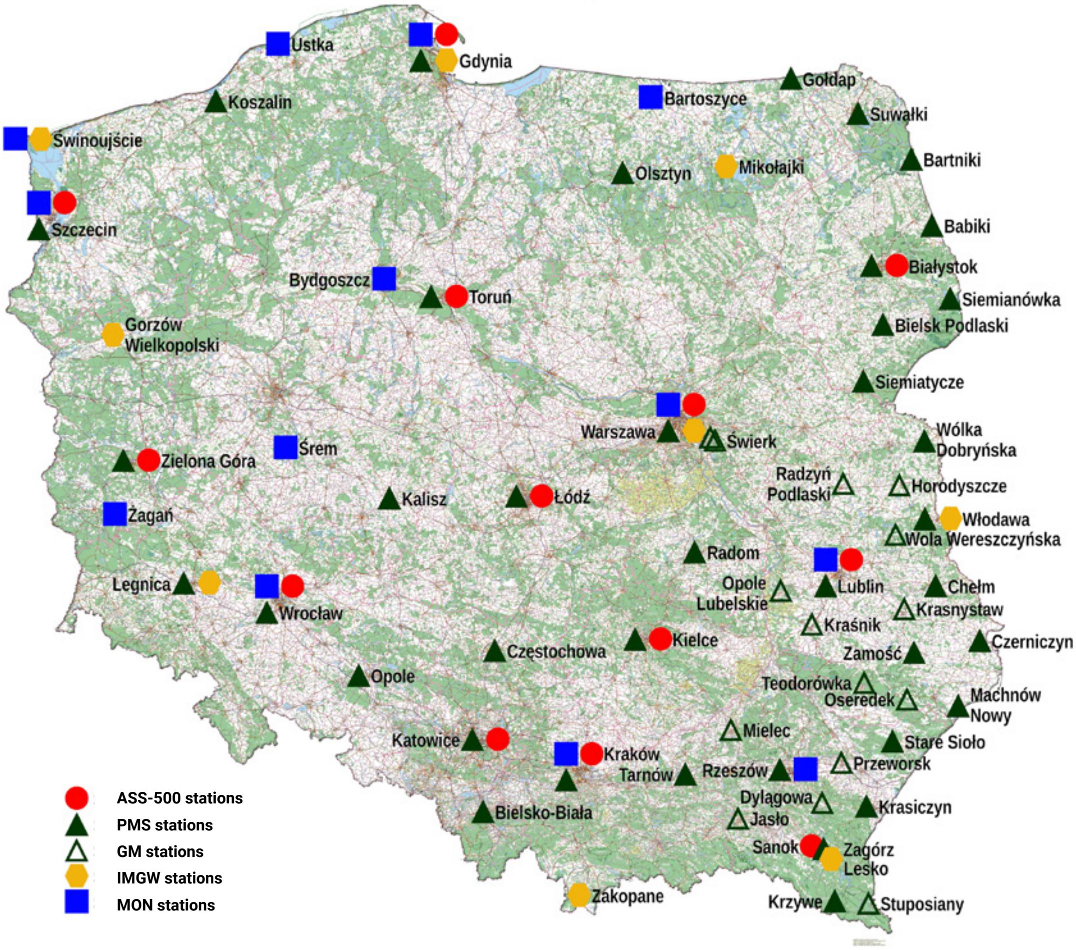
Facilities conducting measurements of radioactive contamination of the environment and foodstuffs

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

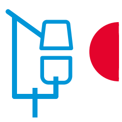
- 16 basic facilities, operating at Voivodeship Sanitary and Epidemiological stations and cooperating with subordinate stations carrying out:
  - determination of total beta activity in samples of milk and food products (once a quarter),
  - determination of the Cs-137 and Sr-90 content in selected agricultural and food products (twice a year on average),
- specialized facilities, which carry out more extensive contamination analyses of environmental samples.

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

Nationwide radiation monitoring



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



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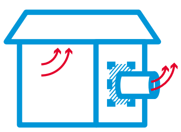
● ASS-500 stations.... The ASS-500 high-performance atmospheric aerosol sampling stations are designed to control radioactive air contamination. The station pumps air through a special filter at an average speed of about 500 m3/h. Aerosols are collected on the filter and subject to a detailed laboratory analysis that can detect even trace amounts of radioactive isotopes present in the air. In normal circumstances, the filter is replaced once a week.



⬢ IMiGW stations .... Stations at the Institute of Meteorology and Water Management measure the dose rate, atmospheric aerosol activity and total fallout.

■ MON stations .... Stations of the Ministry of National Defense carry out gamma radiation dose rate measurements (auxiliary stations).

Basic facilities operating at Sanitary and Epidemiological Stations – conduct measurements of the presence of radioactive isotopes in agricultural and food products

The current results of monitoring of the ionizing radiation dose rate may be found at:
https://monitoring.paa.gov.pl/maps-portal/ 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	SURROUNDING AREA
Air (aerosols)	γ spectrum	●	●
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	●	
Service water	total α total β γ spectrum Sr-90 HTO	●	
Sanitary wastewater	total γ total β γ spectrum Sr-90 total β	●	●
Wastewater from treatment plant	total α, β total γ γ spectrum Sr-90 HTO	●	
Milk	γ spectrum		●
Cereals	γ spectrum		●
Grasses	γ spectrum	●	●
Soils	γ spectrum	●	●
Sludge	Sr-90 γ spectrum	●	●

Summary

The data obtained in 2022 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. The radioactivity of wastewater and drainage and rainwater discharged from the site of the Nuclear Centre in Świerk in 2022 was much lower than the applicable limits.

Nuclear Centre in Świerk

The radiation monitoring of the environment and the radiation 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 online 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 offline 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.

Furthermore, 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 2022, 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.

Furthermore, measurements ordered by the President of the PAA are carried out in the vicinity of the repository. The range of the measurements in 2022 was as follows:

- measurements of radioactive substances in spring water (measurement of gamma spectrum, measurement of total cesium (Cs-137 and Cs-134) concentrations, measurement of tritium and Sr-90 concentrations);
- measurement of radioactive substances in groundwater (piezometers; measurement of total beta activity, of potassium K-40 and tritium concentrations);
- 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

The "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 2022:

- 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 excavations);
- determination of radon concentration in water from public intakes, in water supplying residential premises, and in surface and underground waters (outflows from underground excavations).

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 for radioactive contamination under the system of the Council of the Baltic States

The scope and format of data provided by Poland as part of 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 ('voivodeship emergencies),
- extending beyond the territory of the voivodeship 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 organizations and neighboring 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).

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)[1] fulfils a number of functions, such as: emergency service of the President of the PAA, 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).

INFOGRAPHICS

Classification of radiation emergencies

On-site emergencies

Remedial actions managed by **the head of the organizational entity** according to the on-site emergency response plan.

