ANNUAL REPORT

Activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland in 2017

2017

PAA
NATIONAL ATOMIC ENERGY AGENCY

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WARSAW 2017

PAA
NATIONAL ATOMIC ENERGY AGENCY

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

The vision

The National Atomic Energy Agency is a modern, competent nuclear regulatory respected and trusted by the general public, conducting activities that are significant for ensuring nuclear safety and radiological protection.

The 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.

Objective and legal basis of the Report of the President of the PAA

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).

In accordance with the statutory obligation, this report has been presented to the Prime Minister.

Introduction

It is my pleasure and honour to present to you the Report on activities of the President of the National Atomic Energy Agency in year 2017.

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

In the recent year, particularly important for the National Atomic Energy Agency was Follow-up Mission of the Integrated Regulatory Review Service, conducted by experts of the International Atomic Energy Agency. They checked how Poland had adapted the recommendations presented to us during the initial IRRS Mission conducted several years ago. I may conclude with great satisfaction that the report summarizing the mission has confirmed that activities of the Polish institutions deserve special appreciation, as all of the suggestions and recommendations made have been implemented in the domestic nuclear regulatory system. I also welcome the fact that the report of the Supreme Audit Office underlines the readiness of the National Atomic Energy Agency to perform the nuclear regulatory function at the present stage of implementation of the Polish Nuclear Power Program.

Apart from these extraordinary events, we have also continued ongoing supervision of thousands of applications of ionizing radiation in scientific research, medicine, veterinary science, industry and the sector of services. Our constant and unchanging priority is to ensure nuclear safety and radiation protection of the society and the environment, including those subject to occupational exposure to ionising radiation.

I encourage you to study the Report, wishing you an informative read!

Andrzej Przybycin
President of the National Atomic Energy Agency

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National Atomic Energy Agency

Pic. PAA

Tasks of the President of the National Atomic Energy Agency

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

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

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

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

3. Promulgation of technical and organizational recommendations concerning 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 furnishing the 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 on nuclear safety and radiological protection;

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 ionising 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 ionising 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 organisations 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;

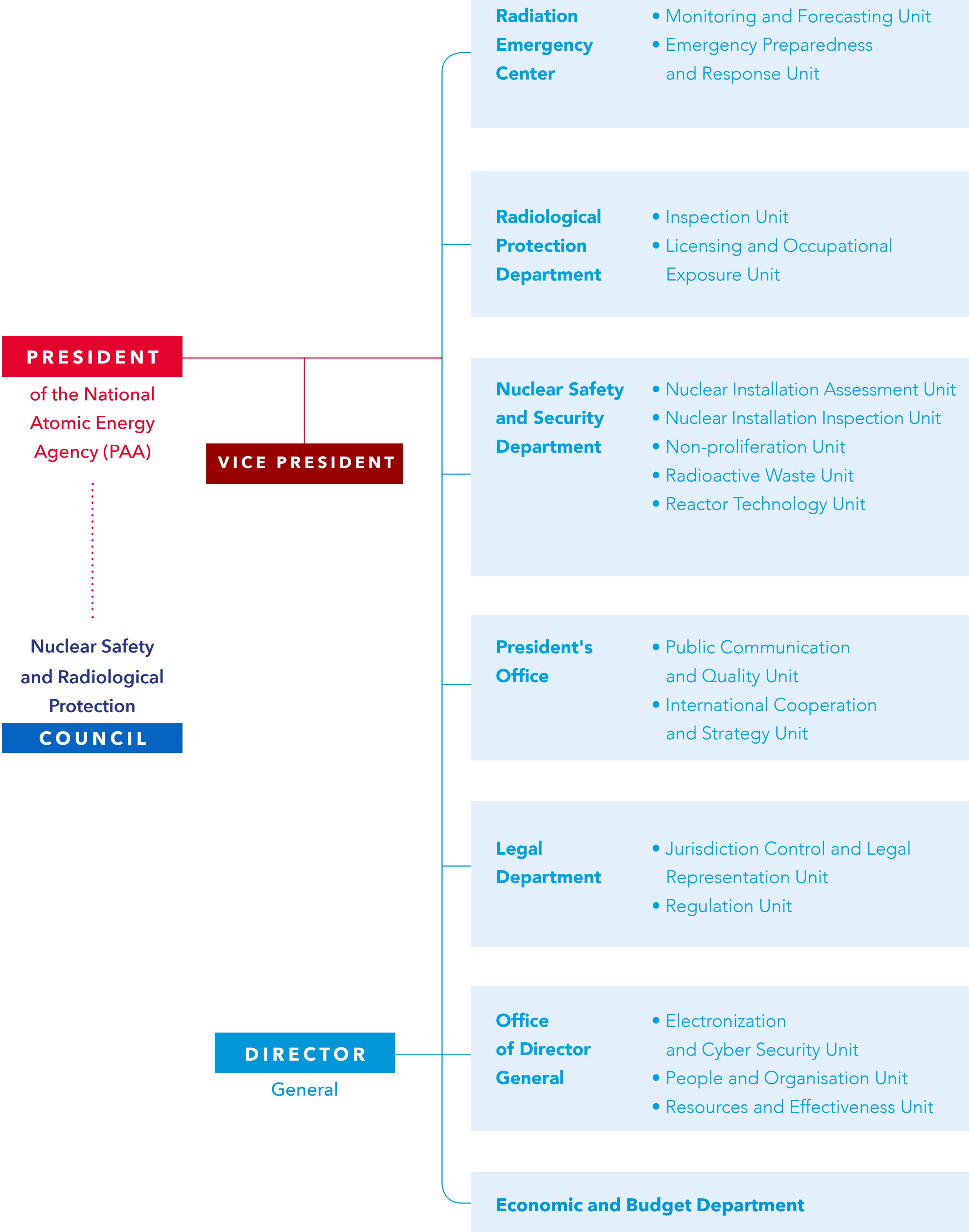
12. Issuing opinions on draft legal acts developed by authorised bodies;

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

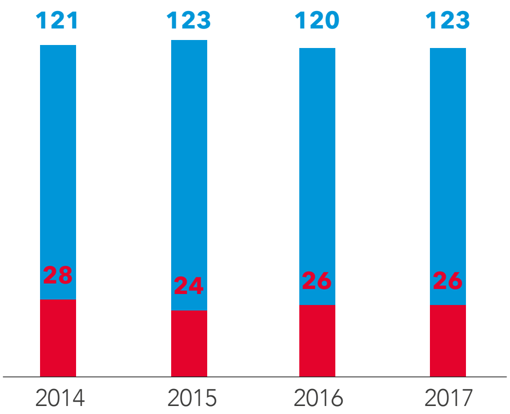


Employment

PAA's mean annual headcount in 2017 came to 123 persons (119.55 full-time employees), including 26 Nuclear Regulatory Inspectors at the end of December.

123 persons

26 Nuclear Regulatory Inspectors



Budget

FIG. 2.

The PAA's budgetary expenses in 2017 amounted to PLN 32.9 million, including:

PLN 32,9 mln

Assessment of the 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 2016 in section 68 – National Atomic Energy Agency.

The Supreme Audit Office positively assessed the state budget implementation in 2016 in section 68 – National Atomic Energy Agency.

Moreover, the Supreme Audit Office conducted an audit of PAA with regard to implementation of the Polish Nuclear Power Program (PPEJ). The NIK expressed a positive opinion of activities undertaken by the PAA in years 2014-2017 in the course of preparations to perform the nuclear regulatory function within the framework of development of nuclear power facilities in Poland. In the follow-up statement, it was underlined that in the opinion of the NIK, the PAA is well prepared to perform the nuclear regulatory function in accordance with the state of implementation of the PPEJ.

National Atomic Energy Agency and the Polish Nuclear Power Programme

The Polish Nuclear Power Programme (PNPP) was adopted by the Council of Ministers on 28 January 2014. It is the first comprehensive document providing a structure for the organisation 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 Programme and performs the role of a 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.

The Council for Nuclear Safety and Radiological Protection

The Council for Nuclear Safety and Radiological Protection (BJiOR) is appointed by the Minister of the 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 crucial from the perspective of nuclear safety supervision.

Council composition

Composition of the BJiOR Council at the end of year 2017:

professor **JANUSZ JANECZEK**, Ph.D.
Chairman of the Council

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

Professor Engineer **KONRAD ŚWIRSKI**, Ph.D.
Secretary of the Council

Professor **MAREK K. JANIAK**, Ph.D., MD
Member of the Council

MATEUSZ MAMCZAR
Member of the Council

TOMASZ NOWACKI, Ph.D.
Member of the Council

Tasks of the Council

- Issuing opinions upon licences for conducting activities involving exposure to ionising 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 of the aforementioned exposure-related activities.

The report of the Council for year 2017 has been provided in the Public Information Bulletin of the PAA.

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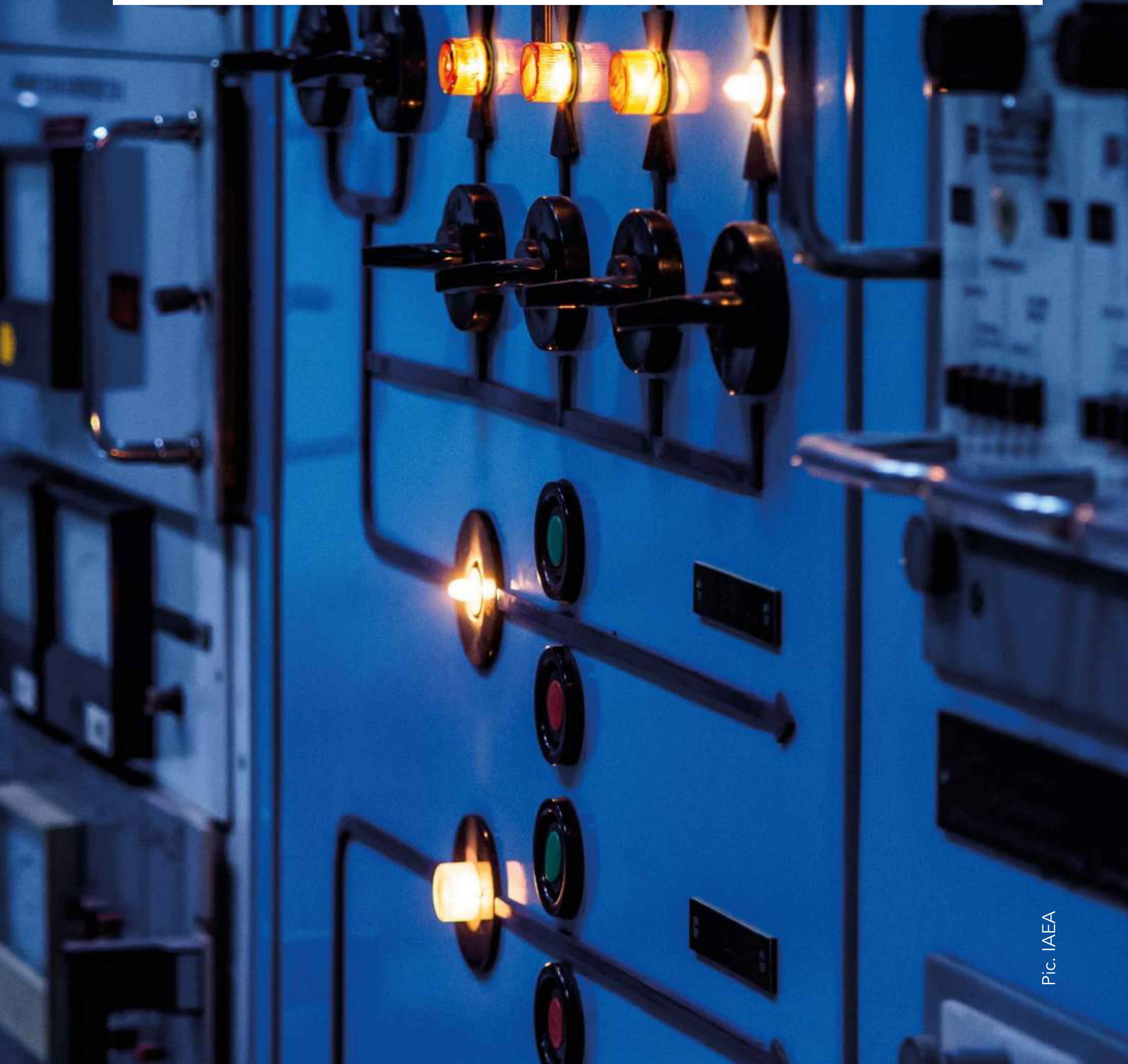
Infrastructure for nuclear regulatory activities in Poland



Pic. IAEA

Definition, structure and functions of 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 ionising 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 physical protection and securing of nuclear materials. 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 following:

- President of the PAA,
- nuclear regulatory inspectors.

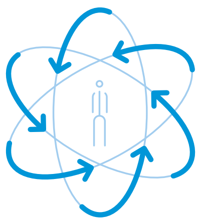
The essential aspects of the nuclear safety and radiological protection system include:

- exercising regulatory supervision over activities, involving nuclear material and ionising 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 the rules of safe conduct of 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 the 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 ionising radiation,
  - control over the 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;
- recognising and assessing the national radiation situation through coordination (including standardisation) 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 recognise and assess the national radiation situation and to respond in cases of radiation 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 organisations 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 Polish borders.

The regulatory tasks are performed by the PAA President with the assistance of nuclear regulatory inspectors and workers 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 ionising 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 licences 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 ionising radiation,
    - commissioning of laboratories where ionising radiation sources are to be used, including X-ray laboratories,
    - intentional adding 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 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 authorisations related to the performance and supervision of those activities.



Within the framework of activities involving ionising 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 supervision 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).

- Controlling the aforementioned activities from the perspective of compliance with the criteria specified 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 material 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 consolidated 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 licences for activities connected with exposure to ionising 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 organisational units conducting activities which involve radiation and prerogatives of the President of the National Atomic Energy Agency to exercise regulatory control and supervision 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 ionising radiation, their optimisation 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 ionising 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 workstations based on the degree of exposure involved in the work performed and designation of protection measures suitable to counteract this exposure,
- training and issuing authorisations 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 2017, the following amendments to the Atomic Law Act came into force:

1. art. 5 of the act of 16 November 2016 on amending certain other acts in association with establishment of the Ministry of the Interior and Administration (Journal of Laws item 2003) introduced amendments to the act, consisting of adapting of terminology resulting from establishment of the Ministry of the Interior and Administration – the amendment came into force on 1 January 2017;

2. on the basis of art. 34 of the act of 16 December 2016 – Provisions introducing the act on the principles of management of state-owned assets (Journal of Laws item 2260), the wording of certain provisions concerning the Radioactive Waste Management

Plant (ZUOP) has been adapted to amendments introduced by this legal act in other acts, also taking into account taking over by the minister competent for energy affairs of the functions of the founding body of the ZUOP – the amendment came into force on 1 January 2017;

3. on the basis of art. 54 of the act of 16 November 2016 – Provisions introducing the act on the National Revenue Administration (Journal of Laws item 1948), organisational changes introduced by the act of 16 November 2016 on the National Revenue Administration (Journal of Laws item 1947), consisting of transformation of the Customs Services into the National Revenue Administration, were implemented in the legal provisions on training in identification and handling of orphan sources (art. 43d section 2 of the Atomic Law Act) and the definition of the first member state (art. 62b clause 8 of the Atomic Law Act) – the amendments came into force on 1 March 2017;

4. on the basis of art. 8 of the act of 7 April amending the Code of Administrative Procedure and some other legal acts (Journal of Laws item 935), in the new provision of art. 124 section 3 of the Atomic Law Act, certain criteria for imposing of administrative penalty payments: duration and intensity of the infringement and the level of risk caused by such infringement; moreover, in art. 126 section 3 of the Atomic Law Act, it was decided that provisions of art. 189e and art.189f § 2 and 3 of the Code of Administrative Procedure, pertaining to exclusion of liability for law infringement due to force majeure and a possibility of waiver of imposing of a financial penalty in the case of remedying of law infringement or notification of appropriate bodies of such infringement, should not apply to penalty payments – the amendments came into force on 1 June 2017;

5. on the basis of art. 34 of the act of 14 December 2016 – Provisions introducing the Education Law Act (Journal of Laws of 2017 item 60, 949 and 2203), in art. 7 section 6 clause 2 of the Atomic Law Act, the words "secondary school" have been replaced with the words "secondary school or secondary vocational school" in association with introduction of secondary vocational schools in the act of 14 December 2016 – Education Law Act (Journal of Laws of 2017 item 59, 949 and 2203) – the amendment came into force on 1 September 2017.

In 2016, works were commenced on the draft act amending the Atomic Law Act, aimed at implementation in the domestic legislation of provisions of the Council directive 2013/59/Euratom. On 14 December 2016, the draft act was subjected to arrangements, consultations and opinions, which lasted until March of 2017. The act amending the Atomic Law act and the Act on fire protection was approved by the Committee of the Council of Ministers for Digitalization Affairs (29 May 2017), the Committee for European Affairs (7 June 2017), the Standing Committee of the Council of Ministers (6 July 2017), the Economic Committee of the Council of Ministers (7 September 2017). Starting from 23 October 2017, works were commenced on the draft act in a legal commission, and these have continued in year 2018.

