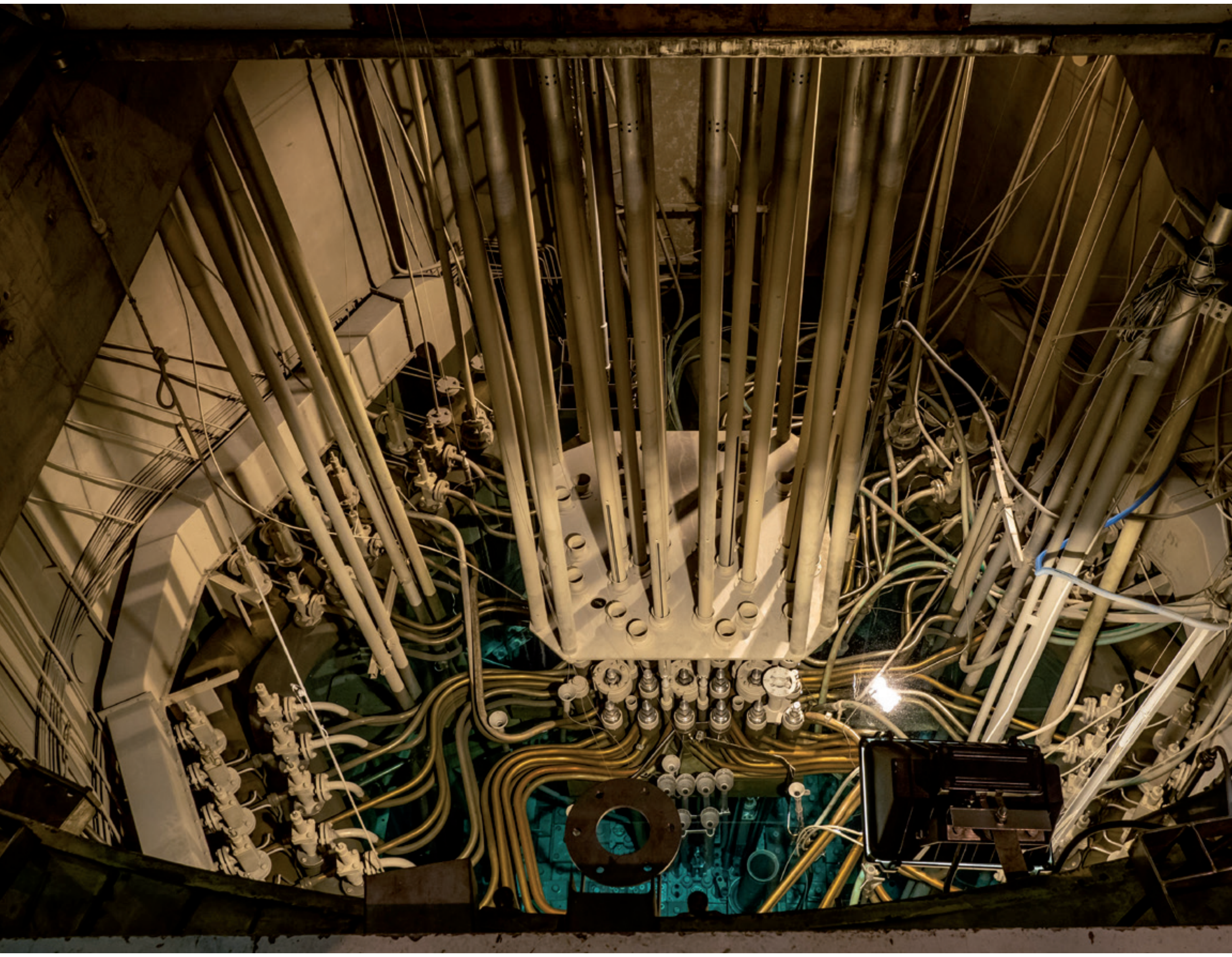


ANNUAL REPORT

Activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland in 2018

2018

NATIONAL ATOMIC ENERGY AGENCY

Activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland in 2018

WARSAW 2019

NATIONAL
ATOMIC ENERGY
AGENCY

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

The report on the activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland has been prepared on the basis of art. 110 section 13 of the Atomic Law Act (Journal of Laws of 2018 item 792, as amended). In accordance with the statutory obligation, this report has been presented to the Prime Minister.

The President of the National Atomic Energy Agency (PAA) is the central State administration body, with a responsibility for national nuclear safety and radiological protection.

Vision

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

Mission

Through regulatory and supervisory activities, the National Atomic Energy Agency aims to ensure that activities involving exposure to ionizing radiation are conducted safely for workers, the general public, and the environment.

Contents

Foreword

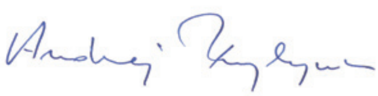
It is my pleasure and honour to present to you the Report on activities of the President of the National Atomic Energy Agency in the year 2018.

Like in the previous years, the population of Poland has been properly protected against ionizing radiation. No radioactive emergency – domestically or abroad – had impact on human health and the natural environment within the territory of Poland.

In the past year, the National Atomic Energy Agency continued preparation for performance of its tasks in the Polish Nuclear Energy Program. The main tasks in this are focused on an analysis and refinement of internal procedures for regulatory assessment of the nuclear plants planned to be built in Poland. Thanks to such in-depth analysis, which will be completed in 2019, the Agency will be better prepared to act as regulator of the nuclear sector in the nuclear energy program.

Of course, the PAA continues constant supervision over thousands of applications of ionizing radiation in medical, veterinary and industrial applications, as well as in the service sector and in scientific research. The priority in our work is to ensure radiation safety of the population and the environment, including persons who are exposed to ionizing radiation at work. I am confident that we will continue to ensure effective protection in the coming years.

I encourage you to study the Report and I hope that you will find it informative!



Andrzej Przybycin
President of the National Atomic Energy Agency

1 National Atomic Energy Agency

Fot. PAA

Role of the President of the National Atomic Energy Agency

The President of the National Atomic Energy Agency (PAA) is the central government administration body competent in matters related to nuclear safety and radiological protection. The activity of the PAA is regulated by the Act of 29 November 2000 – Atomic Law (Journal of Laws of 2018, item 792, as amended) and the relevant secondary legislation to the act in question. The PAA President is obliged to report to the minister competent for environmental matters.

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

1. Preparation of draft documents related to national policies involving nuclear safety and radiological protection, entailing the nuclear power engineering development program, as well as internal and external threats;

2. Exercising regulatory control and supervision over activities leading to actual or potential ionizing radiation exposure of people and natural environment, including inspections conducted in this scope and issuance of decisions on licenses and authorizations connected with the said activity;

3. Promulgation of technical and organisational recommendations with regard to nuclear safety and radiological protection;

4. Performing tasks related to assessment of the national radiation situation in normal conditions and in radiation emergency situations as well as providing relevant information to appropriate authorities and to the general public;

5. Performing tasks resulting from the obligations imposed upon the Republic of Poland in terms of record keeping and control of nuclear materials, physical protection of nuclear materials and facilities, special control measures for foreign trade in nuclear materials and technologies, and from other obligations resulting from international agreements relating to radiological protection, nuclear safety, nuclear security and safeguards;

6. Activities involving public communication, education and popularisation, as well as scientific, technical and legal information concerning nuclear safety and radiological protection, including providing the general public with the relevant information on ionizing radiation and its impact on human health and the environment, and on the available measures to be implemented in the event of radiation emergency, excluding promotion of the use of ionizing radiation and promotion of nuclear power engineering in particular;

7. Cooperation with central and local administration authorities on matters involving nuclear safety, radiological protection as well as scientific research in the field of nuclear safety and radiological protection;

8. Performing tasks involving national and civil defence as well as protection of classified information, as stipulated in separate regulations;

9. Preparing opinions on nuclear safety and radiological protection with reference to plans of technical activities involving peaceful use of nuclear energy for purposes of central and local administration authorities;

10. Cooperation with competent foreign entities and international organizations on matters provided for in the Act;

11. Preparing drafts of legal acts on the matters provided for in the Atomic Law and settling them with other state authorities according to the procedures established in the Rules of Procedure of the Council of Ministers;

12. Issuing opinions on draft legal acts developed by other relevant bodies;

13. Submitting annual reports on the activities of the Agency President and assessments of the status of national nuclear safety and radiological protection to the Prime Minister.

Organizational structure

FIG. 1.

Organizational structure of the PAA
(as of 18 January 2019)

VICE PRESIDENT

PRESIDENT of the National Atomic Energy Agency

DIRECTOR General

COUNCIL for Nuclear Safety and Radiological Protection

Nuclear Safety and International Programs Department
- Regulatory Assessment and Authorisation Unit
- Nuclear Safety Analysis and Reactor Design Unit
- Radioactive Waste and Site Review Unit
- International Programs and Coordination Unit
- Information and Communication Unit

Inspection and Oversight Department
- Nuclear Installation Inspection and Non-proliferation Unit
- Activities Inspection Unit

Radiological Protection Department
- Activities Authorisation Unit

Radiation Emergency Centre
- Monitoring and Prognosis Unit
- Emergency Preparedness and Response Unit

Budget and Organizational Affairs Department
- Chief Accountant
- Financial and Accounting Unit
- Organizational Affairs Unit
- Administrative Affairs Unit

Legal Department
- Regulation Unit
- Jurisdiction Control and Legal Representation Unit

In January 2019, the National Atomic Energy Agency changed its structure. The current statute of the PAA was given by the Minister of Environment in his Order of 9 January 2019 (Official Journal of the Ministry of Environment, item 2). As a part of the reorganization, the division of competencies between departments has changed. In the organization, issue of permits for conducting activities involving exposure to ionizing radiation (which so far have been performed by the Nuclear Safety Department and Radiological Protection Department) were separated from their control by establishing the Inspection and oversight Department that was responsible for controlling all activities involving exposure to ionizing radiation and issues related to security of nuclear materials.

Additionally, tasks associated with coordination of implementation of international programs have been assigned to the former Nuclear Safety Department. The new department was named Nuclear Safety and International Programs Department. Also, as part of the reorganization, the Office of Director General was combined with the Economic and Budget Department to form the new Budget and Organisational affairs.

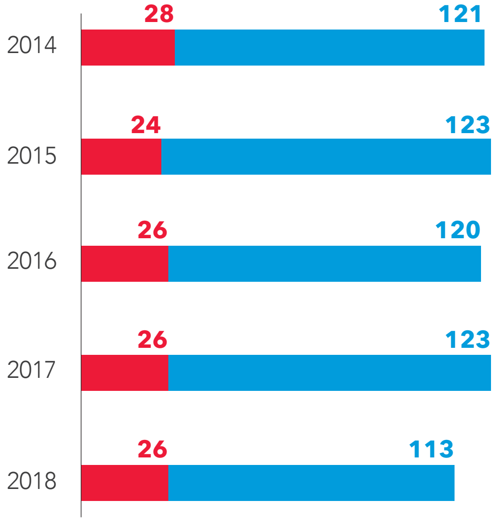
The changes are intended to ensure even greater transparency of the Agency's operations and to enable more efficient exercise of its regulatory functions.

Staffing

The average annual manpower at the PAA in 2018 was 113 persons (number of positions: 110.45). These numbers were calculated based on the employment level, excluding staff currently on unpaid or parental leave. As of 31 December 2018, the PAA employed 26 nuclear regulatory inspectors.

113 employees

26 nuclear regulatory inspectors



Council for Nuclear Safety and Radiological Protection

The Council for Nuclear Safety and Radiological Protection (BJiOR) is appointed by the Minister of Environment. The Council is composed of the chairman, the deputy chairman, the secretary and not more than seven members appointed from among experts in the field of nuclear safety, radiological protection, physical protection, safeguards of nuclear material and other fields of expertise relevant from the perspective of nuclear safety oversight.

Members of the Council

Members of the BJiOR Council as of the end of 2018:

Professor **JANUSZ JANECZEK**
Chairman of the Council

Professor Engineer **ANDRZEJ G. CHMIELEWSKI**
Deputy Chairman of the Council

Professor Engineer **KONRAD ŚWIRSKI**
Secretary of the Council

Professor **MAREK K. JANIAK**
Member of the Council

MATEUSZ MAMCZAR
Member of the Council

TOMASZ NOWACKI, Ph.D.
Member of the Council until 3 October 2018

OLGA CEBULA
Member of the Council since 14 November 2018

Tasks of the Council

- Issuing opinions upon licenses for conducting activities involving exposure to ionizing radiation and consisting in construction, commissioning, operation and decommissioning of nuclear facilities,
- Issuing opinions upon draft versions of legal acts and organizational and technical recommendations,
- Undertaking initiatives concerning improvements in the supervision over the aforementioned exposure-related activities.

The report of the Council for year 2018 has been published in the Public Information Bulletin of the PAA.

Budget

FIG. 2.

The PAA's budgetary expenses in 2018 amounted to PLN 32.9 million, including:

Assessment of PAA's operations

Audits carried out by the Supreme Audit Office

In 2017 PAA was audited by the Supreme Audit Office (NIK) with regard to implementation of the state budget in 2017 in section 68 – National Atomic Energy Agency.

The Supreme Audit Office positively assessed the state budget implementation in 2017 in section 68 – National Atomic Energy Agency.

National Atomic Energy Agency and the Polish Nuclear Power Program

The Polish Nuclear Power Program (PNPP) was adopted by the Council of Ministers on 28 January 2014. It is the first comprehensive document providing a structure for the organization of activities to be undertaken in order to implement nuclear power in Poland.

The National Atomic Energy Agency is one of the main stakeholders to the Polish Nuclear Power Program and performs the role of regulator – it will supervise safety of nuclear facilities and of the activity conducted in these facilities, perform safety inspections and assessments, issue licenses and impose potential sanctions.

As a part of its preparation for the exercise of the role of nuclear oversight for the nuclear power plants planned to be built in Poland, the PAA, in cooperation with the International Atomic Energy Agency and United States Nuclear Regulatory Commission (US NRC), has prepared a long-term Advanced Licensing Exercise Project (ALEP). Its objective is to prepare and improve the system for safety assessment and issuance of decision concerning permits for construction of nuclear power plants that has been developed by the PAA.

In the spring of 2018, the first stage of the project started and will continue for one year. The first workshop in the project was held in Warsaw on 27-31 August 2018. The project is divided into 3 stages and will continue for approx. 2 years.

The participants of the project are 30 PAA employees, supported by experts - retired employees of the American and British nuclear regulatory bodies[1].

1. The ALEP project is described in detail in the Nuclear Safety and Radiological Protection Bulletin, issue 4/2018.

2 Infrastructure for nuclear regulatory activities in Poland

Fot. NCBJ

Definition, structure and functions of the nuclear safety and radiological protection system

The system of nuclear safety and security and radiological protection encompasses all legal, organizational and technical undertakings, ensuring the highest standards of nuclear and radiation safety of nuclear facilities and activities conducted using ionizing radiation sources in Poland. A threat to this type of safety may be posed by operation of nuclear facilities, both in Poland and abroad, as well as other activities involving ionizing radiation sources. In Poland, all issues associated with radiological protection and radiation monitoring of the environment, in accordance with the applicable legal provisions, are considered jointly with the issue of nuclear safety, as well as nuclear security and safeguards. This solution warrants a single, joint approach to the aspects of nuclear safety and security, radiological protection, securing of nuclear materials and radioactive sources, and a uniform nuclear regulatory framework.

LEGAL BASIS

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

The nuclear regulatory authorities in Poland are:

- the President of the PAA,
- nuclear regulatory inspectors.

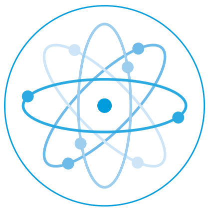
The essential aspects of the nuclear safety and radiological protection system include:

- exercising regulatory oversight over activities, involving nuclear material and ionizing radiation sources through:
  - regulatory safety assessment of the activities applied for, and issuing decisions on granting licenses concerning the performance of these activities or registration of such activities;
  - control over the manner in which activities are performed and applying sanctions in the case of breach of rules of safe conduct in the said activities;
  - control over doses received by workers;
  - supervision of training for radiation protection officers (experts in nuclear safety and radiological protection matters in entities which conduct activities based on the licenses granted), workers employed on the positions significant for nuclear safety and radiological protection and workers exposed to ionizing radiation;
  - control over trade in radioactive material;
  - keeping records of radioactive sources and users of radioactive sources and a central register of individual doses, and in cases of activities involving nuclear material, also detailed records and accountancy for this material, providing approvals for systems of physical protection of nuclear material and control of the technologies applied;
- recognizing and assessing the national radiation situation through coordination (including standardization) of works performed by local stations and units measuring the level of radiation dose rate, content of radionuclides in the chosen elements of natural environment and in drinking water, foodstuffs and feeding stuffs;
- maintaining services prepared to recognize and assess the national radiation situation and to respond in cases of radiological emergencies (in cooperation with other competent authorities and services operating under the national emergency response system);
- performing tasks aimed at fulfilment of obligations resulting from membership in international organizations and imposed upon Poland under treaties, conventions and international agreements with regard to nuclear safety and radiological protection, and bilateral agreements on mutual support in cases of nuclear accidents and cooperation with Poland's neighbouring countries in the scope of nuclear safety and radiological protection, as well as for the purpose of assessment of the condition of nuclear facilities, radioactive sources and waste management, and nuclear safety and radiological protection system located outside of Poland's borders.

The regulatory tasks are performed by the PAA President with the assistance of nuclear regulatory inspectors and staff of specialized organizational units of the PAA. In implementing these tasks, the PAA President also takes advantage of support provided by experts – members of the Council for Nuclear Safety and Radiological Protection and examination committees.

The PAA President's supervision over any activity conducted under conditions involving exposure to ionizing radiation comprises the following:

- Determining conditions which are required to ensure nuclear safety and radiological protection;
- Safety Assessment as a basis for granting and formulating the conditions of licenses and taking other administrative decisions;
- Issuing licenses for performance of activity which involves the exposure, consisting in:
  - production, processing, storage, transport or use of nuclear material or radioactive sources as well as trade in this material or sources;
  - storage, transport, processing or disposal of radioactive waste;
  - storage, transport or processing of spent nuclear fuel and trade in this fuel;
  - isotopic enrichment;
  - construction, commissioning, operation and decommissioning of nuclear facilities;
  - construction, operation and closure of radioactive waste repositories;
  - production, installation, operation and maintenance of equipment containing radioactive sources and trade in such equipment;
  - commissioning and use of equipment generating ionizing radiation;
  - commissioning of laboratories where ionizing radiation sources are to be used, including X-ray laboratories;
  - intentional addition of radioactive substances in processes of manufacturing consumer and medical products, medical products for purposes of in vitro diagnostics, equipment for medical products, equipment for medical products for purposes of in vitro diagnostics, active medical products for implantation, in the meaning of provisions of the Act on Medical Products of 20 May 2010 (Journal of Laws of 2019, no. 107, item 679, as amended), trade in such products, import into and export from the territory of the Republic of Poland of consumer and medical products to which radioactive substances have been added, intentional administration of radioactive substances to people and animals for purposes of medical or veterinary diagnostics, therapy or scientific research;
  - granting personal authorizations related to the performance and supervision of those activities.
- Controlling the aforementioned activities from the perspective of compliance with the criteria specified



Within the framework of activities involving ionizing radiation sources, exceptions include cases of using X-ray devices for purposes of medical diagnostics, interventional radiology, surface radiotherapy and radiotherapy of non-cancerous diseases, since the oversight of the said activities is exercised by provincial national sanitary inspectorates (or other competent sanitary inspection bodies reporting to the Minister of National Defence and to the minister competent for internal affairs).

in the applicable regulations and with requirements of the licenses granted;

- Imposition of sanctions forcing compliance with the above requirements as a result of the implemented administrative proceedings;
- In the scope of activities connected with nuclear materials and facilities, the PAA President's supervision also involves approvals and inspections of physical protection systems as well as activities envisaged in the obligations of the Republic of Poland relating to safeguards.

Basic provisions of law on nuclear safety and radiological protection

Atomic Law Act

The Atomic Law Act of 29 November 2000, effective as of 1 January 2002, introduced a comprehensive system ensuring nuclear safety and radiological protection of workers and the entire population in Poland.

The most important provisions of the aforementioned Act concern issuance of licenses for activities connected with exposure to ionizing radiation (i.e. licenses for activities specified above in the subchapter "Definition, structure and functions of the nuclear safety and radiological protection system"), obligations of heads of organizational units conducting activities which involve radiation and prerogatives of the President of the National Atomic Energy Agency to exercise regulatory control and oversight of these activities. The Act also provides for other tasks of the PAA President related to such matters as the assessment of the national radiation situation and response in cases of radiation emergencies.

The principles and procedures set forth in the aforementioned act pertain, among others, to the following matters:

- justification for instituting activities which involve exposure to ionizing radiation, their optimization and establishing dose limits for workers and the entire population;
- procedure for obtaining the required licenses concerning the performance of such activities as well as the mode and method of controlling the performance of such activities;
- keeping records and inspection of ionizing radiation sources;
- keeping records and inspection of nuclear material;
- physical protection of nuclear material and nuclear facilities;
- management of high-activity radioactive sources;
- classification of radioactive waste and methods of radioactive waste and spent nuclear fuel management;
- classification of workers and their workplaces based on the degree of exposure involved in the work performed and designation of protection measures suitable to counteract this exposure;
- training and issuing authorizations to be employed at particular positions considered important for ensuring nuclear safety and radiological protection;
- assessment of the national radiation situation;
- procedures applied in cases of radiation emergencies;
- siting, designing, construction, commissioning, operation and decommissioning of nuclear facilities.

In year 2018, the following amendments to the Atomic Law Act came into force:

1) Art. 50 of the Act of 3 July 2018 - Implementing regulations introducing the Higher Education and Science Law Act (Journal of Laws, item 1669), adapted the wording of the provisions of the Atomic Law Act to the new Act of 20 July 2018 - Higher Education and Science Law (Journal of Laws, item 1668) by:
   a) replacing in Art. 33 (2) (3) the mention about scientific unit and research institutes with a reference to Art. 7 (1) (1, 2, and 4-8) of the Act - Higher Education and Science Law, in which entities forming the higher education and science system are enumerated (the reference does not include the Polish Academy of Sciences);
   b) replacing in Art. 33h the term "medical scientific units" with a broader reference to the entities

mentioned in Art. 7 (1) (1, 2, and 4-8) of the Higher Education and Science Law Act, conducting activities in the area of medical sciences and health sciences;

c) replacing in Art. 41a (6) and in Art. 108b (2) the term "minister competent for science matters" with the term "minister competent for higher education and science matters";

2) in Art. 51 of the Act of 4 October 2018 on cosmetic products (Journal of Laws, item 2227), the term "cosmetics" contained in Art. 4 (2) was replaced with the words "cosmetic products."

In 2016, works were commenced on the bill amending the Atomic Law Act, aimed at implementation in the domestic legislation of provisions of the Council directive 2013/59/Euratom. In 2016-2018 draft law was subject to consultations and opinions. Council of Ministers adopted the bill on 15 January 2019. On 13 June 2019 the Sejm (the lower house of the Polish Parliament) enacted law on amendment of the Atomic Law act and the Act on fire protection. On 12 July 2019 the Senate (the upper house of the Polish Parliament) has adopted the law without amendments.

Implementing acts to the Atomic Law act

In 2018, no implementing act for the Atomic Law act was adopted and no legislative works were conducted on draft implementing acts.

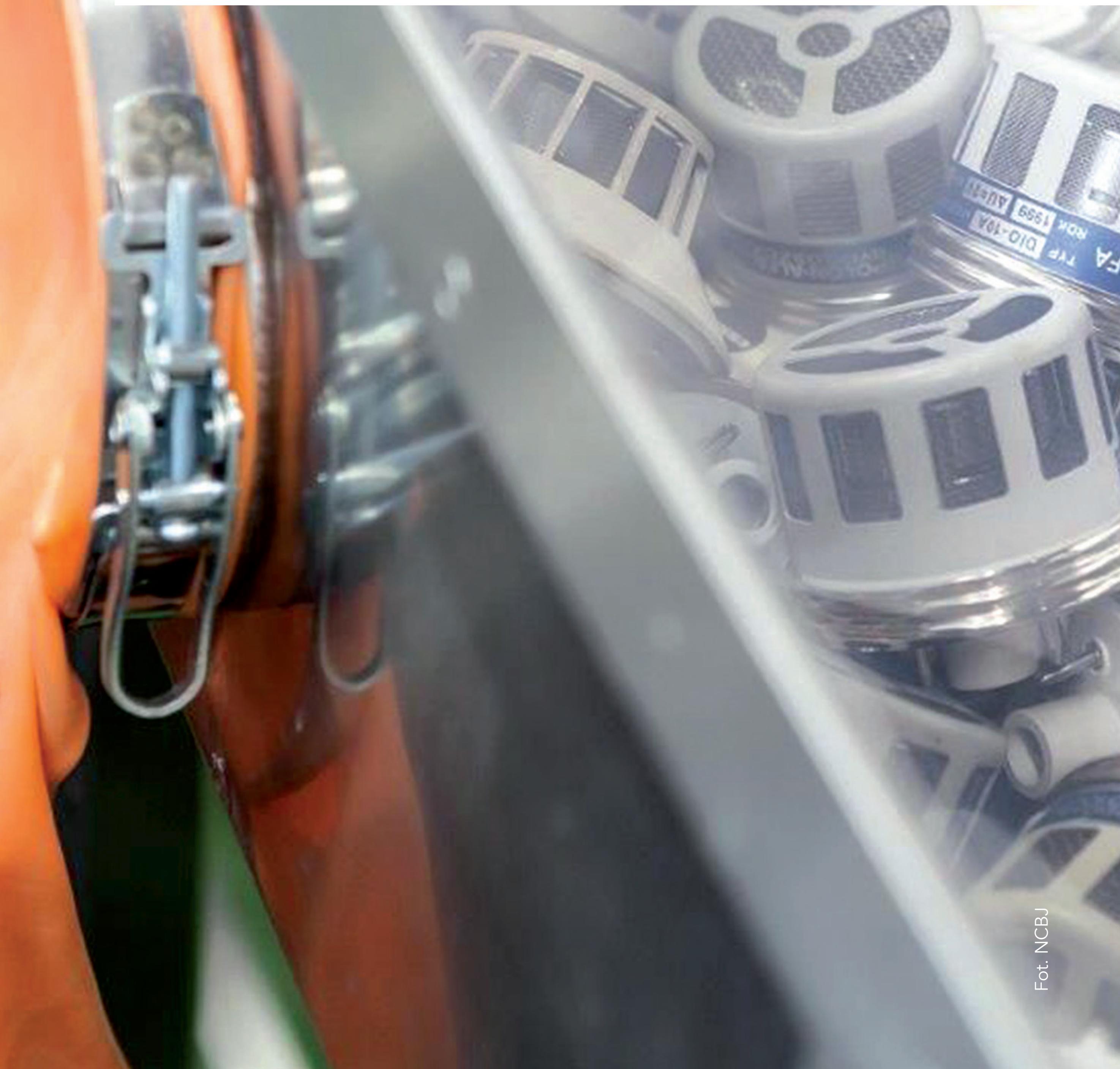
However, in connection with the amendment of the Atomic Law act, works were performed with the aim to prepare drafts of implementing acts necessitated by the enactment of the act amending the Atomic Law act and the fire protection act.

