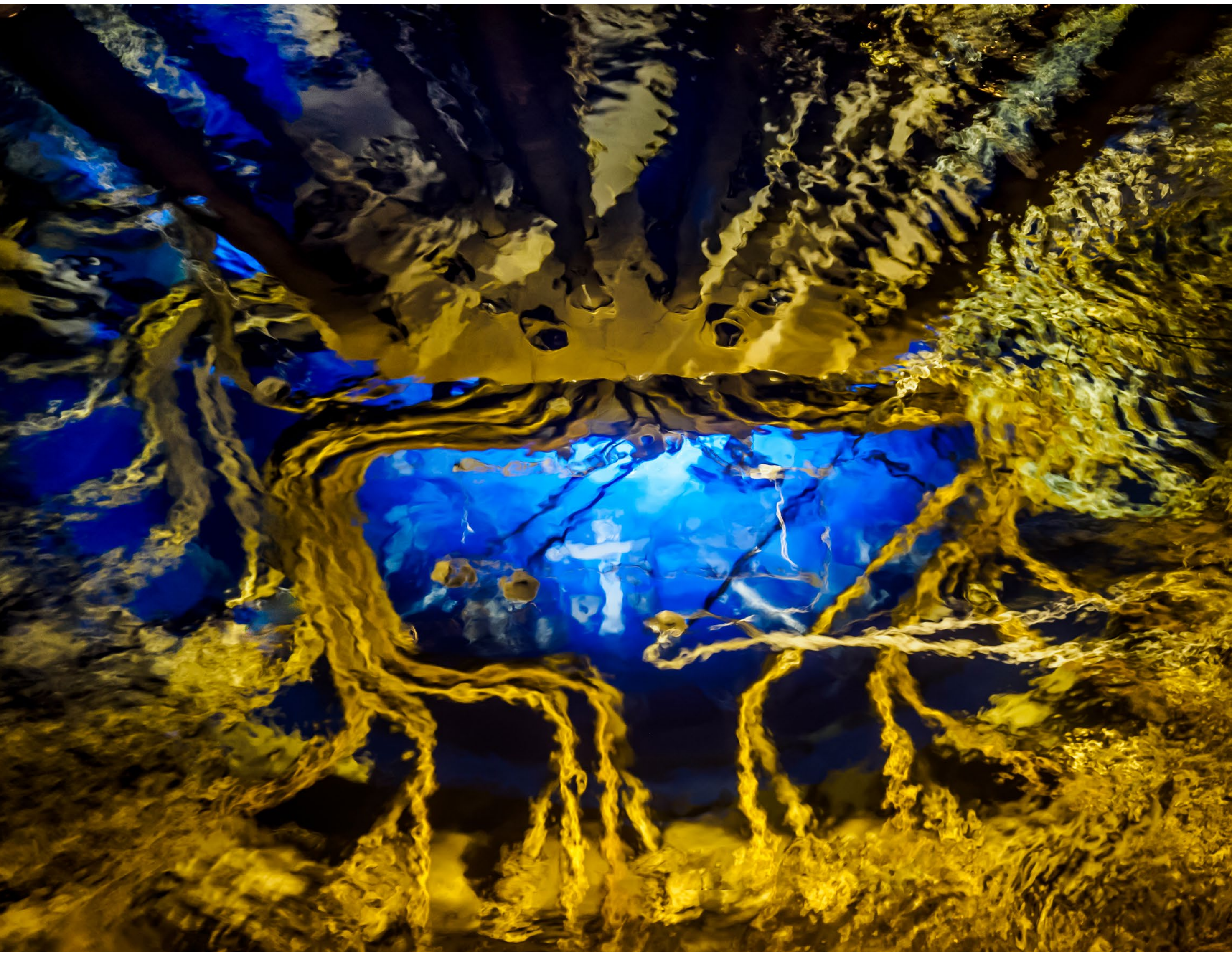

ANNUAL REPORT

Activities of the President of
the National Atomic Energy Agency
and assessment of nuclear safety and
radiological protection in Poland in 2016

2016

PAA
NATIONAL
ATOMIC ENERGY
AGENCY

ANNUAL REPORT

Activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland in 2016

WARSAW 2017

PAA
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The vision and the mission

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

The vision:
The National Atomic Energy Agency is a modern, competent nuclear regulatory authority 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 both 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 2017 item 576).

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 2016.

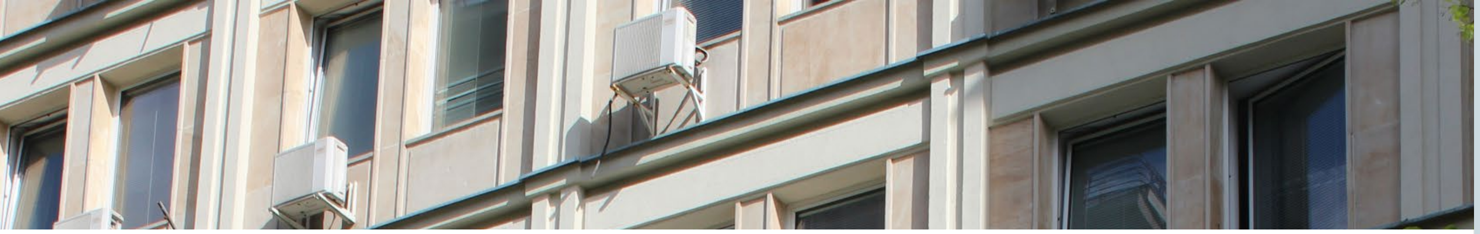
The most important conclusion is that the inhabitants of Poland have been appropriately protected against ionizing radiation. Radiation emergencies in year 2016, in Poland and abroad, had no impact on human health or the natural environment within the territory of Poland.

The key events of the previous year was the shipment of the last batch of spent highly enriched nuclear fuel from MARIA research reactor to the country of origin. Thus, Poland became a country free from nuclear materials of this type. Success of the undertaking, implemented within the framework of the Global Threat Reduction Initiative (GTRI), was possible, among others, thanks to substantial commitment of the National Atomic Energy Agency.

We have also ensured constant supervision of thousands of applications of ionizing radiation in scientific research, medicine, veterinary science, industry and the service sector. In our everyday work, safety of the society and the environment, including workers subject to occupational exposure to ionizing radiation, has been and will always remain a priority.

I invite you to study the Report and wish you an informative read!