Other acts

The provisions associated directly 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 2018 item 169),
- the act of 18 August 2011 on maritime safety (Journal of Laws of 2018 item 181),
- the act of 21 December 2000 on technical inspection (Journal of Laws of 2017 item 1040 as amended).

3

Supervision of the use of ionising radiation sources

Pic. IAEA

Tasks of the PAA President in terms of regulatory supervision of activities connected with exposure to ionising radiation:

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

Users of ionising radiation sources in Poland

The number of registered organisational units conducting activity (one or more) involving exposure to ionising radiation subject to regulatory supervision of the PAA President under the Atomic Law came to 4130 (as at 31 December 2017).

The number of registered activities involving the exposure was 6119 (as at 31 December 2017).

LEGAL BASIS

In 2017, individual documentation types were specified in the Regulation of the Council of Ministers of 30 June 2015 on the documents required when applying for authorization to conduct activity involving exposure to ionizing radiation or when notifying the conduct of such activity (Journal of Laws of 2015 item 1355).

Licenses and notifications

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

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 ionising 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 programme in connection with the activity conducted and an internal emergency plan for cases of radiation emergency.

In cases, in which activity involving ionisation radiation exposure does not require a license, decisions are issued on acceptance of notification of activity involving exposure to ionising 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 ionising 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).

FIG. 3.
Number of licenses for performance of activity involving exposure to ionising radiation and annexes to licenses issued by the PAA President in the years 2008-2017

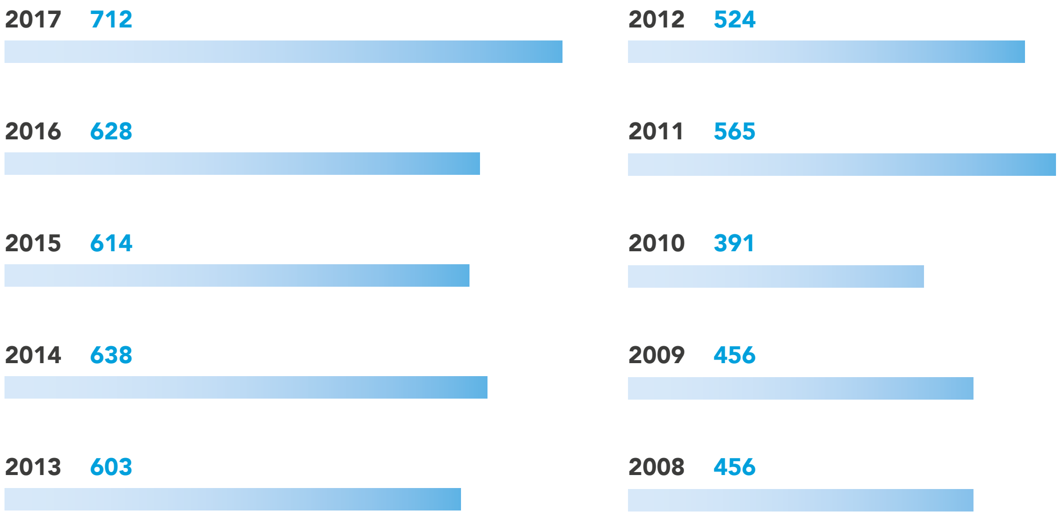
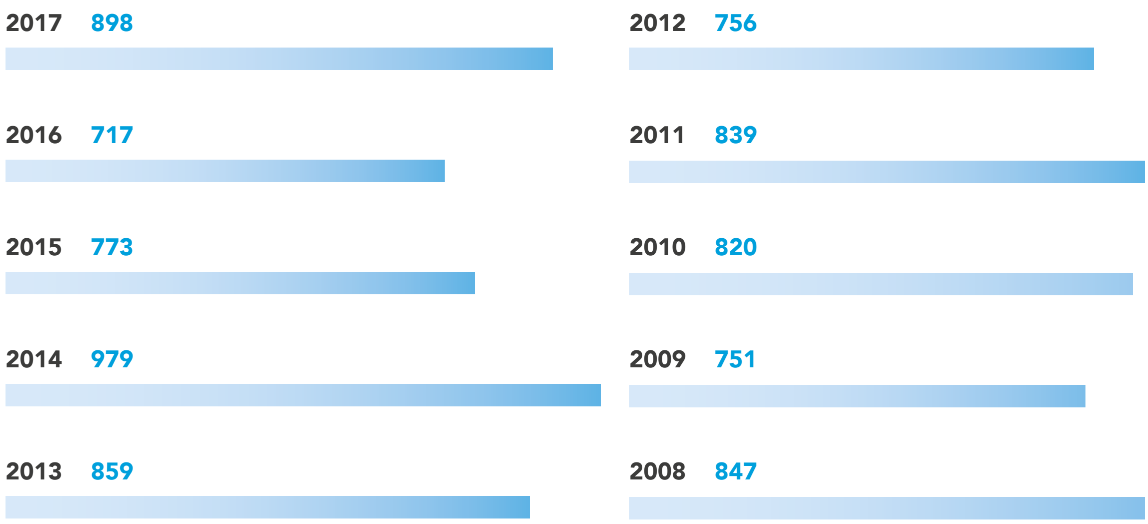


FIG. 4.
The number of inspections conducted by PAA inspectors in years 2008-2017



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 aimless.

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 2017 have been provided in Table 1. (next page).

The number of registered organisational units conducting activity (one or more) involving exposure to ionising radiation subject to regulatory supervision of the PAA President under the Atomic Law came to 4130

The number of registered activities involving the exposure was 6119

TAB. 1.
Users of ionising radiation sources in Poland in numbers (as at 31 December 2017)

Activity type	Symbol	Number of entities	Number of activity types
Class I laboratory	I	2	2
Class II laboratory	II	93	108
Class III laboratory	III	120	233
Class Z laboratory	Z	119	210
Isotope sensor installer	UIC	370	370
Equipment installer	UIA	177	216
Isotope device	AKP	544	691
Manufacture of isotope sources and devices	PRO	28	32
Trade in isotope sources and devices	DYS	80	88
Accelerator	AKC	77	174
Isotope applicators	APL	37	55
Telegamma therapy	TLG	4	4
Radiation device	URD	36	37
Gamma graphic apparatus	DEF	106	108
Storage facility of isotope sources	MAG	144	174
Work with sources outside registered laboratory	TER	68	77
Transport of sources or waste	TRN	485	498
Chromatograph	CHR	228	277
Veterinary X-ray apparatus	RTW	1178	1232
X-ray scanner	RTS	533	708
X-ray defectoscope	RTD	198	220
Other X-ray apparatus	RTG	411	605
Total:			**6119**

NUMBER OF AUTHORISATIONS ISSUED IN 2017			INSPECTIONS	
licenses	annexes	registration decisions	Number of inspections in 2017	Inspection frequency
1	1	0	2	annually
9	20	0	53	every 2 years
2	2	4	68	every 3 years
10	4	13	38	every 4 years
6	2	0	20	ad hoc inspections
22	31	0	76	every 3 years
34	27	3	146	every 3 years
0	4	0	16	every 3 years
5	7	1	14	ad hoc inspections
25	13	0	72	every 2 years
5	1	0	27	every 2 years
0	1	0	2	every 2 years
0	1	0	9	every 3 years
5	19	0	38	every 2 years
34	9	1	60	every 3 years
15	8	0	24	every 3 years
4	5	1	12	ad hoc inspections
0	0	2	0	ad hoc inspections
135	2	0	11	ad hoc inspections
129	23	0	13	ad hoc inspections
8	24	0	83	every 2 years
36	23	2	112	every 7 years
485	**227**	**27**		

Register of sealed radioactive sources

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

Heads of organisational units performing activity which involves use or storage of sealed radioactive sources or equipment featuring such sources under the relevant authorisation 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 organisational units conducting activity involving exposure to ionising radiation. The supervision consists in comparing accountancy cards entries with the scope of the given authorisation 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 26007 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.

26 007

RADIOACTIVE SOURCES IN THE REGISTRY

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

The register contains 1269 sources of this category which are currently 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 2681 sources of this category.

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

The register contains 7793 sources of this category.

TAB. 2.
Examples of radioactive isotopes and sources containing them (as at 31 December 2017)

Isotope	Category 1	Category 2	Category 3
Co-60	793	1,267	2,033
Ir-192	226	178	1
Cs-137	81	269	2263
Se-75	139	127	6
Am-241	10	379	836
Pu-239	2	104	100
Ra-226	-	76	61
Sr-90	-	43	802
Pu-238	1	80	22
Kr-85	5	34	181
Tl-204	-	-	94
Other	12	124	1394
Total	1269	2681	7793

1 269
SOURCES OF CATEGORY 1

2 681
SOURCES OF CATEGORY 2

7 793
SOURCES OF CATEGORY 3

4

Supervision of nuclear facilities

Pic. 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 (subject to decommissioning),
- spent nuclear fuel storages.

These facilities are administered by two separate organisational entities:

- **the MARIA reactor** – at the National Centre for Nuclear Research (NCBJ) based in Świerk near Otwock.
- **the EWA reactor** as well as **spent nuclear fuel storages** – 1 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

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 reactor used in the country. It is a high-flux pool-type reactor with the nominal thermal power of 30 MWt t and the maximum flux density of thermal neutrons in the core of 3,5·1018n/(m^2·s). The MARIA reactor was commissioned in 1975, and in the years 1985–1993, the reactor was shut down for the 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). Under implementation of the Global Threat Reduction Initiative (GTRI) programme, low enriched uranium (LEU) fuel with the content of the U-235 isotope below 20% was introduced into the MARIA reactor core.

There are four nuclear facilities in Poland: MARIA research rector, EWA research reactor (subject to decomissioning) and two spent nuclear fuel storages. All are located at nuclear research facility premises in Świerk near Otwock.

In 2017, 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 5 fuel cycles during which the uranium plates were irradiated in channels adapted to this purpose exclusively;
- irradiation of target materials for the Radioisotope Centre POLATOM, namely tellurium dioxide, potassium chloride, sulphur, lutetium, cobalt and iron intended for radioisotopes production to be used in nuclear medicine. Figure 4 provides statistics concerning the irradiation of target materials (from 1978 to 2017, inclusive).

In 2017, the MARIA reactor remained in service for 4933 hours, working in 36 fuel cycles, as illustrated in Figure 6.

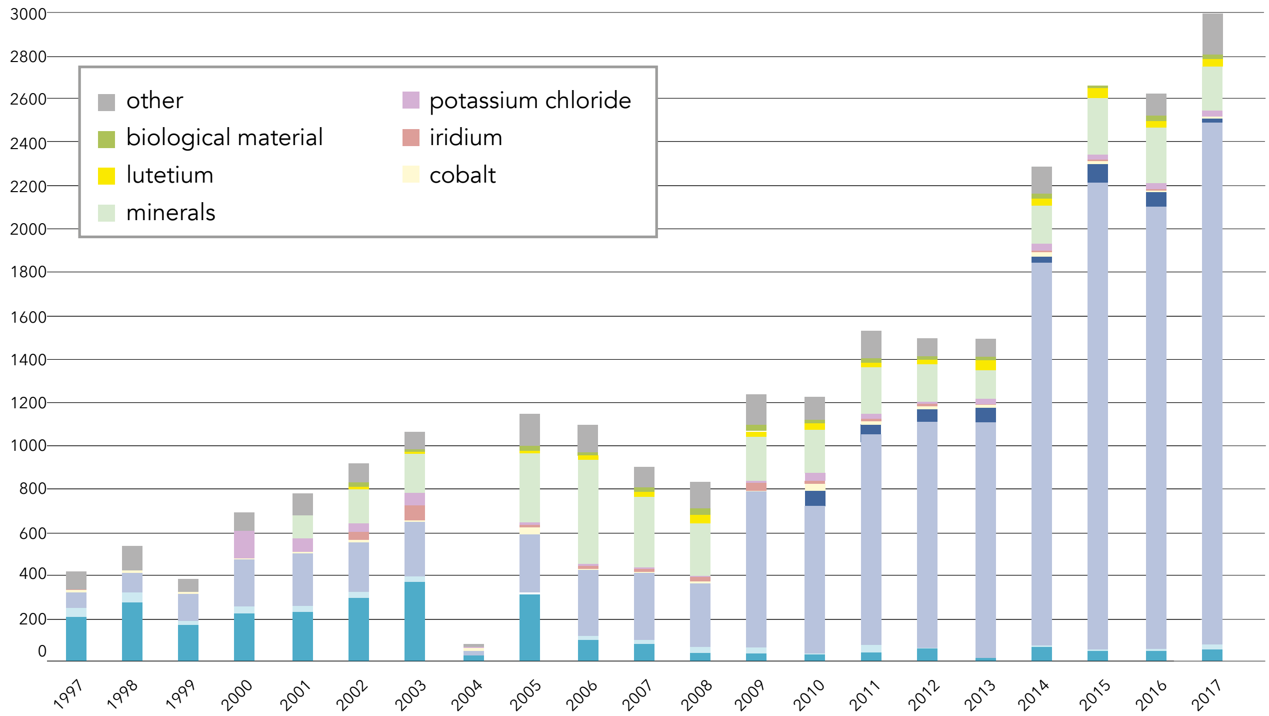
General information concerning operation of the MARIA reactor are presented on p. 30-31.

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 2017, the channels were opened only in the first quarter, and the total opening time for these channels in years 2017 was around 1820 hours. The hall, in which research associated with use of horizontal channels is conducted, has been prepared for modernization in order to install modern research equipment acquired from a different research reactor abroad.

FIG. 5.

Materials irradiated in the MARIA reactor until 2017 (data: NCBJ)



EWA reactor under decommissioning

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

Started in 1997, the reactor decommissioning process, 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. The reactor building was refurbished and office premises were adapted to the needs of the Radioactive Waste Management Plant. A hot cell intended for processing of high-activity material was constructed in the decommissioned EWA reactor hall.

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.

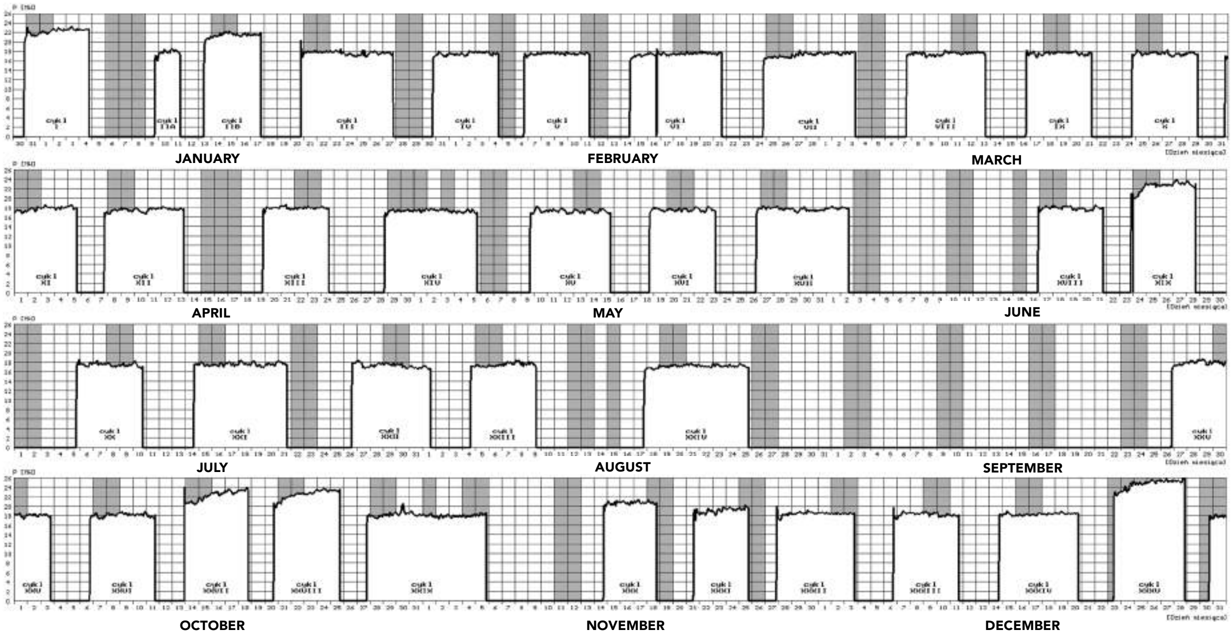
Facility no. 19 was used to store the encapsulated spent low enriched nuclear fuel EK-10 from the EWA reactor, shipped to the country of origin (i.e. the Russian Federation) in September 2012.

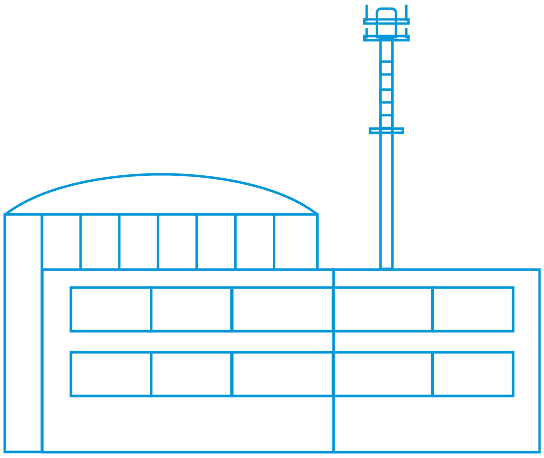
This facility is now used for storage of some solid radioactive waste (structural elements) from decommissioning of the EWA reactor and operation of the MARIA reactor, as well as disused high-activity gamma radiation sources.