Other acts

The provisions associated indirectly with nuclear safety and security and radiological protection can also be found in other legal acts, including in particular:

- the Act of 19 August 2011 on transport of hazardous commodities (Journal of Laws of 2019, item 382, as amended);
- the Act of 18 August 2011 on maritime safety (Journal of Laws of 2018, item 181, as amended);
- the Act of 21 December 2000 on technical inspection (Journal of Laws of 2019, item 667, as amended).

3 Supervision of the use of ionizing radiation sources



Fot. NCBJ

Tasks of the PAA President in terms of regulatory oversight of activities connected with exposure to ionizing radiation:

- issuing licenses and making other decisions concerning nuclear safety and radiological protection following the analysis and assessment of documentation submitted by users of ionizing radiation sources;
- preparing and performing inspections of organizational units which conduct activities connected with exposure;
- maintaining a register of these entities.

Users of ionizing radiation sources in Poland

The number of registered organizational units conducting activity (one or more) involving exposure to ionizing radiation subject to regulatory supervision of the PAA President was 4,233 (as of 31 December 2018).

The number of registered activities involving exposure to ionizing radiation was 6,324 (as of 31 December 2018).

Licenses and notifications

Drafts of the PAA President's licenses for performance of activities involving exposure to ionizing radiation and other decisions in matters considered important for nuclear safety and radiological protection were prepared by the Radiological Protection Department (DOR) of the PAA.

LEGAL BASIS

The type of documentation is specified in the Regulation of the Council of Ministers of 30 June 2015 concerning the documents required when submitting an application for issue of a license for conducting an activity associated with exposure to ionizing radiation or when reporting conduct of such an activity (Journal of Laws of 2015, item 1355).

Issuance of a license, an annex to a license or receipt of a notification is always preceded by the analysis and assessment of the documentation submitted by users of ionizing radiation sources.

Apart from the said documentation, a detailed analysis is also conducted to cover the following issues: substantiation for the commencement of the activity involving exposure, utility dose limits proposed, quality assurance program in connection with the activity conducted and an internal emergency plan for cases of radiation emergency.

In cases, in which activity involving ionization radiation exposure does not require a license, decisions are issued on acceptance of notification of activity involving exposure to ionizing radiation. These cases have been listed in the Regulation of the Council of Ministers of 6 August 2002 concerning cases, in which activity involving exposure to ionizing radiation is not subject to the license or notification obligation and cases, in which it may be conducted on the basis of a notification (Journal of Laws no. 137, item 1153, as amended).

Regulatory inspections

Inspections in organizational units, other than in those that have nuclear facilities and radioactive waste repositories, were conducted by nuclear regulatory inspectors from the Radiological Protection Department of the PAA (currently the Supervision and Control Department) working in Warsaw, Katowice, and Poznań. In 2018, 846 such inspections were conducted, including 5 repeated inspections (second inspections in the same year), of which 319 inspections were conducted by inspectors from the RPD from Warsaw, 334 - from Katowice, and 196 from Poznań. Before each inspection started, a detailed analysis was performed of the collected documentation pertaining to the inspected organizational unit and its operations for the purpose of preliminary evaluation of presence of possible "critical points" in such operations and the quality assurance system in place in such unit.

FIG. 3.

The number of licenses for conducting operations in conditions of exposure to ionizing radiation and amending annexes to licenses granted by the President of the PAA in the years 2008-2018

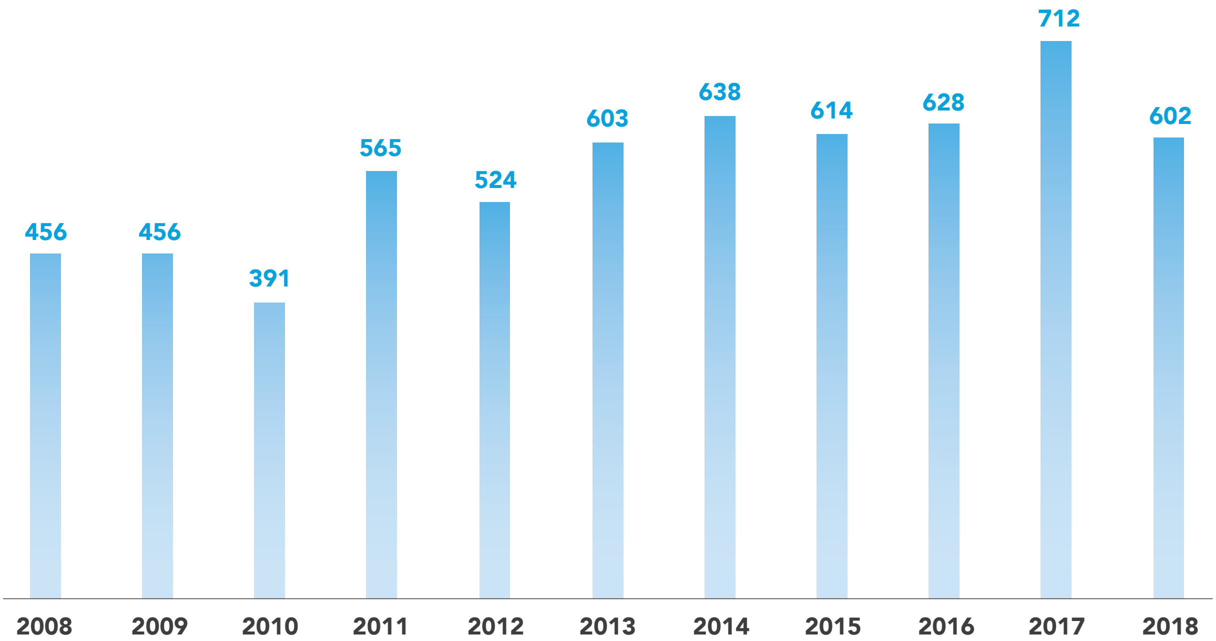


FIG. 4.

Number of inspections conducted by PAA inspectors in the years 2008–2018

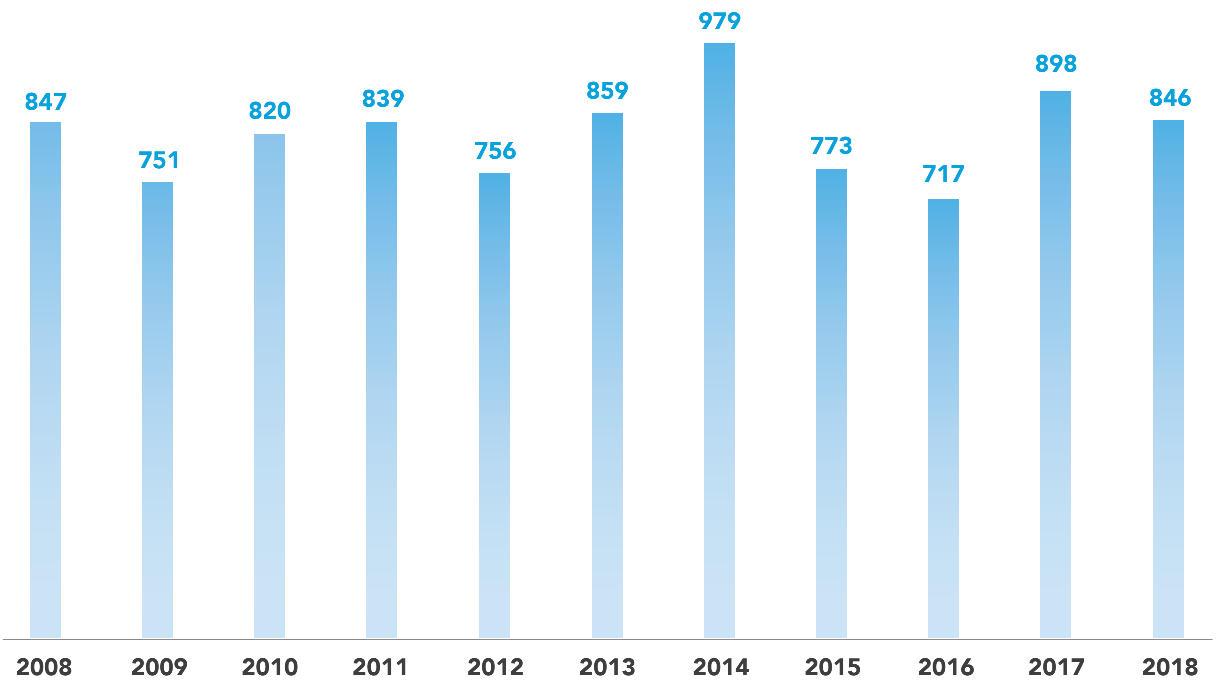


TABLE 1.
Ionizing radiation source users in Poland in numbers (as of 31 December 2018)

Type of operations	Symbol	Number of units	Number of types of operation
Class I laboratory	I	2	2
Class II laboratory	II	91	109
Class III laboratory	III	119	226
Class Z laboratory	Z	133	226
Isotope sensor installer	UIC	367	367
Equipment installer	UIA	179	226
Isotope device	AKP	532	687
Manufacture of isotope sources and devices	PRO	26	31
Trade in isotope sources and devices	DYS	82	89
Accelerator	AKC	76	192
Isotope applicators	APL	37	55
Telegamma therapy	TLG	4	4
Radiation device	URD	36	37
Gamma graphic apparatus	DEF	105	108
Storage facility of isotope sources	MAG	163	194
Work with sources outside registered laboratory	TER	70	81
Transport of sources or waste	TRN	494	507
Chromatograph	CHR	232	284
Veterinary X-ray apparatus	RTW	1227	1285
X-ray scanner	RTS	569	776
X-ray defectoscope	RTD	205	227
Other X-ray apparatus	RTG	418	611
Total:			**6,324**

NUMBER OF AUTHORIZATIONS ISSUED IN 2018			INSPECTIONS	
licenses	annexes	registration decisions	Number of inspections 2018	Inspection frequency
0	1	0	2	annually
8	22	0	42	every 2 years
2	5	4	42	every 3 years
6	9	23	44	every 4 years
5	3	0	14	ad hoc inspections
22	21	0	68	every 3 years
14	20	0	136	every 3 years
1	1	0	5	every 3 years
2	4	2	5	ad hoc inspections
26	16	0	49	every 4 years
0	3	0	15	every 2 years
0	0	0	0	every 2 years
0	0	0	17	every 3 years
7	10	0	60	every 2 years
37	3	0	41	every 3 years
9	2	1	3	every 3 years
6	1	3	9	ad hoc inspections
0	0	8	0	ad hoc inspections
93	0	0	26	ad hoc inspections
107	39	0	31	ad hoc inspections
19	10	0	98	every 2 years
46	22	0	139	ad hoc inspections
410	**192**	**41**	**846**	

Ad hoc inspections

In order to ensure appropriate frequency of inspections, inspection cycles were agreed for particular groups of activities depending on the threat posed by the given group of activities. At the same time, based on the results of inspections performed in recent years, specific activities were distinguished which, from the perspective of assessment of the hazards involved in such activities and on account of the evolving safety culture of personnel performing such activities, do not require direct supervision in the form of routine inspections or when such inspections are pointless.

Ad-hoc inspections in entities performing the selected activities are only conducted occasionally, as the need be, and supervision of such activities is mainly based on the analysis of reports on the activity, records of individual sources and declarations of shipment submitted. Data regarding audits and inspections performed by Nuclear Regulatory Inspectors from the PAA Radiological Protection Department in 2018 is presented in Table 1.

Register of sealed radioactive sources

The obligation of maintaining sealed radioactive sources register stems from article 43c (1) of the Atomic Law Act of 29 November 2000.

Heads of organizational units performing activity which involves use or storage of sealed radioactive sources or equipment featuring such sources under the relevant authorization granted are obliged to submit copies of records concerning the radioactive sources to the PAA President. Such documents include record sheets containing the following data about sources: radioactive isotope name, activity according to a source certificate, date when the activity was established, certificate number and source type, storage vessel type or device name and place of the source use or storage.

Data extracted from the accountancy cards are entered into the register of sealed radioactive sources, used to verify information about individual sources. The information contained in the said register is used to supervise organizational units conducting activity involving exposure to ionizing radiation. The supervision consists in comparing accountancy cards entries with the scope of the given authorization issued. Data from the register are also used to prepare information and statements for central government and local administration bodies for purposes of mutual cooperation and statistics.

The register contains data of 26,500 sources, including disused radioactive sources (taken out of service and delivered to the Radioactive Waste Management Plant), as well as information concerning their movement (i.e. date of receipt and shipment of the given source) and associated documents.

26,500

RADIOACTIVE SOURCES IN THE REGISTER

Depending on the purpose and the activity of the source, and a type of the radioactive isotope contained in the source, the register software enables the given source to be classified under different categories in accordance with recommendations of the International Atomic Energy Agency:

Category 1 sealed radioactive sources used in such fields as teleradiotherapy in medicine, industrial radiography, and radiation technologies.

The register contains 1,303 sources of category 1 which are in use.

Category 2 – sealed radioactive sources used in such fields as medicine (brachytherapy), geology (borehole drilling), industrial radiography (mobile control and measurement instruments and stationary instruments for industrial applications) including level and density meters containing sources of Cs-137 with the activity exceeding 20 GBq and of Co-60 with the activity exceeding 1 GBq, thickness meters containing sources of Kr-85 with the activity exceeding 50 GBq, sources of Am-241 with the activity exceeding 10 GBq, sources of Sr-90 with the activity exceeding 4 GBq and of Tl-204 with the activity exceeding 40 GBq, belt conveyor weighbridges containing sources of Cs-137 with the activity exceeding 10 GBq, sources of Co-60 with the activity exceeding 1 GBq and of Am-241 with the activity exceeding 10 GBq.

The register contains 1,303 sources of category 1 which are in use.

Category 3 – other sealed radioactive sources, including those used in stationary control and measurement instruments.

The register contains 7,675 sources of category 3 which are in use.

TABLE 2.
Selected radioactive isotopes and sources containing them (as of 31 December 2018)

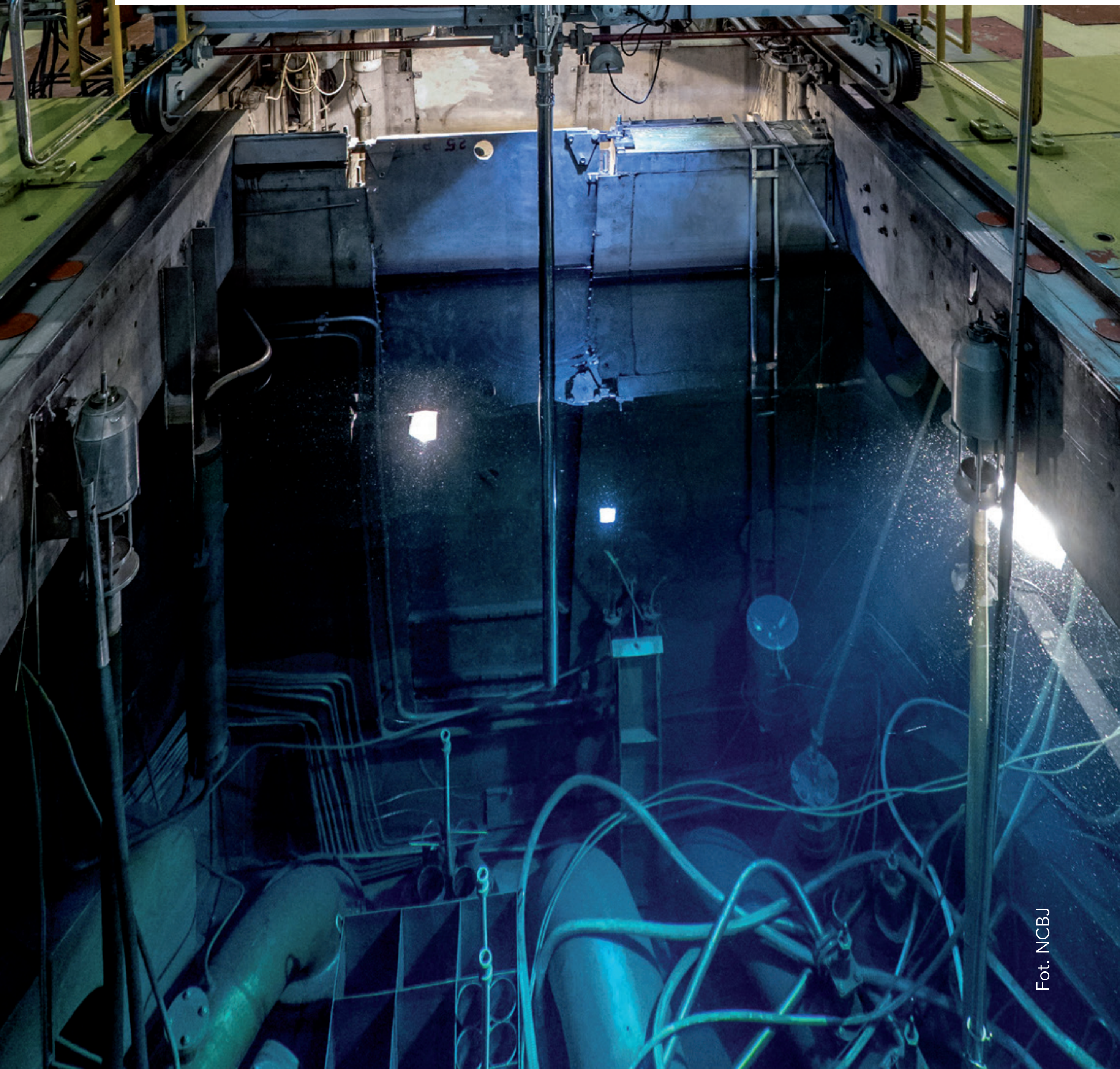
	Number of sources in the register		
Isotope	cat. 1	cat. 2	cat. 3
Co-60	796	1,250	1,969
Ir-192	235	92	4
Cs-137	79	266	2,252
Se-75	165	54	5
Am-241	9	370	805
Pu-239	2	103	99
Ra-226	-	75	61
Sr-90	-	43	779
Pu-238	1	79	22
Kr-85	5	43	176
Tl-204	-	-	96
inne	11	123	1,407
Total	1,303	2,498	7,675

1,303
CATEGORY 1 SOURCES 1

2,498
CATEGORY 2 SOURCES

7,675
CATEGORY 3 SOURCES

4 Supervision of nuclear facilities



Fot. NCBJ

Nuclear facilities in Poland

Nuclear facilities in Poland include:

- the MARIA research reactor along with its technological pool where spent nuclear fuel is stored during the facility operation;
- the EWA research reactor (in the course of decommissioning);
- spent nuclear fuel storages.

These facilities are located in Świerk near Otwock and are administered by two separate organizational entities:

- **the MARIA research reactor** – at the National Centre for Nuclear Research (NCBJ) based in Świerk near Otwock;
- **the EWA reactor** as well **as spent nuclear fuel storages** – at the Radioactive Waste Management Plant (ZUOP) in Świerk near Otwock.

Directors of these entities are responsible for ensuring nuclear safety, radiological protection, physical protection and safeguards.

The MARIA reactor

The MARIA research reactor is historically the second nuclear reactor built in Poland (disregarding the critical assemblies of ANNA, AGATA and MARYLA) and at present, it is the only functioning reactor in the country. It is a high-flux pool-type reactor with a nominal thermal power of 30 MW_t and a maximum flux density of thermal neutrons in the core of $3.5 \cdot 10^{18} n/(m^2 \cdot s)$. The MARIA reactor was commissioned in 1975, and in the years 1985–1993 the reactor was shut down for necessary upgrading which included installation of a passive core cooling system using water from the reactor pool. From April 1999 to June 2002, gradual conversion of the reactor core was conducted in 106 consecutive reactor fuel cycles, thus decreasing the fuel enrichment from 80% to 36% of the U-235 isotope content (HEU – High Enriched Uranium). As part of implementation of the Global Threat Reduction Initiative (GTRI) program, in 2014, the MARIA reactor was adapted to work using low enriched uranium (LEU) fuel with the content of the U-235 isotope below 20%.

FIG. 5.
There are four nuclear facilities in Poland: MARIA research reactor, EWA research reactor (in the course of decommissioning) and two spent nuclear fuel storages. All are located at nuclear research facility premises in Świerk near Otwock.

In 2018, the reactor operation schedule was adapted to:

- demand for irradiation of uranium plates required for production of molybdenum-99 for CURIUM company, and the task was performed in 16 fuel cycles during which the uranium plates were irradiated in channels especially adapted to this purpose;
- irradiation of target materials for the Radioisotope Centre POLATOM, namely tellurium dioxide, potassium chloride, sulphur, lutetium, cobalt and iron, intended for production of radioisotopes to be used in nuclear medicine. Figure 6 provides statistics concerning the irradiation of target materials (from 1978 up to and including 2017)

In 2018, the MARIA reactor was in service for 4,484 hours, working in 35 fuel cycles, as illustrated in Figure 7.

General information concerning operation of the MARIA reactor is presented on p. 28-29.

Compared to the preceding year, the overall number of unplanned shutdowns increased slightly.

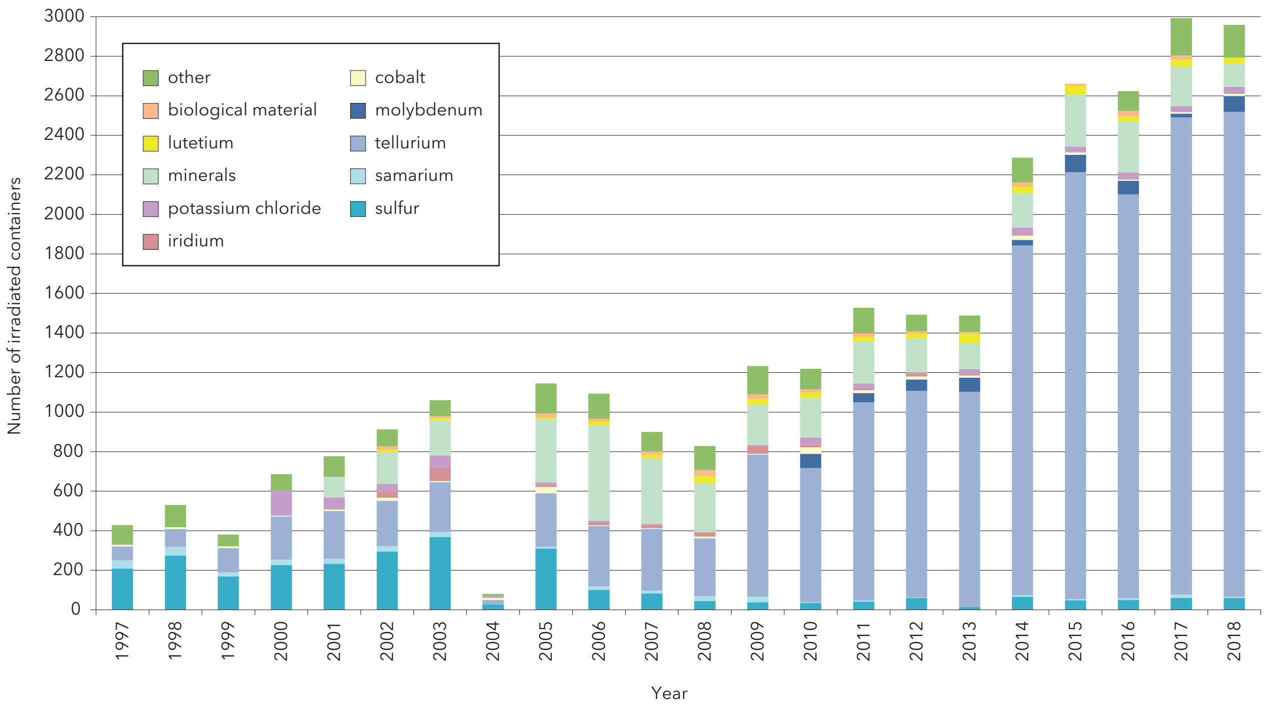
They were caused by minor equipment malfunctions, constituting no threat to nuclear safety, which should result in reactor shutdown in accordance with the reactor design. The number of tests, inspections and maintenance in comparison with the preceding year remained similar.

The MARIA research reactor has also been used for physical studies, mainly of condensed matter, using six horizontal channels (H-3 to H-8). In year 2018, the channels were closed because they were being prepared together with the physical hall (where research is conducted on the use of those channels), for an upgrade. In the coming years, as part of the upgrade, modern research equipment obtained from foreign research reactor will be installed.

The technological pool of the MARIA reactor is currently used to store spent MC nuclear fuel produced in the course of ongoing operation of the reactor.

FIG. 6.

Materials irradiated in the MARIA reactor until 2018 (data: NCBJ)



EWA research reactor in the course of decommissioning

The EWA research reactor was operated in the years 1958–1995. The reactor's original thermal power was 2 MW$_t$, and afterwards increased to 10 MW$_t$.

The reactor decommissioning process, which started in 1997, in 2002 reached the status referred to as "the end of phase two." It means that nuclear fuel and all irradiated structures and components whose activity level might have been hazardous from the perspective of radiological protection, were removed from the reactor. As a result, the EWA reactor does not release any radioactive substances to the environment. The reactor building has been repaired and the offices were adapted for use by the Radioactive Waste Management Plant.

Currently, the building of the former EWA reactor houses:

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

Spent nuclear fuel storages

The category of nuclear facilities also includes wet spent nuclear fuel storages, i.e. facilities no. 19 and 19A operated by the Radioactive Waste Management Plant.

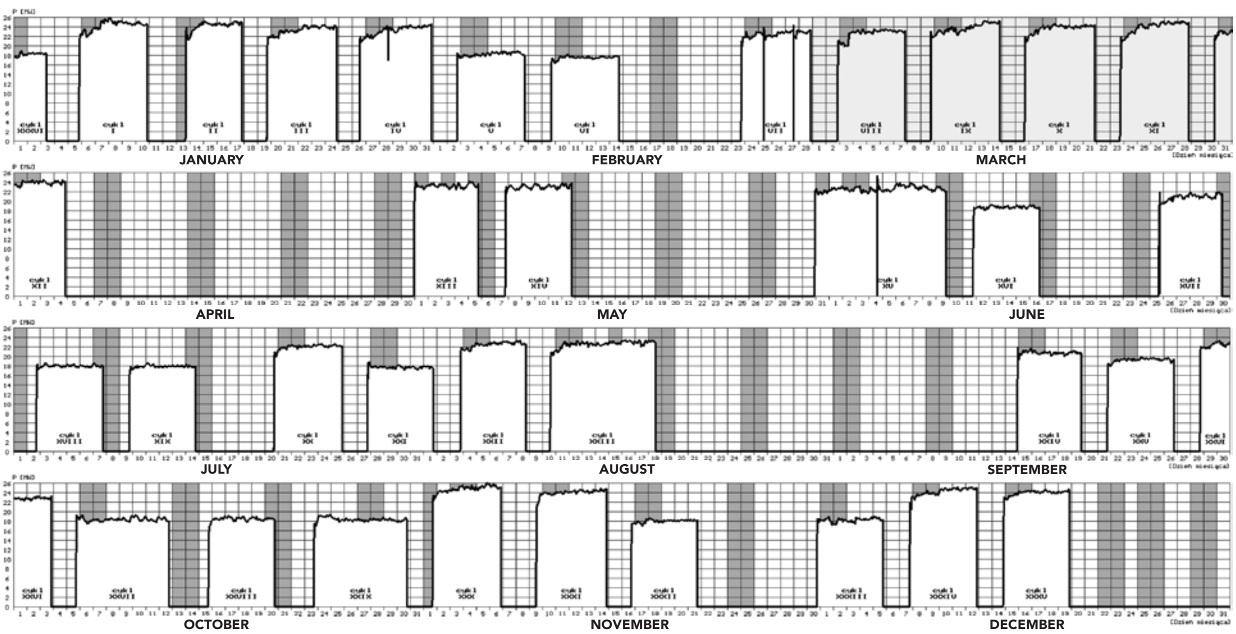
Facility no. 19 was used to store the encapsulated spent low enriched nuclear fuel EK-10 from the EWA reactor, shipped to the country of origin (i.e. the Russian Federation) in September 2012.