Andrzej Przybycin
Acting President
of the National Atomic Energy Agency



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National Atomic Energy Agency

Fot. 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 authority, responsible for national nuclear safety and radiological protection. Activity of the PAA is regulated by the act of November 29th, 2000 - Atomic Law (Journal of Laws of 2017 item 576) 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;

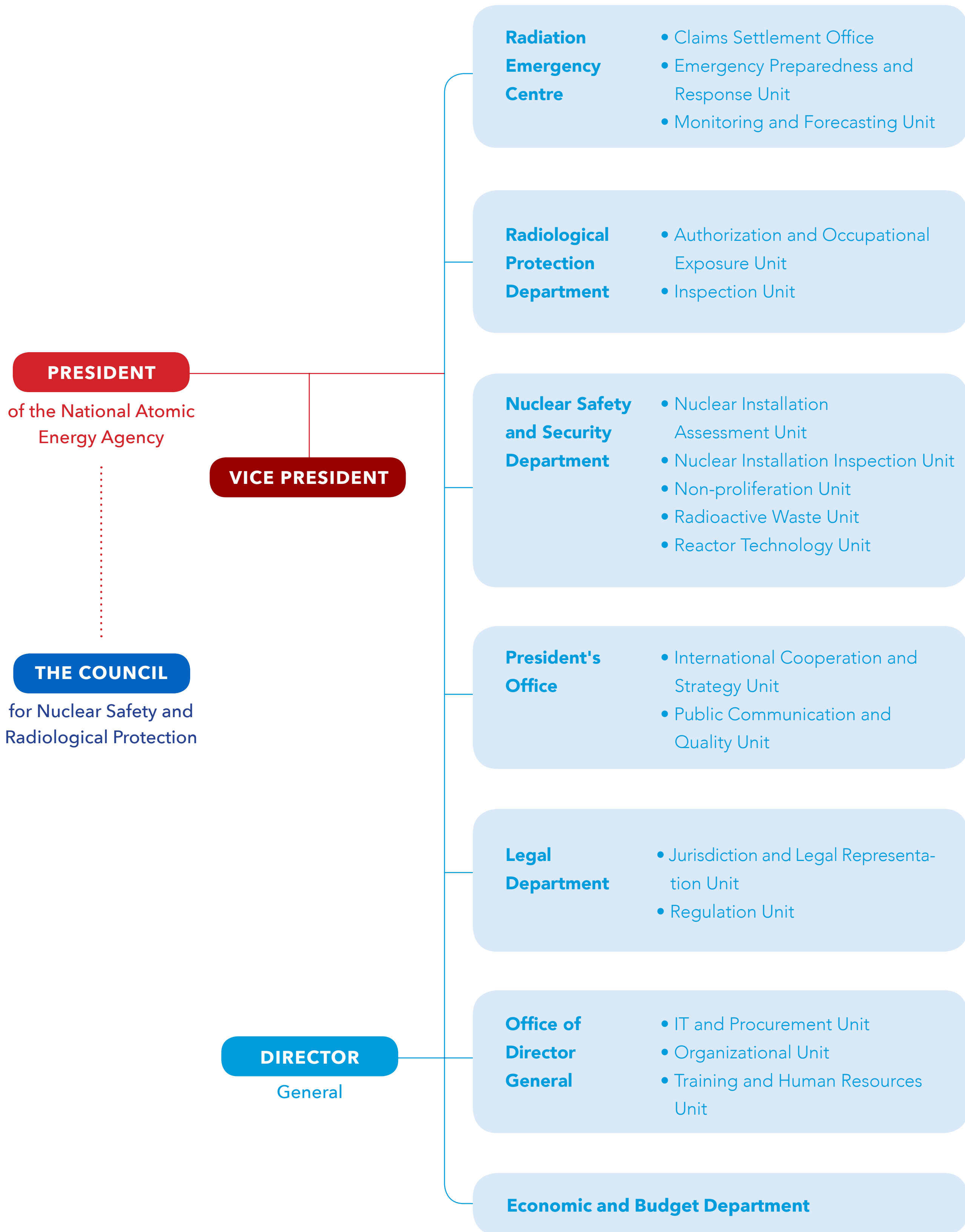
11. preparing drafts of legal acts on the matters provided for in the Atomic Law and settling them with other state authorities according to the procedures established in the Rules of Procedure of the Council of Ministers;

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 Ministe

FIGURE 1.

Organisational structure

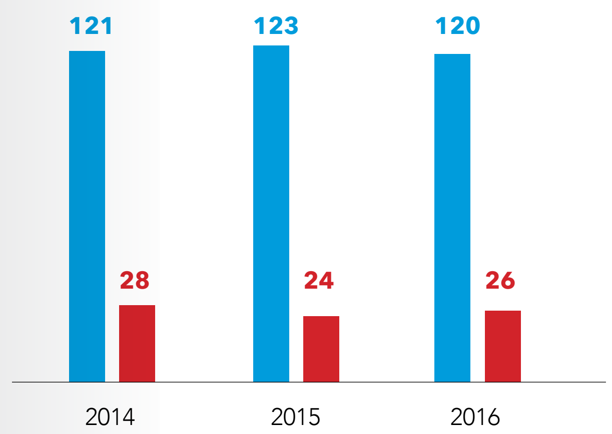


Employment

PAA's mean annual headcount in 2016 came to 120 persons (117 full-time employees), including 26 Nuclear Regulatory Inspectors at the end of December.

120 employees

26 nuclear regulatory inspectors



Assessment of the PAA's operations

Administrative courts' control of administrative decisions issued by PAA President

In 2016, the nuclear regulatory body issued 1517 administrative decisions, and one appeal against the decision of a nuclear regulatory body was filed with the Province Administrative Court in Warsaw. In 7 cases, the Province Administrative Court in Warsaw issued 7 judgments, which were favourable for the regulatory authority, and for 8 judgments, the parties dissatisfied with the decisions made submitted cassation appeals against them to the Supreme Administrative Court.

Audit carried out by the Supreme Audit Office

In 2016 PAA was audited by the Supreme Audit Office (NIK) with regard to implementation of the state budget in 2015 in section 68 – National Atomic Energy Agency. The Supreme Audit Office positively assessed the state budget implementation in 2015 in section 68 –National Atomic Energy Agency.