Voivodeship emergencies

Remedial actions managed by **Voivode in cooperation with the State Voivodeship Sanitary Inspector** in accordance with the voivodeship emergency response plan.

National emergencies

Remedial actions managed by **the minister competent in internal affairs** with aid from the President of the PAA.

Radiation emergencies in Poland

The Dosimetry Team managed by the President of the PAA was dispatched to Mirków (Dolnośląskie Voivodeship) to support local services in a radiation emergency involving the disassembly of a chromatograph component containing radioactive material.

After taking measurements, radioactive contamination was found inside the building and on the property. The sites have been secured from outside access. The Radioactive Waste Management Plant has decontaminated areas where contamination was found. Those involved in the emergency were referred for specialized testing to determine exposure and possible absorption of the radioactive substance into the body.

Furthermore, the Dosimetry Team managed by the President of the PAA was dispatched 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 public utility company and suspected presence of radioactive substances on a private property.

On-duty CEZAR officers provided 672 consultations (not related to the elimination of radiation emergencies and their consequences), and most of them (580 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, as well as border crossing by persons subject to diagnostics or treatment with the use of radiopharmaceutical products. Furthermore, on-duty CEZAR officers provided 62 consultations to other institutions or individuals.

On-duty CEZAR officers received 9,304 notifications in total (e.g. reports on the radiometric control, messages provided by the official information exchange channels at the international level).

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

One radiation emergency was registered in Poland in 2022

Radiation emergencies outside the country

The National Contact Point has received, through the USIE Radiation Emergency Information Exchange System, a notification of an event in Japan, which has been classified as level 3 on the INES scale. It concerned the significant exposure of staff to ionizing radiation.

Also 31 reports on incidents related to ionizing radiation sources or nuclear facilities, mainly unplanned exposures of staff 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 through the USIE and ECURIE systems.

Due to the situation in Ukraine, it should be emphasized that no event in that country has had an impact on the health and life of the population, or on the environment in Poland.

No radiation emergency registered abroad in 2022 caused a threat to people and the environment in Poland.

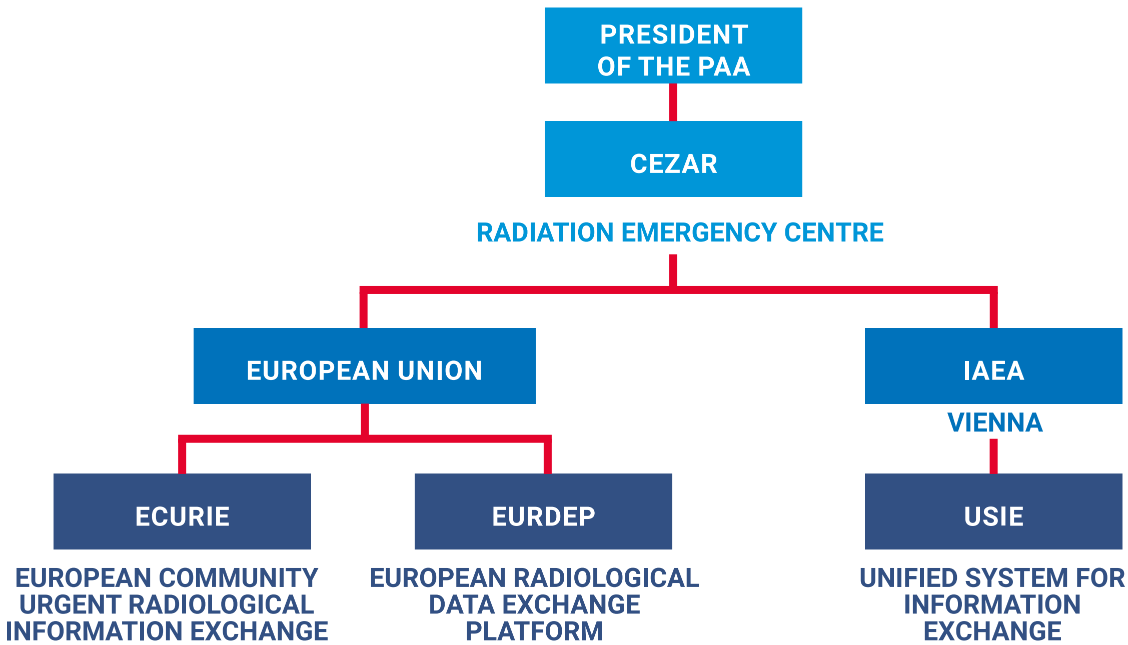
Summary

One radiation emergency was registered in Poland in 2022. The effects of the emergency have been dealt with by the Radioactive Waste Management Plant and the Voivodes' services. The Dosimetry Team of the President of the PAA carried out measurements at the site, confirming effective decontamination. The emergencies recorded worldwide did not affect the health and life of the population and the environment in Poland.

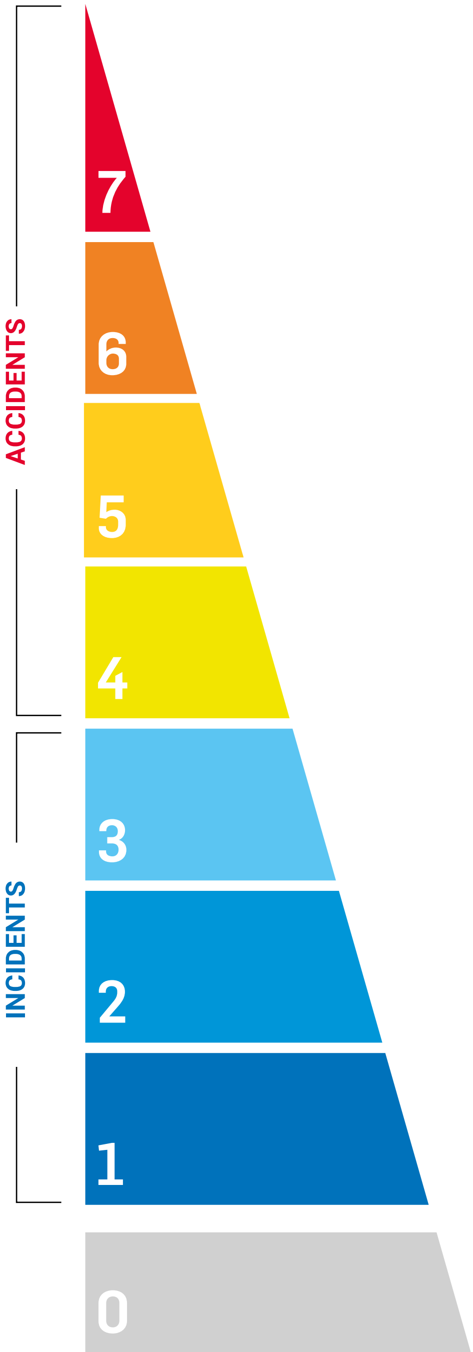
Situations which are not radiation emergencies did not pose a threat to the health or life of the population or to the environment. These were incidents detected by dosimetric portal monitors operated by the Border Guard or located at the entrances to enterprises dealing with metal trade or municipal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