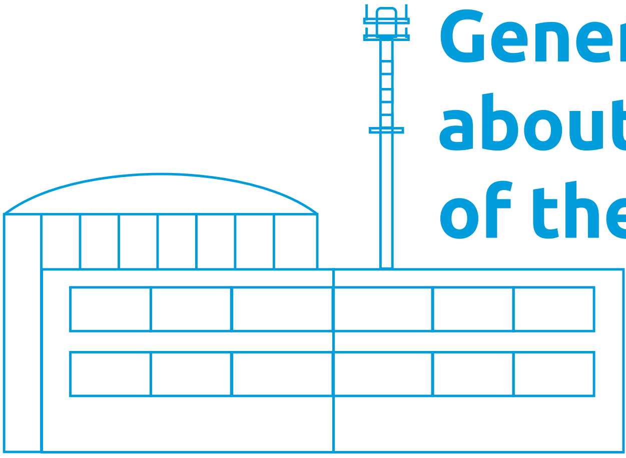
This facility is now used for storage of some solid radioactive waste (structural elements) from decommissioning of the EWA reactor and operation of the MARIA reactor, as well as disused high-activity gamma radiation sources.

Facility no. 19A was used for storage of spent high enriched nuclear fuel marked as WWR-SM and WWR-M2 from the operation of the EWA reactor in the years 1967–1995 as well as the spent encapsulated MR nuclear fuel from the MARIA reactor's operation in the years 1974–2005. Since all the spent nuclear fuel from storage no. 19A was shipped back to the Russian Federation in 2010, the storage is currently used as a backup for storage of spent fuel from the MARIA reactor in case of emergency.

FIG. 7.

Summary of the MARIA reactor operation cycles in 2018 – (data: NCBJ)





General information about operation of the MARIA reactor

Number of work cycles

- I. 12
- II. 5
- III. 8
- IV. 10

Time of operation at nominal power [h]

4,484

- I. 1,423
- II. 706
- III. 1,035
- IV. 1,320

Average reactor power in cycles [MWt]

- I. 17–24
- II. 19–23
- III. 18–23
- IV. 18–25

17–25

Number of fuel elements in the core

25-26

per quarter in 2018

OFF

Unplanned shutdowns and trips

Human error	Equipment malfunction (I.)	Instrumentation error (II.)	Loss of electrical power
0	1	2	2

Malfunctions/defects and non-compliances found

Q1	Q2	Q3	Q4	
2	1	1	1	5

Repair and maintenance works conducted

Q1	Q2	Q3	Q4	
8	12	14	4	38

Tests, inspections and checks conducted

Q1	Q2	Q3	Q4	
21	21	10	29	81

Licenses issued

The MARIA reactor is operated by the National Centre of Nuclear Research (NCBJ) on the basis of license no. 1/2015/ MARIA of 31 March 2015 issued by the PAA President. The license is valid until 31 March 2025.

Furthermore, the PAA President issued the following licenses concerning the functioning of the MARIA reactor which are not licenses to operate a nuclear facility:

- License no. 1/2015/NCBJ of 3 April 2015 for storage of nuclear material;
- License no. 2/2015/NCBJ of 3 April 2015 for storage of spent nuclear fuel.

In 2018, the following decisions were issued, amending license no. 1/2015/Maria of 31 March 2015:

- Decision no. 1/2018/Maria of 10 April 2018, amending license no. 1/2015/Maria associated with change of the conditions of irradiation of uranium plates;
- Decision no. 2/2018/Maria of 20 December 2018, amending license no. 1/2015/Maria associated with inclusion of a temperature difference alarm and warning signal in the safeguard system of the MARIA reactor.

Decommissioning of the EWA reactor, as well as operation of the spent nuclear fuel storages by the Radioactive Waste Management Plant takes place under license no. 1/2002/EWA of 15 January 2002, which has an unlimited period of validity.

Regulatory inspections

In 2018, PAA nuclear regulatory inspectors conducted 12 inspections in relation to nuclear safety, radiation protection, and physical protection of nuclear material and nuclear facilities. The inspections did not show any threat to nuclear safety and radiological protection; however, in some cases the regulatory inspectors identified breaches of provisions related to ongoing operation and violation of the terms and conditions of the licence.

The PAA conducted:

8

8 INSPECTIONS AT THE NATIONAL CENTRE FOR NUCLEAR RESEARCH

4

4 INSPECTIONS AT THE RADIOACTIVE WASTE MANAGEMENT PLANT, INCLUDING: 3 INSPECTIONS AT THE NATIONAL RADIOACTIVE WASTE REPOSITORY (KSOP) IN RÓŻAN AND 1 INSPECTION AT THE RADIOACTIVE WASTE MANAGEMENT PLANT IN OTWOCK.

Inspections conducted at NCBJ covered the MARIA reactor and included, among other aspects, the verification and assessment of:

- compliance of the MARIA reactor current operation and documentation with limits and conditions of the license granted;
- the status of radiation protection in the reactor facility;
- the ways to eliminate the non-compliances identified during previous regulatory inspections;
- the ventilation system;
- the main and emergency power supply system;
- the fuel channel cooling system;
- the liquid low-level radioactive waste system;
- the instruments of the process control and neutron measurements system;
- the reactor protection system settings;
- functioning of the nuclear materials and nuclear facility physical protection system;
- emergency preparedness at the NCBJ.

The inspections conducted in the Radioactive Waste Management Plant (ZUOP) were related to:

- the status of radiological protection in the facilities operated by the ZUOP;
- carrying out the processes of radioactive waste disposal and radioactive waste storage;
- the technical condition of the ZUOP facilities;
- shared records of radioactive waste (a computer database);
- verification of the ways to eliminate the non-compliances identified during previous regulatory inspections.

The inspections carried out at the KSOP in Różan, which belongs to the ZUOP, were focused on:

- the procedures for transport of radioactive waste at the KSOP;
- compliance of current operation with applicable regulations;
- receipt of waste at the KSOP repository and measurements at the repository;
- functions of the physical protection system at the KSOP;
- verification of the ways to eliminate the non-compliances during previous regulatory inspections.

In the course of the inspections, 15 non-compliances were identified: 10 at the MARIA research reactor, 3 at the ZUOP, and 2 at the KSOP. The PAA President initiated 13 procedures ordering remedy of the non-compliances and in 2 cases no such order was issued due to the fact that the non-compliances have already been remedied.

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

In accordance with the provisions of the Atomic Law Act, for purposes of supervision and control of nuclear safety and radiological protection of nuclear facilities, nuclear regulatory bodies cooperate with other public administration bodies through a **coordination system**. The cooperating bodies include the Office of Technical Inspection, the National Fire Service, environmental, protection inspection bodies, building inspection bodies, State Sanitary Inspection authorities, the National Labour Inspectorate and the Internal Security Agency.

The coordination system is directed by the President of PAA. The President has been vested with several necessary entitlements, such as the possibility to convene meetings of representatives of cooperating authorities and inviting to these meetings representatives of other authorities and services as well as laboratories, expert organizations, expert surveyors and specialists who can render advice and support and ultimately contribute to the effectiveness of the system. The latter objective is also attained by establishing teams to handle individual specific tasks connected with the coordination of control and supervision of nuclear facilities.

The cooperation between the bodies covered by the system particularly entails the exchange of information about the controlling activities conducted, organization of joint training courses and exchange of experience as well as new legal acts and technical and organizational guidance.

In 2017, activities within the framework of the coordination system included:

- continued collaboration between PAA and the Internal Security Agency in supervision of the physical protection system of the MARIA reactor;
- joint participation of the UDT and the PAA in the international school for nuclear regulatory inspectors on 3-14 September 2018 in Warsaw.

NUCLEAR POWER PLANTS IN NEIGHBOURING COUNTRIES

In a distance not larger than 300 km from Polish borders, there are 8 nuclear power plants operating 21 power reactor units with the total capacity of approx. 14.4 GWe.

SWEDEN

Oskarshamm NPP

PL 298 km

1 BWR unit
1,450 MWe

CZECH REPUBLIC

EJ Dukovany NPP

PL 119 km

4 WWER-440 units
500 MWe
500 MWe
500 MWe
500 MWe

CZECH REPUBLIC

Temelin NPP

PL 192 km

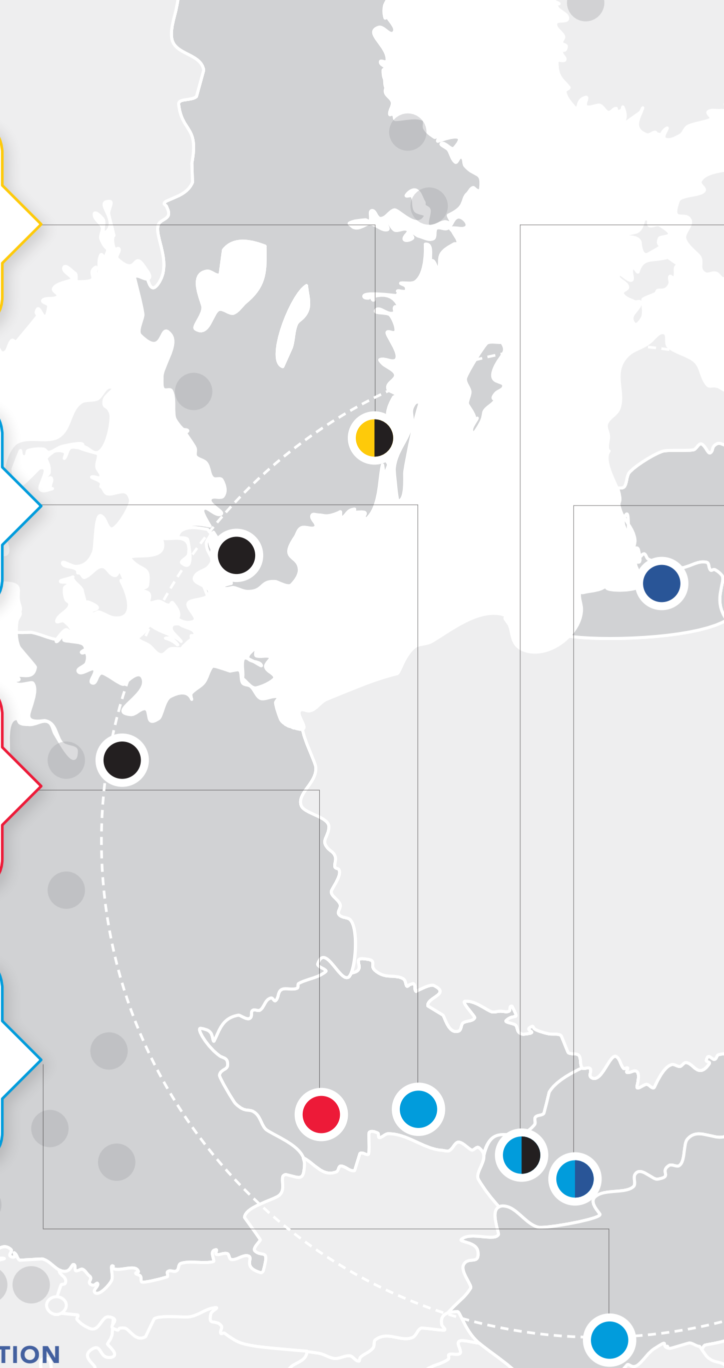
2 WWER-1000 units
1,080 MWe
1,080 MWe

HUNGARY

Paks NPP

PL 300 km

4 WWER-440 units
500 MWe
500 MWe
500 MWe
500 MWe



NUCLEAR REACTORS UNDER CONSTRUCTION

2 WWER-440 reactors at the **Mochovce NPP** (Slovakia)

2 WWER-1200 reactors at the **Ostroviec NPP** (Belarus)

1 WWER-1200 reactor at the **Baltic** (Kaliningrad District, Russia)

2 WWER-1000 reactors at the **Khmelnitzkyi NPP** (Ukraine)

SOME NPP'S FURTHER THAN 300 KM AWAY FROM POLAND

8

NUCLEAR POWER PLANTS IN OPERATION

14

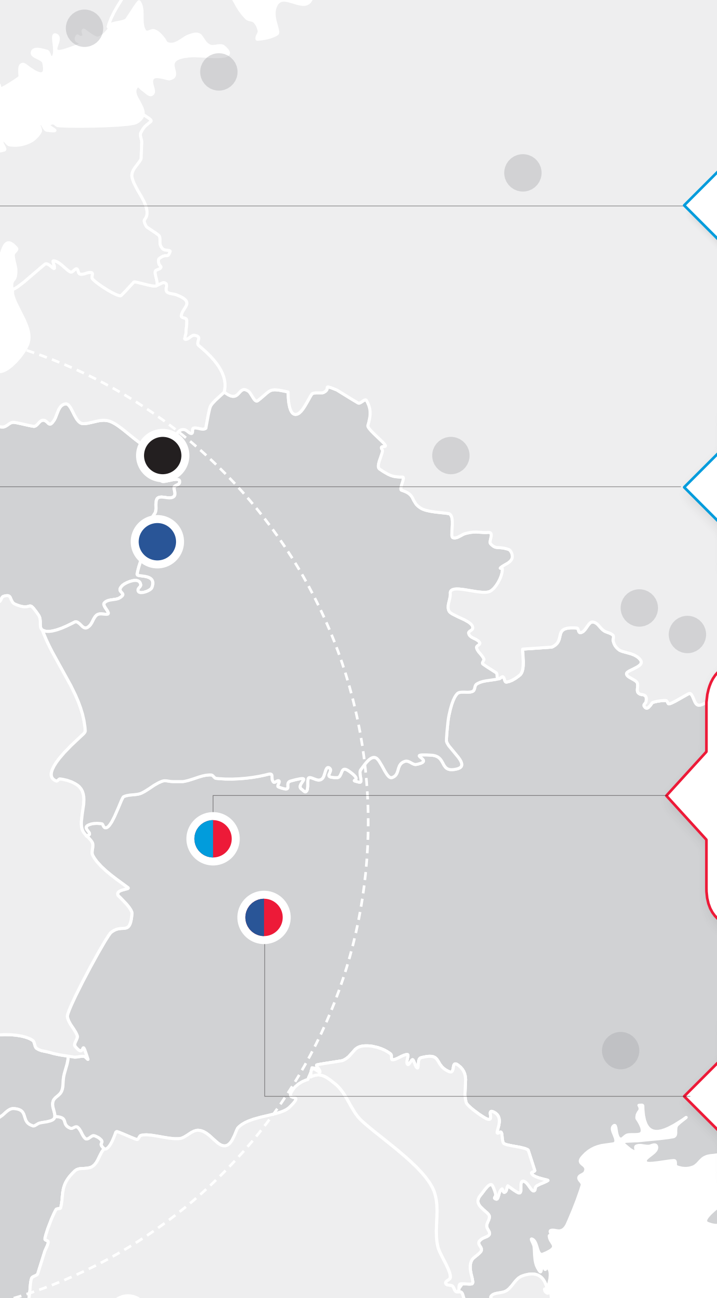
WWER-440 TYPE REACTORS

6

WWER-1000 TYPE REACTORS

1

BWR TYPE REACTOR



SLOVAKIA	Bohunice NPP	**2 WWER-440 units**
	PL **138 km**	505 MWe
		505 MWe

SLOVAKIA	Mochovce NPP	**2 WWER-440 units**
	PL **133 km**	470 MWe
		470 MWe

UKRAINE	Rivne NPP	**2 WWER-440 units**
	PL **134 km**	420 MWe
		415 MWe
		2 WWER-1000 units
		1,000 MWe
		1,000 MWe

UKRAINE	Khmelnitzkyi NPP	**2 WWER-1000 units**
	PL **184 km**	1,000 MWe
		1,000 MWe

NUCLEAR POWER PLANTS AT A PERMANENT SHUTDOWN STAGE

Ignalina NPP (Lithuania)
2 RBMK type reactors with the capacity of 1,300 MWe decommissioned in 2004 and 2009

Bohunice NPP (Slovakia)
2 WWER type reactors with the capacity of 440 MWe decommissioned in 2006 and 2008

Krümmel NPP (Germany)
1 BWR type reactor with the capacity of 1,402 MWe decommissioned in 2011

Barsebäck NPP (Sweden)
2 BWR type reactors with the capacity of 615 MWe decommissioned in 1999 and 2005

Oskarshamn NPP (Sweden)
2 BWR type reactors with the capacity of 492 MWe and 661 MWe decommissioned, respectively, in 2017 and 2016

More information can be found at: Power Reactor Information System **www.iaea.org/pris**

5 Safeguards

Fot. NCBJ

Legal basis for safeguards

LEGAL BASIS

With regard to safeguards Poland fulfils its obligations resulting from the following international regulations:

- Treaty establishing the European Atomic Energy Community (Euratom Treaty) of 25 March 1957. In Poland, the provisions of the Treaty have been binding since Poland's accession to the European Union;
- Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The Treaty came into force on 5 March 1970, and it was extended for an indefinite period of time in 1995. Poland ratified the Treaty on 3 May 1969 and it came into force in the country on 5 May 1970;
- Agreement between Poland, the European Atomic Energy Community and the International Atomic Energy Agency in connection with the implementation of Article III of the Treaty on the Non-Proliferation of Nuclear Weapons, also known as Trilateral Safeguards Agreement INFCIRC/193. It came into force for Poland on 1 March 2007;
- Additional Protocol to the Trilateral Safeguards Agreement in connection with the implementation of Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/193/Add. 8). The Protocol came into force on 1 March 2007;
- Commission Regulation (Euratom) no. 302/2005 of 8 February 2005 on the application of Euratom safeguards (EU OJ L54 of 28 February 2005).

The most common form of safeguards agreement, concluded on the grounds provided by the Treaty on the Non-Proliferation of Nuclear Weapons between countries not being in possession of nuclear weapons and the International Atomic Energy Agency (IAEA), is an agreement based on the IAEA's model document, INFCIRC/153.

Pursuant to the latter, in 1972 Poland and the International Atomic Energy Agency signed the agreement for the application of safeguards, as laid down in the IAEA's document INFCIRC/179.

In March 2006 an integrated safeguards system was introduced in Poland. It became possible following the submission of all the relevant information concerning the safeguards to the IAEA. On this basis the IAEA established that nuclear material was used in Poland for peaceful purposes only. The deployment of the integrated safeguards system allowed for considerable reduction of the number of inspections undertaken by the IAEA in Poland. The bilateral agreement for the application of safeguards concluded between Poland and the IAEA remained effective until February 2007.

Once Poland joined the European Union, the agreement between Poland and the IAEA was suspended. The integrated safeguards system has been binding since 1 March 2007 under a trilateral agreement between Poland, the European Atomic Energy Community and the International Atomic Energy Agency. The PAA President is responsible for the implementation of this agreement.

Pursuant to the trilateral agreement in question, the IAEA and EURATOM have been vested with the power to conduct safeguards inspections. Objectives of these inspections include verification of conformity between reports and the operator's documentation, identification and validation of the nuclear material storage facility, verification of quantity and composition of materials placed under safeguards, explanation of reasons for material unaccounted for and discrepancies in the information provided by the nuclear material shipper and recipient. Inspections are also conducted before nuclear material are removed from the Polish territory or after they are brought in.

Users of nuclear materials in Poland

The tasks of the national system of accounting and control of nuclear material are conducted by the Inspection and Oversight Department of the PAA, which is responsible for the collection and storage of information concerning nuclear material and for carrying out inspections in all material balance areas.

In matters regarding inspection of export and import of nuclear material, strategic goods and dual-use technologies the PAA cooperates with the Department of Trade in Sensitive Goods and Technical Safety of the Ministry of Development. On the basis of opinions submitted by the PAA and other ministries, by way of the Tracker system, the Ministry of Development issues decisions concerning the supervision of import or export of nuclear material and strategic goods and technologies.

- The Radioactive Waste Management Plant (ZUOP), responsible for spent nuclear fuel storages, the shipment warehouse and the National Radioactive Waste Repository in Różan (**WPLG** material balance area);
- MARIA Reactor Operations Division and the associated research laboratories of the NCBJ (**WPLC**);
- POLATOM Radioisotopes Centre at the NCBJ (**WPLD**);
- Institute of Chemistry and Nuclear Technology in Warsaw (**WPLF**);
- 28 medical and research facilities using small quantities of nuclear material and 89 industrial, diagnostic and service facilities equipped mainly with depleted uranium shields. All facilities comprise the material balance area Locations Outside the Facilities (**WPLE**).

Changes to quantities of nuclear materials held in individual areas of the material balance areas (Inventory Change Reports) are reported on a monthly basis to the system of nuclear material accountancy and control managed by the European Commission's Euratom Energy Directorate in Luxembourg. Copies of the foregoing information are also submitted by organizational units to the PAA. Monthly reports on changes of the nuclear materials inventory in the WPLE area are prepared by the PAA and then submitted to the European Commission.

INFOGRAPHIC

Balance of nuclear material in Poland, in kg
(as of 31 December 2018)

Safeguards inspections

In 2018, nuclear regulatory inspectors from the Inspection and Oversight Department of the PAA, unassisted or acting together with IAEA and EURATOM inspectors, performed 40 routine safeguards inspections in all material balance areas in Poland. EURATOM inspectors participated in 9 inspections and IAEA inspectors – in 3 inspections, only in the WPLC. In addition, IAEA inspectors carried out at the WPLC a so-called "short notice inspection," which was also attended by EURATOM and PAA inspectors.

During all of the inspections conducted, the IAEA and EURATOM inspectors formulated no significant reservations with regard to nuclear material safeguards.

Based on the Additional Protocol to the Trilateral Safeguards Agreement in connection with Article III of the Treaty on Non-Proliferation of Nuclear Weapons, in March and September, IAEA conducted supplementary access inspections at the WPLG materials balance areas in Różan and Świerk. Both access inspections were attended by PAA and European Commission inspectors. As a result of the activities, IAEA inspectors confirmed lack of undeclared nuclear materials and activities.

Fulfilling the obligations based on the Additional Protocol to the Trilateral Safeguards Agreement, a declaration was submitted to EURATOM, updating information concerning technical or research activities conducted in the country, associated with the nuclear fuel cycle, information on lack of export of goods listed in Annex II to the Protocol and a declaration concerning users of small quantities of nuclear materials in Poland.

As a result of all inspections conducted, no non-compliances connected with safeguards of nuclear material in Poland were found. In particular, it was confirmed that all nuclear material in Poland was used for peaceful activities.

6 Transport of radioactive materials

Fot. IAEA

Transport of radioactive sources and waste

LEGAL BASIS

Transport of radioactive material is conducted on the basis of the following national regulations:

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

The Polish provisions of law are based on the following international modal regulations:

- **ADR** (L'Accord européen relatif au transport international des marchandises Dangereuses par Route);
- **RID** (Reglement concernant le transport Internationale ferroviaire des marchandises Dangereuses);
- **ADN** (European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways);
- **IMDG** Code (International Maritime Dangerous Goods Code);
- **ICAO** Technical Instructions for the Safe Transport of Dangerous Goods by Air;
- **IATA DGR** (International Air Transport Association – Dangerous Goods Regulation).

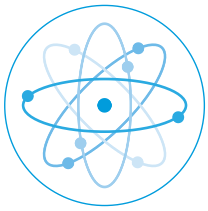
Radioactive material is transported in accordance with transport regulations SSR-6 developed by the International Atomic Energy Agency. They provide grounds for international organizations preparing the aforementioned international modal regulations or they are directly implemented to the national legal framework and constitute the basic legal form in international transport.

Pursuant to the obligations of Poland towards the IAEA, radioactive sources classified under appropriate categories are transported in accordance with the provisions laid down in the Code of Conduct on the Safety and Security of Radioactive Sources and Guidance on the Import and Export of Radioactive Sources as well as in a supplementary document of Guidance on the Import and Export of Radioactive Sources.

In the context of transport of radioactive materials, a particularly significant issue is preventing of attempts of illegal (i.e. without proper authorization or notification) transport of radioactive substances and nuclear material to Poland. These attempts are prevented by the National Border Guard having **329 fixed radiation portal monitors** installed at border crossing points and **1,375 mobile signalling and measurement devices** at their disposal.

As a result of the inspections carried out, in 3 cases the National Border Guard prohibited to continue transport due to exceeding of the acceptable limits of radioactive contamination.

Like in the previous years, in accordance with the Memorandum of Understanding signed in 2009 between the U.S. Department of Energy (DoE), the Minister of the Interior and Administration, and the Minister of Finance of the Republic of Poland concerning cooperation in preventing the illicit trafficking of nuclear and other radioactive material, the National Border Guard was reinforced by the American partner, supplying them with equipment.



In 2018, 31,057 shipments of radioactive materials were performed and 110,777 parcels were carried in road, railway, inland, sea, and air transport in the territory of Poland. Also, the Radioactive Waste Management Plant performed 12 shipments of radioactive waste to the National Radioactive Waste Repository in Różan.

15 spectrometers were shipped for identification of radioactive isotopes. Also, fixed radiation portal monitors were installed in container terminals in Gdańsk and Gdynia and at the Kraków and Rzeszów airports. The National Border Guard also continues activities aimed to install more fixed monitors for radiometric control.

Moreover, the National Border Guard participated in exercises concerning prevention of illegal transport of radioactive sources organized together with the Ukrainian party and the US Department of Energy.

Transport of nuclear fuel

Fresh and spent nuclear fuel is transported under an authorization granted by the PAA President.

In 2018, there was only one shipment of fresh nuclear fuel performed as a part of a transit through the territory of Poland.

Fresh nuclear fuel

In 2018, no fresh fuel was imported.

Spent nuclear fuel

No export of spent fuel took place in year 2018.

INFOGRAPHIC

Basic terms and units used in radiological protection.