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 new BJiOR Council at the end of year 2016:

JANUSZ JANECZEK
chairman of the Council

ANDRZEJ G. CHMIELEWSKI
deputy chairman of the Council

KONRAD ŚWIRSKI
secretary of the Council

MAREK K. JANIAK
member of the Council

Until August 18th, 2016, composition of the Council had been the same as in the previous years.

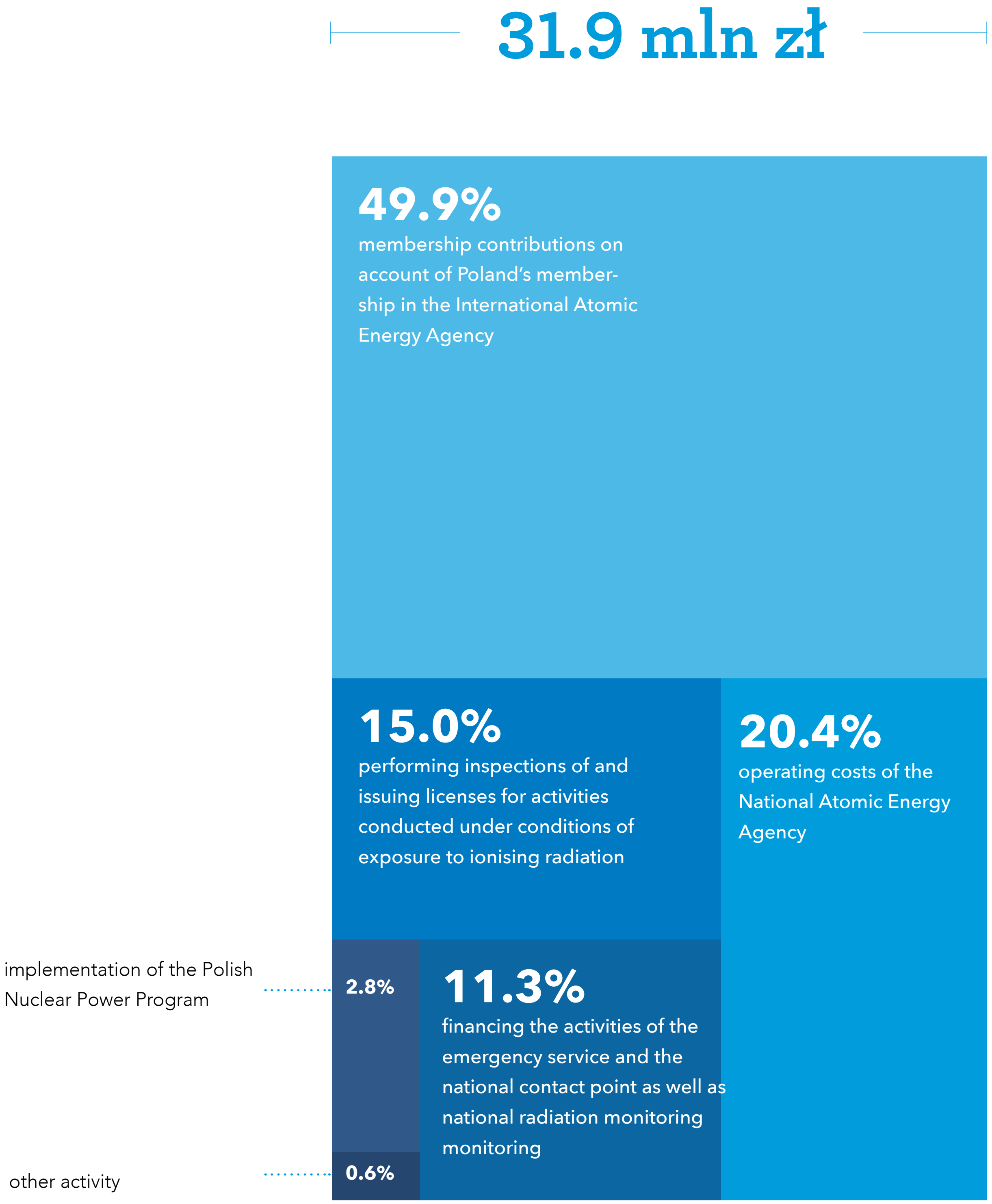
Tasks of the Council

- 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 BJiOR Council activity in year 2016 is available in Public Information Bulletin of the PAA.

FIGURE 2.

The PAA's budgetary expenses in 2016 amounted to PLN 31.9 million, including:



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.

Tasks of PAA as a nuclear regulatory body in relation to nuclear facilities, including nuclear power plants, comprise the following in particular:

- defining requirements for nuclear safety and radiological protection and issuing technical recommendations indicating detailed methods of ensuring safety,
- performing analyses and assessments of technical information provided with appropriate safety analyses by investors or organisations operating a nuclear facility, or obtained as a result of an inspection, in order to verify whether this nuclear facility conforms with the applicable objectives, rules and criteria of safety for purposes of licensing processes and other decisions of the nuclear regulatory body,
- conducting the licensing process with regard to construction, commissioning, operation and decommissioning of nuclear facilities,
- conducting inspections of activities performed by an investor or an organisation operating the nuclear facility in order to ensure safety, including in the scope of compliance with safety requirements set forth in the relevant regulations on nuclear safety and radiological protection as well as compliance with the conditions specified in individual licenses and decisions issued by a nuclear regulator,
- imposing sanctions enforcing compliance with the aforementioned requirements.

Processing of claims submitted by former workers of Industrial Plant R-1 in Kowary

Since 1990, processing of claims submitted by former workers of Industrial Plant R-1 (ZPR-1) in Kowary has been the PAA President's additional duty (resulting from the fact that the PAA President used to perform the function of a founding body of the POLON Nuclear Technology Applications Plant). Until 1972, ZPR-1 had been extracting and preprocessing uranium ores.

The claims settled in 2016 resulted in the following payments:

- compensating benefits payable on a monthly basis to 7 persons (since October 2016 - 5 persons) in the total amount of PLN 47,438.47,
- monetary equivalent for coal allowance in kind paid in accordance with provisions of the collective labour agreement to 166 persons in the total amount of PLN 154,865.00.

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Infrastructure for nuclear regulatory activities in Poland

Fot. PAA

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 proper condition 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 of 29 November 2000 and its secondary legislation, the applicable EU directives and regulations, as well as 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, 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 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 aforementioned tasks are performed by the PAA President with the assistance of nuclear regulatory inspectors and workers of specialized organizational units of the Agency. In implementing its tasks, the PAA President also uses external experts appointed to 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

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 authorities reporting to the Minister of National Defence and to the minister competent for internal affairs).