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. 6.

Summary of the MARIA reactor operation cycles in 2017 – (data: NCBJ)





General information concerning operation of the MARIA reactor

Time of operation at nominal power [h]

4933

I. 1398 II. 1222
III. 913 IV. 1400

Number of cycles

I. 10 II. 9
III. 6 IV. 11

Average reactor power in cycles [MWt]

I. 17–22 II. 17–22
III. 17–18 IV. 18–25

17–25

Number of fuel elements in the core

26

quarterly in 2017

OFF Unplanned shutdowns and trips

Human error	Equipment malfunction	Instrumentation error	Loss of electrical power
0	2	1	0

Malfunctions/defects and non-conformity found

Quarter I	Quarter II	Quarter III	Quarter IV	
2	0	0	1	3

Repair and maintenance works conducted

Quarter I	Quarter II	Quarter III	Quarter IV	
3	8	13	4	28

Tests, inspections and checks conducted

Quarter I	Quarter II	Quarter III	Quarter IV	
24	34	32	31	121

Licenses issued

The MARIA reactor is operated by the National Centre of Nuclear Research 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 the 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 2017, the following decisions were issued, amending license no. 1/2015/Maria of 31 March 2015:

- Decision no. 1/2017/Maria of 11 April 2017 – Amendment of license no. 1/2015/Maria associated with enabling irradiation of a new type of uranium plates in the Maria research reactor,
- Decision no. 2/2017/Maria of 28 July 2017 – Amendment of license no. 1/2015/Maria associated with enabling irradiation of a new type of uranium plates in the Maria research reactor,
- Decision no. 3/2017/Maria of 15 December 2015 – Amendment of license no. 1/2015/Maria associated with enabling irradiation of uranium targets in the case of a different mode of distribution of these targets in the core of the Maria reactor.

The EWA reactor decommissioning as well as the spent nuclear fuel storages are operated by the Radioactive Waste Management Plant under license no. 1/2002/EWA of 15 January 2002. The license is valid for an indefinite period of time.

Regulatory inspections

In 2017, Nuclear Regulatory Inspectors from PAA's Nuclear Safety Department performed 11 inspections concerning nuclear safety and radiation protection as well as physical protection of nuclear material and nuclear facilities. The inspections conducted in NCBJ and KSOP, as well as an analysis of quarterly reports did not show any threat to nuclear safety, any breach of provisions in the scope of radiological protection or any breach of the conditions of licenses and binding procedures of conduct.

The PAA conducted:

7 ●●●●●●●

INSPECTIONS AT THE NATIONAL CENTRE FOR NUCLEAR RESEARCH,

4 ○○●●

INSPECTIONS AT THE RADIOACTIVE WASTE MANAGEMENT PLANT, INCLUDING:

2 ○○

INSPECTIONS AT THE NATIONAL RADIOACTIVE WASTE REPOSITORY IN RÓŻAN (KSOP)

The 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,
- status of radiation protection of the reactor facility,
- fulfilment of recommendations from the inspections conducted in 2016,
- the emergency reactor shutdown system, the emergency core flooding system,
- experimental equipment and irradiation equipment and horizontal channels,
- the fuel channel cooling system,
- the dosimetric system,
- conducting of renovation and operating works,
- the process inspection system apparatus,
- settings of safety thresholds,
- functioning of the system of physical protection of nuclear material and nuclear facilities,
- plans of action in the case of an emergency at the NCBJ

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

- status of radiological protection of the facilities operated by the ZUOP,
- reloading and preparation of nuclear materials for transport,
- carrying out the processes of radioactive waste disposal and radioactive waste storage,
- implementation of conclusions, recommendations and verification of remedying shortcomings from the previous regulatory inspections.

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

- checking the procedure of receipt of radioactive waste for disposal and the documentation of radioactive waste received for disposal in the current year from the ZUOP,
- observance of radiological protection rules of the National Radioactive Waste Repository in Różan,
- collection of soil samples for laboratory tests for the purpose of measurements to detect Cs-137.

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

In accordance with the provisions of the Atomic Law, 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 organisations, 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 organisational guidance.

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

- continued collaboration between PAA and the Internal Security Agency in assessment of issues of modernization of the physical protection system of the MARIA reactor,
- joint participation of the UDT and the PAA in
  - the „Regulatory Oversight of New Licensee Organizational Capability" workshop organised by the NEA/OECD Working Group on Regulation of New Reactors and the Working Group on Human and Organizational Factors (20-22 March, Chester, Great Britain);
  - 4. Conference of the European Regulators Group for Nuclear Safety ENSREG (28-29 June, Brussels, Belgium).
- participation of the PAA in the conference organised by the UDT "Cyber safety in the process-based industry" (Warsaw, 4 October).

NUCLEAR POWER PLANTS IN NEIGHBOURING COUNTRIES

In a distance not larger than 300 km from Polish borders, there are 8 nuclear power plants operating 23 power reactor units with the total capacity of ca. 15 GWe

SWEDEN

Oskarshamn NPP

PL **298 km**

3 BWR units

492 MWe

661 MWe

1450 MWe

CZECH REP.

Dukovany NPP

PL **119 km**

4 VVER-440 units

500 MWe

500 MWe

500 MWe

500 MWe

CZECH REP.

Temelin NPP

PL **192 km**

2 VVER-1000 units

1080 MWe

1080 MWe

HUNGARY

Paks NPP

PL **300 km**

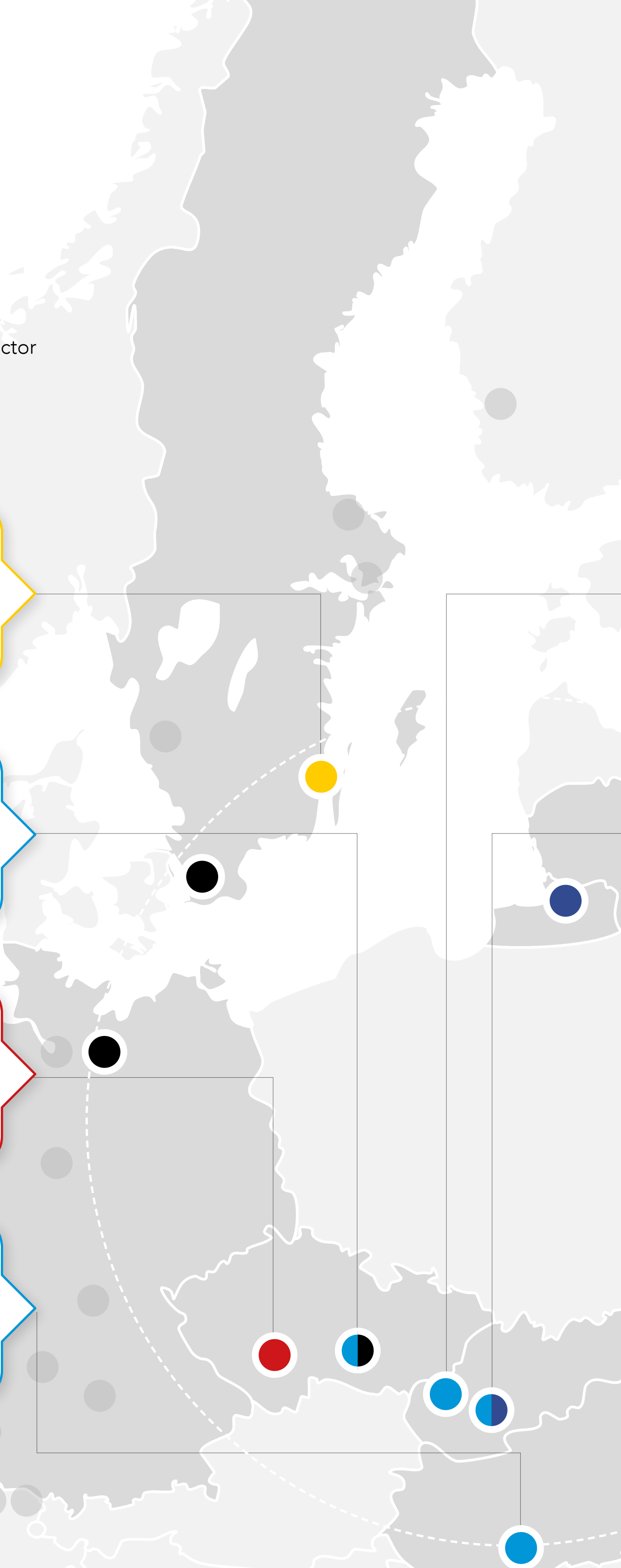
4 VVER-440 units

500 MWe

500 MWe

500 MWe

500 MWe



REACTOR UNITS UNDER CONSTRUCTION

2 VVER-440 units in **Mochovce NPP** (Slovakia)

2 VVER-1200 units in **Ostrovets NPP** (Belarus)

1 VVER-1200 unit in **Baltic NPP** (Kaliningrad Oblast in Russia)

2 VVER-1000 units in **Khmelnytskyi NPP** (Ukraine)

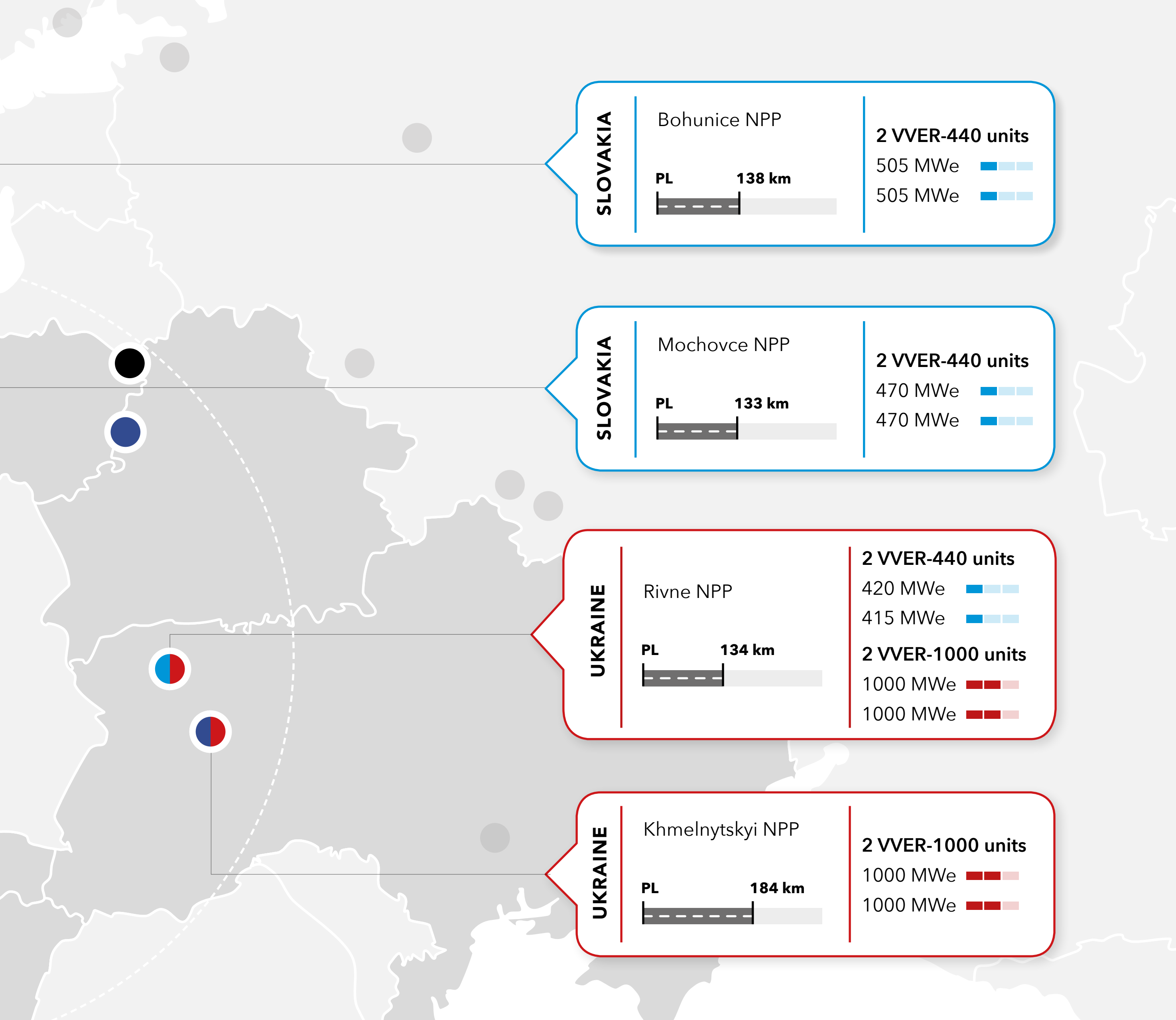
SOME OF THE NPP FURTHER THAN 300 KM AWAY FROM POLAND

8 NUCLEAR POWER PLANTS OPERATING

14 VVER-440 REACTORS

6 VVER-1000 REACTORS

3 BWR REACTORS



NUCLEAR POWER PLANTS IN A PERMANENT SHUTDOWN STAGE

Ignalina NPP (Lithuania) – 2 type RBMK 1300 MWe units, shut down in 2004 and 2009

Barsebäck NPP (Sweden) – 2 type BWR 615 MWe units, shut down in 1999 and 2005

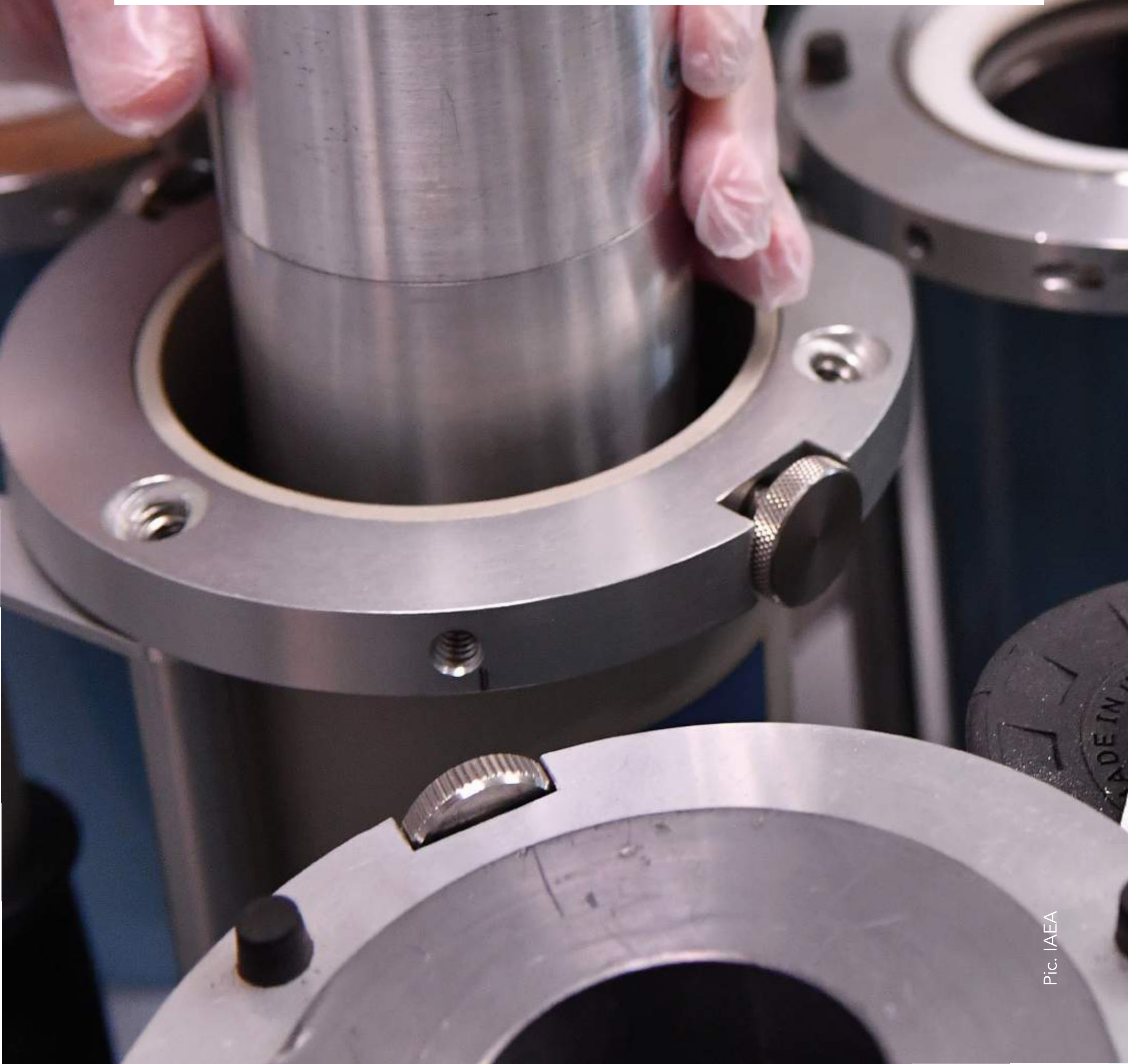
Bohunice NPP (Slovakia) – 2 type WWER-440 440 MWe units, shut down in 2006 and 2008

Krümmel NPP (Germany) – 1 type BWR 1402 MWe unit , shut down in 2011

More: Power Reactor Information System **www.iaea.org/pris**

5

Safeguards



Pic. IAEA

Legal basis for safeguards

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 of 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 of the Non-Proliferation of Nuclear Weapons, also known as Trilateral Safeguards Agreement INFCIRC/193. It came into force in Poland on 1 March 2007;
- Additional Protocol to the Trilateral Safeguards Agreement in connection with the implementation of Article III of the Treaty of the Non-Proliferation of Nuclear Weapons (INFCIRC/193/Add8). 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 of 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. The introduction of this system 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 entitlements 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 dispatcher 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 Non-Proliferation Division of PAA's Department of Nuclear Safety, which is responsible for the collection and storing 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 state system for accounting for and control of nuclear material is based on structures referred to as material balance areas. Nuclear material is used in Poland by the following entities constituting separate material balance areas:

- 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 material held by individual users are reported on a monthly basis to the system of nuclear material accountancy and inspection managed by the European Commission's Euratom Energy Directorate in Luxembourg. Copies of the foregoing information are also submitted by users to PAA. The European Commission's Euratom Safeguards Directorate forwards copies of the reports to the International Atomic Energy Agency based in Vienna.