In 2018, National Border Guard posts conducted the following number of inspections:

	for import to Poland	for transit, export from Poland	transfer at an airport
TRANSPORT OF RADIOACTIVE SOURCES	915 inspections	3785 inspections	176 inspections
TRANSPORT OF MATERIALS CONTAINING NATURAL RADIOACTIVE ISOTOPES	8536 inspections	14 686 inspections	135 inspections
TRANSPORT OF OTHER UNDECLARED ITEMS (E.G. OBJECTS CONTAINING ELEMENTS PAINTED WITH RADIUM PAINT)	2 inspections	9 inspections	2 inspections
PERSONS AFTER TREATMENT OR EXAMINATIONS USING RADIOACTIVE ISOTOPES	1318 inspections		

7 Radioactive waste

Fot. PAA

Management of radioactive waste

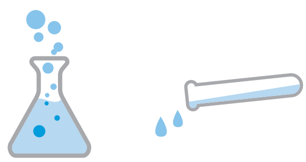
Radioactive waste is generated as a result of the use of radioisotopes in medicine, industry and scientific research, production of sealed and unsealed radioactive sources and in the course of operation of research reactors. This type of waste may occur in gaseous, solid and liquid form.

INFOGRAPHIC

Radioactive waste may occur in the following forms:

SOLID WASTE

includes disused sealed radioactive sources, personal protection items contaminated with radioactive substances (rubber gloves, protective clothing, footwear), laboratory materials and equipment (glass, components of instruments, lignin, cotton wool, foil), used tools and elements of technological equipment (valves, parts of pipelines or pumps) as well as used sorptive and filtering materials utilized in the purification of radioactive solutions or air released from reactors and isotope laboratories (used ionites, precipitation sludge, filter cartridges etc.). What is taken into consideration in the classification of radioactive waste is the radioactive concentration of radioactive isotopes contained in the waste as well as radioactive half-life.



LIQUID WASTE

mainly comprises aqueous solutions and suspensions of radioactive substances.

GASEOUS WASTE

is produced as a consequence of operation of the MARIA research reactor. It mainly comprises radioactive noble gases, iodine, cesium and tritium.

One may distinguish between the following categories of radioactive waste: low-, intermediate- and high- level radioactive waste, classified under three sub-categories, namely transitional, short- and long-lived. There are also spent sealed radioactive sources which constitute an additional category of radioactive waste, classified according to the activity level criterion under the following three sub-categories: low-, medium- and high-activity ones.

Radioactive waste types containing nuclear material and spent nuclear fuel are subject to special regulations on the management procedures applicable at every stage (including storage and disposal), the latter becoming high-activity waste when a decision is made to dispose of it.

Processing and disposal of radioactive waste require reduction of its production quantity, its appropriate segregation, decrease of volume, solidification and packaging in a manner ensuring that all the measures undertaken and barriers provided effectively isolate the waste from people and the environment.

Radioactive waste is **stored** (temporarily) in a way which ensures protection of people and the environment under normal conditions and in cases of radiation emergency, including protection of radioactive waste against leakage, dispersion or release. The means that can be used for these purposes are dedicated facilities or compartments (radioactive waste storages) featuring equipment for mechanical or gravitational ventilation as well as purification of air released from such compartments.

Radioactive waste **disposal** is only allowed at facilities dedicated to this purpose, i.e. at repositories. In accordance with Polish regulations, repositories are divided into near-surface and deep ones, and in the process of their licensing as to the compliance with nuclear safety and radiological protection requirements, this being covered by duties of the PAA President, a detailed specification is prepared regarding types of radioactive waste under particular categories which may be disposed at a given facility.

Radioactive waste in Poland

The organizational entity responsible for collection, transport, processing and disposal of waste generated by radioactive material users in Poland is the Radioactive Waste Management Plant (ZUOP).

The oversight of safety of waste management, including oversight of safety of waste disposal by ZUOP is performed by the PAA President.

TABLE 3.

Quantities of radioactive waste collected by ZUOP in 2018.

Sources of waste	Solid waste [m^3]	Liquid waste [m^3]
From outside of the Świerk Nuclear Centre (medicine. industry. scientific research)	3.93	0.05
National Centre for Nuclear Research/Radioisotope Centre POLATOM	16.97	0.20
National Centre for Nuclear Research + MARIA research reactor*	7.01	50.0
Radioactive Waste Management Plant	0.95	0.00
Total:	28.86	50.25

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

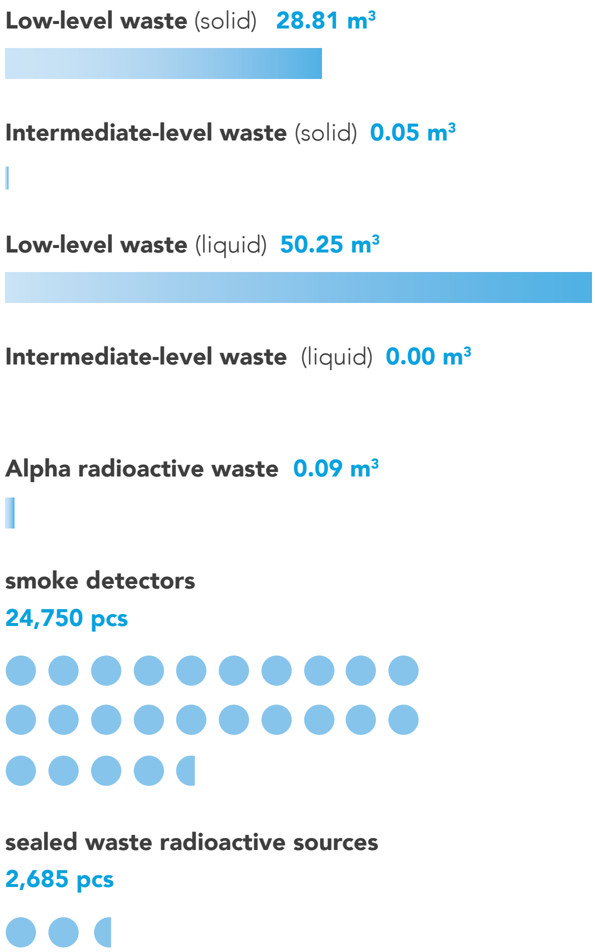
The Radioactive Waste Management Plant operates facilities situated on the premises of the Nuclear Centre in Świerk, all of them fitted with equipment for radioactive waste conditioning.

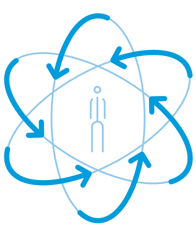
The ZUOP renders its services against payment, however.the revenue generated from this activity covers only a part of costs incurred by this enterprise. In 2017, the lacking funds were covered from a subsidy granted by the Ministry of Energy.

The National Radioactive Waste Repository (KSOP) in Różan (Maków District) is the site of radioactive waste disposal in Poland. The KSOP is a near-surface type repository, intended for disposal of short-lived, low and intermediate-level radioactive waste (with the half life of radionuclides shorter than 30 years). It is also used to store long-lived, mainly alpha radioactive waste, waiting to be placed in a deep repository (also known as geological or underground repository). The KSOP has been in operation since 1961, and it is the only facility of this type in Poland.

In 2018, the ZUOP received 271 orders for collection of radioactive waste from 164 institutions. Table 3 shows the quantities of radioactive waste collected and processed (including the waste generated at ZUOP).

FIG. 8.
The breakdown of solid and liquid waste collected according to its types and categories was as follows:





The performed inspections of radioactive waste disposed and stored at the KSOP and the ZUOP did not identify any threats to people and the environment.

After being processed, radioactive waste is placed in drums with the capacity of 200 and 50 dm^3 and then delivered only in solidified form for disposal.

In 2018, the National Radioactive Waste Repository received 131 drums of 200 litres with processed radioactive waste. Additionally, 3 large-size containers were delivered to the repository. Disused radioactive sources which are not subject to processing (there were 118 containers with 619 disused radioactive sources and 38 shielding containers with 1,717 disused radioactive sources) are sealed in separate containers. Processed solid waste was delivered to the repository in the quantity of 32.99 m^3, with the total activity of 899.11 GBq (as at 31 December 2018).

The repository also receives waste from dismantling of smoke detectors, delivered for the purpose of temporary storage.

ZUOP proceeds with the radioactive waste management based on three licenses granted by the PAA President:

- License no. D-14177 of 17 December 2001 authorizing to perform activity related to the use of nuclear energy and consisting in transport, processing and storage of radioactive waste on the premises of the Świerk centre, collected from organizational entities conducting activity involving the use of nuclear energy from the entire territory of Poland;
- License no. 1/2002/KSOP – Różan of 15 January 2002 authorizing the operation of the National Radioactive Waste Repository in Różan;
- License no. 1/2016/ZUOP of 15 December 2016 authorizing to perform activity involving exposure, consisting in storage of radioactive waste in facility 8a within the boundaries of the National Radioactive Waste Repository in Różan.

The foregoing licenses are valid for an indefinite period of time, and the first two require submission of reports on an annual (the first) and quarterly (the second) basis, which are then analyzed by employees of the PAA. The information contained in these reports is then reviewed during regulatory inspections.

In 2018, nuclear regulatory inspectors from the PAA performed four inspections concerning radioactive waste management at the ZUOP, including:

- three inspections carried out at the KSOP, including an inspection of storage and receipt of radioactive waste, measurement of ionizing radiation doses in selected locations at the repository, a check of the documentation pertaining to the waste received for storage, a check of functioning of the physical security at the KSOP, a check of implementation of the recommendations, orders, and prohibitions, and verification of remedy of non-compliances.
- one inspection at the ZUOP facilities in the nuclear centre in Świerk, which pertained to technological processing of radioactive waste, the technical condition and radiological protection of facilities operated by ZUOP, shared records for actions performed when managing radioactive waste, implementation of recommendations, orders, ad prohibitions, as well as verification of elimination of non-compliances identified during previous regulatory inspections.

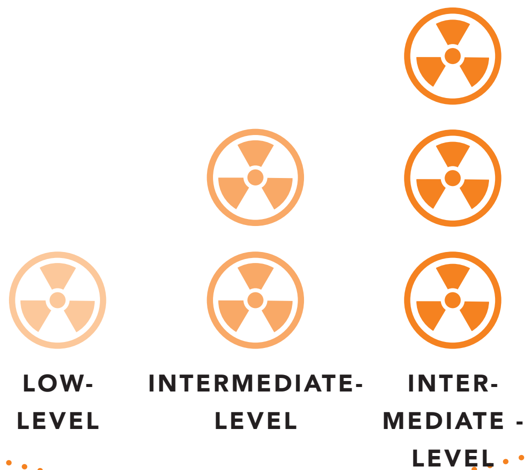
Conclusions and remarks from completed inspections were implemented by the ZUOP management on an ongoing basis, whereas all non-compliances found by nuclear regulatory inspectors were resolved in accordance with provisions of the applicable inspection reports or follow-up statements.

INFOGRAPHIC

Categories of radioactive waste

RADIOACTIVE WASTE

The following categories of radioactive waste are identified: low-, intermediate- and high-level radioactive waste, classified under three sub-categories, namely transitional, and short- and long-lived.



TRANSITIONAL

SHORT-LIVED

LONG-LIVED

NUCLEAR MATERIAL AND SPENT NUCLEAR FUEL

Radioactive waste types containing nuclear material and spent nuclear fuel, the latter becoming high-activity waste when a decision is made to dispose of it, are subject to special regulations on the management procedures applicable at every stage (including storage and disposal).

SPENT SEALED RADIOACTIVE SOURCES

constitute an additional category of radioactive waste which is classified according to the activity level criterion under the following three sub-categories: low-, medium- and high-activity ones.

8 Radiological protection of population and workers in Poland

Fot. NCBJ

Exposure of population to ionizing radiation

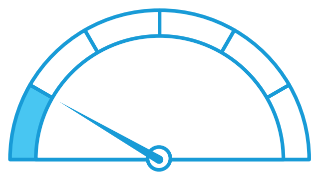
Human exposure to ionizing radiation is caused by two main sources:

- natural radiation sources – ionizing radiation emitted by radionuclides, being natural components of all elements of the environment, as well as cosmic radiation;
- artificial radiation sources (resulting from human activity) – all artificial radiation sources used in different areas of economic and scientific activity as well as for medical purposes, such as artificial isotopes of radioactive elements and devices generating radiation, for example X-ray devices, accelerators, nuclear reactors and other radiation devices.

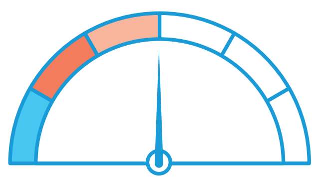
A dose limit for the entire population expressed in terms of an effective dose amounts to 1 mSv in a calendar year. This dose may be exceeded in the given calendar year on a condition that, within the period of the next five years, its total value does not exceed 5 mSv.

The value of an effective dose consists of three components:

- presence of artificial radionuclides in food and the environment coming from nuclear explosions and radiation emergencies;
- use of household products that emit radiation or contain radioactive substances;
- professional activity associated with use of ionizing radiation sources.



1 year = 1 mSv



5 years < 5 mSv

INFOGRAPHIC

Share of different ionizing radiation sources in mean annual effective dose.

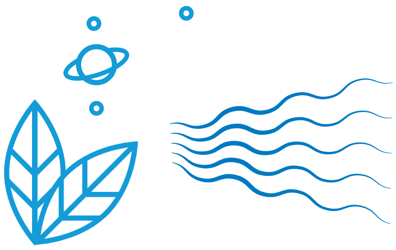
3.74 mSv

the annual effective dose of ionizing radiation, received by a statistical inhabitant of Poland in 2018

NATURAL SOURCES

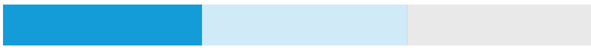
65%

2.43 mSv



RADON

32% **1.2 mSv**



222
Rn
86

GAMMA RADIATION

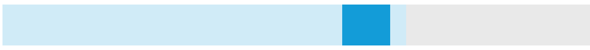
12% **0.46 mSv**

COSMIC RADIATION

10% **0.39 mSv**

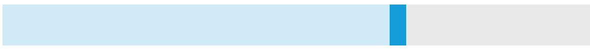
INTERNAL RADIATION

8% **0.28 mSv**



THORON

3% **0.1 mSv**



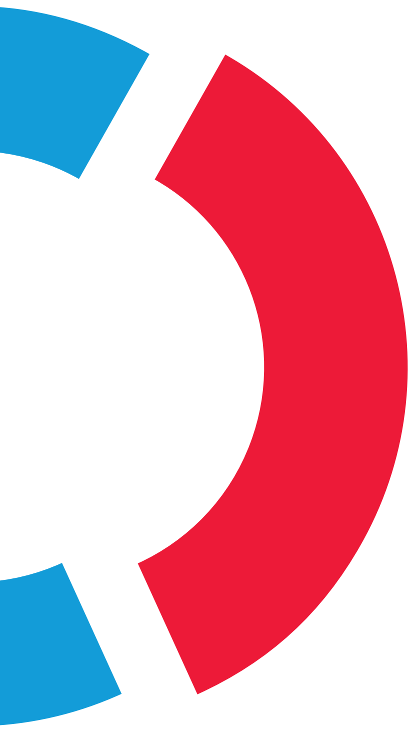
Tn

Exposure from natural sources:

- radon and products of its decay;
- cosmic radiation;
- earth radiation, i.e. radiation emitted by natural radionuclides, found in intact lithosphere;
- natural radionuclides present in the human body.

approx. 0.001 mSv
The exposure to ionizing radiation from household goods (TV, isotope smoke detectors, ceramic tiles).

approx. 0.091 mSv
exposure to radionuclides in foodstuffs (Ra-226, Pb-210, Po-210 and U+Th).



ARTIFICIAL SOURCES

35%

1.31 mSv

MEDICAL DIAGNOSTICS

34.7% **1.3 mSv**

This overall dose predominantly includes doses received during tests performed with the use of:

- computer tomography **0.86 mSv**
- conventional radiography and fluoroscopy **0.17 mSv**

These doses are far lower in other diagnostic examinations, such as:

- mammography tests **0.02 mSv**
- X-ray tests **1.2 mSv**
- chest X-ray tests **0.11 mSv**
- spine and lung X-ray tests **3 mSv – 4.3 mSv**

DEFECTS

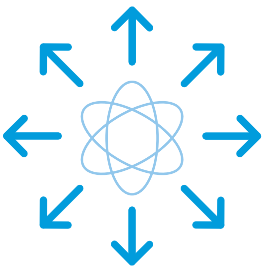
0.1% **0.005 mSv**

OTHER

0.2% **0.006 mSv**

INFOGRAPHIC

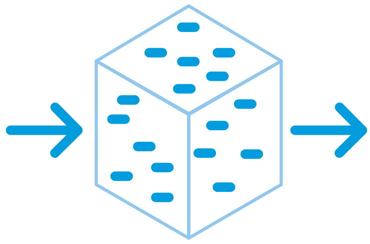
Basic terms and units used in radiological protection.



RADIOACTIVITY

Represents quantity of radioactive decay in given material per unit time.

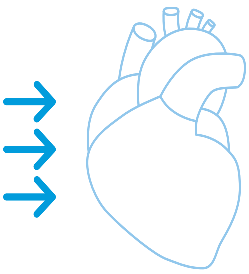
Bq
BEKEREL



ABSORBED DOSE

Specifies the average energy absorbed by the medium through which the radiation passed.

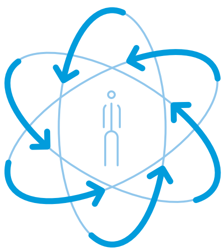
Gy
GREJ



DOSE EQUIVALENT

Specifies the dose absorbed by a tissue or an organ, taking into account the type and energy of the radiation. Makes it possible to determine the biological consequences of radiation to the exposed tissue.

Sv
SIWERT



EFFECTIVE DOSE

Illustrates the exposure of the entire body to radiation. Specifies the level of exposure of the entire body to radiation even when only some parts of the body are irradiated.

Sv
SIWERT

Ionizing radiation is a phenomenon, which has always been present in the human environment, and its presence cannot (and does not have to) be eliminated, but only limited. It is due to the fact that humans cannot affect cosmic radiation or contents of natural radionuclides in the lithosphere or even in their own bodies. **Therefore, the established limitation threshold dose (limit of effective dose for the population) includes only artificial radiation sources, with the exclusion of doses received:**

- by patients as a consequence of irradiation for medical purposes;
- by people in cases of radiation emergency (i.e. under circumstances where the radiation source remains out of control).

A dose limit for the entire population expressed in terms of an effective dose amounts to 1 mSv in a calendar year. This dose may be exceeded in the given calendar year on a condition that, within the period of the next five years, its total value does not exceed 5 mSv.

LEGAL BASIS

The basic national normative act which specifies the aforementioned limits is the Regulation of the Council of Ministers of 18 January 2005 on ionizing radiation dose limits (Journal of Laws of 2005, no. 20, item 168).

Exposure limits for the entire population include external radiation and internal radiation caused by radionuclides which enter human body with the food ingested or the air breathed, and they are expressed, similarly to occupational exposure, as:

- effective dose illustrating the exposure of the whole body
  and
- equivalent dose corresponding to the exposure of particular organs and body tissues.

The annual effective dose of ionizing radiation, received by a statistical inhabitant of Poland, has remained at a similar level in the last several years. The value including radiation from natural and artificial sources of ionizing radiation (including those used in medical diagnostics) **in 2018 amounted to the average of 3.74 mSv**. The percentage share in this hazard of other radiation sources is shown in the infographic on pages 48-49[2].

Exposure to natural ionizing radiation sources

Exposure to natural sources comprises 68.8% of the total effective dose and amounts to approx. **2.43 per year**.

- radon and products of its decay;
- cosmic radiation;
- earth radiation, i.e. radiation emitted by natural radionuclides, found in intact lithosphere;
- natural radionuclides present in the human body.

Radon and radon decay products, from which a statistical Polish inhabitant receives a dose of approx. **1.20 mSv/year**, account for the largest share in the said exposure.

The exposure of a statistical inhabitant of Poland in 2018 to radioactive sources used for medical purposes, and mainly in medical diagnostics including X-ray examinations and in vivo tests (i.e. administering radioactive preparations to patients) is estimated at **1.30 mSv**.

This overall dose predominantly includes doses received during computer tomography examination (**0.86 mSv**) as well as conventional radiography and fluoroscopy (**0.17 mSv**). These doses are far lower in other diagnostic examinations.

An average effective dose received in a single X-ray examination comes to 1.2 mSv, and with the most popular tests, these amounts are as follows[3]:

- chest X-ray tests - approx. 0.11 mSv;
- spine and lung X-ray tests - 3 mSv to 4.3 mSv.

2. The sources of data obtained included the Central Laboratory for Radiological Protection in Warsaw, the National Radiological Protection Centre 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.

3. The range of variability of those values with reference to individual examinations is equal to as much as two orders of magnitude and is due to both the quality of the instruments used and conditions that are radically different from standard examination conditions.

However, it should also be noted that exposure limits for population do not include exposure resulting from the use of ionizing radiation for therapeutic purposes.

Annual effective dose

National regulations have established the annual effective dose for the entire population at the level of 1 mSv. The value of an effective dose, to which a statistical Pole is exposed, included in this limit, consists of three components:

- presence of artificial radionuclides in food and the environment coming from nuclear explosions and radiation emergencies;
- use of household products that emit radiation or contain radioactive substances;
- non-professional exposure associated with use of ionizing radiation sources.

The exposure of a statistical inhabitant of Poland to radionuclides from natural sources (Ra-226, Pb-210, Po-210, and U+Th) in foodstuffs has been estimated based on measurements conducted in the previous years at 0.091 mSv (which corresponds to **9% of the** dose limit for the population). The foregoing values have been calculated based on measurements of the content of radionuclides in foodstuffs which constitute basic ingredients of an average diet, entailing the current data on the consumption of main ingredients. As in previous years, the largest share in the exposure in question is attributed to dairy products, meat products, vegetables (mainly potatoes) and cereals, whereas mushrooms, forest fruit and meat of wild animals (game), despite increased levels of caesium and strontium isotopes, do not contribute significantly – owing to relatively low consumption of these products – to the said exposure. Due to the fact that the concentration of Sr-90 from Chernobyl in food products is currently practically unmeasurable, it was assumed that the dose from food products comes only from Cs-137.

Values illustrating the exposure caused by radiation emitted by artificial radionuclides present in such environmental components as soil, air, and open waters have been established based on measurements of the content of individual radionuclides in samples of environmental materials collected in different parts of Poland (the measurement results are discussed in Chapter X "Assessment of the radiation situation in Poland"). Bearing in mind local discrepancies in the content level of the Cs-137 isotope, still present in soil and food, it can be estimated that the maximum dose value may be about 4-5 times higher than an average value, which means that the exposure caused by artificial radionuclides does not exceed 5% of the dose limit.

The exposure to ionizing radiation from household goods came to **ca. 0.001 mSv in 2018**, which corresponded to 0.1% of the dose limit for the population. The said amount was mainly established based on measurements of radiation emitted by TV picture tubes and isotope smoke detectors as well as gamma radiation emitted by artificial radionuclides used to stain ceramic tiles or porcelain. The calculated value also includes the dose from cosmic radiation received by passengers during air travels. In connection with the increasing popularity of LCD screens and monitors replacing cathode ray tubes, the dose received by a statistical Pole from these devices is continuously decreasing.

The exposure of statistical Poles in their professional activities involving ionizing radiation sources (more information about this problem in given in Chapter VIII.2 "Control of exposure to ionizing radiation") was equal **in 2018 to approx. 0.002 mSv, which corresponded to 0.1% of the dose limit (in the case of exposure at work)**.

In **2018**, the total exposure of a statistical inhabitant of Poland to artificial ionizing radiation sources, with the exception of medical exposure (with the predominant share in the exposure attributed to Cs-137 present in the environment as a consequence of nuclear explosions and the Chernobyl disaster), was equal to approx. **0.01 mSv, i.e. 0.1%** of the dose limit for artificial radioactive isotopes for the entire population, which is equal 1 mSv per year, and only 0.27% of the dose received by a statistical inhabitant of Poland from all ionizing radiation sources.

In light of the radiological protection regulations adopted worldwide and in Poland, the radiation exposure of a statistical inhabitant of Poland in 2018 resulting from use of artificial ionizing radiation sources, should be considered as low.

Control of exposure to ionizing radiation

Occupational exposure to artificial ionizing radiation sources

Performance of occupational duties related to working in nuclear facilities, entities managing radioactive waste and other entities using ionizing radiation sources results in exposure of workers to radiation.

> **LEGAL BASIS**
>
> The principles applicable to exposure control are specified in chapter 3 of the Atomic Law Act which focuses on nuclear safety, radiological protection, and protection of workers' health.

In accordance with the principles of ionizing radiation exposure control, the responsibility for compliance with the relevant requirements rests firstly with a head of the organizational entity which is responsible for the assessment of doses received by workers. This assessment must be performed based on the results of environmental measurements or individual dosimetry conducted by a specialized and authorized radiometric laboratory. Both measurements and the assessment of individual doses were performed in 2018 by the following accredited laboratories, commissioned by the organizational entities involved:

- Individual and Environmental Dosimetry Laboratory of the H. Niewodniczanski Institute of Nuclear Physics in Kraków (IFJ);
- Radiological Protection Unit of the J. Nofer Institute of Occupational Medicine in Łódź (IMP);
- Dose Control and Calibration Department of the Central Radiological Protection Laboratory in Warsaw (CLOR);
- Dosimetry Laboratory of the National Centre for Nuclear Research (NCBJ) in Świerk;
- with regard to monitoring of doses from natural radioactive isotopes received by miners working underground – the Silesian Laboratory of Environmental Radiometry of the Central Mining Institute (GIG) in Katowice.

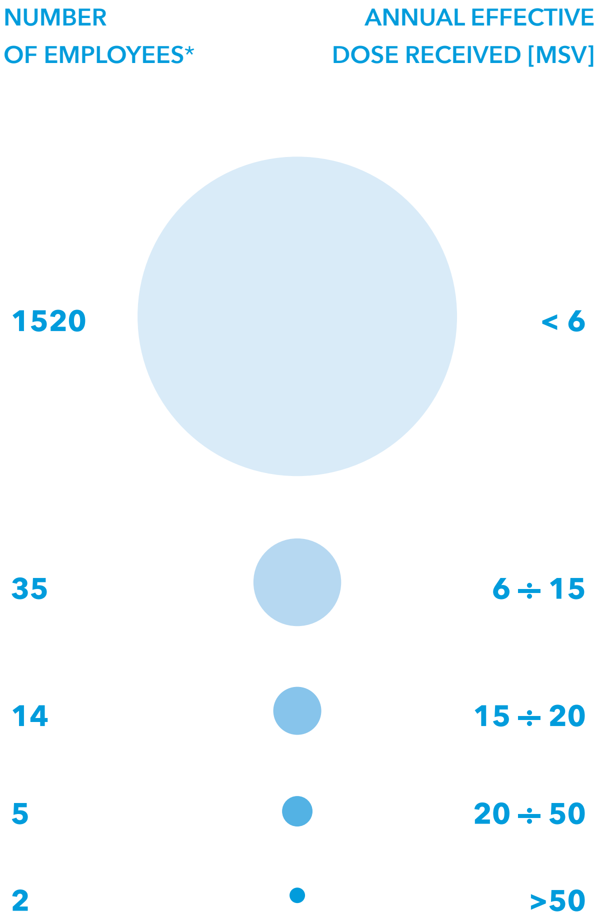
Provisions of the Atomic Law Act have introduced the obligation to maintain a register of doses and to apply personal dosimetry is applicable only to workers classified under category A of ionizing radiation exposure, i.e. those who, according to the head's opinion, may be, under normal occupational conditions, exposed to an effective dose exceeding 6 mSv per year or to an equivalent dose exceeding the level of 0.3 of the relevant dose limits for skin, limbs and eye lenses within the period of 12 months.