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

INTERNATIONAL NOTIFICATION AND INFORMATION EXCHANGE SYSTEMS



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 significant amounts of radioactive substances into the environment after the explosion of a high-level radioactive waste tank

5 ACCIDENT WITH WIDER CONSEQUENCES

Goiania, Brazil 1987

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

EJ Three Mile Island, 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, Indie 2010

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

3 SERIOUS ACCIDENT

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

Exceeding usable dose limits by 2 nuclear power plant workers

Olkiluoto-1 NPP, Finland 2008

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

0 BELOW SCALE

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 the country

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 2022 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 concentrations of artificial isotopes (mainly Cs-137), of which the Chernobyl accident and earlier nuclear weapon tests were the source, are 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 2022 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 2022 in Poland its average daily values ranged from 38 to 135 nSv/h, with an annual average of 78 nSv/h.

W In the surroundings of the Nuclear Centre in Świerk, the values of ambient dose equivalent rate ranged from 89 to 133 nGy/h (on average 105 nGy/h), and in the KSOP surroundings – from 78 to 130 nGy/h (on average 105 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 2022 (PAA)

* Dose rate obtained from early warning stations for radioactive contamination in 2022 (PAA)

* Station symbols defined in chapter "National radiation monitoring". The 13 stations measuring ambient dose equivalent rate, which were installed at the end of 2022, were not included.

*** Station installed on September 20, 2022

STATIONS *	PLACE (LOCATION)	RANGE OF AVERAGE DAILY DOSE RATE [NSV/H]	ANNUAL AVERAGE [NSV/H]
PMS	Babiki	64-108	82
	Bartniki	62-119	83
	Białystok	62-104	71
	Bielsk Podlaski**	60-81	71
	Bielsko-Biała	66-111	91
	Chełm	44-77	57
	Czerniczyn	65-109	86
	Częstochowa	38-105	64
	Gdynia	101-111	104
	Gołdap	56-95	66
	Kalisz	60-80	65
	Katowice	74-108	87
	Kielce	77-103	89
	Koszalin	69-93	82
	Kraków	110-135	118
	Krasiczyn	62-107	81
	Krzywe	60-113	85
	Legnica	72-108	77
	Łódź	84-106	89
	Lublin	89-112	101
	Machnów Nowy	49-86	62
	Olsztyn	48-72	56
	Opole	49-92	64
	Radom	48-72	57
	Rzeszów	70-106	89
	Sanok	68-109	89
	Siemianówka	43-80	53
	Siemiatycze	55-88	63
	Stare Sioło	49-83	65
	Suwałki	73-98	84
	Szczecin	46-76	53
	Tarnów	62-99	78
	Toruń	47-70	51
	Warszawa	81-102	90
	Włodawa	44-82	57
	Wólka Dobryńska	51-88	65
	Wrocław	68-97	77
	Zamość***	54-91	70
	Zielona Góra	84-98	88
IMiGW	Gdynia	70-119	84
	Gorzów	73-102	84
	Legnica	76-119	89
	Lesko	72-125	97
	Mikołajki	73-103	87
	Świnoujście	63-85	69
	Warszawa	57-89	69
	Włodawa	51-85	66
	Zakopane	72-129	103

Atmospheric aerosols

In 2022, the artificial radioactivity of ground-level aerosols, determined from the measurements made at 13 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 0.11 to 12.82 μBq/m³ (on average 0.63 μBq/m³). Average concentrations of I-131 radionuclide in this period ranged from less than 0.08 to less than 3.74 μBq/m³ (on average 0.89 μBq/m³), whereas the mean values of concentrations of naturally occurring radionuclide Be-7 amounted to a few thousand μBq/m³.

Figures 11 and 12 present the average annual concentrations of Cs-137 in atmospheric aerosols in the years 2011-2022 for the entire Poland and Warsaw, respectively.

Measurements of the radioactive isotope concentrations 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 2022 at the NCBJ site are presented in Table 9, while the average annual concentrations of Cs-137 isotope in the air at the KSOP site in 2022 was below the detection limit.

FIGURE 11.

Average annual concentrations of Cs-137 in aerosols in Poland in 2011-2022 (μBq/m³; PAA, CLOR data)

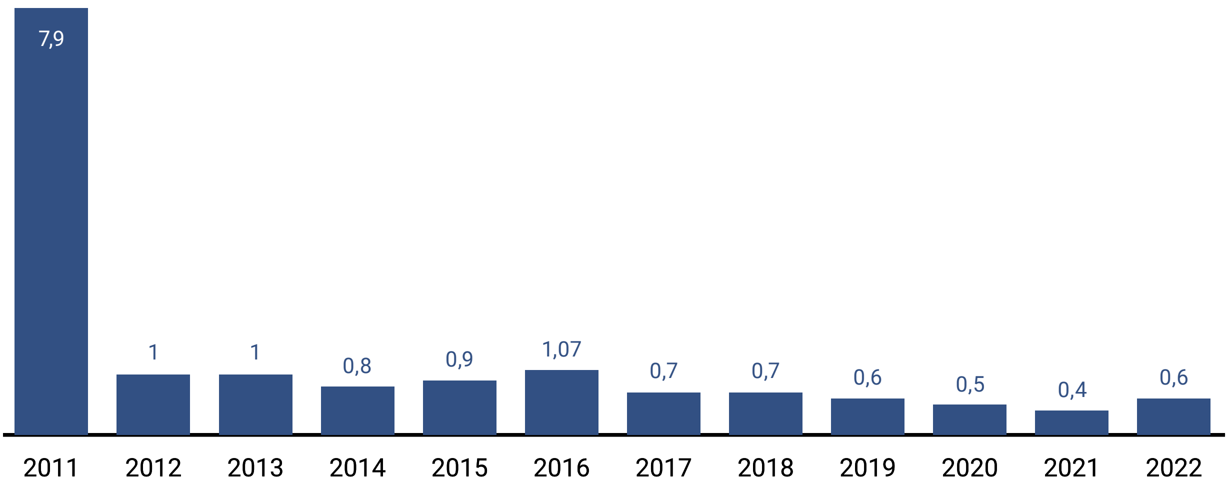


FIGURE 12.