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.

- 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 2016, the Atomic Law Act was amended five times:

1. art. 6 of the act of 11 February on amendment of the act on departments of government administration (Journal of Laws item 266) introduced amendments to the act, consisting of replacement in the entire text of most mentions concerning the minister competent for economic matters with mentions concerning the minister competent for energy matters; it was due to referral to the minister competent for energy matters of issues concerning use of nuclear energy for socio-economic purposes (art. 7 a section 2 clause 2 of the act of 4 September 1997 on departments of government administration, Journal of Laws of 2016 item 543, as amended); the amendment came into force on 17 March 2016;

2. act of 6 July 2016 on amendment of the Atomic Law Act (Journal of Laws item 1343), which came into force on 10 September 2016, introduced in the act provisions clarifying the principles of dismissal of the Vice President of the National Atomic Energy Agency by the minister competent for environmental affairs, as well as bestowing on the minister competent for environmental matters the competences to appoint and dismiss members of the Council for Nuclear Safety and Radiological Protection and specifying the conditions for termination of membership in the Council;

3. art. 72 of the act of 5 September 2016 on trust services and electronic identification (Journal of Laws item 1579) introduced amendments to art. 39n and art. 55n of the Atomic Law Act, adapting these provisions to the terminology used in the amending act; these amendments came into force on 7 October 2016;

4. 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.

5. 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.

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 2016 item 1834 as amended),
- the act of 18 August 2011 on maritime safety (Journal of Laws of 2016 item 281 as amended),
- the act of 21 December 2000 on technical inspection (Journal of Laws of 2015 item 1125 as amended).

Among other things, the act of 22 December 2015 on the rules of recognition of professional qualifications acquired in the member states of the European Union (Journal of Laws of 2016 item 65) provides for authorisation for ministers directing the activities of governmental administration, competent for the matters of recognition of professional qualifications to pursue a regulated profession in Poland to set out in a regulation the detailed issues associated with an adaptation period and an aptitude test (art. 22) - serving as instruments, which allow for recognition of professional qualifications acquired abroad, if the Polish requirements with regard to education and pursuing of a given profession are significantly and substantially different from the requirements applicable in the state, in which such qualifications were acquired. This provision served as a basis for regulation of the Minister of the Environment of 29 December 2016 on adaptation period and aptitude test in the course of the procedure aimed at recognition of professional qualifications acquired in member states of the European Union in the field of nuclear safety and radiological protection (Journal of Laws of 2017 item 28), which came into force on 6 January 2017. The provisions of this regulation apply, when the applicant submits a request to the President of the National Atomic Energy Agency for recognition of their qualifications, acquired in the member states of

Team for the development of the concept of implementation of Council Directive 2013/59/EURATOM

In order to prepare for the implementation to the Polish law of Council Directive 2013/59/EURATOM laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ L 13 of 17 January 2014, p. 1), by way of an order of the Minister of the Environment of 8 August 2014 the Team for the development of the concept of implementation of Council Directive 2013/59/EURATOM to the Polish law (Journal of Laws of the Minister of the Environment, item 50), hereinafter referred to the "Team", was designated. The President of the National Atomic Energy Agency was appointed a chairman of the Team, and the Team was composed of the representatives of the Minister of the Environment and the National Atomic Energy Agency. In accordance with § 3 paragraph 2 of the order of the Minister of the Environment concerning the appointment of the Team, the representatives of the governmental administration and scientific communities, participated in the Team works in an advisory capacity, and were invited by the Team Chairman.

The Team's tasks included:

1. identifying the provisions of Council Directive 2013/59/Euratom which require the implementation to the Polish law;
2. determining which provisions of Council Directive 2013/59/Euratom call for regulation in acts and which call for regulation in regulations;
3. considering, in particular, to the extent described in the report of the mission of the Integrated Regulatory Review Service (IRRS), the need for regulation in the Polish law of other issues related to the activities involving exposure to ionizing radiation and supervision of such activity;
4. cooperation with public administration authorities in order to determine during the course of works on the implementation of Council Directive 2013/59/Euratom the way of regulating of particular issues arising from the said Directive, falling within the competence of those authorities;
5. conducting an assessment of expected socio-economic effects of implementation of Council Directive 2013/59/Euratom and presenting the results of this assessment in a regulatory test;
6. presentation of a report containing the concept of implementation into the Polish law of Council Directive 2013/59/Euratom, the essence of the proposed legislative solutions and the results of assessment of expected socio-economic impact of implementation of the said Directive, to the management of the Ministry of the Environment, by 30 November 2015.

The above tasks were performed within the prescribed deadline. The report from the Team works was approved by the Management of the Ministry of the Environment on 11 January 2016. Pursuant to the concept presented in the above mentioned report, the implementation of Council Directive 2013/59/Euratom is to be carried out by way of amending the Act of 29 November 2000 – Atomic Law. The issues of technical nature aimed at the implementation of the act should be governed in new or amended currently binding regulations issued on the basis of the Atomic Law Act.

The Team elaborated a detailed concept of implementation of the provisions of Council Directive 2013/59/Euratom to the Polish law and attached it to the Report, and the following issues were identified in the said concept:

- issues regulated in the Atomic Law Act so far or in the regulations issued on the basis of the Act which do not require legislative changes;
- issues which have not been regulated in the Atomic Law Act or the regulations issued on the basis of the Act which would require any legislative changes;
- issues which have not been regulated in the Atomic Law Act or regulations issued on its basis or other normative acts so far, therefore, requiring an introduction into the Polish legal system (among others, the issues related to an exposure to radon in residential buildings and at workplaces, issues concerning activities with the use of radioactive material occurring naturally, or a new form of regulating activities involving an exposure, with the use of notifications).