Assessment of doses of category B workers who are exposed to annual doses from 1 to 6 mSv from artificial radiation sources is based on measurements conducted in the work environment. When the head of the given organizational entity considers it necessary, workers of this category may (although they do not have to) be covered by exposure monitoring by means of personal dosimeters.

It is acceptable for people working under the conditions of exposure to ionizing radiation that the limit of 20 mSv (but not more than 50 mSv) is exceeded within a year's time, provided that the dose of 100 mSv is not exceeded in a five-year period. Consequently, it is necessary to check the sum of the doses received in the present year and in previous 4 calendar years while supervising the exposure of workers handling ionizing radiation sources. This means that heads of organizational entities must keep a register of doses received by the exposed workers and send data concerning exposure of subordinate category A workers to the central register of individual doses maintained by the PAA President.

INFOGRAPHIC

Statistics on individual annual effective doses for workers classified under category A of exposure to ionizing radiation in 2018.



* According to notifications to the central register of doses submitted by 30 April 2019 (in accordance with the Regulation of the Council of Ministers of 23 March 2007 concerning the requirements applicable to recording of individual doses).

LEGAL BASIS

Detailed information concerning the mode of recording, reporting and registering of individual doses can be found in the Regulation of the Council of Ministers of 23 March 2007 concerning requirements for registration of individual doses (Journal of Laws of 2007 no. 131, item 913).

There are tens of thousands of people working in contact with ionizing radiation sources in Poland. However, only a small part of them perform routine work under conditions of actual exposure to ionizing radiation. Control of individual doses in Poland in 2018 covered approx. 60,000 persons. For 95% of the group analyzed, the dose control is performed in order to confirm that the use of ionizing radiation sources is not hazardous and should not cause any health detriment. Workers of this group are classified under category B of exposure to ionizing radiation. Medical personnel working at diagnostic X-ray laboratories (approx. 40,000 people working in approx. 10,000 diagnostic centres with X-ray laboratories) constitutes the largest group of persons classified under category B.

About 2,000 potentially endangered persons who must be covered by the personal dosimetry scheme for external exposure or/and assessment of internal doses (committed doses from radioactive substances which, under working conditions, could penetrate the body as a result of an intake) are classified annually under category A of exposure to ionizing radiation.

PAA President's Central Register of Doses

Data concerning doses received by workers classified under category A collected by heads of individual entities are registered in the PAA President's central register of doses. Workers under this category of exposure to ionizing radiation are obliged to undergo measurements of effective doses received by the whole body and/or by individual most exposed body parts (for example, hands). As an exception, in cases of exposure to contamination caused by diffusible radioactive substances referred to as open sources an assessment of committed dose from internal contamination is performed.

From the formation of the central register of doses (2002) until 15 April 2018, more than 6,149 persons were reported and the data of 2,386 persons from among those reported were updated within the past four years. In 2018, data of 1,576 persons was updated.

Owing to appropriate radiological protection, 1,520 persons classified under category A received effective annual doses that did not exceed 6 mSv (being the lower exposure limit assumed for category A workers), and doses exceeding 6 mSv were received by 56 persons, of whom only seven persons were found to have exceeded the annual dose of 20 mSv (the dose limit that may be received during a calendar year as a result of routine work with ionizing radiation). In cases where the dose limit was exceeded, the working conditions and the reasons for the exposure to radiation were analyzed in detail.

A summary of the data for year 2018 concerning exposure to ionizing radiation of workers classified under category A, who were entered into the central register of doses by individual organizational entities is presented in the infographic on page 54.

The data implies that, in 2018, in the group of category A workers, the percentage of individuals who did not exceed the lower limit specified for this exposure category, i.e. 6 mSv per year, was equal to 98.5% and the percentage of individuals who did not exceed the limit of 20 mSv per year – to 99.9%. Consequently, only approx. 1.5% of persons exposed at work who had been classified under category A received doses established for workers of this category.

In 2018, the Central Register of Doses received reports on two cases of exposure to radiation in the circumstances referred to in article 16 (1) (incidental exposure) of the Atomic Law Act. Both cases where the limit dose was exceeded were associated with use of isotope defectoscopes during industrial radiography tests. A particularly high annual dose - 67.7 mSv and 74.5 mSv per year - was recorded in the case of industrial radiography technicians who simultaneously transported high-level sources of Ir-192 in defectoscopes. High doses absorbed in the hands and eyes of surgeons performing hours-long surgical procedures in X-ray radiation, especially during operations on main blood vessels and the heart. The new 2013/59/Euratom directive introduced a new yearly limit dose per lens of the eye, equal to 20 mSv/year, is in force. This value is so restrictive that it is quite often exceeded in intervention surgery procedures; however, appropriate dosimeters for integrating measurement of the equivalent dose in eye lenses are still used rather rarely. In 2008 there were at least two such measured cases of an equivalent dose received in eye lenses that exceeded 20 mSv. Such a dose can lead to a deterministic radiation effect in the form of opacity of the lens or cataract.

All cases where the annual limit dose is exceeded are subject to a detailed investigation by nuclear regulatory inspectors.

Control of exposure to natural ionizing radiation sources in mining

Unlike radiation hazards resulting from artificial radioactive isotopes and devices emitting radiation, radiation hazards in mining (coal mining and extraction of other natural raw materials) are mainly caused by the increased level of ionizing radiation in mines, being the effect of natural radioactivity. Sources of these hazards include:

- radon and products of its decay in the mine air (the basic hazard, along with external gamma radiation);
- gamma radiation emitted by natural radioactive isotopes (mainly radium) contained in the rock mass (the basic source of hazard caused by short-lived products of decay of radon in air);
- mine water (and the related sediments) with increased content of radium isotopes.

The first two factors practically apply to all miners working underground, whereas radiation hazards resulting from mine waters and sediments occur under special circumstances and apply to a limited number of workers.

The total employment at hard coal mines according to WUG data of 31 December 2018 was 82,800 miners.

The dose levels specified in the legal basis are values taking into account the effect of the natural surface background (i.e. outside the working environment). This means that while performing calculations necessary to classify excavations under individual classes of radiation hazard, the dose value calculated based on measurements must be reduced by the dose resulting from natural surface background for the working time assumed. Table 4 shows the values of occupational limits of hazard indicators for both classes of headings where radiation hazards are present. The suggested values result from the model prepared and implemented for calculation of committed doses caused by specific working conditions in underground mining facilities.

The following aspects of the radiation hazard are studied:

- potential alpha energy concentration of short- lived products of radon decay in mine heading air;
- gamma radiation dose rate at a workplace in a mine heading;
- radium concentration in mine water;
- radium concentration in mine water sediments.

Miners' exposure to natural radiation sources is assessed by the Central Mining Institute (GIG) in Katowice.

In underground mines, in workings where radiation hazards are present, work organization methods have been introduced to prevent exceeding the limit dose of 20 mSv.

Table 5 contains information on mines where (based on the identified cases where the values of individual radiation hazard factors are exceeded) workings classified under classes A and B of radiation hazard may be present. It should be emphasized that workings exposed to radiological hazard are classified by managers of individual mining facilities based on the sum of effective doses for all radiation hazard factors measured in the course of the actual work.

LEGAL BASIS

As for radiation hazards, in 2018, the following implementing regulations to the Geological and Mining Law were in force in addition to the secondary legislation to the Atomic Law Act:

- Regulation of the Minister of Energy of 23 November 2016 on the detailed requirements for operation of underground mines;
- Regulation of the Minister of the Environment of 20 June 2017, amending the regulation natural hazards in mining facilities Journal of Laws of 2015, item 1702, as amended) defining the following workings:
  - class A workings, situated controlled areas in the meaning of provisions of the Atomic Law, where the occupational environment creates potential exposure of a worker to an annual effective dose exceeding 6 mSv;
  - class B workings, situated in supervised areas in the meaning of the provisions of Atomic Law, where the occupational environment creates potential exposure to an annual effective dose which is more than 1 mSv, but does not exceed 6 mSv.

Therefore, the number of headings classified under individual categories of radiation hazard is actually smaller.

Furthermore, a percentage share has been estimated with regard to persons working in headings belonging to individual hazard classes. Results of this assessment have been provided in Figure 9.

TABLE 4.
Values of occupational limits of hazard rates for individual classes of workings where radiation hazard is present (GIG)

Hazard indicator	Class A*	Class B*
Potential alpha energy concentration of short-lived products of radon decay (Cα), μJ/m³	Cα > 2.5	0.5 < Cα ≤ 2.5
Radiation kerma rate γ (K), μGy/h	K > 3.1	0.6 < K ≤ 3.1
Specific activity of radium isotopes present in sediments (C_{RaO}), kBq/kg	C_{RaO} > 120	20 < C_{RaO} ≤ 120

* The foregoing values correspond to doses of 1 mSv and 6 mSv, provided that the effects from particular hazard sources are not accumulated and the annual working time is 1,800 hours.

The analysis included the number of mines with radiologically hazardous workings, the working type, the hazard source, and the headcount of the mining crew. Based on the information acquired by the State Mining Authority, it was possible to determine the share of miners working in headings potentially exposed to radiation hazard.

This particularly applies to sites possibly containing water and sediments with increased concentration of radium isotopes, increased concentrations of potential alpha energy and dose rates of gamma radiation higher than average.

In 2018, the Central Mining Institute conducted 3,614 measurements of potential alpha energy of short-lived radon decay products, 750 measurements of exposure to external gamma radiation in underground mining facilities, 426 analyses of radioactivity of mine water sampled in underground headings of hard coal mines, as well as 137 analyses of concentration of radionuclides found in samples of mine water sediments.

In 2018, measurements of individual doses of gamma radiation were conducted in eight hard coal mines. In other mining facilities, no such measurements were undertaken. The employees subject to the examinations, namely 81 persons, were mainly involved in removal of radioactive mine sediments or worked at locations where such sediments may accumulate. One of the persons subject to individual examination worked on the surface. In two hard coal mines, the annual dose estimated, based on results of individual dose measurements, exceeded 1 mSv but was lower than 6 mSv (category B). No dose exceeding 6 mSv (category A) was measured in 2018.

TABLE 5.

Number of hard coal mines featuring headings with radiological hazard (Central Mining Institute)

Hazard class	A	B
Number of mines	3	18
γ radiation threat from short-lived products of radon decay	-	10
Threat of γ radiation	2	4
Threat of radioactive sediments	1	2
External γ radiation (individual dosimetry)	-	2

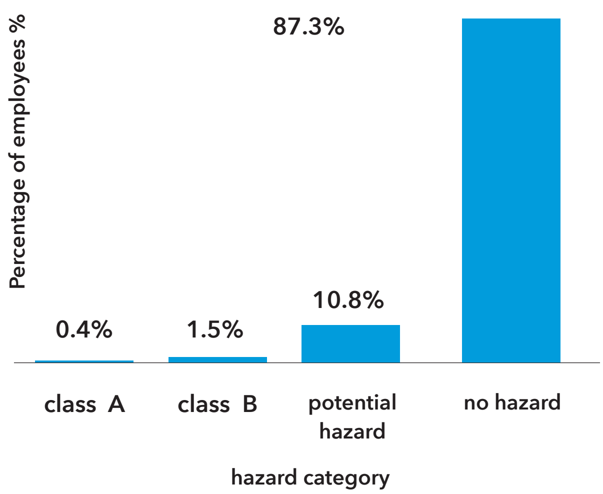
Based on the radiation hazard monitoring conducted, it was found that under disadvantageous circumstances (lack of a proper ventilation system) it may occur in nearly every single mine heading. The hazard assessment performed by the Central Mining Institute for coal mines has demonstrated that there are three mines with active class A headings (the hazard affects 0.4% of all working miners) and 18 mines with class B headings (the hazard affects 1.5% of all working miners). In mine headings with slightly increased natural radiation background (yet below the level corresponding to class B), 10.8% of the total number of miners employed work, whereas 87.3% of miners work in headings where the radiation level remains on the level of natural surface background.

The estimated (maximum) dose per miner in 2018 was equal to 21.5 mSv, taking into account the measurement uncertainty and assuming that the annual working time is equal to 1800 hours and the background radiation is equal to 0.1 μGy/h. With the realistic assumption that the working time is equal to 750 hours, the maximum dose is approximately 8.9 mSv.

The Silesian Environmental Radiometry Center of the Central Mining Institute has precise information regarding the work time in individual workings only for calculations of committed effective doses. For other radiation hazard factors, an analysis of the extent of hazard was performed according to specific assumptions: nominal work time of 1,800 hours and – as frequently reported – work time in water galleries of 750 hours. The estimates developed on the basis of these values may depart significantly from the actual situation.

FIG. 9.

The percentage of hard coal miners working in headings classified under individual radiation hazard classes. The total employment at hard coal mines according to data from 31 December 2018 was 82,800 miners.



In 2018, the maximum additional annual effective dose associated with individual hazard sources was equal to:

- for short-lived radon decay products – E_{α} = 3.7 mSv (assuming the annual working time of 1,800 hours);
- for environmental gamma radiation measurements – E_{γ} = 8.9 mSv (assuming the annual work time in water galleries of 750 hours);
- and expressed as an effective committed dose – ER_{a} = 0.70 mSv for absorption of radium isotopes into human organism (with regard to declared annual work time of 213 hours).

In accordance with the requirements of the Atomic Law Act concerning controlled and supervised areas, underground workings classified under category B (supervised area) must be reclassified to category A (controlled area) whenever contamination may spread, e.g. in the course of works associated with removal of sediment or wastewater.

An analysis of measurement results against the data collected in recent years showed that, in underground mining facilities (with the work times assumed for individual hazard factors), there are always workings classified under radiation hazard category B, including sites where the dose exceeds 1 mSv. The headings which should be classified under radiation hazard category A are those where the dose received by miners could exceed 6 mSv and they are very infrequent.

In 2018, the main reasons for the occurrence of increased effective doses for miners was the exposure to external gamma radiation and short-lived products of radon decay.

In no mine was the dose of 20 mSv found to be exceeded throughout the entire year. This is a limit dose for persons whose vocational activity involves the radiation hazard.

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

In nuclear facilities and in other entities where exposure to ionizing radiation occurs, on certain positions, persons holding authorizations granted by the PAA President are employed. The prerequisites for obtaining of such authorization include completion of training for persons applying for authorizations enabling their employment in positions of significant importance to ensuring radiological protection and nuclear safety in the scope required for the specific types of authorizations, and passing an examination before the PAA President's examination board.

LEGAL BASIS

Article 7 (6) and Article 12 (2) of the Act of 29 November 2000 – Atomic Law Act and Regulation of the Council of Ministers of 2 September 2016 on positions important for ensuring nuclear safety and radiological protection and on radiation protection officers (Journal of Laws of 2016, item 1513).

The required training courses are conducted by organizational entities authorized to conduct such activity by the PAA President, having at their disposal the sufficient staff of instructors and the necessary technical equipment enabling practical classes to be conducted in accordance with the course syllabus developed for each such entity, in line with the type of training approved by the PAA President. In 2018, training courses were attended in total by 647 persons. Information on entities, which conducted the training courses, can be found in Table 6.

In 2017, there were two examination boards appointed by the PAA President pursuant to Article 7 (1) and Article 12a (6) of the Atomic Law Act:

- an examination board entitled to grant authorizations of a radiological protection officer (RPO);
- an examination board entitled to grant authorizations which allowed for being employed at positions considered particularly important for ensuring nuclear safety and radiological protection.

TABLE 6.
Entities that conducted training for persons applying for authorizations enabling employment in positions of significant importance to ensuring nuclear safety and radiological protection in 2018

Authorization type	Entity name	Number of training courses held	Number of training participants	Number of authoriza-tions *
Radiological protection	Central Radiological Protection officer Laboratory	2	62	174
	Polish Federation of Engineering Associations	3	40	
Positions of significant importance for ensuring NS&RP	Central Radiological Protection Laboratory	3	49	582
	Association of Radiation Protection Officers	12	344	
	Central Radiological Protection Laboratory	3	50	
	Nuclear Chemistry and Technology Institute	2	61	
	National Nuclear Research Center	1	14	
	Oncology Center in Gliwice	1	27	

* Including persons who attended training before 2018 or were authorized to take examination without an obligation to attend training.

INFOGRAPHIC

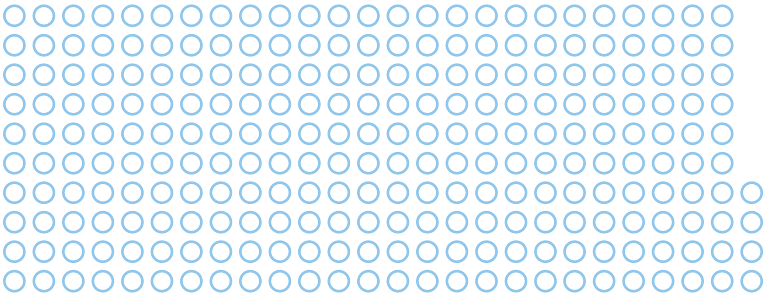
Number of persons who were granted authorizations to work as a radiation protection officer or authorizations enabling them to be employed in positions of importance for ensuring nuclear safety and radiological protection.

Having passed the examination and fulfilled all the remaining conditions required to obtain the relevant authorizations, 174 persons were granted authorizations of a radiation protection officer and 570 persons received authorizations enabling them to be employed in positions of special importance for ensuring nuclear safety and radiological protection, including:

570 persons

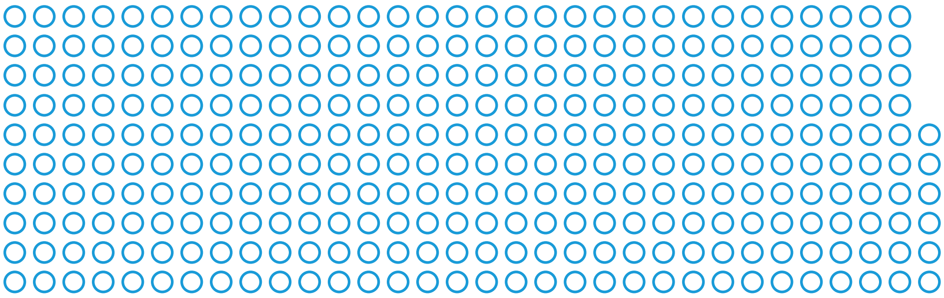
254 persons

who were granted authorizations of a radiation protection officer applicable to purposes other than medical



316 persons

received authorizations enabling them to be employed in positions of an operator of a medical accelerator and equipment for teleradiotherapy, and or an operator of brachytherapy equipment with radioactive sources



Moreover, authorizations to hold positions of significant importance to ensuring nuclear safety and radiological protection in an organizational entity performing operations consisting in construction, startup, operation, or decommissioning of nuclear facilities were granted to 12 persons including:

12 persons

4 persons
research reactor operator

3 persons
research reactor manager

2 persons
research reactor dosimetrist

1 person
research reactor shift manager

1 person
Radioactive Waste Management Facility manager and Radioactive Waste Repository manager

1 person
deputy director for nuclear safety and radiological protection in an organizational unit having a research reactor

In 2018, the total number of persons who received authorizations of a radiation protection officer and authorizations to be employed in positions of special importance for nuclear safety and radiological protection was

756 persons

9 National radiological monitoring

Fot. PAA

In Poland, continuous radiological monitoring is ensured, consisting in systematic measurements of the gamma radiation dose rates and measurements of content of radioactive isotopes in the environment and foodstuffs. The monitoring system operates 24 hours a day, 7 days a week, and it allows for ongoing monitoring of the national radiological conditions and early detection of potential hazards.

There are two types of monitoring:

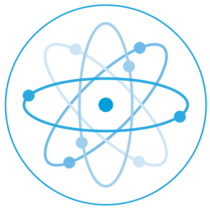
- nationwide monitoring – making it possible to obtain data necessary to assess the radiological situation of the entire country under normal conditions and in cases of radiation emergency. It serves as a basis for examination of long-term changes in the environment and foodstuff radioactivity.
- local monitoring – making it possible to obtain data from areas where activities are (or have been) conducted potentially causing local increase of radiation exposure of local population (it applies to the Świerk nuclear centre, the radioactive waste repository in Różan and areas of former uranium ore plants in Kowary).

Monitoring measurements are conducted by:

- **measurement stations** forming the early warning network for radioactive contamination;
- **measurement units** which conduct measurements of radioactive contamination related to environmental materials and foodstuffs;
- **services of entities operating nuclear facilities and nuclear regulatory bodies** responsible for local monitoring.

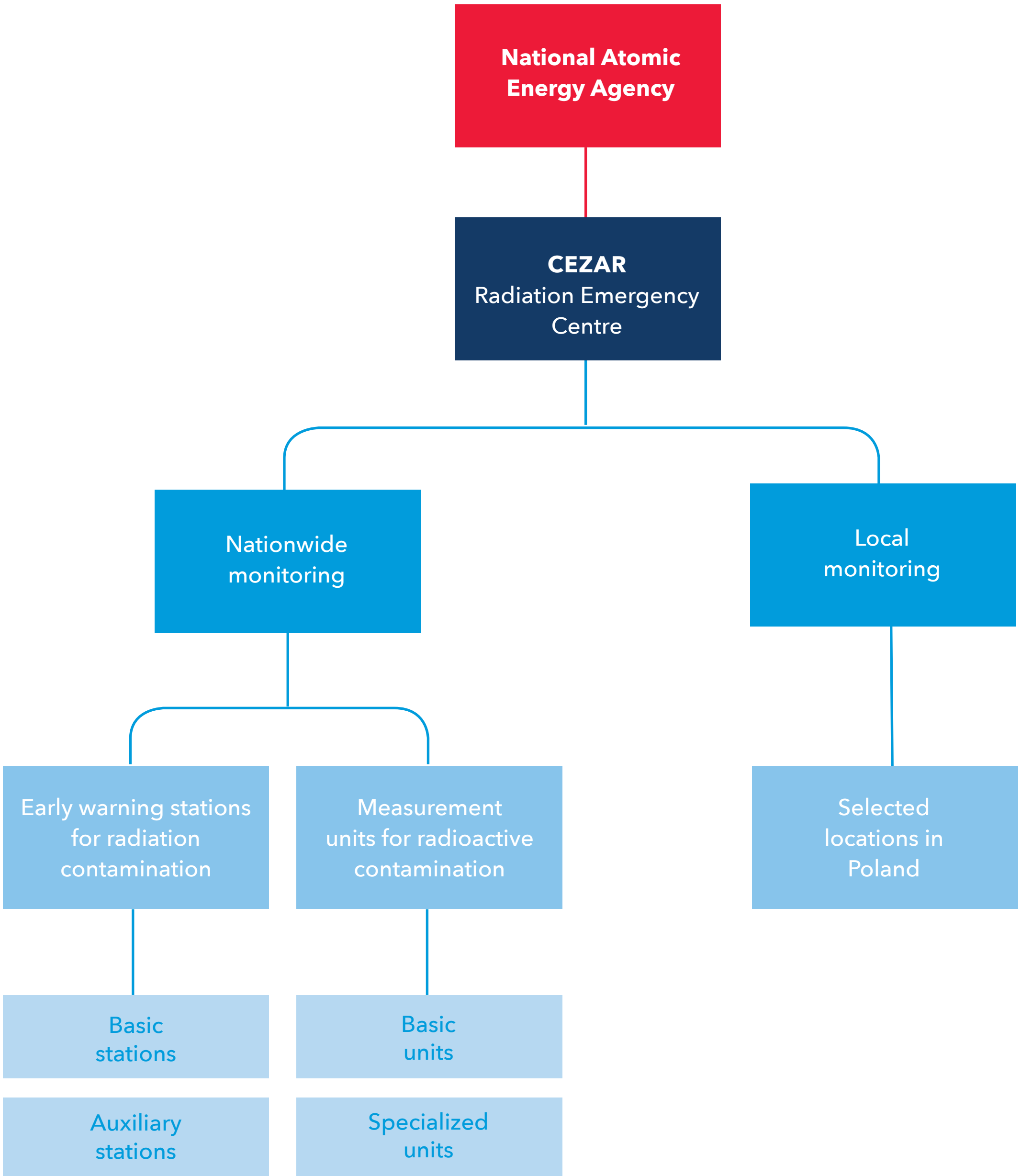
The PAA Radiation Emergency Centre (CEZAR) is responsible for coordination of a network of measurement stations and units.

A general schematic overview of this system has been depicted in Figure 10.



In Poland, continuous radiological monitoring is ensured, consisting in systematic measurements of the gamma radiation dose rates and measurements of content of radioactive isotopes in the environment and foodstuffs. The monitoring system operates 24 hours a day, 7 days a week, and it allows for ongoing monitoring of the national radiological conditions and early detection of potential hazards.

FIG. 10.
The radiological monitoring system in Poland



The results of the national radiological monitoring provide grounds for the national radiological status assessment made by the PAA President, which is systematically presented:

- on the website paa.gov.pl – ambient gamma dose rate;
- in quarterly releases published in the Official Gazette of the Republic of Poland titled Monitor Polski – ambient gamma dose rate and content of Cs-137 in air and milk
- in the annual report of the PAA President – the full range of measurement results.

In the event of emergency, the frequency of communication releases is agreed individually. The information thus provided constitutes the basis for the assessment of radiation hazards for people and for undertaking suitable intervention measures, if the situation so requires.

Nationwide monitoring

Early warning stations for radioactive contamination

The purpose of measurement stations operating in the early warning network for radioactive contamination is to provide information necessary for ongoing assessment of the radiological status of Poland and to enable early detection of radioactive contamination in the event of radiation emergency. The system consists of the so-called basic and auxiliary stations (see the infographic on page 66).

Basic stations:

- **19 automatic Permanent Monitoring Stations (PMS)** managed by PAA as well as operating under the international systems of the EU and of the Baltic States (Council of the Baltic Sea States), conducting ongoing measurements of:
  - radiological values: the power of the spatial dose equivalent *(10) and ambient gamma dose rate and spectrum caused by radioactive elements in the air and in the ground;
  - basic weather parameters (precipitation and ambient temperature), which enables verification whether the indications of the radiometric devices are correct in changing weather.