Average annual concentrations of Cs-137 in aerosols in Warsaw in 2011-2022 (μBq/m³; PAA, CLOR data)

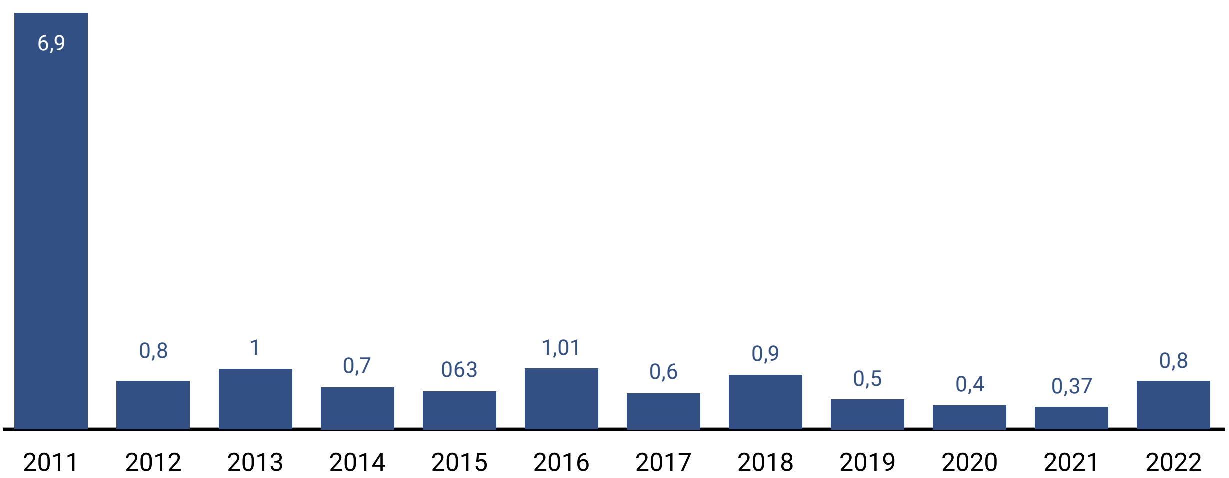


TABLE 9.

Summary of weekly measurement results of radionuclide concentrations in atmospheric aerosols at the Świerk site and its surroundings in 2022 (μBq/m³; PAA, NCBJ data)

	ON-SITE		WÓLKA MLĄDZKA	
	I-131 [μBq/m³]	Cs-137 [μBq/m³]	I-131 [μBq/m³]	Cs-137 [μBq/m³]
Average	8.07	1.67	2.33	1.56
Minimum	0.81	0.51	1.20	0.54
Maximum	42.7	5.3	9.70	5.50

TABLE 10.

Mean Cs-137 and Sr-90 activity and mean beta activity in total annual fallout in Poland in 2008-2022 (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
2022	0.4	0.1	0.32

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 2022 were at the level observed in the previous years.

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

In 2022, 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). Average concentrations of mentioned isotopes: for Cs-137 - 20.6 Bq/m³ – in surface layer waters - and 17.6 Bq/m³ – bottom waters, 3.12 Bq/m³ for Ra-226 and a few thousand Bq/m³ on average for K-40 and do not differ from the previous years' results.

The last measurement cycle of radionuclide concentrations in river and lake water samples was completed in 2022. In June 2023, the measurement results are available on the website of the Chief Inspectorate for Environmental Protection (https://www.gov.pl/web/gios/monitoring-promieniowania-jonizujacego).

The total Cs-134 and Cs-137 content in open water samples, taken in 2022 from sampling points located near the Nuclear Centre in Świerk, were on average:

- the Świder River: 2.55 mBq/dm³ (upstream from the Centre) and 2.27 mBq/dm³ (downstream from the Centre),
- waters from the wastewater treatment plant in Otwock discharged to the Vistula River: 7.11 mBq/dm³.

The Sr-90 concentrations in bulk samples of the river water taken from the surroundings of the National Centre for Nuclear Research in Świerk: 8.60 (upstream from the Centre) and 4.18 mBq/dm³ (downstream from the Centre).

The tritium concentration in open water samples taken in 2022 from sampling points located near the Nuclear Centre in Świerk was on average:

- the Świder River: 0.6 mBq/dm³ (upstream from the Centre) and 0.9 mBq/dm³ (downstream from the Centre),
- waters from the wastewater treatment plant in Otwock discharged to the Vistula River: 0.9 Bq/dm³.

Ground waters – local monitoring

The results of measurements of radioactive isotope concentrations in waters conducted as part of the local monitoring in 2022 do not substantially differ from the previous years' results.

Nuclear Centre in Świerk

In 2022, the average concentrations of radioactive cesium and strontium isotopes in well waters of the farms situated in the Świerk Centre surroundings amounted to 3.63 μBq/dm³ for cesium isotopes (Cs-134, Cs-137) and 18.22 μBq/dm³ for Sr-90 on average. The concentrations of tritium (H-3) were also determined and averaged 1.62 μBq/dm³.

National Radioactive Waste Repository (KSOP) in Różan

The concentrations of radioactive isotopes Cs-137 and Cs-134 in spring waters in the vicinity of the National Radioactive Waste Repository in Różan averaged 1.95 mBq/dm³.

In 2022, tritium concentrations were also investigated in groundwater in the vicinity of KSOP in Różan, and averaged less than 0.5 Bq/dm³.

Former uranium ore mining and processing sites

The recommendations of the World Health Organization (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 to interpret the measurement results. They state that, in principle, the total alpha activity of drinking water should not exceed 100 mBq/dm³, while the beta activity should not exceed 1,000 mBq/dm³. 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 28 water samples in former uranium ore mining sites with the following results:

- ublic intakes of drinking water:
  - total alpha activity
    - from 2.8 to 48.1 mBq/dm³,
  - total beta activity
    - from 31.2 to 213.0 mBq/dm³.
- waters flowing from mine workings (drifts, rivers, ponds, springs, wells):

- total alpha activity
  - from 12.4 to 571.3 mBq/dm³,
- total beta activity
  - from 50.3 to 3,185.2 mBq/dm³.

The radon concentrations in water from public intakes and domestic wells in the localities comprised by the Union of Karkonosze Municipalities ranged from 3.9 to 212.9 Bq/dm³. The radon concentrations in waters flowing form mining facilities, which featured the highest total alpha and beta radioactivity, had the highest value of 254.5 Bq/dm³ in water flowing from gallery 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 December 7, 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 2022. In June 2023, the measurement results are available on the website of the Chief Inspectorate for Environmental Protection (www.gios.gov.pl).

Radionuclide concentrations in dry matter samples of bottom sediments of the Baltic Sea in 2022 remained at the levels observed in previous years. Table 11 presents the measurement results.

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.

Soil samples were taken in 2022 for concentration determinations of Cs-137 and natural radionuclides: Ra-226, Ac-228, and K-40.

Measurements of the collected soil samples will be taken in 2023, and their results will be made available in 2024 on the website of the Chief Inspectorate for Environmental Protection (https://www.gov.pl/web/gios/monitoring-promieniowania-jonizujacego).