The works on the amending act commenced in 2016. On 14 December 2016, the draft act was subjected to arrangements, consultations and opinions. Completion of works on the act has been planned for year 2017. Pursuant to Article 106 paragraph 1 of Council Directive 2013/59/Euratom, its provisions should be implemented by the member states until 6 February 2018.

the European Union, the Swiss Confederacy or in the member states of the European Free Trade Agreement - parties to the agreement on the European Economic Area, for pursuing of specific professions in the field of nuclear safety and radiological protection, listed in the appendix to the draft regulation. These include: 1st and 2nd degree nuclear regulatory inspector, radiological protection officer (with the exception of radiological protection officers in X-ray laboratories using X-ray apparatus for the purpose of medical diagnostics, interventional radiology, surface radiotherapy and radiotherapy of non-cancerous diseases), a position of significance for ensuring of nuclear safety and radiological protection (14 fields of expertise) and work positions associated with performance of tasks of significance for ensuring of nuclear safety and radiological protection in organisational entities performing activities comprising commissioning, operation or decommissioning of nuclear power plants. The competence of the President of the National Atomic Energy Agency to recognise qualifications for pursuing of regulated professions, listed above, is based on § 1 of the related regulation of the Minister of the Environment of 22 December 2016 on authorisation to recognise qualifications for pursuing of regulated professions, acquired in the member states of the European Union (Journal of Laws item 2215).

Secondary legislation of the Atomic Law Act

In 2016 four regulations of the Council of Ministers were issued. Their drafts were elaborated by PAA. These are:

1. Regulation of the Council of Ministers of 30 June, 2015 concerning documents required while submitting a request for issuing a licence for activity involving exposure to ionising radiation or a notification about such activity (Journal of Laws item 1355) - entered into force on 1 January 2016.

This regulation replaced the regulation of the Council of Ministers of 3 December, 2002 concerning documents required while submitting a request for issuing a licence for activity involving exposure to ionising radiation or a notification about such activity (Journal of Laws no. 220, item 1851 as amended). This Regulation is aimed at implementation of a range of directives of the European Atomic Energy Community (Euratom)[1], and is a successive element of adaptation of the Polish legal system to the implementation of the Polish Nuclear Power Programme, and in particular to the construction of a nuclear power plant. The Regulation takes into account the changes that have occurred in the provisions concerning nuclear facilities, especially as a result of the enactment of the act of 13 May 2011 amending the Atomic Law Act and certain other acts (Journal of Laws No. 132, item 766) and implementing regulations issued as a result of the entry into force of this act. The said regulation takes into account the changes of the legal status which were introduced by the entry into force of the act of 4 April 2014 amending the Atomic Law Act and certain other acts (Journal of Laws item 587), concerning activity mainly related to radioactive waste management.

2. Regulation of the Council of Ministers of 14 December 2015 concerning periodical safety assessment of a radioactive waste disposal facility (Journal of Laws of 2016 item 28) entered into force on 23 January 2016.

The Regulation is aimed to enable the fulfilment of the obligation of regular assessment and verification and continuous improvement, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity, directly resulting from Article 7 paragraph 2 of the Council Directive 2011/70/ Euratom and the IAEA Fundamental Safety Principles SF-1. So far no detailed provisions in this regard have been binding in the Republic of Poland. Therefore, the Regulation was based on the guidelines of the International Atomic Energy Agency (IAEA) pertaining to radioactive waste management prior to their disposal, disposal of radioactive waste, supervision and monitoring of surface radioactive waste disposal facilities, periodical safety assessments of nuclear facilities, safety assessments of nuclear facilities and surface radioactive waste disposal facilities, as well as on fundamental safety principles developed by the IAEA. Apart from that, the reference levels for storage of radioactive waste and spent nuclear fuel, developed by the Western European Nuclear Regulators Association (WENRA), were taken into account.

3. Regulation of the Council of Ministers of 14 December 2015 amending the regulation concerning nuclear regulatory inspectors (Journal of Laws of 2016 item 29) entered into force on 23 January 2016.

This Regulation was adopted in connection with the amendments introduced by the act of 4 April 2014 on the amendment of the Atomic Law Act, which liquidated one of nuclear regulatory authorities – Chief Nuclear Regulatory Inspector and transferred its rights to the PAA President. Thanks to the regulation, it was possible to transfer to the PAA President the rights of the Chief Nuclear Regulatory Inspector in the scope covered by the amended Regulation of the Council of Ministers of 24 August 2012 concerning nuclear regulatory inspectors (Journal of Laws of 2012 item 1014), such as:

- development of traineeship programme for a can didate for a nuclear regulatory inspector,
- confirmation of traineeship attended,,
- setting the date and place of an examination and issuance of a certificate of passing the qualifying examination for the position of a nuclear regulatory inspector.

Model certificates of passing the qualifying examination for the position of 1st degree or 2nd degree nuclear regulatory inspector were also changed.

4. Regulation of the Council of Ministers of 2 September 2016 on the position important for ensuring nuclear safety and radiological protection and on radiation protection officers (Journal of Laws item 1513) - entered into force on 21 September 2016

This Regulation takes into account amendments to the Atomic Law Act made in this regard by the Act of 5 August 2015 on amendment of acts regulating the conditions of access to pursuing of certain professions.

1. These directives include: 1) Council Directive 96/29/ Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation (OJ L 159 of 29 June 1996, p. 1; OJ L EU, Polish special edition, chapter 5, vol. 2, p. 291);
2) Council Directive 2003/122/ Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and radioactive waste (OJ L 346 of 31.12.2003, p. 57; OJ L , Polish special edition, chapter 15, vol. 7, p. 694);
3) Council Directive 2009/71/ EURATOM of June 25th, 2009, establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172 of 02.07.2009, p. 18, as amended);
4) Council Directive 2011/70/ Euratom of July 19th, 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (OJ L 199 of 02.08.2011, p. 48).

3 Supervision of the use of ionising radiation sources

Fot. PAA

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 3,966 (as at 31 December 2016). The number of registered activities involving the exposure was 5,834 (as at 31 December 2016).

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.

> **LEGAL BASIS**
>
> In 2016 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).

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).