Balance of nuclear material in Poland
(status as at 31 December 2017)

Inspections of nuclear material safeguards

In 2017, nuclear regulatory inspectors from the Non-Proliferation Division of PAA's Nuclear Safety Department, unassisted or acting together with the IAEA and EURATOM inspectors, performed 38 routine safeguards inspections in all material balance areas in Poland. EURATOM inspectors participated in 14 inspections, and IAEA inspectors – in 3 inspections. 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.

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-conformities 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 material

Pic. 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
- IATA DGR (International Air Transport Association – Dangerous Goods Regulation).

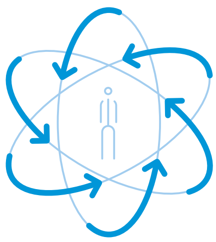
Radioactive material is transported in accordance with transport regulations SSR-6 developed by the International Atomic Energy Agency. They provide grounds for international organisations preparing the aforementioned international modal regulations or they are directly implemented to the national legal 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 counteracting of attempts of illegal (i.e. without proper authorisation or notification) transport of radioactive substances and nuclear material to Poland. These attempts are prevented by the National Border Guard having **330 fixed radiation portal monitors** installed at border crossing points and **1370 mobile signalling and measurement devices** at their disposal.

In 2017, the National Border Guard units performed the inspections as follows:

- shipments of radioactive sources:
  - regarding import to Poland – 882 inspections,
  - regarding transit through and transport out of Poland – 3020 inspections,
  - transfer at airports – 88 inspections,
- shipments of materials containing naturally occurring radioactive isotopes:
  - regarding import to Poland – 4480 inspections,
  - regarding transit through and transport out of Poland – 12315 inspections,
  - transfer at airports – 8 inspections,



In 2017, in Poland, 32,131 shipments of radioactive materials were made and 107, 201 items were transported by roads, railway, inland, sea and air means within the territory of Poland. The Radioactive Waste Management Plant also made 14 shipments with radioactive waste to the National Radioactive Waste Repository in Różan.

- transport of other undeclared objects (such as objects containing elements painted with radium paint):
  - regarding import to Poland – 7 inspections,
  - regarding transit through and transport out of Poland – 5 inspections,
  - transfer at airports – 6 inspections,
- persons treated or diagnosed with radioactive isotopes – 1068 inspections.

As a result of the inspections carried out, in 8 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 by and 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, as in previous years, supplying them with equipment. Those were modern vehicles – mobile detection systems, stationary equipment and mobile spectrometers and signalling equipment. At the same time, the National Border Guard has been coordinating activities aimed at installation of further stationary equipment at the container terminals and airports, and, in the subsequent years, at the Poland-Russia state border.

Transport of nuclear fuel

Fresh and spent nuclear fuel is transported under an authorisation granted by the PAA President. In 2017, there was only one shipment of fresh nuclear fuel performed in the territory of Poland.

Fresh nuclear fuel

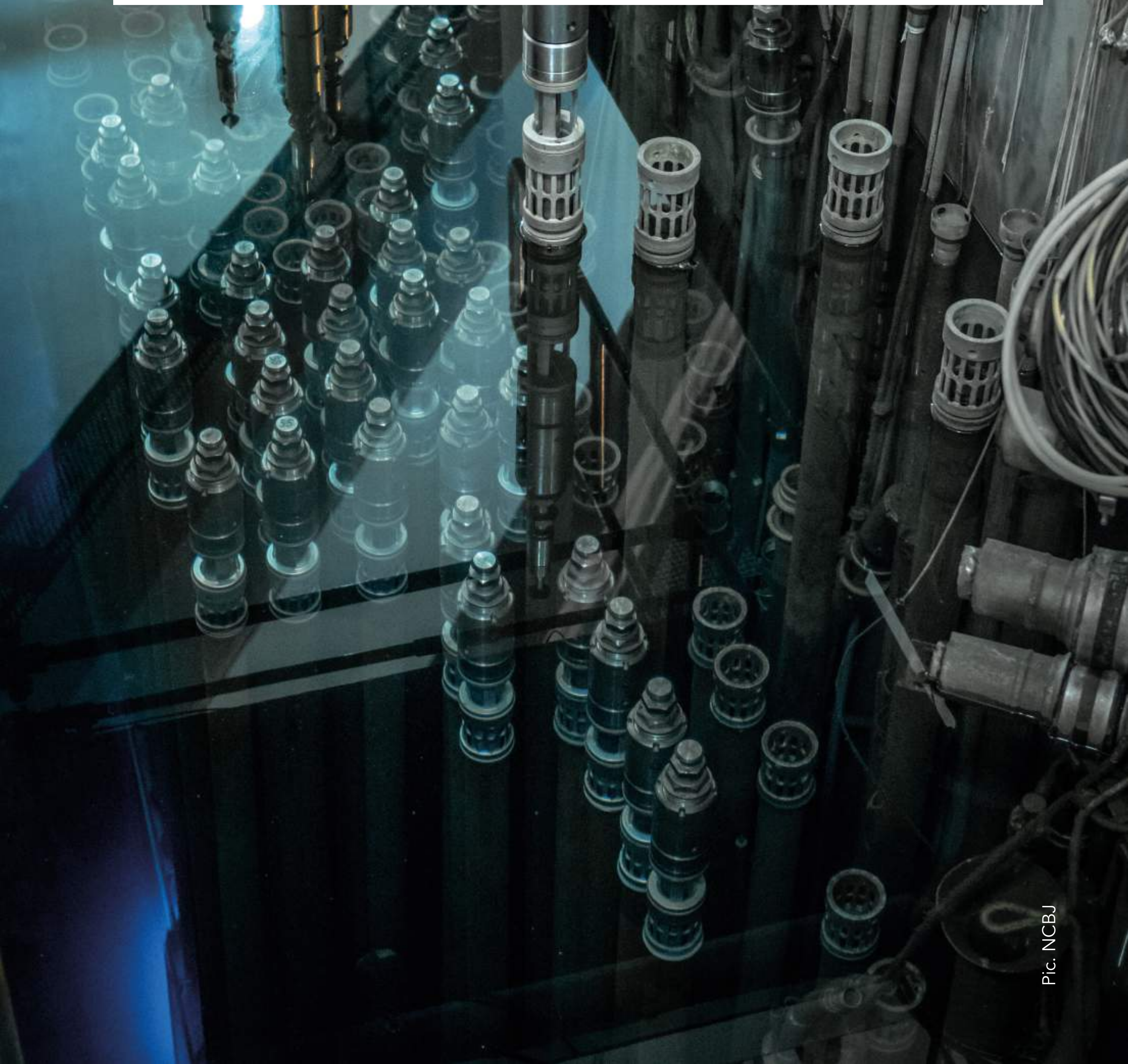
In 2017, one transport was conducted to import MR type fresh nuclear fuel from the Russian Federation to Poland for the purpose of operation of the MARIA research reactor at the National Centre for Nuclear Research in Świerk.

Spent nuclear fuel

No export of spent fuel took place in year 2017.

7

Radioactive waste



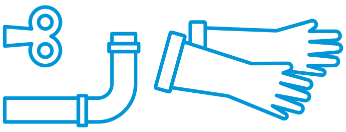
Pic. NCBJ

Handling of radioactive waste

Radioactive waste is generated as a result of the use of radioisotopes in medicine, industry and scientific research, production of open and sealed 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:



SOLID FORM

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 utilised 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 classification of radioactive waste is the radioactive concentration of radioactive isotopes contained in the waste as well as radioactive half-life.

LIQUID FORM

mainly constitutes aqueous solutions and suspensions of radioactive substances.

GASEOUS FORM

is produced as a consequence of operation of the MARIA research reactor. It mainly comprises radioactive noble gases, iodine, caesium 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 temporarily **stored** 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 the 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 supervision of safety of waste management, including supervision of safety of waste disposal by ZUOP is performed by the PAA President.

TAB. 3.
Quantities of radioactive waste collected by ZUOP in 2017

Sources of waste	Solid waste [m^3]	Liquid waste [m^3]
From outside of the Świerk Nuclear Centre (medicine. industry. scientific research)	11.10	0.74
National Centre for Nuclear Research /Radioisotope Centre POLATOM	17.93	0.19
National Centre for Nuclear Research + MARIA research reactor*	6.69	23.00
Radioactive Waste Management Plant	1.77	0.00
Total:	37.49	23.93

*Total number of waste from 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.

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 (district of Maków) is the site of radioactive waste disposal in Poland. 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 being shorter than 30 years). It is also used to store long-lived, mainly alpha radioactive waste, as well as disused sealed radioactive sources 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 2017, the ZUOP received 278 orders covering collection of radioactive waste from 225 institutions. Tab. 3 presents the quantities of radioactive waste collected and processed (including the waste generated at ZUOP).

INFOGRAPHIC

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

Low-level waste (solid) **37.45 m³**

Intermediate-level waste (solid) **0.04 m³**

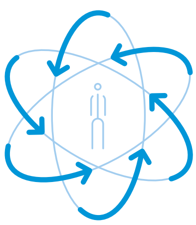
Low-level waste (liquid) **23.93 m³**

Intermediate-level waste (liquid) **0.00 m³**

Alpha radioactive waste **0.77 m³**

smoke detectors
17 445 pcs.

disused sealed radioactive waste
3,764 pcs.



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

After being processed, radioactive waste in the solidified form is placed in drums of 200 and 50 dm³ in capacity, and only then delivered for disposal.

In 2017, the National Radioactive Waste Repository received 162 drums of 200 litres with processed radioactive waste as well as 6 hobbocks of 50 litres containing 47129 disused and sealed radioactive sources. Additionally, 12 non-standard packages were delivered to the repository. Disused radioactive sources which are not subject to processing (there were 115 containers with 546 disused radioactive sources and 34 shielding containers with 782 disused radioactive sources) are sealed in separate containers. Processed solid waste was delivered to the repository in the quantity of 52.5 m³ with the total activity of 2,354.82 GBq (as at 31 December 2017).

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 authorising 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 the country,
- License no. 1/2002/KSOP – Różan of 15 January 2002 authorising the operation of the National Radioactive Waste Repository in Różan,
- License no. 1/2016/ZUOP of 15 December 2016 authorising 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 they require submission of reports on an annual (the first) and quarterly (the second) basis, subsequently to be analysed by Nuclear Regulatory Inspectors from PAA's NSD. The information contained in these reports is then reviewed during regulatory inspections.

In 2017, Nuclear Regulatory Inspectors from the PAA performed two inspections on radioactive waste management at ZUOP, including:

- two inspections carried out at the KSOP, including measurements of dose rates of ionising radiation in the selected points of the repository, checking of documentation of waste received for disposal, checking of functioning of physical protection of KSOP facilities, checking of implementation of conclusions, recommendations and eliminations of shortcomings and irregularities from the previous regulatory inspections, as well as collecting of soil samples for laboratory tests for the purpose of conducting measurements to detect the presence of Cs-137;
- one inspection at the ZUOP facilities in the nuclear centre in Świerk, which pertained to technological processing of radioactive waste, the condition of radiological protection of facilities operated by ZUOP and implementation of conclusions and recommendations, as well as verification of elimination of shortcomings and irregularities from the previous regulatory inspections..

Conclusions and remarks from the inspections completed were deployed by the ZUOP management on an ongoing basis, whereas all non-conformities and infringements found by Nuclear Regulatory Inspectors were eliminated in accordance with provisions of the applicable inspection reports or follow-up statements.

INFOGRAPHIC

Categories of radioactive waste

RADIOACTIVE WASTE

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.

- TRANSITIONAL
- SHORTLIVED
- LONGLIVED

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

Pic. IAEA

Exposure of population to ionising radiation

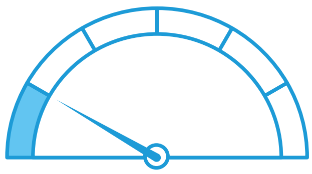
Human exposure to ionising radiation is caused by two main sources:

- natural radiation sources – ionising 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.

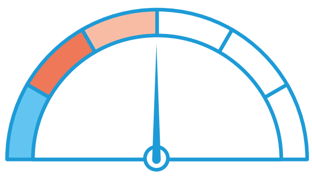
A dose limit for the entire population expressed in terms of an effective dose amounts to 1 mSv in a calendar year.

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, to which a statistical Pole is exposed consists of three components:
• natural radiation sources – ionising 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.



1 year = 1 mSv



5 years < 5 mSv

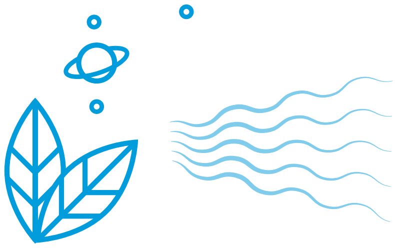
INFOGRAPHIC

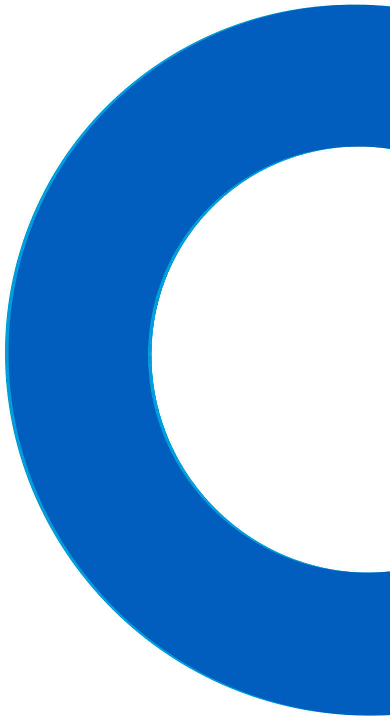
Share of different ionising radiation sources in mean annual effective dose.

3.56 mSv

the annual effective dose of ionising radiation, received by a statistical inhabitant of Poland in 2017

NATURAL SOURCES





68.7%

2.449 mSv

RADON

33.7% **1.201 mSv**

222
Rn
86

GAMMA RADIATION

13% **0.463 mSv**

COSMIC RADIATION

10.9% **0.390 mSv**

INTERNAL RADIATION

8.3% **0.294 mSv**

THORON

2.8% **0.101 mSv**

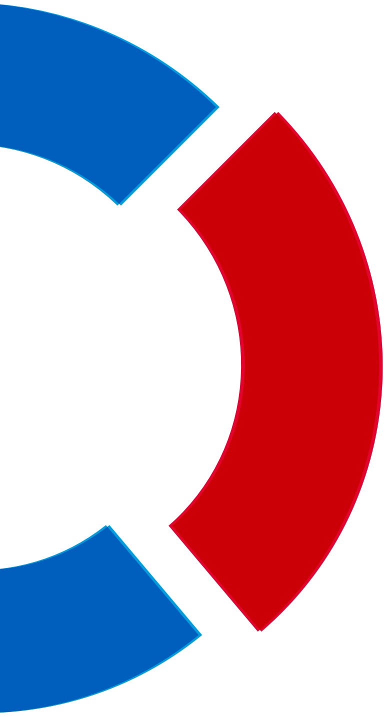
Tn

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

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

ok. 0,005 mSv
exposure to radionuclides in foodstuffs (corresponds to 0.5% of a dose limit for the population)



ARTIFICIAL SOURCES

31.3%

1.114 mSv

MEDICAL DIAGNOSTICS

30.9% 1.102 mSv

This overall dose predominantly includes doses received during
- computer tomography examination **0.67 mSv**
- conventional radiography and fluoroscopy **0.17 mSv**

These doses are far lower in other diagnostic examinations:
- mammography tests **0.02 mSv**
- mammography tests **1.2 mSv**
- chest X-ray **0.11 mSv**
- spine and lungs X-ray **3 mSv – 4.3 mSv**

DEFECTS

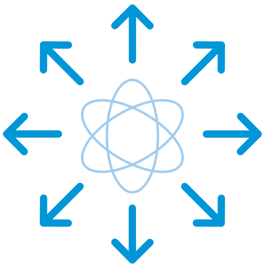
0.2% 0.006 mSv

OTHERS

0.2% 0.006 mSv

INFOGRAPHIC

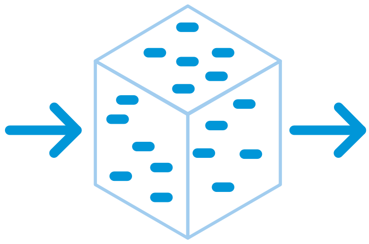
Basic terms and units in radiological protection



RADIOACTIVITY

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

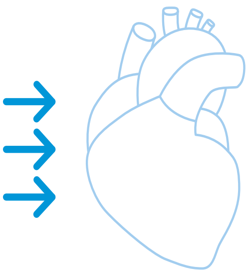
Bq
BEQUEREL



ABSORBED DOSE

Representing the mean energy imparted to matter per unit mass by ionizing radiation.