Average Cs-137, Cs-134 concentrations in soil

The average values of surface contamination in Świerk and KSOP in Różan in 2022 amounted to 15.26 Bq/kg and 6.62 Bq/kg, respectively. The deposition of Cs-134 isotope in soil samples varied during the period of monitoring in accordance with its half-life and this isotope is not present in measurable amounts in Polish soils.

TABLE 11.
Concentrations of artificial radionuclides Cs-137, Pu-238, Pu-239, 240 and Sr-90 in the bottom sediments of the southern part of the Baltic Sea in 2022 (PAA, CLOR data)

ISOTOPE		LAYER THICKNESS 0-20 CM
Cs-137	Bq/kg	51.53
Pu-239, 240	Bq/kg	1.20
Sr-90	Bq/kg	3.94

Radioactivity of basic foodstuffs and other food products

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

The activity of radioactive isotopes in foods and food products should be compared to the values laid down in the Regulation of the Council of Ministers of April 27, 2004, on the value of intervention levels for different types of intervention activities and the criteria for revoking these activities. The document states, among others, that consumption of contaminated food and water should be banned or restricted if the concentrations of isotopes with a half-life greater than 10 days, mainly Cs-134 and Cs-137, exceed:

- 400 Bq/kg in foods intended for infants,
- 1,000 Bq/kg in milk and milk products, as well as water and other food liquids,
- 1,250 Bq/kg in all other foodstuffs and food products.

At the same time, foodstuffs and food products from non-EU countries affected by the Chernobyl and Fukushima accidents are subject to restrictions under Commission Regulations (EU) No. 2020/1158 and No. 2021/1533.

TABLE 12.
Summary of food consumption restriction levels based on the concentrations of Cs-134 and Cs-137 isotopes in foodstuffs and food products.

ALLOWABLE CONTAMINATION WITH CS-134 AND CS-137	FOODS INTENDED FOR INFANTS	MILK AND MILK PRODUCTS	WATER AND OTHER FOOD LIQUIDS	OTHER FOODSTUFFS
IN FUKUSHIMA	50	50	10	100
IN POLAND	400	1,000	1,000	1,250
IN CHERNOBYL	370	370	600	600

Currently, the concentrations of Cs-134 in foodstuffs and food products are below 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 concentrations of radioactive isotopes in milk are a significant indicator for the assessment of oral radiation exposure.

In 2022, Cs-137 concentrations in liquid (fresh) milk ranged from 0.14 to 2.96 Bq/dm³ and averaged approx. 0.81 Bq/dm³, see infographics on pages 86-87.

Meat, poultry, fish, and eggs

In 2022, the results of the 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 concentrations of Cs-137):

- livestock meat – from 0.09 to 5.62, 0.74 Bq/kg on average,
- poultry – from 0.14 to 2.10 Bq/kg, 0.47 Bq/kg on average,
- fish – from 0.18 to 4.02 Bq/kg, 0.64 Bq/kg on average,
- eggs – from 0.08 to 2.47 Bq/kg, 0.54 Bq/kg on average.

The temporal distribution of Cs-137 activity between 2011 and 2022 in different types of livestock meat (beef, pork), as well as in poultry meat, eggs and fish is presented in the infographics on pages 86-87. The data obtained indicate that in 2022, the average activity of the cesium 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 taken in 2022 show that the concentrations of Cs-137 isotope in vegetables ranged from 0.18 to 1.17 Bq/kg, 0.39 Bq/kg on average, and in fruit from 0.15 to 5.46 Bq/kg, 0.67 Bq/kg on average (see infographics on pages 86-87). In long-term comparisons, the 2022 results were at the 1985 level, and several times lower than in 1986.

Cs-137 activity in cereals in 2022 ranged from 0.07 to 1.87 Bq/kg (0.55 Bq/kg on average) and were similar to the values observed in 1985.

Cs-137 activity in feed in 2022 ranged from 0.15 to 19.21 Bq/kg (3.91 Bq/kg on average).

The average activity of Cs-137 isotope in grass in the surroundings of the Nuclear Centre in Świerk and KSOP (referred to dry matter) in 2022 ranged from 0.23 to 22.26 Bq/kg (7.27 Bq/kg on average) for the Nuclear Centre in Świerk and from <0.14 to 0.37 Bq/kg (0.21 Bq/kg on average) for KSOP.

The average cesium activity in the primary fresh mushroom species in 2022 did not differ from the values in previous years. It should be emphasized that in 1985, i.e. before the Chernobyl accident, Cs-137 activity in mushrooms was 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 programmes conducted in Poland in 2022 show that both the environment food, and drinking water are safe for the population.

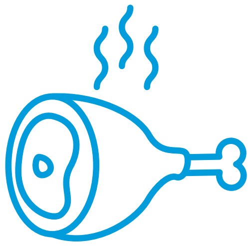
The contamination with Cs-137 isotope generated as a result of the Chernobyl accident generally mostly remains at a very low level with no significant impact on human health. Higher concentrations of Cs-137 can be observed in forest products, which also do not have a significant impact on human health, and the results of the sampled food from forest areas did not exceed the limits for consumption in 2022.

FOOD RADIOACTIVITY

The activity of radioactive isotopes in foodstuffs and food products should be compared to the values laid down in the Regulation of the Council of Ministers of April 27, 2004 on the value of intervention levels for different types of intervention activities and the criteria for revoking these activities.

1,000 Bq/kg

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


AVERAGE CS-137 CONCENTRATIONS	MILK	MEAT	POULTRY
2022	**0.81 Bq/dm^3**	**0.74 Bq/kg**	**0.47 Bq/kg**
2021	0.63	1.10	0.80
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

1,250 Bq/kg

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

Cs-137

the measurement results only features the Cs-137 isotope concentrations, because the Cs-134 concentrations are below 1% of their total activity.

EGGS	FISH	VEGETABLES	FRUIT
0.54 Bq/kg	**0.64 Bq/kg**	**0.39 Bq/kg**	**0.67 Bq/kg**
0.69	0.74	0.64	0.97
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

11 International cooperation

Fot. US NRC

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 regulatory mission, i.e. ensuring nuclear safety and radiation protection in the country.

This objective is achieved by the PAA's participation in the development of international legal instruments and international standards, through the exchange of information on nuclear safety with neighboring 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 PAA's representatives in the work of international organizations and associations, and also by bilateral cooperation.

Multilateral cooperation

In 2022, the President of the PAA was involved in the performance of tasks resulting from multilateral cooperation of Poland within:

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

Cooperation with international organizations

European Atomic Energy Community (EURATOM) In 2022, 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.