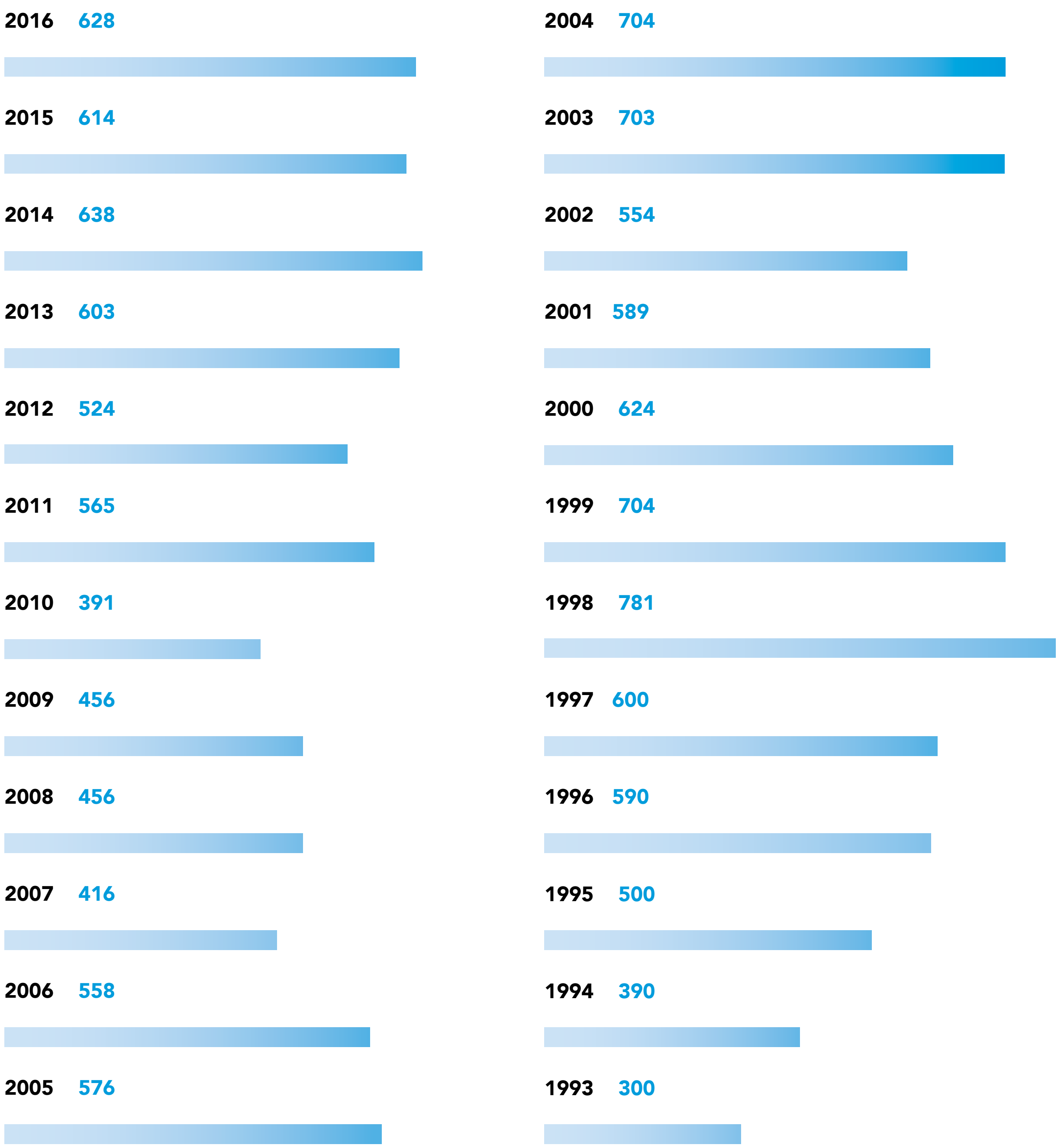
Regulatory inspections

Inspections covering organisational entities, other than nuclear facilities or radioactive waste repository, were performed by Nuclear Regulatory Inspectors from the PAA Radiological Protection Department (RPD) operating in Warsaw, Katowice and Poznań. In 2016, 717 such inspections were performed, including 6 re-inspections (i.e. second inspections performed in the same year), out of which 191 inspections were conducted by RPD inspectors from Warsaw, 331 – by inspectors from the RPD unit in Katowice and 195 – by inspectors from the Poznań unit. Prior to commencement of every inspection, a detailed analysis was performed covering documentation concerning the inspected organisational entity and the activity it conducts from the perspective of initial assessment of potential "critical points" of the activity conducted and the quality system deployed at the given unit.

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

FIGURE 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 1993-2016



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 2016 have been provided in Table 1.

Register of sealed radioactive sources

LEGAL BASIS
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 authorities for purposes of mutual cooperation and statistics.

The register contains data of 25,392 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.