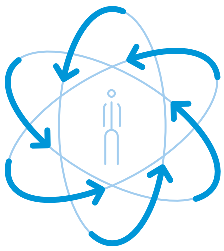
Gy
GRAY



DOSE EQUIVALENT

It is derived from the physical quantity absorbed dose, but also takes into account the biological effectiveness of the radiation, which is dependent on the radiation type and energy. Allows to represent possible biological effects of exposure on given tissue or organ.

Sv
SIEVERT



EFFECTIVE DOSE

Calculation of the dose for a whole human body. Enables to present an overall calculated effective dose for a whole body, even if only some organs were exposed.

Sv
SIEVERT

Ionising 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 ionising 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 ionising 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 ionising radiation (including those used in medical diagnostics) **in 2017 amounted to the average of 3.56 mSv**. Radiological protection of population and workers in Poland[1].

Exposure to natural ionising radiation sources

Exposure to natural sources comprises **68.8%** of the total effective dose and amounts to ca. **2.449 mSv per annum**.

- 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 ca. **1.201 mSv** per annum, account for the largest share in the said exposure.

The exposure of a statistical inhabitant of Poland in 2017 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 **1.102 mSv**.

This overall dose predominantly includes doses received during computer tomography examination (**0.67 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[2]:

- chest X-ray – ca. 0.11 mSv,
- spine and lungs X-ray from 3 mSv to 4.3 mSv respectively

1. 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.

2. Zakres zmienności tych wartości w odniesieniu do pojedynczych badań osiąga nawet dwa rzędy wielkości i wynika zarówno z jakości aparatury, jak i stosowania maksymalnie odmiennych od typowych warunków badania.

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

Annual effective dose

The 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 foodstuffs and the environment resulting from nuclear explosions and radiation emergencies,
- use of household articles which emit radiation or contain radioactive substances,
- professional activity connected with the use of ionising radiation sources.

The exposure of a statistical inhabitant of Poland to radionuclides in foodstuffs has been estimated at ca. **0.006 mSv** (which corresponds to **0.6%** of a 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. Similarly to 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. It should also be mentioned that exposure to the natural K-40 isotope, which commonly occurs in foodstuffs, amounts to ca. **0.17 mSv** per annum, which is 20 times higher than the exposure caused by artificial radionuclides.

Values illustrating the exposure caused by radiation emitted by artificial radionuclides present in such environmental components as: soil, air, 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 have been discussed in Chapter XI "Assessment of the national radiation situation"). 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 ionising radiation from household goods came to ca. **0.001 mSv in 2017**, 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 value calculated also entailed the dose from cosmic radiation received by passengers during air travels. In relation to the increasing popularity of LCD screens and monitors replacing picture tube lamps, the dose received by a statistical Pole from these devices is continuously decreasing.

The exposure of statistical Poles in their professional activities involving ionising radiation sources (read more about this problem in Chapter IX.2 "Control of exposure to ionising radiation at work") came to ca. **0.002 mSv** in 2017, which corresponded to **0.2% of the dose limit**.

In 2017, the total exposure of a statistical Polish inhabitant to artificial ionising radiation sources, exclusive 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), came to ca. **0.009 mSv**, i.e. **0.9%** of a dose limit for artificial radioactive isotopes for the entire population, which is 1 mSv per annum, and only **0.25%** of a dose received by a statistical inhabitant of Poland from all ionising radiation sources.

In light of the radiological protection regulations adopted all around the world and applied in Poland, the radiation exposure of a statistical inhabitant of Poland in 2017, being a consequence of the use of artificial ionising radiation sources, should be considered as low.

Control of exposure to ionising radiation

Occupational exposure to artificial ionising radiation sources

Performing occupational duties related to working in nuclear facilities, entities managing radioactive waste and other entities using ionising radiation sources is a cause of radiation exposure of workers.

LEGAL BASIS

Legal basis – The principles applicable to exposure control are included in the Chapter of the Atomic Law, dedicated to nuclear safety, radiological protection and protection of workers' health.

In accordance with these provisions, the responsibility for compliance with the relevant requirements applicable in this scope rests firstly with a head of the organisational entity which is responsible for the assessment of doses received by workers. This assessment must be performed with reference to results of environmental measurements or individual dosimetry conducted by a specialised and authorised radiometric laboratory. Both measurements and the assessment of individual doses were performed in 2017 by the following authorised laboratories, commissioned by the organisational entities involved, i.e.:

- Laboratory of Individual and Environmental Dosimetry 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),
- Department of Dose Control and Calibration of the Central Laboratory for Radiological Protection in Warsaw (CLOR),
- Laboratory of Dosimetry of the National Centre for Nuclear Research in Świerk,
- in terms of monitoring of doses from natural radioactive isotopes received by miners working underground – the Silesian Laboratory of Environmental Radiometry of the Central Mining Institute 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 ionising 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 annum 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.

The 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 working environment. When the head of the given organisational 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 ionising 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. Due to the foregoing, it is necessary to check a sum of doses received in the present year and in previous 4 calendar years while supervising the exposure of workers handling ionising radiation sources. The foregoing means that heads of organisational entities must maintain 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.

TAB. 4.
Statistics on individual annual effective doses of workers classified under category A of exposure to ionising radiation in 2017

Annual effective dose received [mSv]	Number of employees*
< 6	1636
6 ÷ 15	45
15 ÷ 20	13
20 ÷ 50	6
< 50.0	1

* According to notifications to the central register of doses submitted until 30 April 2018.

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 several dozen thousand people working in contact with ionising radiation sources in Poland. However, only a small part of them perform routine work under conditions of actual exposure to ionising radiation. Control of individual doses in Poland in 2017 covered approximately 50,000 persons. For 95% of the group analysed, the dose control is performed in order to confirm that the use of ionising radiation sources is not hazardous and should not cause any health detriment. Workers of this group are classified under category B of exposure to ionising radiation. Medical personnel working at diagnostic X-ray laboratories (ca. 30,000 people working in ca. 4,000 diagnostic centres featuring X-ray laboratories) constitutes the largest group of persons classified under category B.

Ca. 2,500 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 ionising radiation.

Central Register of Doses of the PAA President

Data concerning doses received by workers classified under category A are collected by heads of individual entities in the PAA President's central register of doses. Workers under this category of exposure to ionising 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). Exceptionally, in cases of exposure to contamination caused by diffusible radioactive substances referred to as open sources, an assessment of committed dose from internal contaminations is performed.

Since the beginning of the central register of doses, i.e. since 2002, until 15 April 2018 more than 6 000 persons were reported, and data of 2318 from among those reported were updated within the past four years. In 2017, data of 1636 persons was updated.

Owing to appropriate radiological protection, only a small percentage of persons classified under category A received effective annual doses exceeding 6 mSv (being the lower exposure limit assumed for category A workers), and doses exceeding 6 mSv were received by 65 persons, among whom only seven cases were found to have exceeded the annual dose of 20 mSv, i.e. a dose limit which may be received during a calendar year as a result of routine work with ionising radiation. In cases of the dose limit exceedance, working conditions and reasons for the exposure to radiation were analysed in detail.

The data summary for year 2017 concerning exposure to ionising radiation of workers classified under category A, who were entered into the central register of doses by individual organisational entities, has been provided in Table 4.

The foregoing data imply that, 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 annum, in 2017, came to 98.5%, and the percentage of individuals who did not exceed the limit of 20 mSv per annum – to 99.9%. Consequently, only ca. 1.5% of persons exposed at work, who had been classified under category A, received doses established for workers of this category.

In 2017, the Central Register of Doses received the reports on two cases of exposure to radiation under circumstances referred to in article 16, section 1 (incidental exposure), of the Atomic Law. All cases of exceedance of the limit dose were associated with application of isotope defectoscopes during industrial radiography tests. A particularly high annual dose of 67.7 mSv was recorded in the case of an industrial defectoscope operator's assistant, who, apart from exposure to the uncovered source of Ir-192 during field tests of metal structures, also escorted the defectoscope during transport without maintaining a safe distance from the radiation source.

Control of exposure to natural ionising radiation sources in mining

Unlike with 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 ionising radiation in mines, being the effect of natural radioactivity. Sources of these hazards include:

- radon and products of its decay in the mine air,
- gamma radiation emitted by natural radioactive isotopes (mainly radium) contained in the rock mass,
- mine water (and the related sediments) with increased content of radium isotopes.

The former 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.

Total employment at hard coal mines according to WUG data of 31 December 2017 was: 84 600 miners

LEGAL BASIS

As for radiation hazards, apart from secondary legislation to the Atomic Law, also the following implementing regulations to the Geological and Mining Law applied in 2017:

- 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 and 2204, of 2016 item 949 and of 2017 item 1247. defining the following headings:
  - class A excavations, situated in controlled area within 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 excavations, situated in supervised area within 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.

The foregoing dose levels are values entailing the effect of the natural surface background (i.e. from outside the working environment). It 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 5 contains values of working limits of hazard rates for both classes of headings which create radiation hazards. The values proposed result from the model prepared and implemented for calculation of committed doses caused by specific working conditions in underground mining facilities. In examinations, one must consider the following aspects of radiation hazard:

- 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 headings creating radiation hazards, work organisation methods have been introduced to prevent exceeding the limit dose of 20 mSv.

Table 6 contains a collation of the mines where headings classified under classes A and B of radiation hazard may occur. It should be stressed that headings exposed to radiological hazard are classified by managers of individual mining facilities based on a sum of effective doses for all radiation hazard factors in the course of the actual work. Therefore, the number of headings classified under individual categories of radiation hazard is in fact 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 7.

TAB. 5.
Values of working limits of hazard rates for individual classes of headings creating radiation hazards (Central Mining Institute)

Hazard rate	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 (CRaO), kBq/kg	$C_{RaO} > 120$	$20 < C_{RaO} \leq 120$

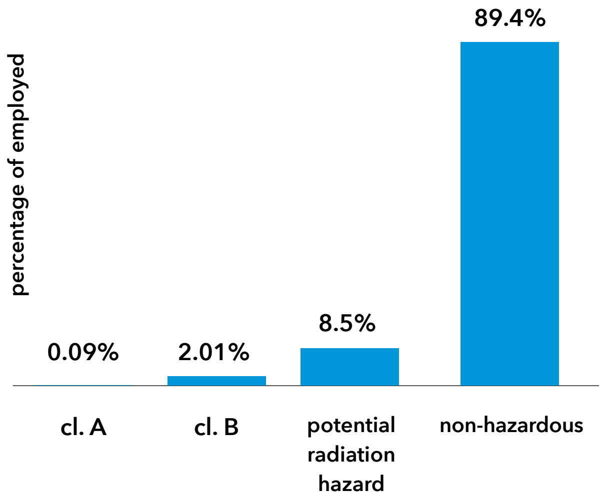
* The foregoing values correspond to doses of 1 mSv and 6 mSv, provided that the effects from particular hazard sources are not accumulated and the annual working time is 1,800 hours.

TAB. 6.
Number of hard coal mines featuring headings with radiological hazard (Central Mining Institute)

Hazard class	A	B
Number of mines	4	22
Threat of short-lived radon decay products	-	11
Threat of γ radiation	1	4
Threat of radioactive sediments	1	2
External radiation γ (individual dosimetry)	2	5

FIG. 7.

Percentage share of hard coal miners working in headings classified under individual radiation hazard classes. Total employment at hard coal mines according to data of 31 December 2017 was: 84 600 employees.



The analysis entailed the number of mines with radiologically hazardous headings, the heading 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. The foregoing 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 2017, the Central Mining Institute conducted 3184 measurements of potential alpha energy of short-lived radon decay products, 785 measurements of exposure to external gamma radiation in underground mining facilities, 552 analyses of radioactivity of mine water sampled in underground headings of hard coal mines as well as 135 analyses of concentration of radionuclides found in samples of mine water sediments.

In 2017, 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 87 persons, were mainly involved in removal of radioactive mine sediments or worked at locations where such sediments may accumulate. In five hard coal mines, the annual dose estimated, based on results of individual dose measurements, exceeded 1 mSv, but it was lower than 6 mSv (category B), and it exceeded 6 mSv (category A) in one mine.

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 implied that there are four mines with active class A headings (the hazard being applicable to 0.09% of all working miners) and 22 mines with class B headings (the hazard being applicable to 2.01% of all working miners). In mine headings with slightly increased natural radiation background (yet below the level corresponding to class B), 8.5% of the total number of miners employed work, whereas 89.4 % of miners work in headings where the radiation level remains on the level of natural surface background..

The maximum dose in 2017 was 26.9±4.6 mSv at the assumption of the annual working time of 1800 hours, and at the realistic assumption of working time of 750 hours, the maximum dose is approximately 12 mSv.

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

In 2017, the maximum additional annual effective dose connected with individual hazard sources amounted to:

- for short-lived radon decay products – E_{α} = 2.9 mSv (assuming the annual working time of 1,800 hours),
- for environmental gamma radiation measurements – E_{γ} = 7.2 mSv (assuming the annual working time in water galleries of 750 hours);
- and expressed as an effective committed dose – E_{ra} = 0.39 mSv for absorption of radium isotopes into human organism (with regard to declared annual working time of 200 hours).

The analysis of measurement results against the data collected in recent years has showed that, in underground mining facilities (with working times assumed for individual hazard factors), there are always headings classified under radiation hazard category B, including stations where the dose exceeds 1 mSv. The headings which should belong to radiation hazard category A are those where the dose received by miners could exceed 6 mSv and they are very infrequent and can be abandoned after detecting a threat.

In 2017, 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.

Granting personal authorisations on nuclear safety and radiological protection

In nuclear facilities and in other entities where exposure to ionising radiation occurs, on certain positions, persons holding authorisations granted by the PAA President are employed. The prerequisites for obtaining of such authorisation include completion of training on radiological protection and nuclear safety in the scope required for the specific type of authorisations, and passing an examination before the PAA President's examination board.

Article 7, section 6 and article 12, section 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 training courses required are conducted by organisational entities authorised 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 year 2017, training courses were attended in total by 671 persons. Information on entities, which conducted the training courses, can be found in Table 7.

TAB. 7.
Entities which conducted nuclear safety and radiological protection safety training in 2017

Type of authorisations	Entity name	Number of training co-urses held	Number of training participants	Number of autho-risations received*
Radiological protection officer	Central Laboratory for Radiological Protection in Warsaw	2	48	233
	Chief Technical Organ-isation in Katowice	3	70	
	Association of Radia-tion Protection Officers in Poznań	1	10	
	War Studies University	1	10	
Accelerator operator	Central Laboratory for Radiological Protection in Warsaw	7	121	617
	Association of Radia-tion Protection Officers in Poznań	14	392	
	National Centre for Nuclear Research	2	20	

* Including persons who attended training before 2017 or were authorised to take examination without an obligation to attend training.

In 2017, there were two examination boards functioning, appointed by the PAA President pursuant to article 7, section 1 and article 12a, section 6 of the Atomic Law:

- an examination board entitled to grant authorisations of a radiological protection officer,
- an examination board entitled to grant authorisations which allowed for being employed at positions considered particularly important for ensuring nuclear safety and radiological protection.

FIG. 8.
Number of persons who were granted authorisations of a radiation protection officer or authorisations enabling them to be employed at positions of special importance for ensuring nuclear safety and radiological protection in 2017.

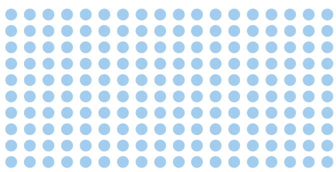
In 2017, the total number of 859 persons received authorisations of a radiation protection officer and authorisations to be employed at positions of special importance for nuclear safety and radiological protection.

859 persons

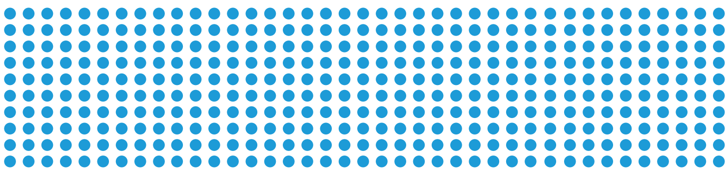
Having passed the examination and fulfilled all the remaining conditions required to obtain the relevant authorisations, 233 persons were granted authorisations of a radiation protection officer and 617 persons received authorisations enabling them to be employed at positions of special importance for ensuring nuclear safety and radiological protection, including:

617 persons

233 persons
were granted authorisations of a radiation protection officer



617 persons
received authorisations enabling them to be employed at positions of special importance for ensuring nuclear safety and radiological protection



Moreover, having passed the examination before the PAA President's Examination Board, 9 persons not having attended previous training were granted extensions of authorisations to be employed at positions of special importance for ensuring nuclear safety and radiological protection, including:

9 persons

1 person
research reactor operator

2 persons
research reactor dosimetrist

1 person
research reactor senior dosimetrist

3 persons
research reactor shift manager

1 person
expert for record keeping of nuclear materials.