The ENSREG plenary meetings took place on March 24,June 20-21 and November 21, 2022. Poland was represented by the President of the PAA, Łukasz Młynarkiewicz, Ph.D., and Vice-President of the PAA, Mr. Andrzej Głowacki. Issues related to the work on the second thematic evaluation, the so-called Second Topical Peer Review, were discussed, among others, during the meetings. The meetings were also devoted to the performance of safety analyses for nuclear power plants, the so-called stress tests, in the countries outside the European Union, and safety issues of Ukrainian nuclear installations in relation to the military activities on its territory, and the experiences of the pandemic.

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 the 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 and nuclear security guidance,
- 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 in establishing the 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)[5];
- Radiation Safety Standards Committee (RASSC)[6];
- Waste Safety Standards Committee (WASSC)[7];
- Transport Safety Standards Committee (TRANSSC)[8];
- Nuclear Security Guidance Committee (NSGC)[9];
- Emergency Preparedness and Response Standards Committee (EPRESC)[10].

IAEA General Conference

The General Conference is the highest statutory body of the IAEA. It is composed of representatives of the 176 (as of January 2023) 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 66th General Conference of the International Atomic Energy Agency was held on 26-30 September 2022.

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, held bilateral meetings with representatives of partner nuclear regulatory authorities: The U.S. Nuclear Regulatory Commission (US NRC), the Canadian Nuclear Safety Commission (CNSC), the Nuclear Regulatory Authority of the Slovak Republic (UJD SR), the State Office for Nuclear Safety of the Czech Republic (SÚJB), the Hungarian Atomic Energy Authority (OAH), the State Nuclear Energy Safety Inspectorate (VATESI), the UK Office for Nuclear Regulation (ONR), the State Nuclear Regulatory Inspectorate of Ukraine. (SNRIU), the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), and the Netherlands Authority for Nuclear Safety and Radiation Protection (ANVS).

Furthermore, the PAA Delegation took part in consultations with IAEA staff on ongoing cooperation, in particular with representatives of the regulatory activities section in the IAEA Nuclear Safety and Security Department, a meeting with representatives of the European Commission, a bilateral meeting with the IAEA Technical Cooperation Department, a meeting of IAEA National Technical Cooperation Liaison Officers, and a meeting on the Integrated Regulatory Review Service (IRRS) mission.

Designated members of the delegation also attended meetings accompanying the General Conference:

- Senior Safety and Security Regulators' Meeting,
- Regulatory Cooperation Forum (RCF).

Poland in the Board of Governors

In 2022, the Board of Governors met five times (twice in March, and once in June, September, and November), addressing topics related to the assumptions of the IAEA's draft budget and work plan for the coming years, as well as the issue of nuclear facility safety and security in relation to the military activities in Ukraine.

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.

Nuclear Harmonization and Standardization Initiative (NHSI)

At the initiative of the IAEA Director General, the Nuclear Harmonization and Standardization Initiative (NHSI) programme was established to promote harmonization and standardization of regulatory and industrial approaches to facilitate the safe and successful deployment of Small Modular Reactors (SMRs) worldwide. The first meeting attended by the President of the PAA was held on June 23-24. The purpose of the meeting was to develop a charter and work plan.

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 2022, the PAA coordinated the participation of national expert and research organizations in 180 meetings, training courses, and conferences organized by the IAEA. Because of the pandemic, many events were cancelled or postponed. Only selected training courses were organized in a remote form. In the second half of the year, some training courses were available in hybrid 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.

In the 2022-2023 edition of technical projects, the National Center for Radiological Protection in Health Care has been coordinating projects in the area of medicine, the Ministry of Climate and Environment – in the area of expanding the infrastructure necessary for nuclear power, while the PAA is focusing on further expanding the competencies necessary to effectively perform its regulatory function.

Bilateral agreements concluded by Poland within the areas of National Atomic Energy Agency's activities outside 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. Concluded in Oslo on November 15, 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 December 22, 1987.

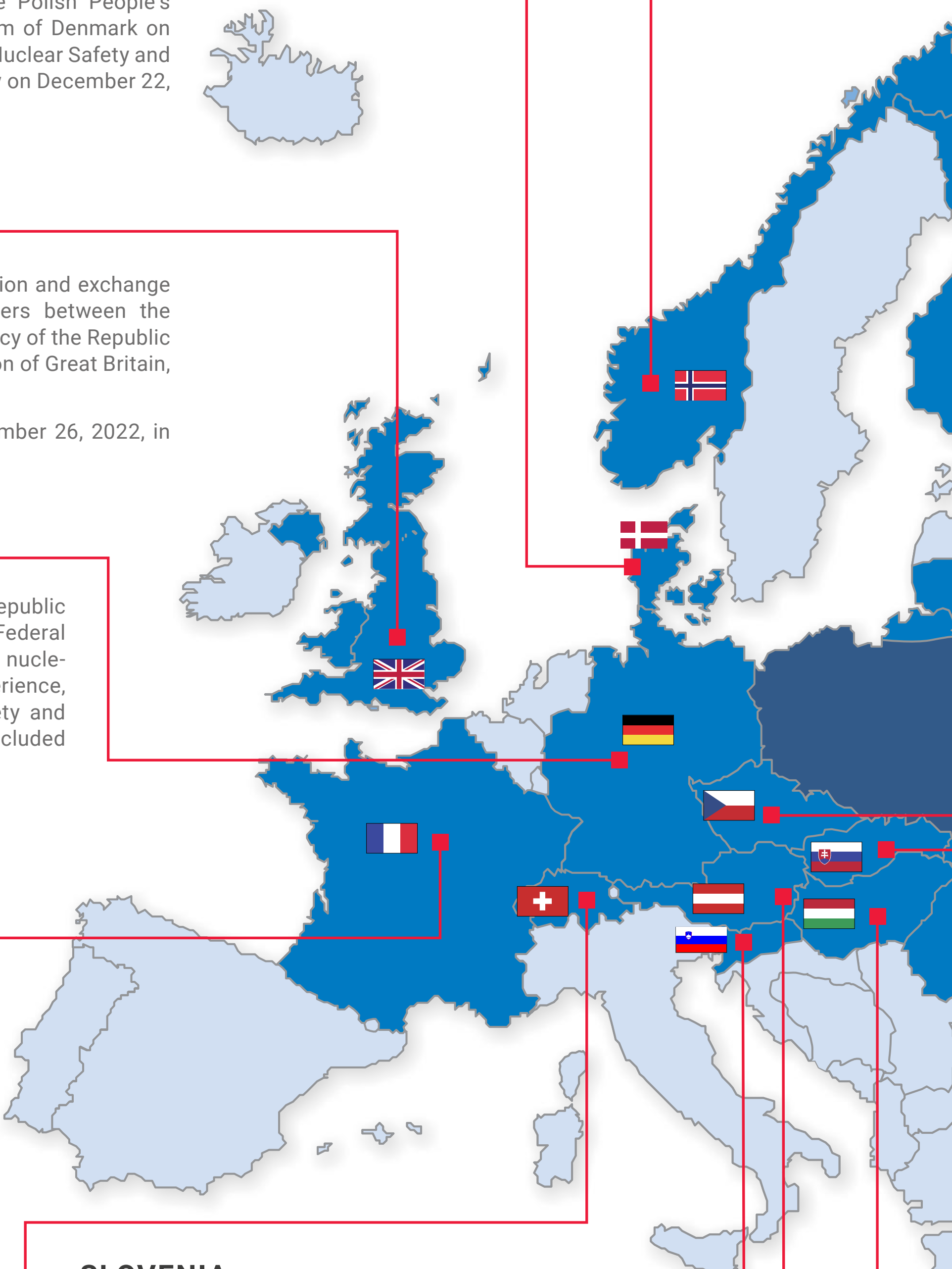
UNITED KINGDOM

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 September 24, 2014.