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1,806
SOURCES OF CATEGORY 1

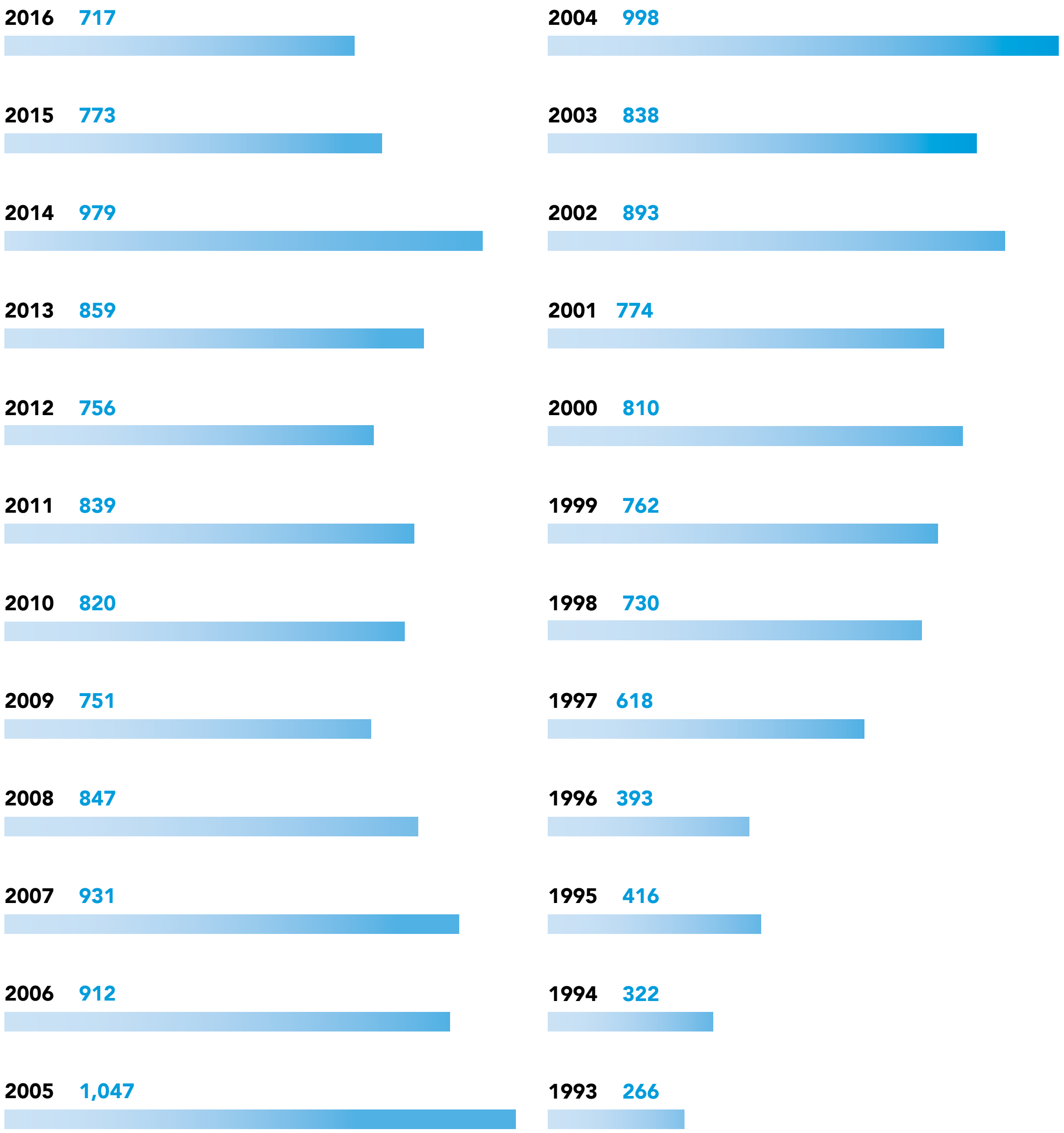
2,685
SOURCES OF CATEGORY 2

8,102
SOURCES OF CATEGORY 3

TABLE 1.
Users of ionising radiation sources in Poland in numbers (as at December 31, 2016)

				NUMBER OF AUTHORISATIONS ISSUED IN 2016			INSPECTIONS	
Activity type	Symbol	Number of entities	Number of activity types	licenses	annexes	registration decisions	Number of inspections in 2016	Inspection frequency
Class I laboratory	I	1	1	1	0	0	1	annually
Class II laboratory	II	94	107	6	20	0	41	every 2 years
Class III laboratory	III	124	242	12	4	5	28	every 3 years
Class Z laboratory	Z	108	199	13	9	2	40	every 4 years
Smoke detector service	UIC	372	372	5	2	0	13	ad hoc inspections
Device service	UIA	168	197	31	15	0	43	every 3 years
Isotope devices	AKP	556	696	23	28	11	109	every 3 years
Manufacture of isotope sources and devices	PRO	28	32	2	3	0	13	every 3 years
Trade in isotope sources and devices	DYS	76	85	4	5	5	8	ad hoc inspections
Accelerator	AKC	77	156	14	24	0	70	every 2 years
Isotope applicators	APL	37	53	6	13	0	26	every 2 years
Telegamma therapy	TLG	5	5	0	1	0	1	every 2 years
Radiation device	URD	36	37	0	1	0	13	every 3 years
Gamma graphic apparatus	DEF	111	113	3	8	0	59	every 2 years
Storage facility of isotope sources	MAG	120	145	72	4	0	28	every 3 years
Work with sources outside registered laboratory	TER	56	62	6	4	2	5	every 3 years
Transport of sources or waste	TRN	488	499	6	7	0	12	ad hoc inspections
Chromatograph	CHR	227	275	0	0	1	3	ad hoc inspections
Veterinary X-ray apparatus	RTW	1,083	1,128	114	2	0	15	ad hoc inspections
X-ray scanner	RTS	471	609	41	18	0	9	ad hoc inspections
X-ray defectoscope	RTD	206	229	9	14	0	95	every 2 years
Other X-ray apparatus	RTG	399	592	49	29	0	83	every 7 years
Total			**5,834**	**417**	**211**	**26**		

FIGURE 4.
The number of inspections conducted by PAA inspectors in years 1992-2016



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

Category 1 – sealed radioactive sources used in such fields as: teleradiotherapy in medicine, industrial radiography, radiation technologies.
The register contains 1,806 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 2,685 sources of this category.

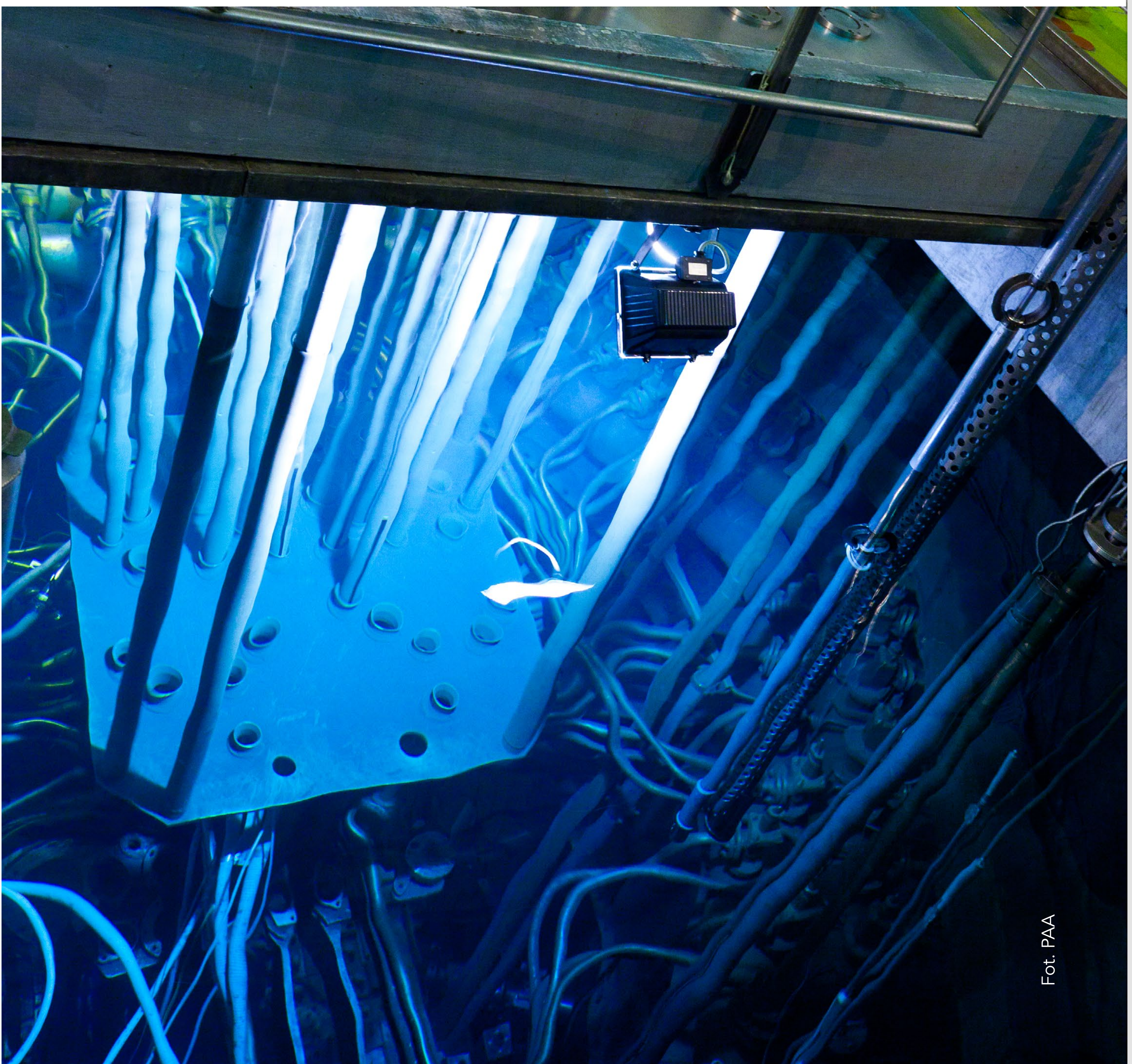
Category 3 – other sealed radioactive sources, including those used in stationary control and measurement instruments.
The register contains 8,102 sources of this category.