1 person
deputy director for nuclear safety and radiological protection at an organisational entity having a research reactor

9

National radiological monitoring

Pic: 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.

One may distinguish between two types of monitoring:

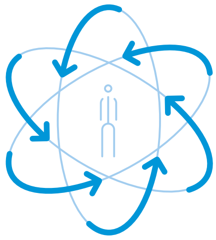
- **nationwide monitoring** – making it possible to obtain data necessary to assess the radiological situation of the entire country under normal conditions and in cases of radiation emergency. It serves as a basis for examination of long-term changes in the environment and foodstuff radioactivity.
- **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.

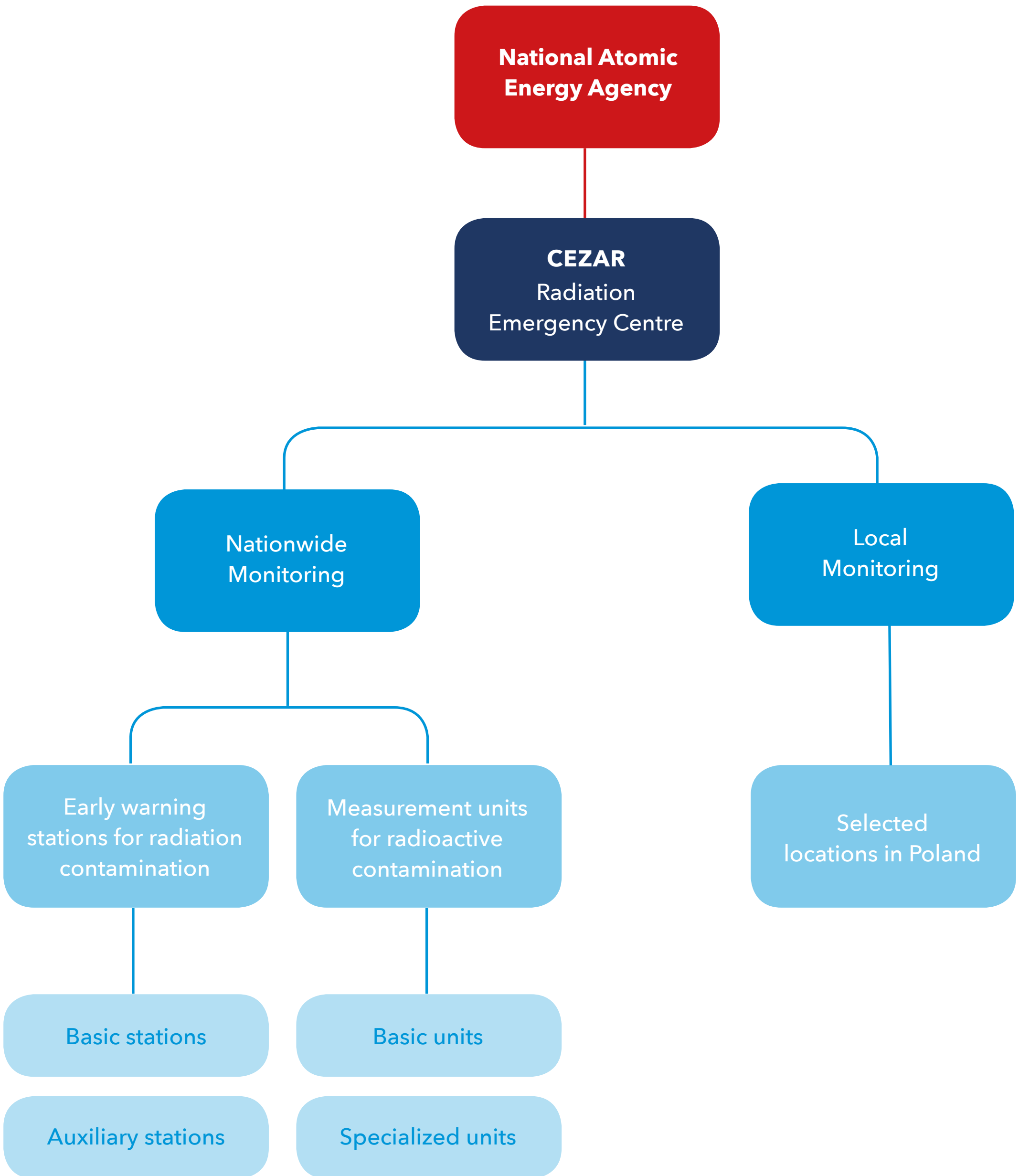
The PAA Radiation Emergency Centre (CEZAR) is responsible for coordination of a network of measurement stations and units.

A general schematic overview of this system has been depicted in Figure 9.



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. 9.
The radiological monitoring system in Poland



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 (infographic).

Basic stations:

- **17 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:
  - ambient gamma dose rate and spectrum caused by radioactive elements in the air and in the ground,
  - intensity of precipitation and ambient temperature.
- **12 ASS-500 stations**, 11 of which are owned by the Central Laboratory for Radiological Protection and 1 belonging to PAA, which:
  - continuously sample atmospheric aerosols on the filters
  - perform spectrometric determination of content of individual radioisotopes on a weekly basis
  - conduct continuous measurements of activity of atmospheric aerosols collected on the filters, which enable immediate detection of a significant increase in the concentration of the Cs- 137 and I-131 isotopes in air.
- **9 stations of the Institute of Meteorology and Water Management (IMiGW)** which conduct:
  - continuous measurement of ambient gamma dose rate,
  - continuous measurement of total and artificial alpha and beta activity of atmospheric aerosols (7 stations),
  - measurement of total beta activity in 24-hour and monthly samples of total fallout.
  - determination 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.

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

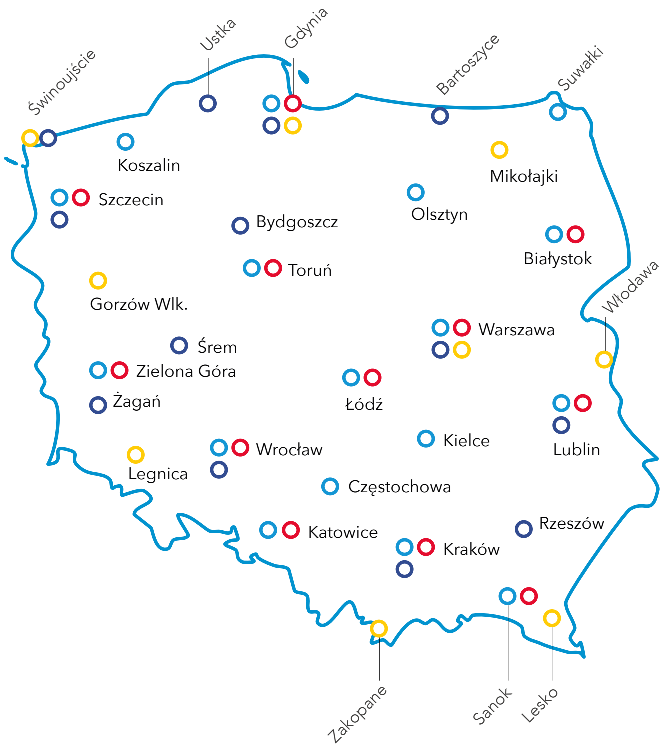
It is a network of sites, which perform measurements of radioactive contamination content in samples of environmental materials, foodstuffs and animal feed, using laboratory methods. The network includes:

- 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.

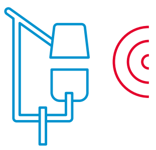
National radiological monitoring

Number of monitoring stations

PMS Stations	17
ASS-500 Stations	12
IMiGW Stations	9
MON Stations	13

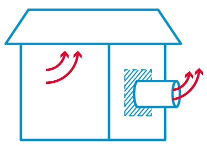


PMS Stations



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.

ASS-500 Stations



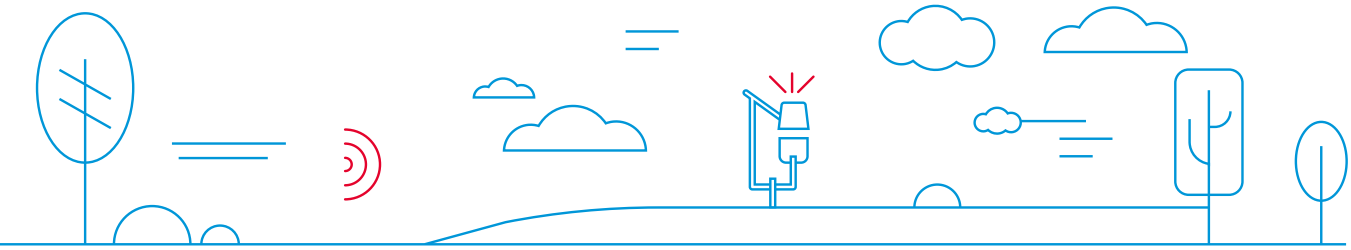
Aerosol Sampling Stations ASS-500 are designed to monitor air pollution with radioactive particles. The station, in a normal situation for 7 days, is pumping air through a special filter located within. All the particles contained in the pumped air gather on it. After 7 days the filter becomes a subject of detailed laboratory analysis. This type of station allows detecting even smallest traces of radioactive isotopes present in the air.

IMiGW Stations

Stations of the Institute of Meteorology and Water Management (IMiGW)

MON Stations

Monitoring stations of the Ministry of National Defence (MON) (auxiliary stations)



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

Current monitoring results are published here:
www.paa.gov.pl/monitoring.html
http://remap.jrc.ec.europa.eu/GammaDoseRates.aspx

Local monitoring

TAB. 8.
Measurements of radioactive isotopes on the premises and in the vicinity of the Nuclear Centre in Świerk.

Type of measurement and sample	Nuclear centre premises	Nuclear centre vicinity
gamma isotopes in atmospheric aerosols	●	●
beta and gamma isotopes in atmospheric fallout	●	
beta and gamma isotopes in well water		●
beta isotopes in water from the water supply system	●	
beta isotopes in water from the Świder river		●
gamma as well as alpha and beta isotopes (including the content of H-3 and Sr-90) in drainage and storm water	●	
H-3 in underground water	●	
Sr-90 and gamma isotopes in sludge	●	●
gamma and beta isotopes (including the content of Sr-90) in sanitary sewage	●	
beta isotopes in sludge from an in-house sewage pumping station		●
gamma isotopes in soil and grass	●	●
gamma isotopes in milk and crops		●

Nuclear Centre in Świerk

Radiological monitoring on the premises and in the vicinity of the Świerk nuclear centre was conducted in 2017 by the Laboratory of Dosimetry of the NCBJ, 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 sewage, drainage water and atmospheric aerosols with regard to alpha, beta and gamma 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 8.

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,
- 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 national radiation situation".

Data from 2017 and from the preceding years confirm that the operation of the Nuclear Centre in Świerk and of the National Radioactive Waste Repository does not affect natural environment, whereas the radioactivity of sewage as well as drainage and storm water removed from the premises of the Nuclear Centre in Świerk in 2017 was much lower than the applicable limits..

Areas of former uranium ore extraction and processing plants

Since 1998, at the former uranium ore plants, the "Programme of radiological monitoring of areas degraded due to uranium ore extraction and processing" has been implemented. In 2017 the following measures were undertaken under the programme 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 headings),
- determination of radon concentration in water from public intakes, in water supplied to residential premises and in surface and underground water (outflows from underground headings).

Results of the measurements have been provided in Chapter X "Assessment of the national radiation situation – Environmental radioactivity of natural radionuclides increased due to human activity".

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:

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

Poland provides its measurement results once every hour. The current radiological conditions in Europe are published on an ongoing basis on the EURDEP map.

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

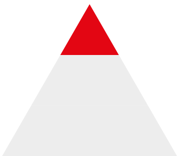
Emergency procedures

In accordance with the definition laid down in the Atomic Law, radiation emergency is a hazardous situation which requires urgent actions to be undertaken for the sake of protection of workers or the population1 . In cases of radiation emergency, intervention measures are taken as scheduled separately for incidents occurring within the area of the given organisational unit (on-site emergency incidents) and for those whose results reach beyond the organisational 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.

1. 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 section 53 of the Atomic Law Act.

INFOGRAPHIC

Radiation events classification

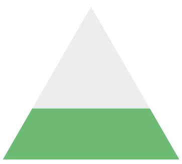


National level

Action conducted by Ministry of the Interior and Administration in co-operation with the PAA's President.

Regional level

Action conducted by the regional government (by the region's governor in co-operation with regional sanitary inspector) in co-operation with local emergency services (civil defense, fire brigades, medical teams) under content-related supervision of the CEZAR.



On-site

Action conducted by the licensee (in cooperation with police, fire brigade etc.. if needed, under content-related supervision of CEZAR)

The Radiation Emergency Centre of the PAA (CEZAR) 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 organisations 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). PAA 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 as well as remove the contamination and transport the radioactive waste from the incident site to the Radioactive Waste Management Plant.

CEZAR performs a number of functions, such as: emergency service of the PAA President, 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.

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

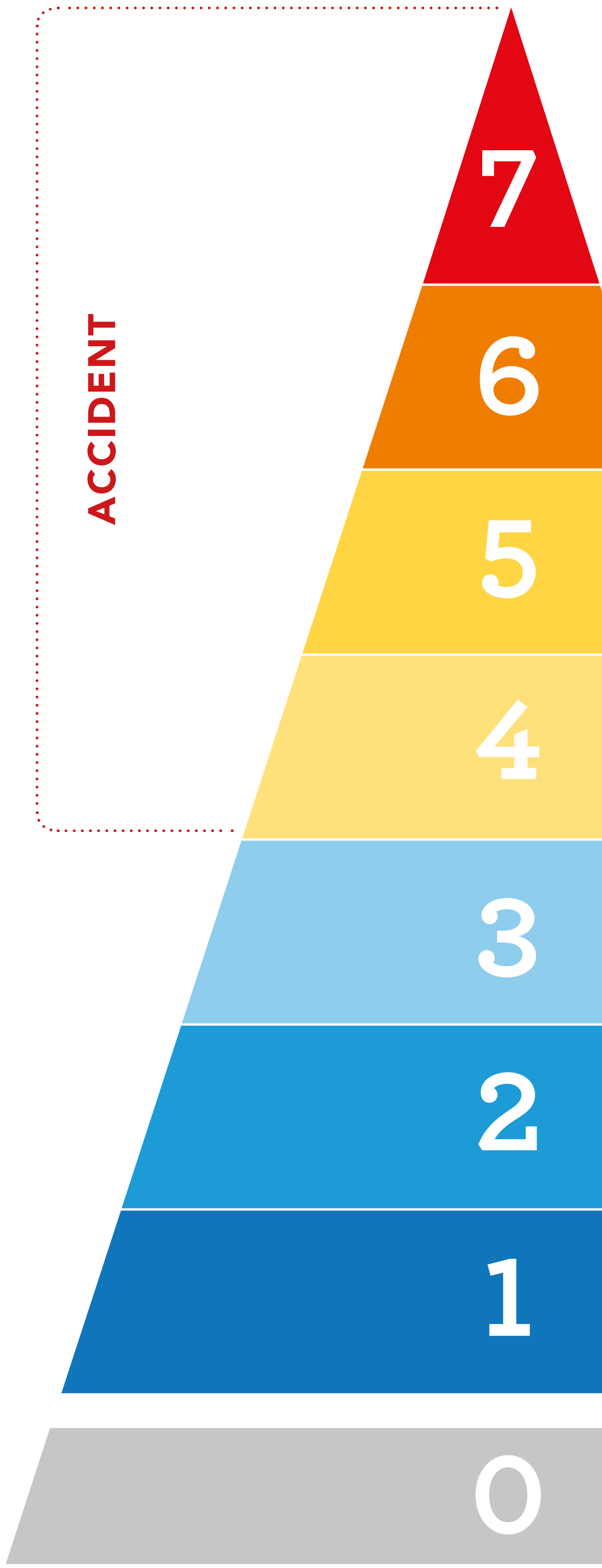
ACCIDENT WITH LOCAL CONSEQUENCES

Stamboliysky, Bulgaria, 2011

Overexposure of four workers at an irradiation facility,

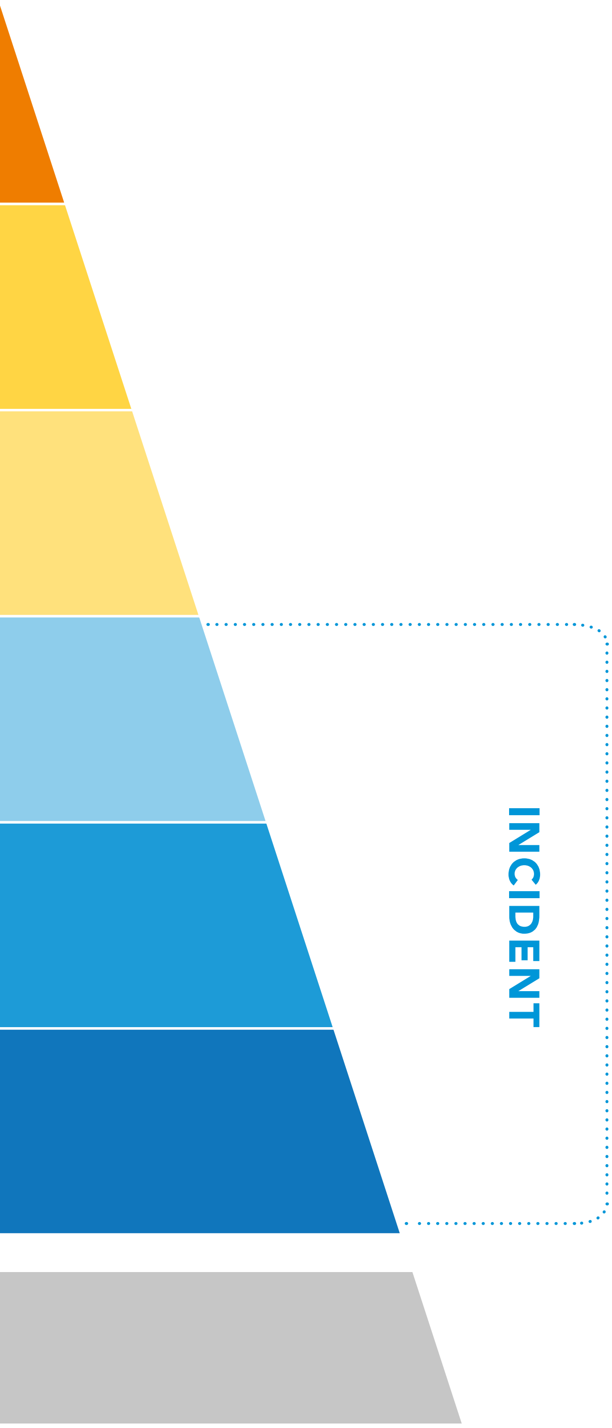
New Delhi, India, 2010

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 2017 outside the country borders resulted in a threat to humans and the environment in Poland.