Another memorandum was signed on September 26, 2022, in Brussels.

GERMANY

Agreement between the Government of the Republic of Poland and the Government of the Federal Republic of Germany on early notification of a nuclear accident, exchange of information and experience, and cooperation in the field of nuclear safety and radiation protection. The agreement was concluded in Warsaw on July 30, 2009.



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 Paris on June 6, 2012.

SLOVENIA

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 Slovenian Nuclear Safety Administration, signed in Ljubljana on May 24, 2022.

SWITZERLAND

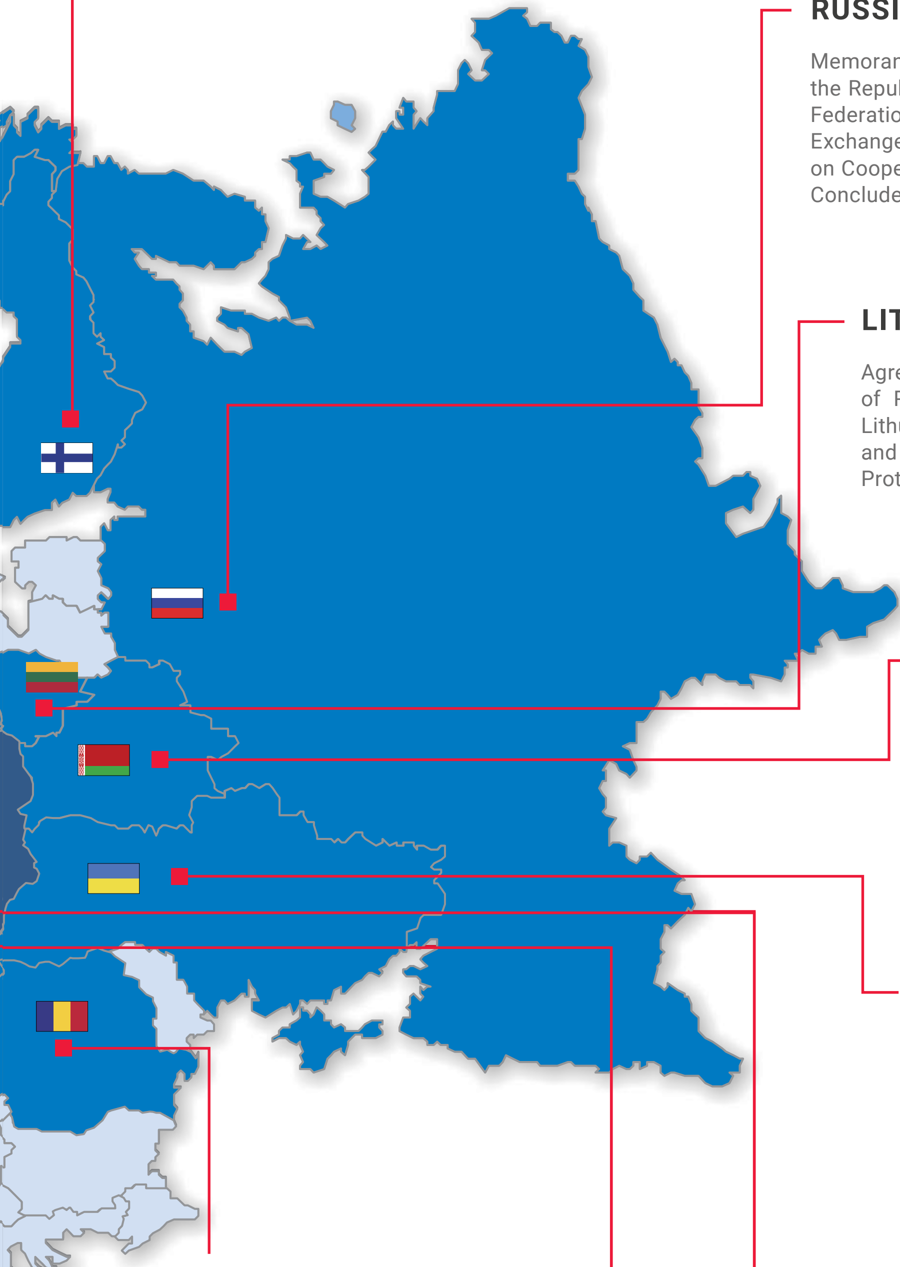
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Swiss Federal Nuclear Safety Inspectorate ENSI, signed in Vienna on September 26, 2016.

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. Concluded in Vienna on December 15, 1989.

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 at Vienna on September 19, 2017.



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. Concluded in Warsaw on February 18, 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. Concluded in Warsaw on June 2, 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. Concluded in Minsk on October 26, 1994.

UKRAINE

Agreement between the Government of the Republic of Poland and the Government of Ukraine on early warning of nuclear accidents, on the exchange of information and on cooperation in the field of nuclear safety and radiation protection. Concluded in Kiev on May 24, 1993.

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 September 25, 2014.

CZECH REPUBLIC

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

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. Concluded in Bratislava on September 17, 1996.

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 Radiation and the Hungarian Atomic Energy Authority, signed at Vienna 19 September 2017.

Cooperation with the Regulatory Cooperation Forum (RCF)

The Regulatory Cooperation Forum (RCF) was established to ensure that the countries with developed nuclear power programmes 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 June 22-24 and September 26-30, 2022, the Vice-President of the PAA 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 2020, 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.

The Organization for Economic Cooperation 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 June 2022, the President of the PAA 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 2022, WENRA work areas included activities within working groups dedicated to the harmonization of reference levels for nuclear power plants and research reactors and a working group dedicated to radioactive waste.

On April 5-6 and November 9-10, 2022, the President of the PAA 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. During the meetings, the issue of safety of Ukraine's nuclear facilities in relation to the military activities on its territory was also discussed.