  Since 2016, the PAA has been enlarging the PMS stations network. In 2018, in addition to the 13 old type stations, there were also 6 new stations in operation, which were equipped with new, specially designed spectrodosimetric probes (TDSG3) and independent weather probes. Further expansion of the entire network is planned for the coming years.
- **12 ASS-500 stations**, 11 of which are owned by the Central Laboratory for Radiological Protection and 1 belongs to PAA, which:
  - continuously sample atmospheric aerosols on the filters;
  - perform spectrometric determination of content of individual radioisotopes on a weekly basis.
- **9 stations** of the Institute of Meteorology and Water Management (IMiGW) which conduct:
  - continuous measurement of ambient gamma dose rate;
  - ccontinuous measurement of total and artificial alpha and beta activity of atmospheric aerosols (7 stations);
  - cmeasurement of total beta activity in 24-hour and monthly samples of total fallout;
  - cdetermination of the content of Cs-137 (by a spectrometric method) and Sr-90 (by a radiochemical method) in cumulative monthly samples of total fallout from all 9 stations (once a month).

Auxiliary stations:

- 13 monitoring stations of the Ministry of National Defence (MON) which perform ongoing measurements of ambient gamma dose rate, registered automatically at the Centre for Analysis of Contamination (COAS).

Facilities conducting measurements of radioactive contamination of the environment and foodstuffs

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

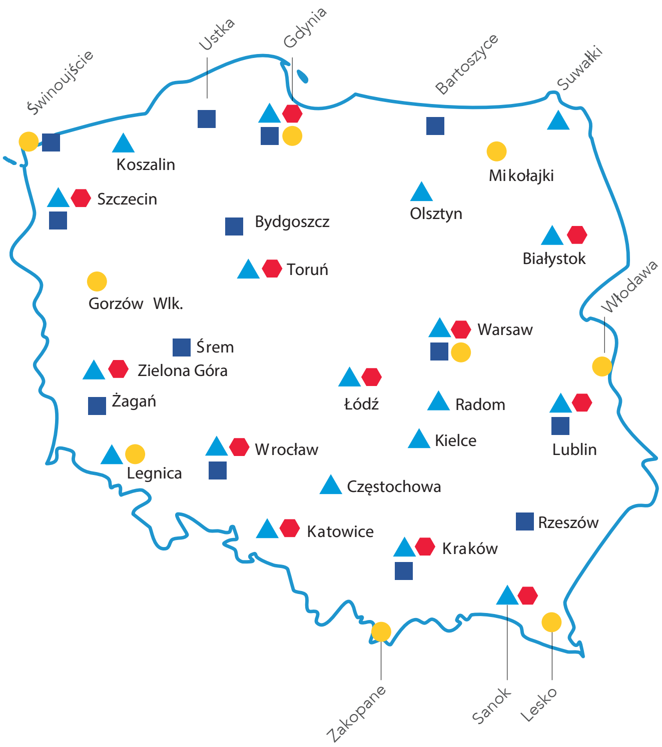
- 30 basic units operating at Sanitary and Epidemiological Stations;
- measurements of total beta activity in milk samples and foodstuffs (on a quarterly basis);
- determination of the content of individual radionuclides (Cs-137, Sr-90) in selected foodstuffs (twice a year on average);
- special facilities conducting more extensive analyses concerning radioactivity of environmental samples.

The location of the basic stations is shown in the infographic on page 67.

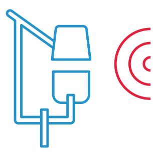
Nationwide monitoring
of the radiation situation

Number of measurement stations

▲ PMS stations	19
⬣ SAA-500 stations	12
● IMiGW stations	9
■ MDN stations	13

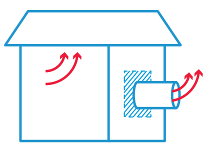


▲ PMS stations



Permanent Monitoring Stations (PMS) System provide monitoring of the level of ionizing radiation in the area of Poland 24 hours a day, 7 days a week. Spectrometric measurements (gamma radiation spectrum) enable detection of occurrence of artificial isotopes in the environment.

⬣ ASS-500 stations



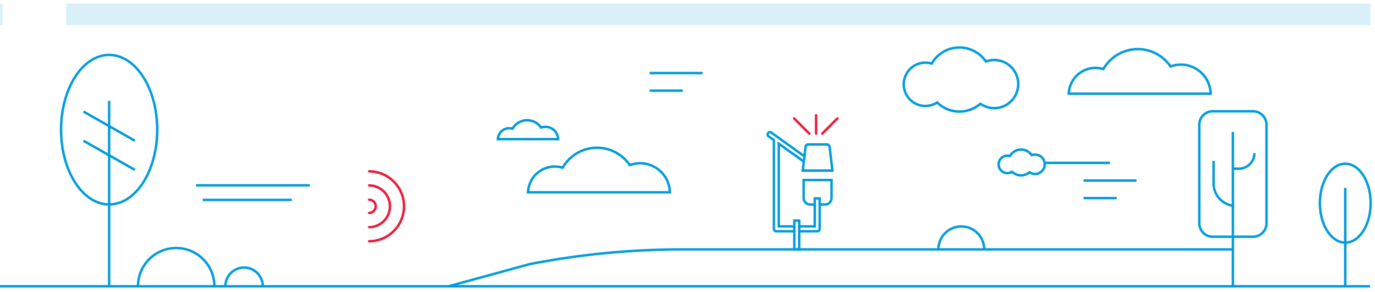
Highly-effective Aerosol Sampling Stations ASS-500 are designed to monitor air pollution with radioactive particles. The station pumps air through a special filter at the average rate of approx. 500 m^3/h. All the particles contained in the pumped air gather on the filter. Afterwards, it undergoes a detailed laboratory analysis. This type of station allows detecting even smallest traces of radioactive isotopes present in the air. Normally, the filter is changed once a week.

● IMiGW stations

Stations of the Institute of Meteorology and Water Management (IMiGW) measure the dose rates and the activity of atmospheric aerosols and total precipitation.

■ MND stations

Monitoring stations of the Ministry of National Defence (MON) (auxiliary stations) measure the gamma radiation dose.



Facilities of Sanitary-Epidemiological Stations – conducting measurements of radioactive contamination of the environment and foodstuffs

The current monitoring results can be found at:
www.paa.gov.pl/monitoring.html
http://remap.jrc.ec.europa.eu/GammaDoseRates.aspx

Local monitoring

TABLE 7.
Measurements of radioactive isotopes on the premises and in the vicinity of the Nuclear Centre in Świerk.

Measurement and sample type	Site of the center	Nuclear center surroundings
gamma in atmospheric aerosols	•	•
beta and gamma in precipitation	•	
beta and gamma in well water		•
beta in mains water	•	
beta in the waters of the Świder river		•
gamma, alpha and beta including the content of H-3 and Sr-90) in drainage water-rainwater	•	
H-3 in underground water	•	
Sr-90 and gamma in slime	•	•
gamma and beta (including the content of Sr-90) in sanitary wastewater	•	
beta in wastewater from treatment plant		•
gamma in soils and glasses	•	•
gamma in milk and grain		•

The data obtained in 2018 and in the previous years confirm that there is no negative impact of operation of the nuclear center in Świerk and of the KSOP on the natural environment and the radioactivity of wastewater and drained rainwater removed from the site of the nuclear center in Świerk was much lower in 2018 than the applicable limits.

Nuclear center in Świerk

Radiological monitoring on the premises and in the vicinity of the Świerk nuclear centre was conducted in 2018 by the Laboratory of Dosimetry of the National Centre for Nuclear Research, and additionally, in the close vicinity of the Centre – by the Central Laboratory for Radiological Protection in Warsaw, commissioned by the PAA President. The monitoring was performed in the manner described below:

- on-line (measurement every 2 minutes) gamma radiation fields are controlled at the entrance gate to the Centre and in selected places of its premises, as well as radioactive concentration in the utilities released to the environment (sanitary wastewater, drainage water and atmospheric aerosols with regard to alpha, beta and gamma radioactive isotope content);
- off-line (according to the measurement schedule) on the premises and in the vicinity of the Świerk Nuclear Centre, the Laboratory of Dosimetry of the National Centre for Nuclear Research conducted measurements of concentration of radioactive isotopes specified in Table 7.

Measurements of gamma radiation were also conducted for selected locations on the premises and in the vicinity of the Centre using thermoluminescent dosimeters (TLD) in order to establish annual dose levels.

As commissioned by the PAA President, measurements of the content of natural and artificial radioactive isotopes were conducted in the vicinity of the Centre, addressing the following components of the environment:

- water from the nearby Świder river;
- water from a sewage treatment plant in the closest (to the Centre) municipality of Otwock;
- well water;
- soil; and
- grass.

Also, the gamma radiation dose rate was measured at five locations chosen, as well as the content of iodine isotopes in gaseous form and radioactive noble gases.

National Radioactive Waste Repository in Różan (KSOP)

Radiological monitoring on the premises and in the vicinity of the National Radioactive Waste Repository (KSOP) is conducted by the Radioactive Waste Management Plant, and additionally in the vicinity of the Repository – by the Central Laboratory for Radiological Protection commissioned by the PAA President.

On the premises of the KSOP, the following were measured:

- the content of radioactive isotopes in underground water, water from the water supply system, atmospheric aerosols, soil and grass;
- gamma radiation dose rate;
- radioactive contamination on the KSOP premises.

In the vicinity of the KSOP the following were measured:

- concentration of Cs-137, Cs-134, H-3 and Sr-90 in spring water;
- content of radioactive substances in surface water, drainage water, underground water and water from the water supply system;
- content of radioactive beta isotopes, including H-3, in groundwater (piezometers);
- content of artificial (mainly Cs-137) and natural radioactive gamma isotopes in soil and grass;
- content of radioactive gamma isotopes in atmospheric aerosols;
- radioactive contamination of roads' surface;
- The gamma radiation dose rate was also measured at five fixed check points.

The most important measurement results and data illustrating the radiological situation on the premises and in the vicinity of the Nuclear Centre in Świerk and KSOP have been discussed in Chapter X" Assessment of the radiation situation in Poland."

Areas of former uranium ore extraction and processing plants

Since 1998, at the former uranium ore plants, the "Program of radiological monitoring of areas degraded due to uranium ore extraction and processing" has been implemented. In 2018 the following measures were undertaken under the program in question:

- measurements of the content of radioactive alpha and beta isotopes in drinking water (from public water intakes) within the territory managed by the Association of Municipalities of the Karkonosze Region (Związek Gmin Karkonoskich), in the town of Jelenia Góra as well as in surface and underground water (outflows from underground workings);
- determination of radon concentration in water from public intakes, in water supplied to residential premises and in surface and underground water (outflows from underground workings).

The results of the measurements are presented in Chapter X "Assessment of the national radiation situation."

International exchange of radiological monitoring data

The National Atomic Energy Agency participates in international exchange of data from radiation monitoring. The Radiation Emergency Centre of the PAA, within the framework of implementation of Art. 36 of the EURATOM Treaty of the EU prepares and shares data from radiation monitoring conducted in Poland and receives and analyses data on radiation conditions in other countries. The Centre also participates in data exchange within the framework of the Council of the Baltic Sea States.

The European Union measurement data exchange system based on routine radiological monitoring of the environment, deployed in the European Union Member States

The system encompasses data concerning dose rate, air contamination, contamination of drinking water, surface water, milk and food (diet). The data are submitted by the PAA to the Joint Research Centre (JRC) based in the city of Ispra in Italy on an annual basis (by 30 June each year, data for the previous year are submitted).

Exchange of data from early warning stations under the European Union's EURDEP system

The European Radiological Data Exchange Platform (EURDEP) covers the exchange of the following data from early warning stations for radioactive contamination. Primarily, the results of measurements of the gamma radiation dose rate are published. Many countries also publish results of measurement of activity of atmospheric aerosols and other measurements that are important for evaluation of the radiation situation that are available in an automatic mode. The current radiological conditions in Europe are published on an ongoing basis on the EURDEP map.

Poland provides the following measurement results once an hour:

- the ambient gamma dose rate (Permanent Monitoring Stations and stations of the Institute of Meteorology and Water Management);
- the total alpha and beta activity from artificial radionuclides in atmospheric aerosols (stations of the Institute of Meteorology and Water Management).

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

The scope and format of data submitted by Poland under the data exchange system of the Council of the Baltic Sea States (CBSS), i.e. under the framework of regional exchange, is identical to the EURDEP system operating in the European Union.

Radiation emergencies

Emergency procedures

In accordance with the definition laid down in the Atomic Law, radiation emergency is a hazardous situation4 which requires urgent actions to be undertaken for the sake of protection of workers or the population. In cases of radiation emergency, intervention measures are taken as scheduled separately for incidents occurring within the area of the given organizational unit (on-site emergency incidents) and for those whose results reach beyond the organizational unit ("regional" and "national" emergency incidents, including those of cross-border effects). A head of the given entity, a provincial governor or a minister competent for the interior are in charge of elimination of the hazard and of consequences of the incident, depending on the scale of emergency.

4. A threat is a potential exposure; an exposure that can take place, and the probability of its occurrence can be estimated in advance (in accordance with Art. 3 (53) of the Atomic Law Act).

INFOGRAPHIC

Radiation events classification

On-site

Elimination of the consequences of the emergency is conducted by **the manager of the organizational entity** in accordance with the company emergency procedure.

Regional level

Elimination of the consequences of the emergency is conducted by **the province government in co-operation with the state provincial sanitary inspector** in accordance with the provincial emergency plan.

National level

Actions related to elimination of consequences of events are managed by **the minister competent for interior** in co-operation with the PAA's President.

National Atomic Energy Agency (PAA) provides information and consultancy for assessing the doses, contamination levels and measures which are required on the incident site, as well as other expert advice. Furthermore, CEZAR informs the communities which are exposed as an outcome of the emergency, international organizations and neighbouring countries about the radiation threat. The same procedure also applies in cases when illegal trade in radioactive substances is revealed (including attempts of illegal shipment across the national border).

The PAA President employs a dosimetry team which may perform on-site measurements of radiation dose rate and radioactive contamination, identify the contamination type and the abandoned radioactive substances, and secure the emergency site.

The Radiation Emergency Centre of the PAA (CEZAR) performs a number of functions, such as: emergency service of the PAA President[5], the function of a National Contact Point (NCP) for the International Atomic Energy Agency (the Unified System for Information Exchange in Incidents and Emergencies – USIE), for the European Commission (the European Community Urgent Radiological Information Exchange – ECURIE), for the Council of the Baltic Sea States, NATO and states bound with Poland by virtue of bilateral agreements on early notification and cooperation in cases of radiation emergency. It is on duty for 7 days a week and 24 hours a day, and conducts assessments of the domestic radiation conditions on a regular basis, and, in the event of occurrence of a radiation emergency, uses computer decision support systems (RODOS and ARGOS).

5. Together with the Central Radiological Protection Laboratory (based on a contract concluded by the PAA President and CLOR).

7

MAJOR ACCIDENT

Fukushima, Japan, 2011

Significant release of the radioactive material to the environment

Chernobyl, Ukraine, 1986

Significant release of the radioactive material to the environment

6

SERIOUS ACCIDENT

Kyshtym, Russian Federation, 1957

Significant release of radioactive material to the environment after the explosion of a high activity waste tank

5

ACCIDENT WITH WIDER CONSEQUENCES

Goiania, Brazil, 1987

Four people died after being overexposed from an abandoned and ruptured high activity source

NPP Three Mile Island, USA, 1979

Severe damage to the reactor core

4

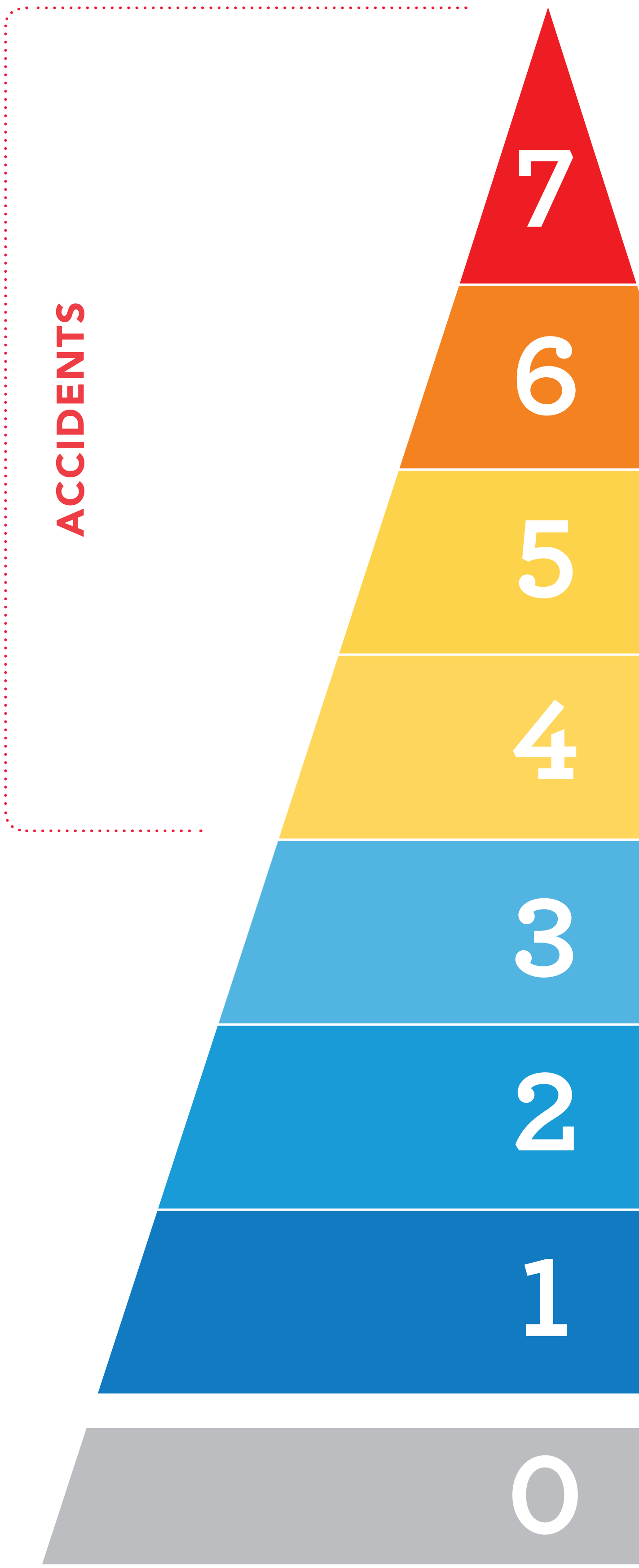
ACCIDENT WITH LOCAL CONSEQUENCES

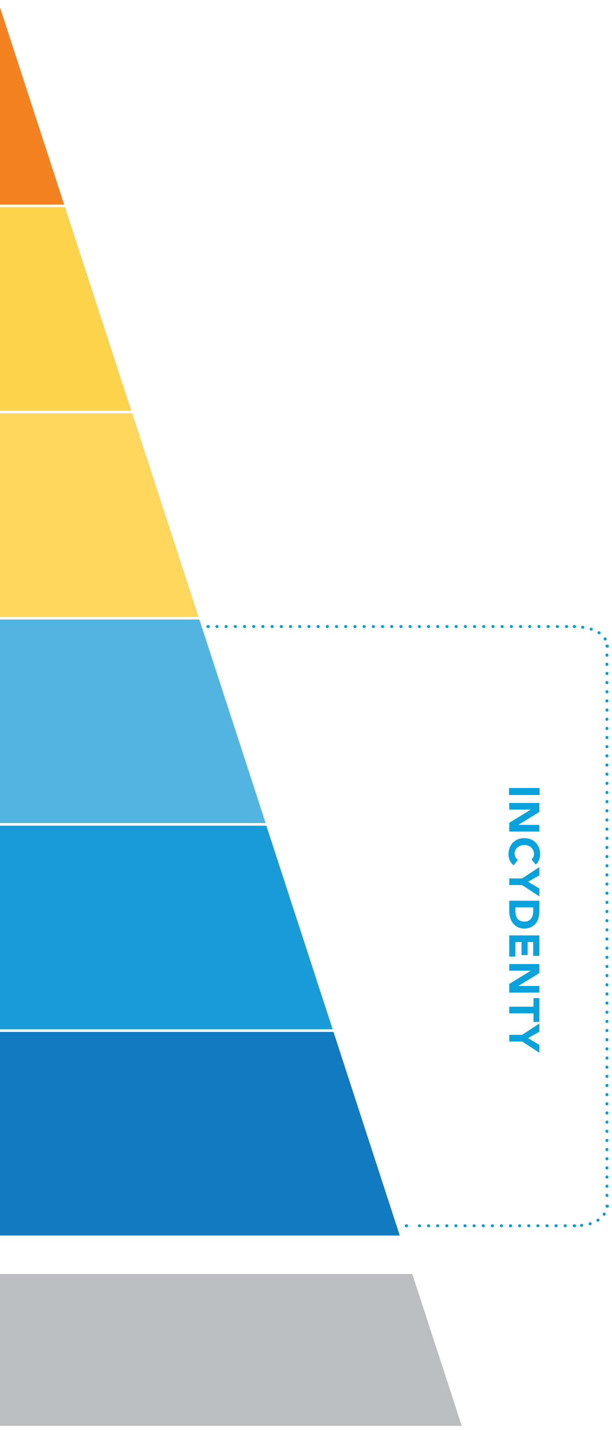
Stamboliysky, Bulgaria, 2011

Overexposure of four workers at an irradiation facility

New Delhi, India, 2010

Radioactive material in scrap metal facility resulted in acute exposure of scrap dealer





INES

The International Nuclear and Radiological Event Scale

3

SERIOUS INCIDENT

Fleurus, Belgium, 2008

Release of I-131 into the environment from the radioelements production facility

Lima, Peru 2012

Severe overexposure of a radiographer

2

INCIDENT

NPP Laguna Verde-2, Mexico, 2011

Reactor trip due to high pressure in the reactor pressure vessel

Paris, France, 2013

Overexposure of a practitioner in interventional radiology exceeding the annual limit

1

ANOMALY

NPP Rajasthan-5, India, 2012

Exposure of two workers in the nuclear power plant beyond the dose constraints

NPP Olkiluoto-1 Finland, 2008

Fast stop of the main circulation pumps and simultaneous loss of their fly wheel systems during reactor scram

0

BELOW SCALE

No radiation safety significance

No radiation emergencies recorded in 2018 outside Poland's borders resulted in a threat to humans and the environment in Poland.

No radiation emergency recorded in 2018 in Poland posed a threat to human health and the environment in the country.

TABLE 8.
Radiation events reported in 2018

The notices concerned:	
Finding of containers made of depleted uranium in a scrap metal batch	1
Detection by officers of a border guard post of an attempt to bring radioactive sources into Poland by a Vietnamese citizen	1
Finding of a radioactive source in a scrap metal batch	1
During exchange of a source in a brachytherapy device, surface contamination of the new source was detected	1
Defective defectoscope	1
TOTAL	**5**

Radiation events outside of Poland

In 2018, the National Contact Point did not receive any reports concerning accidents in nuclear facilities classified above level 3 in the seven-point international INES scale.

However, 19 notifications were submitted with regard to minor incidents associated with ionizing radiation sources or nuclear facilities, which mainly concerned unplanned exposure of workers to ionizing radiation. Moreover, the National Contact Point, via the USIE and the ECURIE system, received several dozen organizational and technical reports or notifications related to international exercises.

Radiation emergencies in Poland

Duty employees of the CEZAR received 4 notifications of radiation emergencies within the territory of Poland, concerning detection of radioactive substances in scrap metal. This emergency was classified as level 0 (below the scale) according to the INES scale. At the end of 2018 there was an event related to degradation of multi-level safeguards i work with a high-level source that was classified on level 1 according to the INES scale.

The Dosimetry Team of the PAA President travelled to a radioactive emergency site two times. It was also sent to support local activities of relevant agencies in situations that are not radiation emergencies in the meaning of the provision of the Atomic Law Act. Moreover, it participated in two exercises: An FTX at the Polish-Ukrainian border and an exercise of the National System for Contamination Detection and Alarming (KSWSiA) at a railroad siding in Warsaw.

CEZAR duty officers rendered consulting services in 14,720 cases (which were not connected with mitigation of the consequences of radiation emergency incidents), and in the majority of the cases (14,641), the consultancy was provided to National Border Guard units in relation to detection of an increased radioactivity level. The consultations concerned such matters as transit carriage or import to Poland, for domestic recipients, of ceramic materials, minerals, charcoal, refractory brick, propane-butane, electronic and mechanical components, chemicals, radioactive sources (10,926 cases in total), as well as crossing the border by nuclear medicine patients (1,243 cases). Ponadto, dyżurni CEZAR udzielili 79 konsultacji innym instytucjom oraz osobom prywatnym.

10 Assessment of the national radiation situation in Poland

Fot. NCBJ

In 2018, the level of gamma radiation in Poland and in the vicinity of the Nuclear Centre in Świerk and the National Radioactive Waste Repository did not differ from the level measured in the previous year.

Concentration of natural radionuclides in the environment has remained similar in the last decade. On the other hand, concentration of artificial isotopes (mainly Cs-137), which was mainly caused by the Chernobyl disaster and the earlier tests of nuclear weapons, has been decreasing successively in accordance with the natural radioactive decay process. The radionuclide content found does not pose a radiological hazard to humans and the environment in Poland.

Gamma radiation dose rate

In 2018 the level of gamma radiation in Poland and in the vicinity of the Nuclear Centre in Świerk and the National Radioactive Waste Repository did not differ from the level measured in the previous year. The differences in the dose rate values (even for the same municipality) result from the local geological conditions affecting the level of earth radiation.

The values of the ambient dose rate equivalent, including cosmic radiation and radiation generated by radionuclides present in the soil (the Earth component) presented in Table 9 show that in Poland, the average 24-hour values in 2017 were in the range of 54 to 142 nSv/h, with the annual average of 93 nSv/h.

In the vicinity of the Świerk nuclear centre, gamma radiation exposure dose rates, taking into account the earth component only, were between 47 and 64 nGy/h (the average value being 54 nGy/h). Exposure dose rates were also performed in the vicinity of the National Radioactive Waste Repository with another dosimeter, which contained both the cosmic component and the Earth component). The measured values were in the range of 72 to 86 nGy/h (the average being 77 nGy/h). The values do not differ significantly from dose rate measurement results obtained in other regions of the country.

TABLE 9.
Dose rate values obtained from early warning stations for radioactive contamination in 2018 (PAA)

Stations*	Town (location)	Range of the average daily dose rate [nSv/h]	Annual average rate [nSv/h]
PMS	Białystok	88-110	92
	Częstochowa	62-85	69
	Gdynia	102-121	106
	Katowice	84-105	90
	Kielce	79-94	83
	Koszalin	85-103	90
	Kraków	116-129	119
	Legnica	77-88	81
	Łódź	85-101	91
	Lublin	92-115	103
	Olsztyn	83-98	87
	Radom	54-63	58
	Sanok	101-130	117
	Suwałki	75-100	84
	Szczecin	91-101	95
	Toruń	83-93	87
	Warsaw	89-102	93
	Wrocław	82-97	87
	Zielona Góra	87-101	91
Institute of Meteorology and Water Management	Gdynia	83-96	87
	Gorzów	81-95	87
	Legnica	89-116	100
	Lesko	83-116	104
	Mikołajki	92-120	103
	Świnoujście	73-85	77
	Warsaw	72-100	81
	Włodawa	72-96	80
	Zakopane	92-142	114

* Symbols of stations as specified in Chapter IX "National radiological monitoring"

Atmospheric aerosols

In 2018, the artificial radioactivity of aerosols in the near-surface atmosphere, determined based on measurements performed by early warning stations for radioactive contaminations (ASS-500), primarily demonstrated, similarly to the several preceding years, presence of detectable amounts of the Cs-137 radionuclide. Its average concentrations in the period analyzed varied from below 0.09 to 7.05 µBq/m^3 (the average being 0.74 µBq/m^3). The average values of the I-131 radionuclide concentration in the same period varied between less than 0.05 to 22.77 µBq/m^3 (the average being 0.68 µBq/m^3), whereas average values of the natural Be-7 radionuclide concentration came to a few millibecquerels per cubic meter.