The only radiation emergency recorded in 2017 in Poland did not pose a threat to humans and the environment.

Radiation emergencies outside the country borders

In 2017, the National Contact Point did not receive any reports concerning accidents in nuclear facilities classified above level 3 in the seven-degree international INES scale.

However, 58 notifications were submitted with regard to minor incidents associated with ionising radiation sources or nuclear facilities, which mainly concerned unplanned exposure of workers to ionising radiation. Moreover, the National Contact Point, via the USIE and the ECURIE system, received several dozen organisational and technical reports or notifications related to international exercises.

In association with detection of ruthenium isotope Ru-106 in atmospheric aerosols in Europe, the National Contact Point received information on measurement results in the territory of countries of Europe. The measurement result information was published on an ongoing basis on the Website of the PAA.

Radiation emergencies in the country

Duty employees of CEZAR received a notification of a radiation emergency 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.

There was no need to deploy the dosimetry team of the PAA President to the radiation emergency location; on the other hand, it was deployed in to support the local services in situations other than radiation emergencies as defined in the Atomic Law Act.

CEZAR duty officers rendered consulting services in 12116 cases (which were not connected with mitigation of the hazard and of consequences of radiation emergency incidents), and in the majority of cases (11965), 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 (10926 cases in total), as well as crossing the border by nuclear medicine patients (1039 cases). Furthermore, CEZAR officers on duty provided consulting and advisory services in 151 cases to other state authorities and individuals.

10

Assessment of the national radiation situation

Pic. IAEA

In 2017 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.

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 former 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 2017 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.

Values of the ambient dose rate equivalent, including cosmic radiation and radiation generated by radionuclides present in the soil, as provided in Table 9, imply that in Poland, the average 24-hour values varied in 2017 between 65 and 142 nSv/h, with the annual average of 92 nSv/h.

In the vicinity of the Świerk nuclear centre, gamma radiation exposure dose rates, taking into account the earth component only, were between 45.4 and 61.1 nGy/h (the average value being 53.9 nGy/h), whereas in the vicinity of the National Radioactive Waste Repository – from 59.8 to 77.6 nGy/h (with the average of 68.6 nGy/h). The foregoing values do not differ significantly from dose rate measurement results obtained in other regions of the country.

TAB. 9.

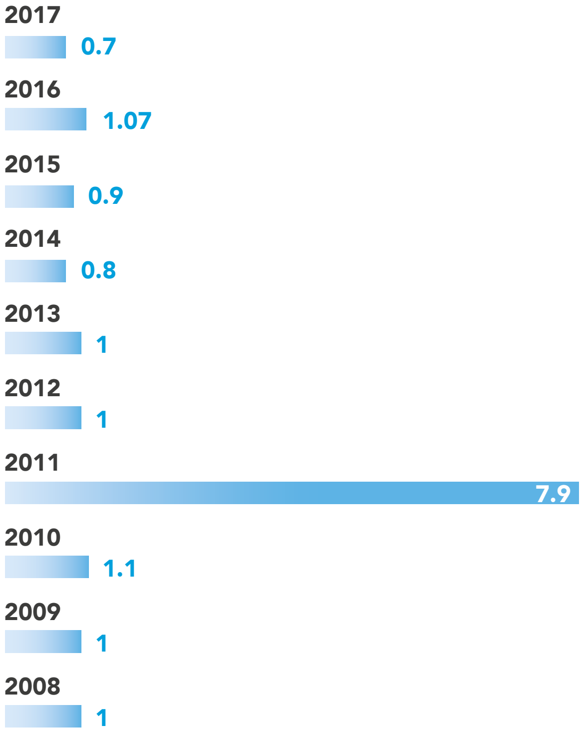
Dose rate values obtained from early warning stations for radioactive contamination in 2017 (PAA)

Stations*	Municipality (location)	Range of average daily dose rate [nSv/h]	Annual average rate [nSv/h]
PMS	Białystok	85-105	92
	Częstochowa	76-86	79
	Gdynia	101-124	105
	Kielce	78-98	84
	Koszalin	85-97	88
	Kraków	108-128	119
	Łódź	81-101	89
	Lublin	69-118	97
	Olsztyn	80-99	87
	Sanok	94-130	114
	Suwałki	77-103	86
	Szczecin	92-111	96
	Toruń	83-96	87
	Warszawa	88-106	92
	Wrocław	82-99	86
	Zielona Góra	84-99	90
Institute of Meteorology and Water Management	Gdynia	82-101	87
	Gorzów	78-101	86
	Legnica	85-114	96
	Lesko	79-121	102
	Mikołajki	84-115	99
	Świnoujście	71-84	76
	Warszawa	69-97	79
	Włodawa	65-94	79
	Zakopane	86-142	115

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

FIG. 10.

Annual average concentration of Cs-137 in aerosols in Poland in the years 2008-2017 (PAA, based on data provided by the Central Laboratory for Radiological Protection).



Atmospheric aerosols

In 2017, 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 implied, similarly to the several preceding years, presence of detectable amounts of the137 radionuclide. Its average concentrations in the period analysed varied from below 0.09 to 21.62 µBq/m^3 (the average being 0.70 µBq/m^3). Average values of the I-131 radionuclide concentration in the same period varied between less than 0.05 to 7.18 µBq/m^3 (the average being 0.60 µBq/m^3), whereas average values of the natural Be-7 radionuclide concentration came to a few millibecquerels per m^3.

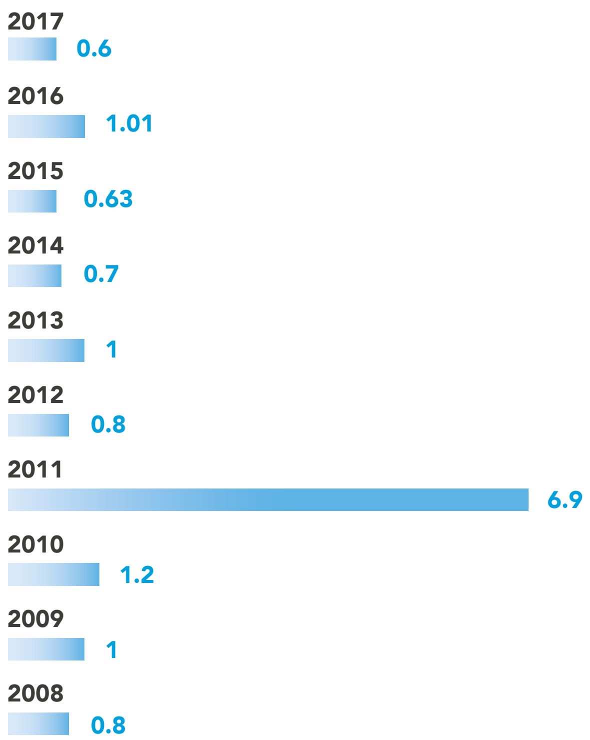
Figures 10 and 11 show the annual average concentration of Cs-137 in atmospheric aerosols in the years 2008-2017, across the entire territory of Poland and in Warsaw, respectively.

In 2017, weekly concentrations of the Cs-137 isotope in the air on the premises of 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 2017 within the territory and in the vicinity (Wólka Mlądzka) of the National Centre for Nuclear Research in Świerk on weekly basis. Measurement results obtained in 2017 on the premises of the Centre have been provided in Table 10.

FIG. 11.

Annual average concentration of Cs-137 in aerosols in Warsaw in the years 2008-2017 (PAA, based on data provided by the Central Laboratory for Radiological Protection).



Total fallout

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

Results of the measurements presented in Table 11 imply that the content of artificial Sr-90 and Cs-137 radionuclides in the total annual fallout in 2017 remained on the level observed in previous years.

TAB. 10.

Summary of results of weekly measurements of radionuclide concentrations in atmospheric aerosols on the premises of the Świerk Nuclear Centre in 2017.

	Be-7 [mBq/m^3]	K-40 [μBq/m^3]	I-131 [μBq/m^3]	Cs-137 [μBq/m^3]
Average	2.87	18.90	7.21	1.25
Minimum value	1.25	9.70	0.97	0.36
Maximum value	5.46	65.50	10.34	6.22

TAB. 11.

Average activity of Cs-137 and Sr-90 and average beta activity in total annual fallout in Poland in the years 2008–2017 (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	
2017	0,3	0,2	0,32
2016	0,5	0,1	0,31
2015	0,6	0,1	0,31
2014	0,5	0,1	0,32
2013	0,3	0,2	0,31
2012	0,3	0,1	0,32
2011	1,1	0,2	0,34
2010	0,4	0,1	0,33
2009	0,5	0,1	0,33
2008	0,5	0,1	0,30

TAB. 12.

Concentrations of Cs-137 and Sr-90 in river and lake water in Poland in 2017 [mBq/dm^3] (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	0.4 – 4.98	1.90 – 4.31	1.23 – 3.01
	Average value	2.37	3.20	1.88
Sr-90	Range	1.38 – 5.59	2.45 – 3.94	1.32 – 9.01
	Average value	3.06	3.24	3.10

Waters and bottom sediments

Radioactivity of waters and bottom sediments was established 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 last year and were similar to those observed in other European countries.

In 2017, 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). Average concentrations of the aforementioned three isotopes remained on the level of 28.3 mBq/dm^3 for Cs-137, 3.85 mBq/dm^3 for Ra-226 and 4257 mBq/dm^3 for K-40, and did not depart from the results obtained in previous years.

Concentrations of Cs-134 and Cs-137 in open water samples collected in 2017 at check points located in the vicinity of the Nuclear Centre in Świerk came to:

- Świder river: 4.12 mBq/dm3 (upstream of the Centre) and 3.25 mBq/dm^3 (downstream of the Centre),
- water from a sewage treatment plant in Otwock discharged to the Vistula river: 7.51 mBq/dm^3.

Concentrations of tritium in open water samples collected in 2017 at check points located in the vicinity of the Nuclear Centre in Świerk came to:

- Świder river (upstream and downstream of the Centre): below 0.5 Bq/dm^3
- water from a sewage treatment plant in Otwock discharged to the Vistula river: 1.5 mBq/dm^3.

Waters – local monitoring

Measurements of concentrations of radioactive isotopes in waters in local monitoring in 2017 did not depart substantially from the results for the previous years.

Nuclear Centre 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 2017 was : 4.88 and 5.24 mBq/dm^3 for Cs-134 and Cs-137 and 21.9 and

1.23 mBq/dm^3 for Sr-90. The concentration of tritium (H-3) was also determined, and it came to less than 0.5 Bq/dm^3 on average.

National Radioactive Waste Repository (KSOP) in Różan:

Concentrations of radioactive isotopes of Cs-137 and Cs-134 in spring water near the National Radioactive Waste Repository in Różan came to 1.98 Bq/dm^3 on average.

In 2017, the concentration of tritium was also examined in the vicinity of the National Radioactive Waste Repository in Różan, and it amounted to less than 0.5 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 in cases of their exceedance, identification of radionuclides is recommended.

Measurements of the alpha and beta activity were conducted for 73 water samples in areas where uranium ore plants used to operate, and the following results were obtained:[1]:

- 1 public intakes of drinking water:
  - 1 total alpha activity – from 1.1 to 57.3 mBq/dm^3,
  - 1 total beta activity – from 16.4 to 227.0 mBq/dm^3,
- 1 waters flowing out of mine headings (adits, rivers, ponds, springs, wells):
  - 2 total alpha activity – from 3.5 to 578.1 mBq/dm^3,
  - 3 total beta activity – from 30.9 to 3362.4 mBq/dm^3,

Concentration of radon in water from public intakes within the area managed by the Association of Municipalities of the Karkonosze Region was 1.0 to 577.0 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 "Pogórze" mine.

The Commission Recommendations 2001/928 EURATOM on radon present in water stipulate that, for public intakes with radon concentration exceeding 100 Bq/dm^3, the Member States should individually establish what is referred to as reference levels of radon concentration, and for concentrations exceeding 1,000 Bq/dm^3, it is necessary that specific countermeasures be undertaken for the sake of radiological protection. In 2017, none of the results obtained in radon concentration measurements in water exceeded the threshold of 1,000 Bq/dm^3.

Bottom sediments

In 2017, 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. Results of the measurements presented in Tables 13 and 14.

1. Upper activity levels were observed in the water flowing out of adit no. 19a of the former "Podgórze" mine in Kowary.

TAB. 13.
Concentrations of caesium and plutonium in river and lake water in Poland in 2017 [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	Lakes
Cs-137	Range	0.26 – 6.00	0.49 – 6.88	1.37 – 14.94
	Average value	2.76	2.09	5.09
Pu-239,240	Range	0.003-0.0344	0.006-0.0487	0.004-0.0551
	Average value	0.019	0.017	0.018

TAB. 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 2017 (PAA, based on data provided by the Central Laboratory for Radiological Protection).

		Layer thickness
Cs-137	$kBqm^2$	2.52
Pu-238	Bqm^2	1.82
Pu-239,240	Bqm^2	81.9
K-40	$kBqm^2$	41.5
Sr-90	Bqm^2	141.8

Soil

Concentrations of both natural and artificial radionuclides 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.

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 and kBq/m^2 and it amounts on the average to 1.52 kBq/m^2.

Average deposition for 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 52 kBq/m^2 in 2016. Deposition value for Cs-134 in soil samples changed during the monitoring period according to the half-life, and so this isotope does not appear in detectable amounts in Polish soils at present.

The average deposition of Cs-137 in individual regions of Poland has been shown in Table 15, whereas average provincial concentrations of natural radioactive isotopes in soil determined in 2016 have been provided in Table 16.

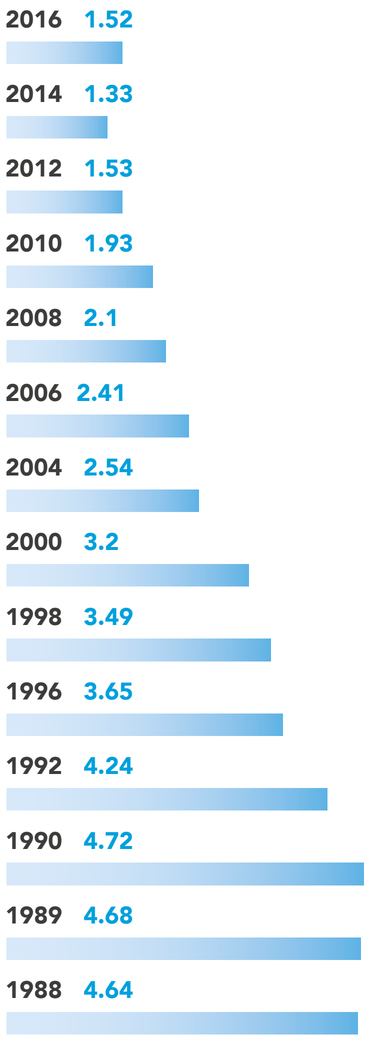
TAB. 15.

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 of ^{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. 12.

Average 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)



Average values of surface contamination of soil with Cs-137 in 2017 in the vicinity of the Nuclear Centre in Świerk and of the National Radioactive Waste Repository in Różan equalled 5.6 Bq/kg and 40 Bq/kg, respectively.

Average concentrations of natural radioactive isotopes in soil

The average concentration ranges for natural radionuclides are as follows:

- 2 for Ra-226: average 27.5 Bq/kg;
  range: 4,3 ÷ 112,0 Bq/kg,
- 3 for Ac-228: average 23.5 Bq/kg;
  range: 3,5 ÷ 115,0 Bq/kg,
- 4 for K-40: average 425 Bq/kg;
  range: 60 ÷ 1011 Bq/kg.