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 May 19-20 and December 14-15, 2022, the President of the PAA 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 organization's current and planned activities. The tasks carried out by the various working groups were discussed, as well as the issues of harmonizing the actions of member states in the event of a nuclear or radiation emergency.

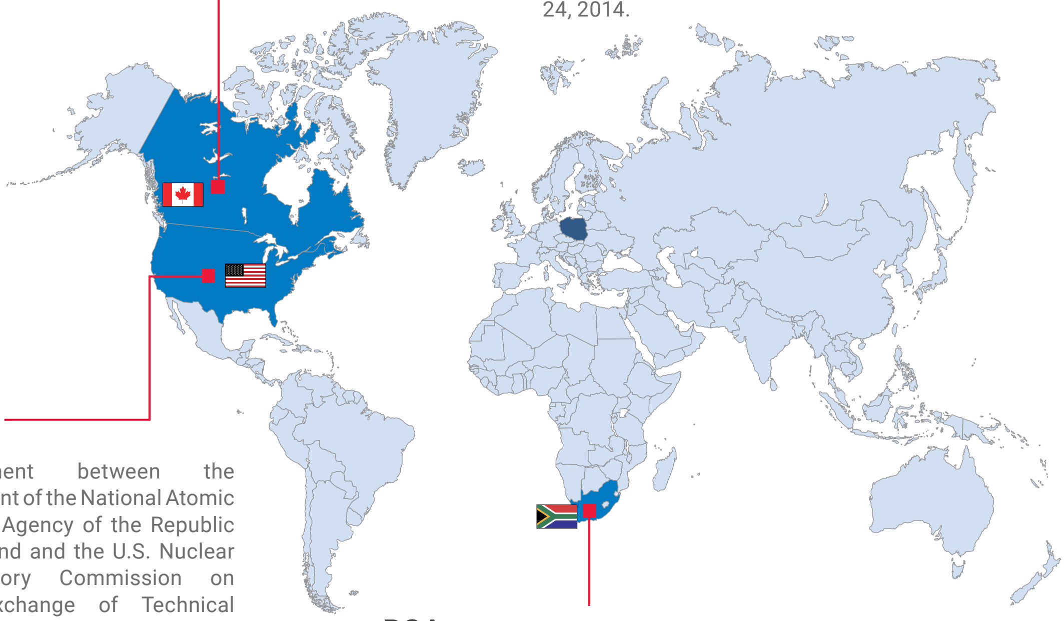
Council of the Baltic Sea States (CBSS)

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. In view of the importance that member states attach to the Council's long-term priority of a "Safe and Stable Region," especially in view of the consequences of the armed conflict in Ukraine for the region, it is assumed that the Task Force will continue its activities.

In recent years, nuclear safety and radiation protection have receded into the background of the Council's activities. 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 seminar titled "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 nuclear security in the EU Member States.



CANADA

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 Canadian Nuclear Safety Commission, signed in Vienna on September 24, 2014.

USA

Agreement between the President of the National Atomic Energy Agency of the Republic of Poland and the U.S. Nuclear Regulatory Commission on the Exchange of Technical Information and Cooperation in the Field of Nuclear Safety, signed in Vienna on September 28, 2016. On November 24, 2022, the agreement on cooperation and exchange of information was signed in Brussels.

RSA

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 Nuclear Regulator of South Africa, signed in Centurion on November 24, 2017.

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 popularization 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 U.S. 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 neighboring countries. The President of the PAA is responsible for the implementation of these agreements.

In 2022, the PAA continued cooperation with foreign partners, experienced in the oversight of large nuclear facilities. The PAA implemented a bilateral cooperation programme:

- 1A virtual workshop between the PAA and Canada's CNSC nuclear regulator on licensing new nuclear facilities was held on March 11, 2022. The workshop was opened by Vice-President of the PAA, Andrzej Glowacki, and Director General of the Department of Advanced Reactors and Technology, Caroline Ducrose;
- A bilateral meeting with the Head of the Slovenian Nuclear Safety Administration (SNSA), Igor Sirc, was held on May 23-24, 2022;
- A meeting with. Petteri Tiippana, the Director General of the Finnish Radiation and Nuclear Safety Authority (STUK) was held on June 9, 2022;
- A remote meeting with Bernard Doroszczuk, Commission Chairman of the French Nuclear Safety Authority (ASN) and Jean-Christoph Niel, Head of the Institution of Radiation Protection and Nuclear Safety (IRSN), was held on July 6-8, 2022;
- An online meeting with Head of the Nuclear Regulatory Inspectorate of Ukraine, Oleh Korikov, was held on September 6, 2022;
- A meeting with Christopher T. Hanson, Chairman of the;
- U.S. Nuclear Regulatory Commission (US NRC)
- was held on August 29, 2022;

The bilateral cooperation with the US NRC also allowed to organize the following in 2022:

- two editions of OJT (On the Job Training) internships: the first from April 11 to June 27 and the second from September 12 to November 11. The internships took place based on the Technical Training Center (Chattanooga, Tennessee) and the Vogtle Nuclear Power Plant;
- A technical workshop on licensing nuclear power plants was held in Warsaw on December 5-8, 2022.

As part of the bilateral cooperation with the USA, the management of the PAA and the PAA's experts met with representatives of the company Polskie Elektrownie Jądrowe (PEJ) and an American operator, Southern Nuclear. The 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 at the Vogtle 3 and 4 nuclear power plant. Southern Nuclear has also been managing the Farley and Hatch nuclear power plants for years, and previously constructed two units at the Vogtle nuclear 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 Organizations in Vienna, represented Poland on the IAEA Board of Governors for the 2020-2022 term. Her first deputy was Łukasz Młynarkiewicz, Ph.D., President of the PAA, the second deputy was Adam Guibourgé-Czetwertyński, Undersecretary of State in the Ministry of Climate and Environment, and the third deputy was Arkadiusz Michoński, Deputy Permanent Representative of the Republic of Poland to the Office of the United Nations and the International Organizations in Vienna.

The PAA participates in all remote meetings organized by associations and other forms of multilateral cooperation. The PAA's representatives actively participated in working and expert groups focusing on nuclear safety, nuclear regulatory competence building, nuclear law and new reactors.

Despite the still-present threat of the COVID-19 virus, bilateral meetings have gradually begun, allowing for the expansion of bilateral cooperation.

The exchange of experience and good practices in the field of safe 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 inter- national 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
- **ECURI**E – 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** – IAEA International 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 radio protection 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 Nuclear Safety and Security 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 Radiation Protection Standards Committee
- **RCF** – Regulatory Cooperation Forum
- **RID** – Règlement 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 Radiation Waste Standards Committee
- **WENRA** – Western European Nuclear Regulators Association
- **WHO** – World Health Organization
- **ZUOP** – Radioactive Waste Management Plant

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