Figures 11 and 12 show the average annual concentration of Cs-137 in atmospheric aerosols in the years 1998-2018, in the entire territory of Poland and in Warsaw, respectively.

In 2018, weekly concentrations of the Cs-137 isotope in the air on the premises of the KSOP did not exceed the detection threshold of 0.13 µBq/m^3 per week.

Measurements of concentration of radioactive isotopes in the air were conducted in 2018 within the territory and in the vicinity (Wólka Mlądzka) of the National Centre for Nuclear Research in Świerk on a weekly basis. The measurement results obtained in 2018 on the premises of the Center are presented in Table 10.

FIG. 11.

Average annual concentration of Cs-137 in aerosols in Poland in the years 2009-2018 (µBq/m^3; PAA, based on data provided by the Central Laboratory for Radiological Protection)

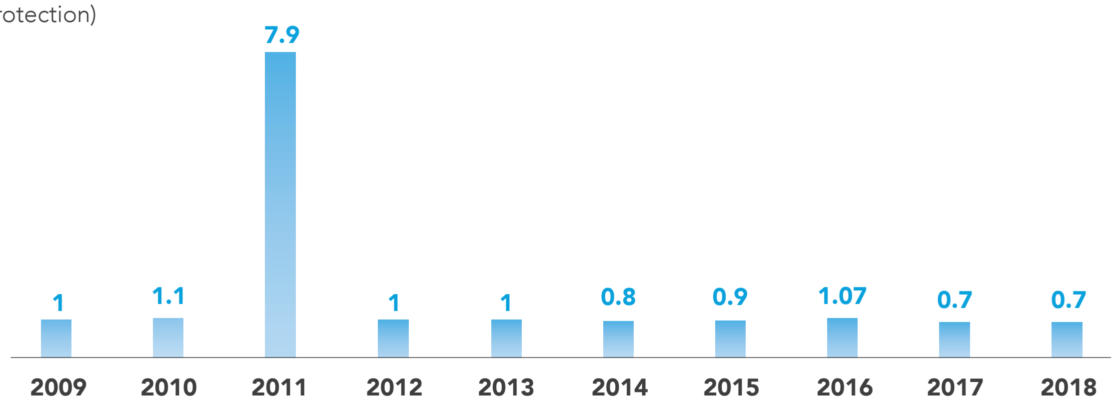


FIG. 12.

Average annual concentration of Cs-137 in aerosols in Warsaw in the years 2009-2018 (µBq/m^3; PAA, based on data provided by the Central Laboratory for Radiological Protection)

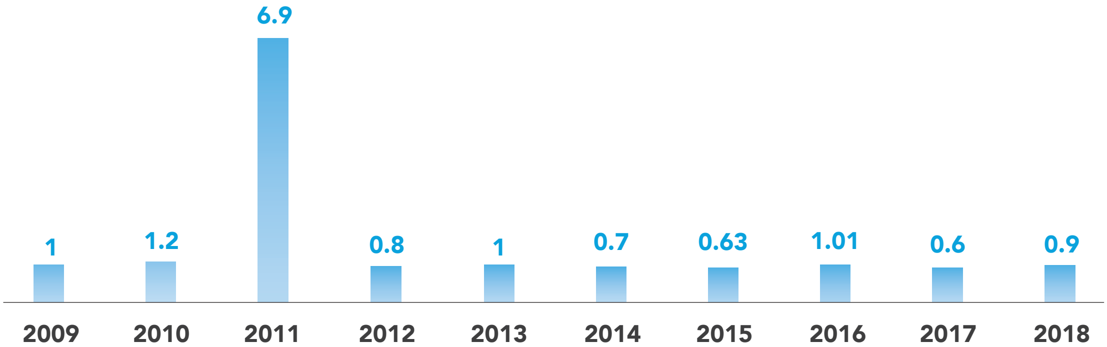


TABLE 10.

Summary of results of weekly measurements of radionuclide concentrations in atmospheric aerosols on the premises of the Świerk Nuclear Centre in 2018.

	Be-7 [mBq/m^3]	**K-40** [μBq/m^3]	**I-131** [μBq/m^3]	**Cs-137** [μBq/m^3]
Average	3.3	27	12	1.4
Minimum value	1.0	17	1.4	0.41
Maximum value	6.6	73	158	7.3

Total fallout

The notion of total fallout refers to dusts contaminated with isotopes of radioactive elements which, due to gravity and atmospheric precipitation, settle on the surface of the earth.

The results of the measurements presented in Table 11 indicate that the content of artificial Sr-90 and Cs-137 radionuclides in the total annual fallout in 2018 remained on the level observed in previous years.

TABLE 11.

Average activity of Cs-137 and Sr-90 and average beta activity in total annual fallout in Poland in the years 2008– 2018 (Chief Inspectorate of Environmental Protection, measurements conducted by the Institute of Meteorology and Water Management)

Year	**Activity** [Bq/m^2]		**Beta activity** [kBq/m^2]
	Cs-137	Sr-90	
2008	0.5	0.1	0.30
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

TABLE 12.
oncentrations of Cs-137 and Sr-90 in river and lake water in Poland in 2018 [mBq/dm3] (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

		Vistula, Bug and Narew	Oder and Warta	Lakes
Cs-137	Range	0.22 – 6.23	2.18 – 6.11	0.63 – 3.01
	Average	3.21	3.98	2.29
Sr-90	Range	1.14 – 4.68	1.80 – 4.08	1.37 – 12.08
	Average	2.71	2.88	3.50

Waters and bottom sediments

Radioactivity of waters and bottom sediments was determined based on determination of the chosen artificial and natural radionuclides in samples collected at fixed sampling points.

Open waters

Concentrations of caesium Cs-137 and strontium Sr-90 remained on the same level as in the previous year and were similar to those observed in other European countries.

In 2018, radioactivity of surface waters of the southern zone of the Baltic Sea was measured for the following isotopes: Cs-137, Ra-226, and K-40 (measurements conducted by the Central Laboratory for Radiological Protection). The average concentrations of the aforementioned three isotopes remained on the level of 26.9 mBq/dm^3 for Cs-137 - water from the surface layer - and 24.1 mBq/dm^3 - water near the bottom, 3.15 Bq/dm^3 for Ra-226, and 3,729 mBq/dm^3 for K-40, and are similar to the concentrations from the previous years.

The total content of Cs-134 and Cs-137 in samples of open waters taken in 2018 from the monitoring points in the vicinity of the Nuclear Center in Świerk were equal to, respectively:

- Świder river: 2.75 mBq/dm^3 (upstream of the Center) and 3.14 mBq/dm^3 (downstream of the Center);
- water from the wastewater treatment center in Otwock discharged to the Vistula river: 9.01 mBq/dm^3.

The concentration of strontium in open water samples collected from the surroundings of the National Nuclear Research Center in Świerk was equal to 8.55 and 9.55 mBq/dm^3.

The concentrations of tritium in open water samples collected in 2018 at monitoring points located in the vicinity of the Nuclear Centre in Świerk was equal to:

- Świder river (upstream and downstream of the Center): on average 1.45 Bq/dm^3;
- water from the wastewater treatment center in Otwock discharged to the Vistula river: 3.0 Bq/dm^3.

Waters - local monitoring

The results of measurements of concentrations of radioactive isotopes in waters conducted as a part of local monitoring in 2018 did not differ substantially from the results for the previous years.

Nuclear Center in Świerk:

The average concentration of radioactive isotopes of caesium and strontium in well water from farms located in the vicinity of the Nuclear Centre in Świerk in 2018 was equal to 5.72 mBq/dm^3 for caesium isotopes (Cs-134, Cs-137) and 18.7 mBq/dm^3 for Sr-90. The concentration of tritium (H-3) was also determined, and was equal to less than 1.35 Bq/dm^3 on average.

National Radioactive Waste Repository in Różan (KSOP):

Concentrations of radioactive isotopes of Cs-137 and Cs-134 in spring water in the vicinity of the National Radioactive Waste Repository in Różan were equal to 2.58 Bq/dm^3 on average.

In 2018, the concentration of tritium in ground water was also examined in the vicinity of the National Radioactive Waste Repository in Różan, and it was less than 0.98 Bq/dm^3 on average.

Areas of former uranium ore extraction and processing plants

For the purpose of interpretation of the relevant measurement results, recommendations developed by the World Health Organisation – Guidelines for drinking-water quality, Vol. 1 – Recommendations. Geneva, 1993, item 4.1.3, p. 115) were applied, introducing what is referred to as reference levels for drinking water. In accordance with the aforementioned guidelines, the total alpha activity of drinking water should not, as a rule, exceed 100 mBq/dm^3, whereas the beta activity should not exceed 1,000 mBq/dm^3. However, it should also be noted that the said levels function as indicators only, and they are exceeded, identification of radionuclides is recommended.

Measurements of the alpha and beta activity were conducted for 50 water samples in former areas of uranium ore mining and the following results were obtained[6]:

- public drinking water intakes:
  - total alpha activity
    – from 1.5 to 86.1 mBq/dm^3,
  - total beta activity
    – from 21.8 to 273.0 mBq/dm^3.
- waters flowing out of mine workings (adits, rivers, ponds, springs, wells):
  - total alpha activity
    – from 5.2 to 615.0 mBq/dm^3,
  - total beta activity
    – from 30.8 to 3,212.4 mBq/dm^3.

The concentration of radon in water from public intakes and private wells in locations within the area managed by the Association of Municipalities was in the range of 1.0 to 900.2 Bq/dm^3. The concentration of radon in water flowing out of mining facilities, which displayed the highest total alpha and beta radioactivity, showed the highest value of 309.2 Bq/dm^3 in water flowing out of adit no. 17 of the "Podgórze" mine.

The requirements concerning the quality of water intended to be consumed by people, with regard to the content of radioactive substances, are specified in Regulation of the Minister of Health of 7 December 2017 *concerning the quality of water intended to be consumed by people* (Journal of Laws of 2017, item 2294). The parametric value, assumed to be equal to 100 Bq/l, of concentration of radon activity indicates the content of radioactive substances in water, above which it is necessary to assess whether presence of radioactive substances poses a threat to the health of people that requires taking an action and, if it does, it is necessary to take a remedial action to improve the quality of water so that it reaches a level that meets the requirements concerning.

Bottom sediments

In 2018, the concentration of radionuclides in samples of dry mass of bottom sediments from rivers, lakes, and the Baltic Sea remained on the same levels as observed in previous years. The results of the measurements are shown in Tables 13 and 14.

6. The upper levels of activity were present in waters flowing out of adit no. 19a of the former "Podgórze" mine in Kowary.

TABLE 13.

Concentrations of cesium and plutonium radionuclides in bottom sediments in rivers and lakes in Poland in 2018 [Bq/kg of dry mass] (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

		Vistula, Bug and Narew	Oder and Warta	Jeziora
Cs-137	Range	0.35 – 9.12	0.16 – 9.24	0.48 – 15.8
	Average	3.05	1.90	3.40
Pu-239, 240	Range	0.003-0.079	0.004-0.042	0.005-0.085
	Average	0.021	0.012	0.021

TABLE 14.

Concentrations of artificial radionuclides of Cs-137, Pu-238, Pu-239, Pu-240 and Sr-90, and of the natural radionuclide of K-40 in bottom sediments from the southern Baltic Sea in 2018 (PAA, based on data provided by the Central Laboratory for Radiological Protection)

		Layer thickness 0-19 cm
Cs-137	$kBqm^2$	2.37
Pu-238	Bqm^2	1.48
Pu-239, 240	Bqm^2	41.5
K-40	$kBqm^2$	48.8
Sr-90	Bqm^2	186.17

Soil

Concentrations of radioactive isotopes in soil are determined based on cyclic spectrometric measurements conducted every few years on samples of non-cultivated soil collected from 10 and 25 cm thick layers of soil.

The last completed measurement cycle was conducted in the years 2016-2017. In 2016, 264 samples of soil were taken at 254 fixed check points spread across the country. In 2017, spectrometric measurements of these samples were conducted and the concentrations of artificial (Cs- 137, Cs-134) and natural radioisotopes were determined[7]. The next measurement cycle is planned for the years 2019-2020.

Average deposition of Cs-137, Cs-134 in the soil

The tests conducted indicate that average deposition of Cs-137 in the surface layer of the soil in Poland is at the level of 0.24 kBq/m^2 to 10.76 kBq/m^2 and is equal on average to 1.52 kBq/m^2.

The average deposition for the Cs-137 isotope in Poland, in the period of monitoring of radioactive soil contamination, decreased from the value of 4.64 kBq/m^2 in 1988 to 1.52 kBq/m^2 in 2016. The deposition value for Cs-134 in soil samples changed during the monitoring period according to the half-life, and consequently this isotope is currently not present in detectable quantities in Polish soils.

The average deposition of Cs-137 in individual regions of Poland is shown in Table 15, whereas the average concentrations of natural radioactive isotopes in soil determined in 2016 are shown in Table 16.

7. The document can be found at http://www.gios.gov.pl/stan--srodowiska/monitoring-promieniowania-jonizujacego

For comparison, the average values of surface contamination of soil with Cs-137 in 2018 in the surroundings of the Nuclear Center in Świerk and of the KSOP in Różan were equal, respectively, to 6.4 Bq/kg and 44.7 Bq/kg.

TABLE 15.
Average, minimum and maximum deposition of Cs-137 in soil in individual provinces of Poland in samples collected in October 2016 (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

Province	Concentration ^{137}Cs [kBq/m^2]		
	Average value	Range	
		Minimum	Maximum
dolnośląskie	1.72 ± 0.46	0.25	10.76
kujawsko-pomorskie	0.60 ± 0.05	0.38	0.78
lubelskie	1.29 ± 0.41	0.33	6.25
lubuskie	0.69 ± 0.12	0.25	1.05
łódzkie	0.73 ± 0.13	0.36	1.39
małopolskie	2.48 ± 0.36	0.44	10.53
mazowieckie	1.61 ± 0.32	0.32	5.54
opolskie	4.36 ± 0.97	0.76	10.17
podkarpackie	0.81 ± 0.10	0.30	2.35
podlaskie	1.01 ± 0.11	0.74	1.60
pomorskie	0.83 ± 0.09	0.39	1.80
śląskie	2.07 ± 0.28	0.28	4.36
świętokrzyskie	1.43 ± 0.19	0.61	2.64
warmińsko-mazurskie	1.05 ± 0.17	0.31	2.12
wielkopolskie	0.63 ± 0.05	0.37	1.05
zachodniopomorskie	0.50 ± 0.09	0.24	1.17
Poland	**1.52 ± 0.11**	**0.24**	**10.76**

FIG. 13.
verage deposition of Cs-137 (10 cm thick soil layer) in Poland in the years 1988-2016 (PAA, based on data provided by the Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

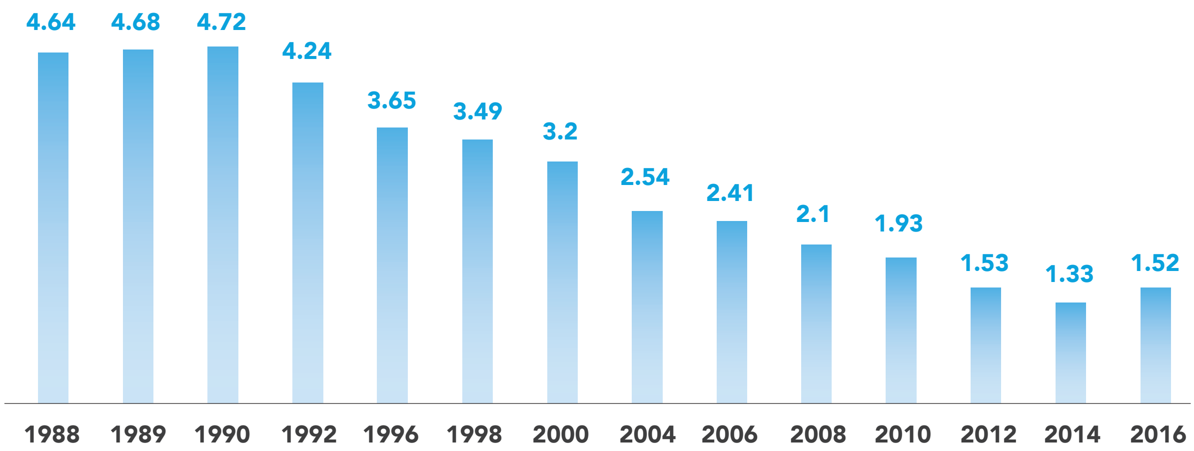


TABLE 16.
Average concentrations of natural radioactive isotopes in soil

The average concentration ranges for natural radionuclides are as follows:

	dla Ra-226	dla Ac-228	dla K-40
Range	4.3 ÷ 112.0 Bq/kg	3.5 ÷ 115.0 Bq/kg	60 ÷ 1011 Bq/kg
Average	27.5 Bq/kg	23.5 Bq/kg	425 Bq/kg

TABLE 17.
Average, minimum, and maximum concentrations of natural isotopes in soil samples collected in individual provinces of Poland in October of 2016 (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

Province	Concentration [Bq/kg]		
	^{40}K		
	Average value	Minimum	Maksimum
dolnośląskie	559 ± 44	191	1011
kujawsko-pomorskie	406 ± 42	230	561
lubelskie	350 ± 33	189	592
lubuskie	320 ± 36	221	447
łódzkie	304 ± 25	206	431
małopolskie	512 ± 18	238	789
mazowieckie	333 ± 26	165	623
opolskie	473 ± 47	243	662
podkarpackie	500 ± 33	118	705
podlaskie	471 ± 75	60	622
pomorskie	356 ± 25	175	624
śląskie	394 ± 29	148	577
świętokrzyskie	329 ± 51	97	583
warmińsko-mazurskie	424 ± 41	228	676
wielkopolskie	346 ± 16	211	482
zachodniopomorskie	340 ± 41	169	599
Poland	**425 ± 10**	**60**	**1011**

Radioactivity of basic food processing products and other foodstuffs

Measurements of radioactive contamination of basic food processing products and other foodstuffs is conducted by Sanitary-Epidemiological Stations..

Values of activity of radioactive isotopes in food processing products and other foodstuffs should be referred to values specified in Council Regulation no. 733/2008. This document stipulates that concentration of the Cs-137 and Cs- 134 isotopes may not jointly exceed 370 Bq/kg in milk and dairy products and 600 Bq/kg in all food processing products and other foodstuffs. At present, the concentration of Cs-134 in food processing products and other foodstuffs is below the level of 1‰ of the Cs-137 activity Therefore, Cs-134 is not included in the discussions further in this section.

The data provided in this subchapter are based on measurement results submitted to the PAA by facilities conducting measurements of radioactive contamination (sanitary and epidemiological stations).

Milk

Concentration of radioactive isotopes in milk constitutes an important factor for the assessment of radiation exposure by ingestion.

In 2018, concentrations of Cs-137 in liquid (fresh) milk ranged from 0.20 to 1.50 Bq/dm^3 and were equal to approx. 0.52 Bq/dm^3 on average - see the infographic on pages 88-80.

Meat, poultry, fish, and eggs

The results of the Cs-137 activity measurements conducted on different kinds of meat from animal farms (beef, veal, pork) as well as poultry, fish and eggs in 2018 were as follows (annual average concentration of Cs-137):

- meat from animal farms – approx. 1.09 Bq/kg;
- poultry - approx. 0.47 Bq/kg;
- fish - approx. 0.85 Bq/kg;
- eggs - approx. 0.57 Bq/kg.

The time distribution of the Cs-137 activity in the years 2005-2018 in different types of meat from animal farms (beef, pork), as well as in poultry, eggs and fish are shown in the infographic on pages 88-89. The data obtained indicates that in 2018 the average activity of the caesium isotope in meat, poultry, fish and eggs remained on the same level as in the previous year.

Vegetables, fruits, cereals, feed, and mushrooms

The results of measurements of artificial radioactivity in vegetables and fruits conducted in 2018 indicate that the concentration of the Cs-137 isotope in vegetables ranged from 0.21 to 0.86 Bq/kg, with the average value being 0.40 Bq/kg, and in fruits it was in the range of 0.12-2.59 Bq/kg with the average value of 0.75 Bq/kg (see the infographic on pages 88-89). In long-term comparisons, the results from 2018 remained on the same level as in the year 1985, and compared to the year 1986 they were more than ten times lower.

The values of activity of Cs-137 in cereals observed in 2018 ranged from 0.23 to 2.69 Bq/kg (the average value being 0.70 Bq/kg) and were similar to the amounts measured in 1985.

The values of activity of Cs-137 in animal feed in 2018 were in the range of 0.22 to 3.44 Bq/kg (1.65 Bq/kg on average).

The average values of activity of the caesium isotope in grass in the vicinity of the Świerk Nuclear Centre and of the KSOP (with reference to dry mass) in 2018 ranged from <0.17 to 2.05 Bq/kg (the average value being 1.23 Bq/kg) for the Nuclear Centre in Świerk and from <0.20 to 6.41 Bq/kg (the average value being 2.22 Bq/kg) for the KSOP.

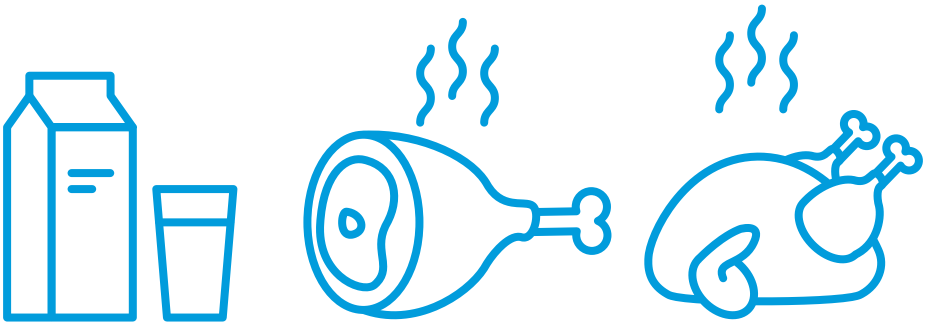
In 2018, the average activity of caesium in basic specimens of fresh mushrooms did not differ from the values measured in the previous years. It should be emphasized that in 1985, i.e. before the Chernobyl disaster, the activity of Cs-137 in mushrooms was also much higher than in other foodstuffs. At that time, this radionuclide was produced in the course of nuclear weapons tests (which is confirmed by an analysis of the proportion of the Cs-134 and Cs-137 isotopes in 1986).

RADIOACTIVITY OF BASIC FOOD PROCESSING PRODUCTS AND OTHER FOODSTUFFS

Values of activity of radioactive isotopes in food processing products and other foodstuffs should be referred to values specified in Council Regulation no. 733/2008.

370 Bq/kg

highest permitted concentration of the Cs-137 and Cs- 134 isotopes in milk, dairy products and infant food products.



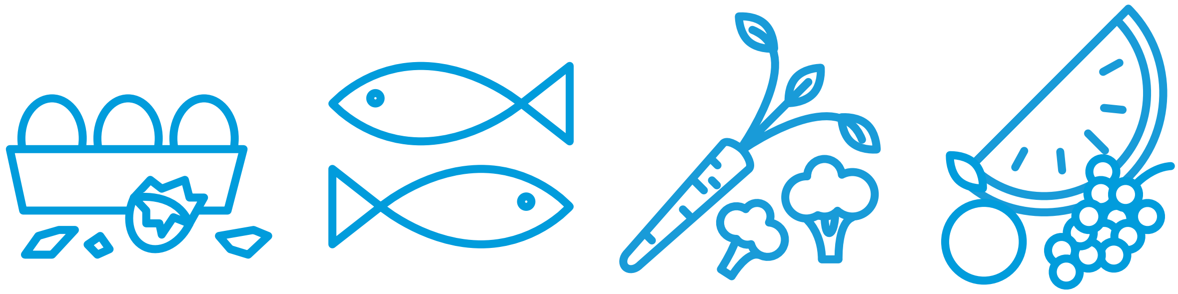
average concentration Cs-137	MILK	MEAT	POULTRY
2018	**0.52 Bq/dm³**	**1.09 Bq/kg**	**0.47 Bq/kg**
2017	0.46 Bq/dm³	0.89 Bq/kg	0.50 Bq/kg
2016	0.40	0.63	0.54
2015	0.50	0.77	0.60
2014	0.50	0.83	0.73
2013	0.60	0.95	0.90
2012	0.60	0.90	0.70
2011	0.49	0.64	0.60
2010	0.48	0.83	0.58
2008	0.60	0.85	0.52
2009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

600 Bq/kg

highest permitted concentration of the Cs-137 and Cs- 134 isotopes in all food processing products and other foodstuffs.

Cs-137

Only the concentration of Cs-137 is presented because the concentration of Cs-134 is below 1‰ of their total activity.



EGGS	FISH	VEGETABLES	FRUIT
0.57 Bq/kg	**0.85 Bq/kg**	**0.40 Bq/kg**	**0.75 Bq/kg**
0.49 Bq/kg	0.61 Bq/kg	0.42 Bq/kg	0.38 Bq/kg
0.42	0.77	0.39	0.33
0.40	0.77	0.41	0.27
0.45	0.86	0.46	0.50
0.60	1.10	0.50	0.60
0.50	1.00	0.50	0.40
0.45	1.00	0.49	0.40
0.43	1.00	0.47	0.35
0.42	0.70	0.45	0.37
0.39	0.84	0.54	0.28
0.43	0.96	0.46	0.25

Data source: sanitary and epidemiological stations

11 International cooperation

Fot. IAEA

Coordination of Poland's international cooperation in the field of nuclear safety and radiological protection is a statutory duty of the President of the National Atomic Energy Agency (PAA). This duty is performed by the President in close collaboration with the Minister of Foreign Affairs, the Minister of Energy and with other competent ministers (heads of central offices) in line with their respective responsibilities.

The goal of international cooperation in which PAA has become involved, is to pursue the mission of a nuclear regulatory body, i.e. ensuring nuclear safety and radiological protection of the country. PAA strives to accomplish this goal by entering international legal acts and implementing international standards by the exchange of information on nuclear protection between the neighbouring countries, as well as increasing their own competence in action by sharing experience and know-how with foreign partners. The international cooperation in question is pursued by way of participation of PAA's representatives in the efforts undertaken by international organizations and associations, as well as their involvement in bilateral cooperation.