TAB. 16.

Average 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	Minimum	Maximum
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 has been disregarded further on in this subsection.

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 through the alimentary tract.

In 2017, concentrations of Cs-137 in liquid (fresh) milk ranged from 0.20 to 1.33 Bq/dm^3 and amounted to ca. 0.46 Bq/dm^3 on average.

Meat, poultry, fish and eggs

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 2017 were as follows (annual average concentration of Cs-137):

- meat from animal farms – ca. 0.89 Bq/kg,
- poultry – ca. 0.50 Bq/kg,
- fish – ca. 0.61 Bq/kg,
- eggs – ca. 0.49 Bq/kg.

The time distribution of the Cs-137 activity in the years 2008-2017 in different types of meat from animal farms (beef, pork), as well as in poultry, eggs and fish has been shown in infographic (p. 90-92). The data obtained imply that, in 2017, 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 and mushrooms

Results of measurements of artificial radioactivity in vegetables and fruits conducted in 2017 imply that the concentration of the Cs-137 isotope in vegetables ranged from 0.10 to 0.66 Bq/kg, with the average value being 0.42 Bq/kg, and in fruits it came to 0.16-0.80 Bq/kg with the average value of 0.38 Bq/kg. In long-term comparisons, the results from 2017 remained on the level from year 1985, and in relation to the year 1986 – they were more than a dozen times lower.

The values of activity of Cs-137 in cereals observed in 2017 ranged from 0.04 to 1.04 Bq/kg (the average value being 0.49 Bq/kg) and were similar to amounts measured in 1985.

Average values of activity of the caesium isotope in grass in the vicinity of the Świerk Nuclear Centre and of KSOP (with reference to dry mass) in 2017 ranged from 1.62 to 16.67 Bq/kg (the average value being 6.94 Bq/kg) for the Nuclear Centre in Świerk and from <0.14 to 7.05 Bq/kg (the average value being 3.40 Bq/kg) for KSOP.

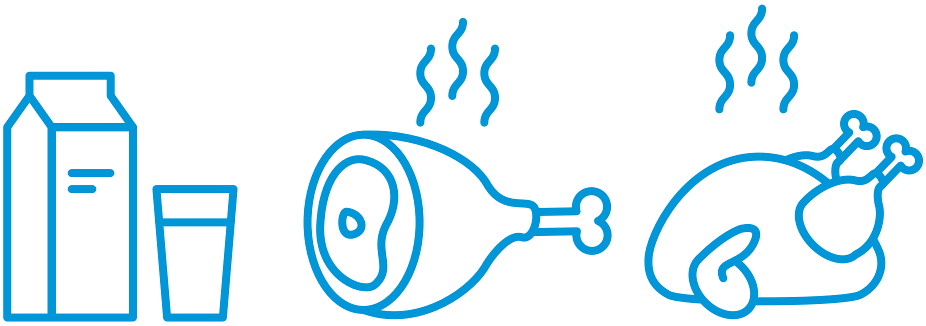
In 2017, the average activity of caesium in basic specimens of fresh mushrooms did not differ from the values for the previous years. It should be stressed that in 1985, i.e. before the Chernobyl disaster, the activity of Cs-137 in mushrooms was also much higher than in other foodstuffs. At that time, this radionuclide was produced in the course of tests of nuclear weapons (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.



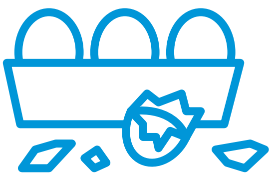
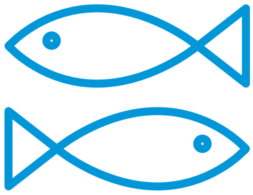
average concentration Cs-137	**MILK**	**MEAT**	**POULTRY**
2017	**0,46 Bq/dm³**	**0,89 Bq/kg**	**0,50 Bq/kg**
2016	0,40	0,63	0,54
2015	0,50	0,77	0,60
2014	0,50	0,83	0,73
2013	0,60	0,95	0,90
2012	0,60	0,90	0,70
2011	0,49	0,64	0,60
2010	0,48	0,83	0,58
2008	0,60	0,85	0,52
2009	0,60	0,70	0,52
2007	0,70	0,64	0,67

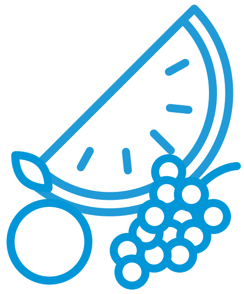
600 Bq/kg

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

Cs-137

Only measurements of Cs-137 are presented, since values of Cs-134 are below 1‰ of the Cs- 137 activity and therefore coud be disregarded.



EGGS	FISH	VEGETABLES	FRUITS
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: sanitary and epidemiological stations

11

International cooperation

Pic. 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 the 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 2017, 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 organisations

European Atomic Energy Community (EURATOM)

PAA's involvement resulting from the membership of Poland in the Euratom Community in 2017 focused mainly on activities conducted in two groups:

- the European Nuclear Safety Regulators' Group (ENSREG) composed of representatives of the senior management of European nuclear regulators from the Member States and a representative of the European Commission, providing advisory support to the European Commission
- the Working Party on Atomic Questions – B.07 WPAQ.

International Atomic Energy Agency (IAEA)

Next to the Ministry of Foreign Affairs, PAA is the leading institution for cooperation with the IAEA. The second 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 2017, the fee amounted to: EUR 2 426 246 and USD 361 416 to the regular budget of the IAEA, and EUR 693 030 to the Technical Cooperation Fund of the IAEA,
- implementation of own projects in collaboration with the IAEA.

Cooperation in establishing the IAEA Safety Standards

A vital part of the IAEA's activities is dedicated for establishing of Safety Standards for peaceful use of nuclear energy. Works devoted to these Standards are performed by six committees:

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

International review missions – Integrated Regulatory Review Service IRRS

IAEA offers to the member states a number of thematic review missions, during which international experts assess compliance with safety standards and present their recommendations, aimed at constant improvement of quality in activities for safety. In 2017, on the invitation of the Government of the Republic of Poland, IAEA carried out one such mission – an Integrated Regulatory Review Service Follow-up Mission) to verify implementation by Poland of the recommendations and suggestions presented by the international team of experts from the review mission of the IRRS, carried out in 2013, with regard to nuclear safety and radiological protection. The experts were of opinion that the activities of the Polish institutional bodies deserved particular appreciation, as all of the suggestions and recommendations made have been implemented in the national nuclear regulatory system[7].

The General Conference of the IAEA

The General Conference (GC) is the highest statutory body of the IAEA. Its members are representatives of all member states of the Agency. The CG is held once a year to review and approve the programme 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.

From 18 to 22 September 2017, the 61st General Conference of the International Atomic Energy Agency was held.

The General Conference was attended by a delegation from the Republic of Poland, in which the Deputy Chairman of the Delegation of the Republic of Poland was Andrzej Przybycin – the President of the National Atomic Energy Agency (PAA).

On 19 September 2017, President Andrzej Przybycin signed two agreements on bilateral cooperation with the Finnish and Hungarian nuclear regulatory bodies:

- the Polish-Finnish agreement was signed by the President of the PAA and Mr. Petteri Tippana, Director General of the Radiation and Nuclear Safety Authority (STUK).
- the Polish-Hungarian agreement was signed by the President of the PAA and Mr. Gyula Fichtinger, Director General of the Hungarian Atomic Energy Authority (HAEA).

Both agreements were signed for exchange of technical information and cooperation in the field of nuclear safety. They will facilitate development of competences of the PAA to perform the nuclear regulatory function in the course of implementation of the PPEJ.

During the conference, within the framework of activities aimed at strengthening of nuclear safety on the global scale, the PAA engaged in a number of consultations with its international partners:

- with the Nuclear Regulatory Commission of the United States of America (NRC) managed by Ms. Kristine Svinicki, the chairwoman of the NRC
- with the Canadian Nuclear Safety Commission (CNSC) managed by Mr. Ramzi Jammal, the vice-president of the CNSC
- with the South African National Nuclear Regulator (NNR), managed by Mr. Bismark Tyobeka, Director General of the NNR.

Expert cooperation under the aegis of the IAEA

A significant instrument of the IAEA is the Technical Cooperation Programme, in which Poland has participated for many years, performing two roles: as a net payer of the Programme 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.

7. Information on the IRRS mission in Poland can be found at http://paa.gov.pl/strona-61-przeglad_irrs.html

At the PAA, there is a team for coordination of technical cooperation with the IAEA at the national level. The team members include the National Liaison Officer (NLO) and the National Liaison Assistant (NLA). The role of the NLA and the NLO is to support domestic organizations in taking advantage of the possibility of participating in technical cooperation projects.

In 2017, the PAA coordinated participation of the national expert and research organisations in more than 270 meetings, trainings and conferences organised by the IAEA.

A significant component of expert cooperation are special domestic projects, implemented in association with Poland's priorities in the area of nuclear safety and radiological protection.

In years 2018-19, Poland has been implemented 2 such projects in the fields of:

- strengthening of preparedness of the nuclear regulatory authorities to issue licenses for new nuclear facilities,
- strengthening of the domestic potential for the purpose of launching of the nuclear power programme.

One of the key projects implemented by the PAA is participation in the Regulatory Cooperation Forum (RCF), an IAEA initiative, grouping nuclear regulatory authorities from countries with advanced nuclear programmes and countries implementing new nuclear power programmes. The PAA participates in the RCF as a member of the Executive Committee of the RCF and an organisation receiving expert support. Within the framework of the project, since 2015, the PAA inspectors and analysts have participated in position-related in-service training visits at the foreign nuclear regulatory authorities, supervising nuclear power plants.

The 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 the 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.

Cooperation in associations and other forms of multilateral cooperation

The Western European Nuclear Regulators' Association (WENRA)

In 2017, the fields of activity of the WENRA included determination of reference safety levels for handling of radioactive waste, as well as issues of harmonisation of activities with regard to nuclear safety. The WENRA appointed a new working group for harmonisation of reference levels for research reactors, in which a representative of the PAA is one of the members. The WENRA has contributed significantly to the nuclear safety strategy, developed by the IAEA. It also dealt with issues of the necessary improvements in the field of safety in the existing nuclear installations in accordance with the nuclear safety directive (Euratom) requirements.

In the early 2017, recommendations developed by the WENRA with regard to self-assessment with regard to management of aging of nuclear safety were adapted by the ENSREG as the basis for preparation of national reports within the framework of the first Topical Peer Review. The review included a Polish report on the MARIA research reactor, located in NCBJ Świerk.

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 2017, the works of HERCA focused mainly on implementation of the BSS directive, in particular, issues associated with personal authorisations required in radiological protection, radon and radionuclides occurring naturally in the environment.

Council of the Baltic Sea States (RPMB)

Poland has been represented in the Expert Group on Nuclear and Radiation Safety by the PAA since 1992. The Group meets twice a year, and, additionally, organises 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 specialise in nuclear safety and radiological protection (e.g. IAEA, IRSN (France) etc.), as well as representatives of organisations involved in the issues of CBRNE.

The European Nuclear Security Regulators Association (ENSRA)

At present, the Association incorporates 14 Member States of the European Union.

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 physical protection in the European Union countries..

The European Safeguards Research and Development Association (ESARDA)

The PAA has been a member of the European Safeguards Research and Development Association (ESARDA) since 2009. The organisation serves as a forum for exchange of information and experience in the field of nuclear material safeguards, associated with performance of obligations based on the Treaty of the Non-Proliferation of Nuclear Weapons and its derivative agreements. The organisation has cooperated with the IAEA and with the laboratories of the Joint Research Centre of the European Commission. It incorporates scientific institutes, universities, industrial companies, specialists and administration bodies of 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 2017, the PAA continued to develop the network of cooperation with its foreign partners having experience in supervision of large nuclear facilities. In September, during the MAEA General Conference, the PAA entered into new agreements on cooperation with the regulatory authorities of Finland and Hungary.

Talks were also initiated on strengthening and initiation of cooperation with the American (NRC), Canadian (CNSC) and South African (NRC) regulatory bodies.

Within the framework of implementation of bilateral cooperation programmes, the PAA organised bilateral meetings with the Austrian regulatory authorities in Warsaw in 2017.

Off-site meetings were also held with the nuclear regulatory authorities of Switzerland, the Czech Republic and Belarus. During a visit to the South African nuclear regulatory authority (NRC), an agreement for cooperation was signed between the PAA and the NRC.

The meetings were held to exchange information on significant experiences, resulting from supervision of nuclear facilities and sources, and the good practices gathered. The second significant form of bilateral cooperation were in-service training visits of nuclear inspectors and analysts of the PAA in the nuclear regulatory authorities of the United States, the Czech Republic, Slovakia, Canada and the Republic of South Africa, which allowed them to get familiar with and to exercise in practice the tasks performed in supervision of large scale nuclear facilities.

List of abbreviations

- **ABW** – Internal Security Agency – Agencja Bezpieczeństwa Wewnętrznego
- **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
- **RPMB** – Council of the Baltic Sea States (CBSS)
- **CEZAR** – Radiation Emergency Centre
- **CLOR** – Central Laboratory for Radiological Protection
- **CNRA** – Committee on Nuclear Regulatory Activities
- **COAS** – Centre for Analysis of Contamination
- **CSNI** – Committee on the Safety of Nuclear Installations
- **DBJ PAA** – Nuclear Safety Department National Atomic Energy Agency
- **DoE** – U.S. Department of Energy
- **DOR PAA** – Radiological Protection Department National Atomic Energy Agency
- **DSS** – Decision Support Systems
- **ECURIE** – European Community Urgent Radiological Information Exchange
- **EGNRS** – Expert Group on Nuclear and Radiation Safety
- **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** – Chief Inspectorate of Environmental Protection
- **GTRI** – Global Threat Reduction Initiative
- **HERCA** – Heads of the European Radiological Protection Competent Authorities
- **HEU** – Highly Enriched Uranium
- **IAEA** – International Atomic Energy Agency
- **IAEA Safety Standards**
- **IATA** – DGR International Air Transport Association Dangerous Goods Regulation
- **ICAO** – International Civil Aviation Organization
- **IChTJ** – Institute of Nuclear Chemistry and Technology
- **IEA** – International Energy Agency
- **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
- **IPJ** – Institute for Nuclear Studies
- **IPPAS** – International Physical Protection Advisory Service
- **IRRS** – Integrated Regulatory Review Service
- **IRSN** – L'Institut de Radioprotection et de Sûreté Nucléaire – Institute for Radiological Protection and Nuclear Safety
- **JRC** – European Comission's Joint Research Centre
- **KG** – General Conference IAEA
- **KPK** – National Contact Point
- **KSOP** – National Radioactive Waste Repository
- **LEU** – Low Enriched Uranium
- **LPD** – Dosimetric Surveys Lab
- **ME** – Ministry of Energy
- **MF** – Ministry of Finance
- **MG** – Ministry of Economy
- **MON** – Ministry of National Defence
- **MSWiA** – Ministry of the Interior and Administration
- **NCBJ** – National Centre for Nuclear Research
- **IEA** – POLATOM Institute of Atomic Energy
- **NEA OECD** – Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
- **NIK** – Supreme Audit Office
- **NLC** – Nuclear Law Committee
- **NOT** – Chief Technical Organisation
- **NSGC** – Nuclear Security Guidance Committee
- **NUSSC** – Nuclear Safety Standards Committee
- **PAA** – National Atomic Energy Agency
- **WCZK** – Provincial Centre for Crisis Management (PCCM)
- **PMS** – Permanent Monitoring Station
- **POL** – technical cooperation national project for Poland
- **POLATOM** – Radioisotopes Centre
- **PPEJ** – Polish Nuclear Power Programme
- **PSG** – Border Guards Units
- **RASSC** – Radiation Safety Standards Committee
- **RCF** – Regulatory Cooperation Forum
- **RID** – Reglement concernant le transport Internationale ferroviaire des marchandises Dangereuses
- **SG** – Border Guard
- **SIOR** – Association of Radiation Protection Officers
- **TLD** – thermoluminescent dosimeters
- **TRANSSC** – Transport Safety Standards Committee
- **UDT** – Office of Technical Inspection
- **US NRC** – United States Nuclear Regulatory Commission
- **USIE** – Unified System for Information Exchange in Incidents and Emergencies
- **WASSC** – Waste Safety Standards Committee

- **WENRA** – Western European Nuclear Regulators Association
- **WGAMA** – Working Group on Analysis and Management of Accidents
- **WGIP** – Working Group on Inspection Practices
- **WGPC** – Working Group on Public Communication of Nuclear Regulatory Organizations
- **WGRISK** – Working Group on Risk Assessment
- **WGRNR** – Working Group on Regulation of New Reactors
- **WHO** – World Health Organization
- **WPAQ** – Working Party on Atomic Questions
- **WPNEM** – Working Party on Nuclear Emergency Matters – Grupa robocza ds. zagrożeń jądrowych
- **ASW** – War Studies University
- **ZUOP** – Radioactive Waste Management Plant

Cover photo:
PAA

Graphic design:
Papercut graphic design studio

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ATOMIC ENERGY
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