Multilateral cooperation

In 2018, the PAA President was involved in fulfilment of tasks resulting from Poland's multilateral cooperation under the framework of:

- the European Atomic Energy Community (EURATOM);
- the International Atomic Energy Agency (IAEA);
- the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (NEA OECD);
- the Western European Nuclear Regulators' Association (WENRA);
- Meetings of Heads of the European Radiological 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)

PAA's involvement resulting from the membership of Poland in the Euratom Community in 2018 focused mainly on activities conducted in two groups of the European Nuclear Safety Regulators' Group (ENSREG). It is composed of representatives of the senior management of European nuclear regulators from the Member States and a representative of the European Commission, ENSREG provides advisory support to the European Commission.

On 14-18 May 2018, in Luxembourg, the first topic-specific review meeting on nuclear safety was held; it focused on management of ageing of nuclear facilities in Europe. During that meeting, Poland presented on the European Union forum a report about the MARIA research reactor.

International Atomic Energy Agency

Next to the Ministry of Foreign Affairs, the PAA is the leading institution in the cooperation with the IAEA. Another key national institution, involved in cooperation with the IAEA, is the Ministry of Energy, which is responsible for development of nuclear energy in Poland.

The main tasks of the PAA associated with Poland's membership in the IAEA include:

- coordination of cooperation of the domestic institutions with the IAEA;
- participation in development of the IAEA international safety standards;
- participation in works of the annual General Conference of the IAEA, which is the key statutory body of the IAEA;
- payment of Poland's membership fee in the IAEA from the budget of the PAA (in 2018, the fee amounted to: EUR 2,426,246 and USD 361,416 paid to the regular budget of the IAEA and EUR 693,030 paid to the Technical Cooperation Fund of the IAEA);
- implementation of own projects in collaboration with the IAEA.

Cooperation in establishing the IAEA Safety Standards

One of the elements of cooperation with the IAEA is the establishment of Safety Standards for peaceful use of nuclear energy. Works devoted to these Standards are performed with participation of PAA experts in the following six committees:

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

IAEA General Conference

The General Conference (GC) is the highest statutory body of the IAEA. Its members are representatives of 171 (as for 5 February 2019) Member States of the Agency. The General Conference is held once a year to review and approve the program and budget of the Agency and to make decisions and resolutions in matters submitted to it by the Board of Governors, the Director General, and the Member States.

On 17-21 September 2018, the 62nd General Conference of the International Atomic Energy Agency was held.

It was attended by a Polish Delegation whose Chairman was Andrzej Przybycin - the President of the National Atomic Energy Agency On 18 September, the second day of the conference, Andrzej Przybycin gave a speech on behalf of the Republic of Poland[8].

8. The opening speeches given by representatives of the delegations are published on the IAEA website at https://www.iaea.org/about/policy/gc/gc62/statements

The Polish delegation voted in support of a resolution specifying the amount of the membership fee to be paid to the regular budget of the IAEA in 2019 (Poland's membership fee is equal to EUR 2,481,864 and USD 374,728); the President of the PAA also made a declaration that Poland would pay its membership fee to the Technical Cooperation Fund of the IAEA in 2019 (EUR 697,075).

During the General Conference, the PAA delegation held a number of meetings with representatives of:

- the Hungarian Atomic Energy Authority (HAEA) led by Mr. Szabolcs Hullán, the deputy Director General;
- the Canadian Nuclear Safety Commission (CNSC) led by Ms. Rumina Velshi, the President of the CNSC;
- the US Nuclear Regulatory Commission (NRC) led by Ms. Kristine Svinicki, the Chairman of the NRC;
- the Spanish Nuclear Regulatory Council (CSN) led by Mr. Fernando Marti Scharfhausen, President of the SNC;
- the South-African National Nuclear Regulator (NNR) led by Mr. Bismark Tyobeka, the Director and Chief Executive Officer of the NRR;
- the Ukrainian Nuclear Regulatory Authority (SNRIU) led by Mr. Hryhorii Plachkov, the President of the SNRIU;
- the Czech Nuclear Regulatory Authority (SÚJB) led by Ms. Dana Drabova, the President of the SÚJB;
- the Lithuanian Nuclear Regulatory Authority (VATESI) led by Mr. Michail Demcenko, the President of the VATESI.

During the meetings and talks between the PAA President and the representatives of partner nuclear regulators, current cooperation and technical exchange, as well cooperation in the field of nuclear safety were discussed.

During the General Conference, as a part of actions intended to enhance nuclear safety globally, the PAA conducted a number of consultations with its international partners:

- Ms. Ana Raffo-Caiado, the Director of the Technical Cooperation Department of the International Atomic Energy Agency;
- during a meeting with the Lithuanian delegation led by Ms. Lina Sabaitienė from the Lithuanian Ministry

of Energy, where issues related to nuclear safety, the status of implementation of the Polish Nuclear Energy Program, the works related to decommissioning of the Ignalina nuclear power plant, and the construction of new nuclear facilities in the region were discussed;
- during a meeting with the delegation of the US Department of Energy led by Mr. Edward Mcginnis, where further American support for the Polish nuclear program was confirmed;
- in the panel of the Forum of the International Nuclear Safety Group (INSAG) on implementation of safety standards by IAEA member states;
- during the 62nd Senior Regulator's Meeting where topics related to the role of nuclear regulators in issues concerning use of radiology in veterinary tests and regulations concerning readiness and response in nuclear and radiological accidents were discussed;
- during the meeting of the Regulatory Cooperation Forum.
- The forum was established on the initiative of the IAEA in order to provide support of countries with advanced nuclear power technologies to countries planning to develop nuclear power.

Expert cooperation under the aegis of the IAEA

An important instrument of the IAEA is the Technical Cooperation Program, in which Poland has participated for many years, performing two roles: as a net payer of the Program and as a beneficiary of expert cooperation with the IAEA and its Member States. Polish institutions have participated for many years in the national and regional technical cooperation projects of the IAEA.

In 2018, the PAA coordinated participation of the national expert and research organizations in more than 290 meetings, training courses, and conferences organized by the IAEA.

Polish institutions actively take advantage of expert support and the Technical Cooperation Program on projects that are important to the development of the Polish science, medicine, and power sector, as well as to ensuring nuclear safety and radiological protection of the country. The IAEA offers support in development of competence, advice of international experts, and assistance in purchase of necessary equipment. Four national organizations plan the performance of cooperation projects for the years 2020-2021. A new project in the area of medicine is being prepared by the National Center for Radiological Protection in Healthcare, which intends to compare the quality of the iodine (I-131) activity measurements on the national scale. In the area of science, the National Center for Nuclear Research intends to improve its competencies related to safe and effective operation of the MARIA research nuclear reactor in Otwock-Świerk. The Ministry of Energy is continuing its project related to expansion of the infrastructure necessary for the nuclear energy sector, while the PAA will focus on further improvement of the competencies needed for effective exercise of the role of nuclear regulator.

In the middle of the year, the PAA President presented a national report during the 6th review meeting of the Joint Convention on the Safety of Spent Fuek Management and on the Safety of Radioactive Waste Management. The review meeting is organized every three years at the IAEA headquarters in Vienna.

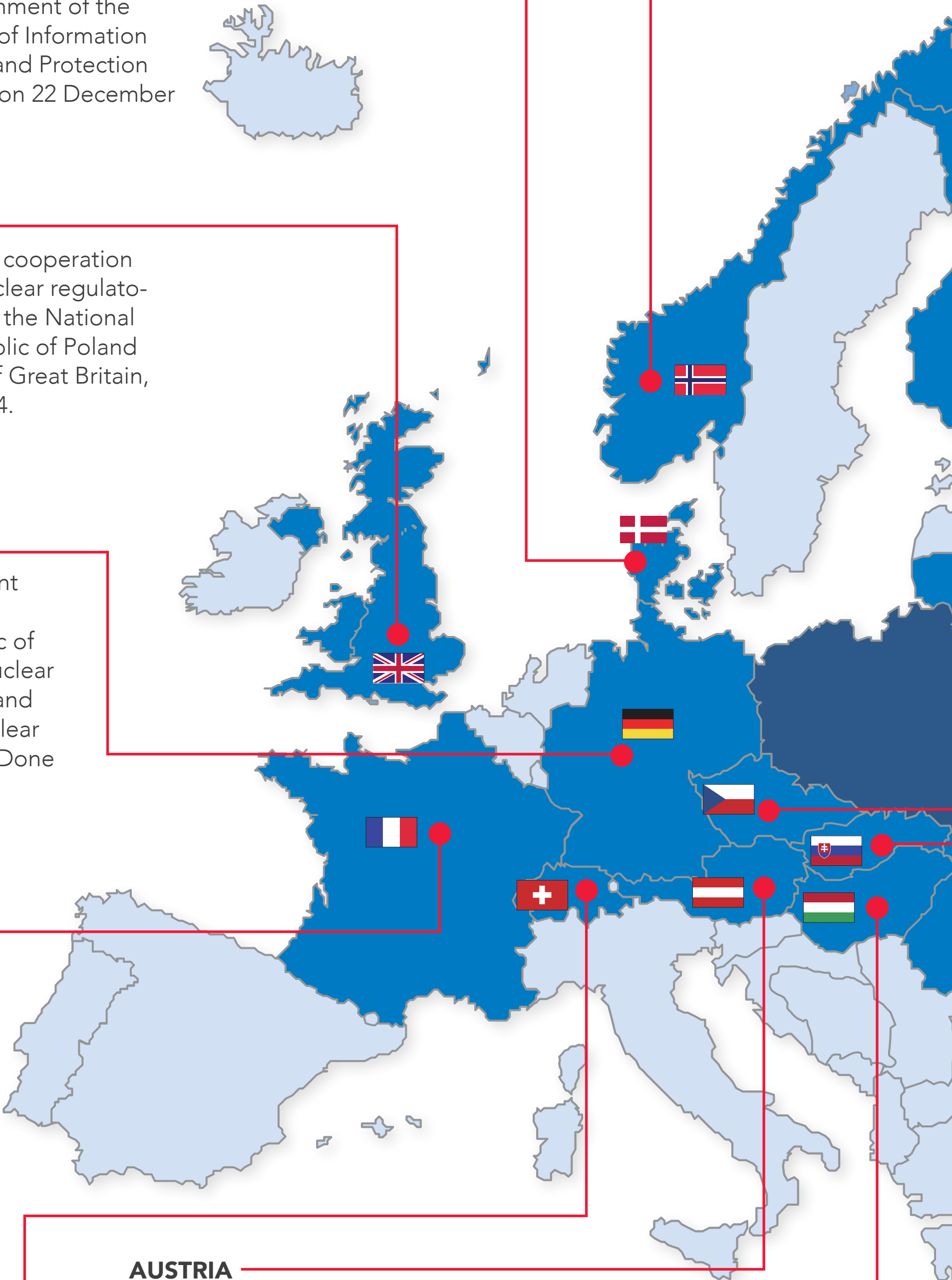
In May, in response to the PAA's invitation, an IAEA expert mission was conducted to support the development of the integrated management system at the PAA. The integrated management system is immensely important as it ensures priority of nuclear safety in all activities of the PAA. The mission made it possible to evaluate the current status of the integrated management system and to identify the key challenges; also, it will enable planning further actions related to this issue.

As part of cooperation with the IAEA, the long-term PAA Advanced Licensing Exercise Project (ALEP) was initiated, with the aim to test and improve the system, prepared by the PAA, for evaluation of safety and issue of decisions permitting construction of nuclear power plants (NPP).

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

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

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



GREAT BRITAIN
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 Office for Nuclear Regulation of Great Britain, signed at Vienna 24 September 2014.

GERMANY
Agreement between the Government of the Republic of Poland and the Government of the Federal Republic of Germany on Early Notification of Nuclear Accident, Exchange of Information and Experience and Cooperation in Nuclear Safety and Radiological Protection. Done at Warsaw on 30 July 2009.

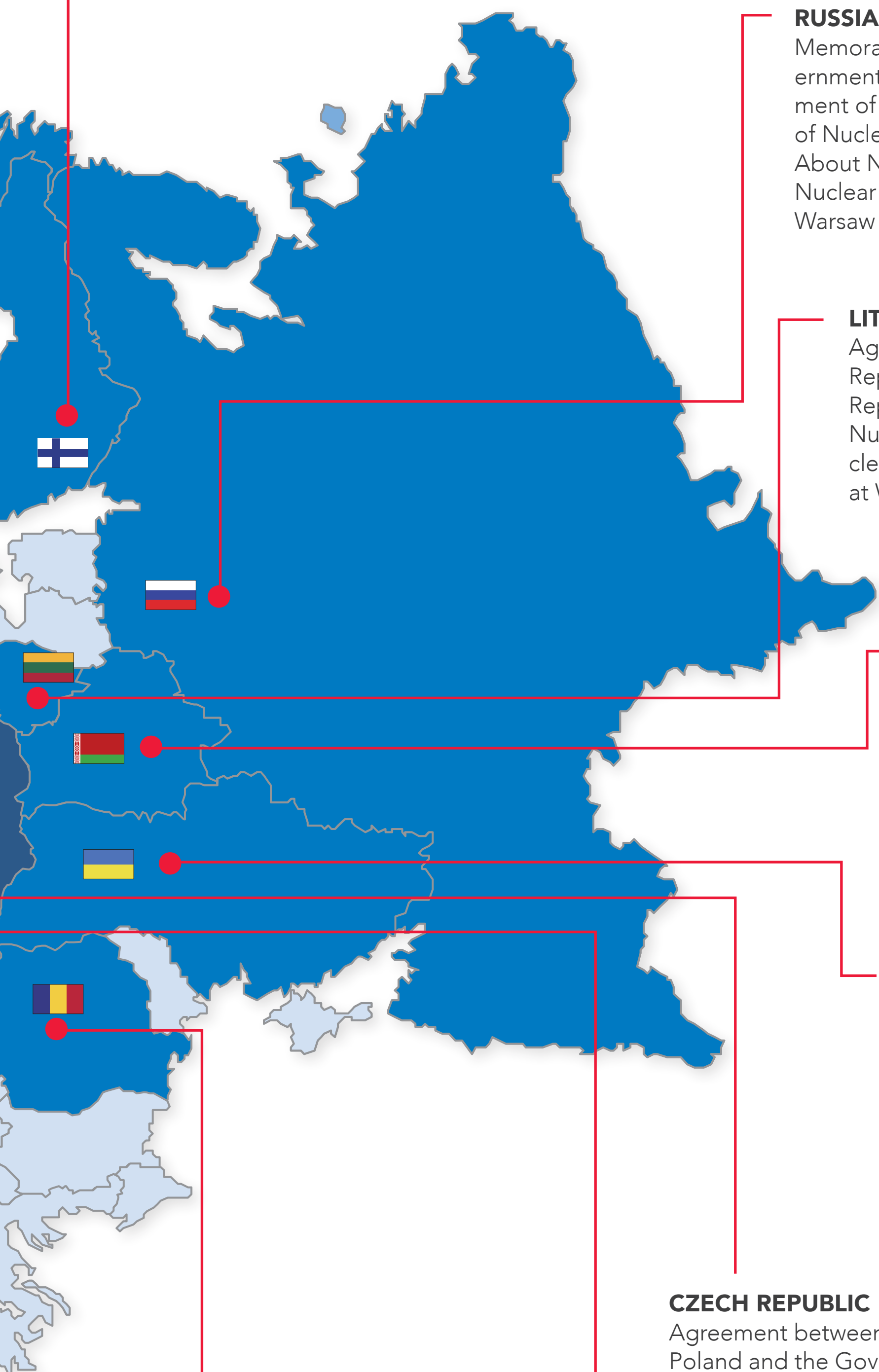
FRANCE
Agreement concluded between the President of the National Atomic Energy Agency in the Republic of Poland and the Office of the Nuclear Safety (l`Autorité de sûreté nucléaire) of the French Republic on the exchange of technical information and cooperation in the field of nuclear safety. Done at Warsaw on 14 June 2012 and Paris 26 June 2012. (*Unofficial translation - agreement concluded in Polish and French*).

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 at Vienna 26 September 2016

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

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.

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 19 September 2017.



RUSSIAN FEDERATION
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 Radiological Protection. Done at Warsaw on 18 February 1995.

LITHUANIA
Agreement between the Government of the Republic of Poland and the Government of the Republic of Lithuania on Early Notification of Nuclear Accident and on Cooperation in Nuclear Safety and Radiological Protection. Done at Warsaw on 2 June 1995.

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

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

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

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

SLOVAKIA
Agreement between the Government of the Republic of Poland and the Government of the Republic of Slovakia on Early Notification of Nuclear Accident, on Exchange of Information and on Cooperation in Nuclear Safety and Radiological Protection. Done at Bratislava on 17 September 1996.

In the spring of 2018, the first stage of the project started and will continue for one year; the first workshop. The first workshop in the project was held in Warsaw on 27-31 August 2018. The project is divided into 3 stages and will continue for approx. 2 years.

The participants of the project are 30 PAA employees, supported by experts - longterm employees of the American and British nuclear regulatory bodies[15].

Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (NEA OECD)

The NEA's activity is based on the cooperation of national experts in 7 standing technical committees and several subordinate working groups. Poland became an NEA member in 2010 and participates actively in the tasks of the working groups. The national leading institution for the NEA is the Ministry of Energy. The PAA is involved in works of working groups and committees of the NEA in the fields of nuclear safety, nuclear regulatory activity, nuclear law and new reactors.

In May, the PAA President Andrzej Przybycin met in the PAA's offices with Mr. William D. Magwood, IV, the Director General of the (NEA). During the meeting, they discussed Poland's involvement in the works of the NEA OECD working groups in which PAA's experts participate.

Cooperation in associations and other forms of multilateral cooperation

The Western European Nuclear Regulators' Association (WENRA)

In 2018, the areas in which WENRA was active included the works of a working groups on radioactive waste and of a working group for harmonization of reference levels for research reactors.

15. The ALEP project is described in detail in the Nuclear Safety and Radiological Protection Bulletin, issue 4/2018.

Heads of the European Radiological Protection Competent Authorities (HERCA)

Representatives of Poland participate in plenary works of heads of the European regulatory authorities and in HERCA working groups, dealing with such issues as radiological protection in medicine, veterinary science, industry, as well as preparation for radiation emergencies. In 2018, the works of HERCA focused mainly on implementation of the BSS directive, in particular, issues associated with personal authorizations required in radiological protection, radon and radionuclides occurring naturally in the environment.

Council of the Baltic Sea States (RPMB)

Poland is represented in the Expert Group on Nuclear and Radiation Safety by the PAA. The Group meets twice a year, and, additionally, organizes ad-hoc meetings on specific topics in sub-groups. The Group meetings may be attended by observers from the European Commission, as well as other institutions that specialize in nuclear safety and radiological protection (e.g. IAEA, IRSN (France) etc.), as well as representatives of organizations involved in the issues of CBRNE.

European Nuclear Security Regulators Association (ENSRA)

At present, the Association incorporates 14 Member States of the European Union, including the PAA since 2012. The main goals of the Association include exchange of information concerning physical protection of nuclear material and facilities as well as promotion of a uniform approach towards nuclear security in the European Union countries.

Bilateral cooperation

Poland has signed agreements on cooperation and exchange of information with regard to nuclear safety, radiation protection and nuclear accidents with all of its neighbouring countries. The PAA President is responsible for performance of these agreements.

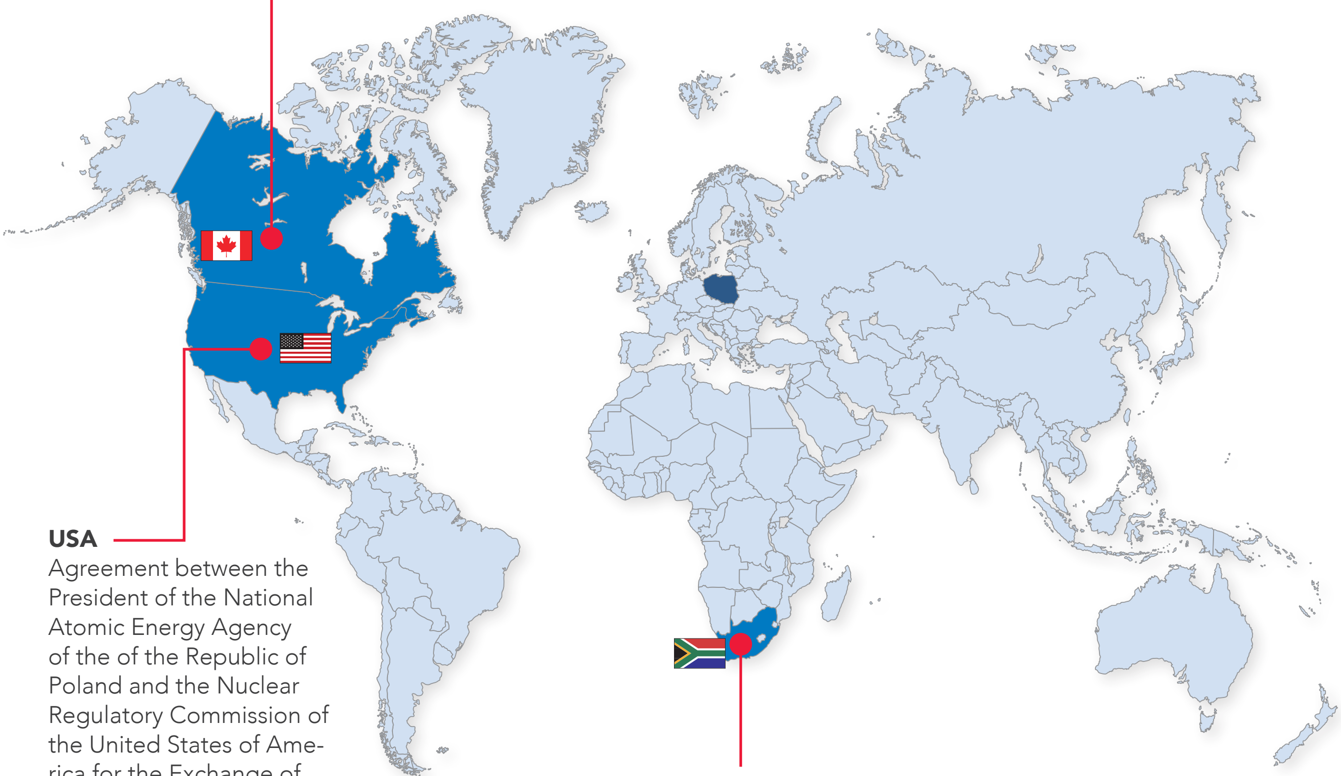
In 2018, the PAA continued to develop the network of cooperation with its foreign partners which already have experience in supervision of large nuclear facilities.

In addition to the aforementioned bilateral meetings that were held during the General Conference of the IAEA, the PAA implemented a bilateral cooperation program:

- In February, a bilateral meeting was held in Warsaw with a delegation of the Federal Ministry of Environment, Nature Protection, Construction, and Nuclear Safety (BMUB) of the Federal Republic of Germany led by Thomas Elsner, the Deputy Director General of the BMUB for safety of nuclear installations.
- In April, a bilateral meeting was held in Warsaw with a delegation of the Nuclear Regulatory Office of Macedonia (RSD); also, a bilateral meeting was held in Paris with the French Nuclear Regulatory Office (ASN).
- In June, a bilateral meeting was held in Budapest with a delegation of the Hungarian Nuclear Regulatory Office (HAEA) led by Gyula Fichtinger, the Director General of the HAEA.
- In October, a bilateral meeting was held in Mojmirovce with a delegation of the Nuclear Regulatory Office of the Slovak Republic (UJD SR).
- In November, a bilateral meeting was held in Cracow with a delegation of the South-African Nuclear Regulator (NNR) led by Dr. Bismark Tyobeka, the Director and Chief Executive Officer of the NRR.
- In December, a bilateral meeting was held in Warsaw with a delegation of the Nuclear Regulatory Office of Georgia (ANRS) led by Vasil Gedevanishvili, the Director of the ANRS.

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

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 24 September 2014.



USA
Agreement between the President of the National Atomic Energy Agency of the of the Republic of Poland and the Nuclear Regulatory Commission of the United States of America for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters. Done in Vienna on 22 September 2010.

REPUBLIC OF SOUTH AFRICA
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 at Centurion on 24 November 2017.

List of acronyms

- **ADN** – European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways
- **ADR** – L'Accord européen relatif au transport international des marchandises dangereuses par route
- **ASN** – Autorité de sûreté nucléaire
- **ASS-500** – Aerosol Sampling Station
- **BSS** – Basic Safety Standards
- **CEZAR PAA** – Radiation Emergency Centre of the PAA
- **CLOR** – Central Laboratory for Radiological Protection
- **COAS** – Center for Analysis of Contamination
- **DBJPM PAA** – Nuclear Safety and International Programs Department of the PAA
- **DNK PAA** – Inspection and Oversight Department of the PAA
- **DoE** – U.S. Department of Energy
- **DOR PAA** – Radiological Protection Department of the PAA
- **ECURIE** – European Community Urgent Radiological Information Exchange
- **ENSRA** – European Nuclear Security Regulators Association
- **ENSREG** – European Nuclear Safety Regulators' Group
- **ESARDA** – European Safeguards Research and Development Association
- **EURATOM** – European Atomic Energy Community
- **EURDEP** – European Radiological Data Exchange Platform
- **GIG** – Central Mining Institute
- **GIOŚ** – Central Environmental Protection Inspectorate
- **GTRI** – Global Threat Reduction Initiative
- **HERCA** – Heads of the European Radiological Protection Competent Authorities
- **HEU** – Highly Enriched Uranium
- **IAEA** – International Atomic Energy Agency
- **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 officer
- **IRSN** – L'Institut de Radioprotection et de Sûreté Nucléaire
- **JRC** – European Comission's Joint Research Centre
- **GC** – General Conference IAEA
- **NCP** – National Contact Point
- **KSOP** – National Radioactive Waste Repository
- **LEU** – Low Enriched Uranium
- **MDN** – Ministry of National Defence
- **NCBJ** – National Centre for Nuclear Research
- **NEA OECD** – Nuclear Energy Agency of the Organisation for Economic Co-operation and Development

- **NIK** – Supreme Audit Office
- **NUSSC** – Nuclear Safety Standards Committee
- **PAA** – National Atomic Energy Agency
- **PMS** – Permanent Monitoring Station
- **POLATOM** – Radioisotopes Centre
- **PPEJ** – Polish Nuclear Power Program
- **RASSC** – Radiation Safety Standards Committee
- **RCF** – Regulatory Cooperation Forum
- **RID** – Reglement concernant le transport Internationale ferroviaire des marchandises dangereuses
- **RPMB** – Council of the Baltic Sea States
- **TLD** – thermoluminescent dosimeters
- **TRANSSC** – Transport Safety Standards Committee
- **UDT** – Office of Technical Inspection
- **USIE** – Unified System for Information Exchange in Incidents and Emergencies
- **WASSC** – Waste Safety Standards Committee
- **WENRA** – Western European Nuclear Regulators Association
- **WHO** – World Health Organization
- **ZUOP** – Radioactive Waste Management Plant

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