TABLE 2.
Examples of radioactive isotopes and sources containing them, classified under individual categories (as at 31 December 2016)

Isotope	cat. 1	cat. 2	cat. 3
Co-60	791	1.357	2,111
Ir-192	465	113	1
Cs-137	81	290	2,318
Se-75	439	37	5
Am-241	10	416	893
Pu-239	2	114	103
Ra-226	-	79	63
Sr-90	-	37	834
Pu-238	1	81	22
Kr-85	5	27	193
Tl-204	-	-	97
inne	12	134	1,462
Total	1,806	2,685	8,102

4

Supervision of nuclear facilities



Fot. PAA

Nuclear facilities in Poland

Nuclear facilities in Poland include:

- MARIA research reactor with its technological pool where spent nuclear fuel is stored during the facility operation,
- EWA research reactor (subject to decommissioning),
- spent nuclear fuel storages.

These facilities are administered by two separate organisational entities:

- The MARIA research reactor — by the National Centre for Nuclear Research (NCBJ) based in Świerk near Otwock,
- The EWA research reactor as well as spent nuclear fuel storages - by 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 research reactor

The MARIA research reactor is historically the second nuclear reactor built in Poland (disregarding the critical assemblies of ANNA, AGATA and MARYLA) and at present, it is the only reactor operated in the country. It is a high-flux pool-type reactor with the nominal thermal power of 30 MWt and the thermal neutrons maximum flux density in the core of $3{,}5 \cdot 10^{18} n/(m^{2} \cdot s)$. The MARIA research reactor was commissioned in 1974, 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, 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 research reactor core.

In 2016, the reactor operation schedule was adapted to:

- demand for irradiation of uranium plates required for production of molybdenum-99 for an American company, Mallinckrodt Pharmaceuticals, and the task was performed in 21 fuel cycles during which the uranium

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

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 5 provides statistics concerning the irradiation of target materials (from 1978 to 2016, inclusive).

The MARIA reactor's technological pool is mainly used for the storage of spent MC nuclear fuel from the current operation of the reactor. The number of fuel elements as at 31 December 2016 was 36.

In 2016, the MARIA reactor remained in service for 4,862 hours, working in 36 fuel cycles, as illustrated in Figure 6.

General information on the reactor operation has been presented in Table 3.

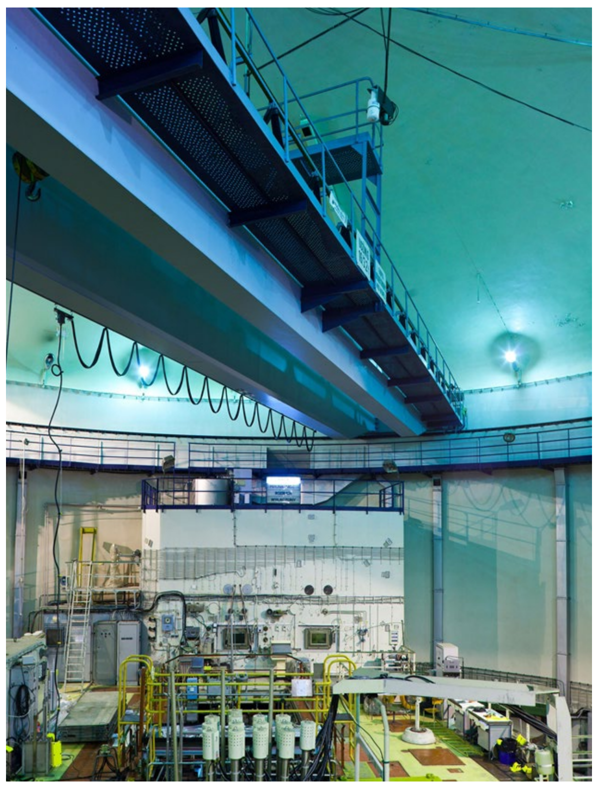
Compared to the preceding year, the overall number of unplanned shutdowns decreased significantly. The unplanned shutdowns were caused by minor losses of electrical power and instrumentation errors, not constituting a risk. On the other hand, the number of tests, inspections and maintenance in comparison with the preceding year increased by about 12%.

The MARIA research reactor has also been used for physical studies, mainly of condensed matter, using six horizontal channels (H-3 to H-8). The total opening time of these channels in 2016 came to ca. 6,220 hours.

EWA reactor under decommissioning

The EWA research reactor was operated in the years1958–1995. 2 MWt, 10 MWt. 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. Low enriched spent nuclear fuel marked



Fot. PAA

FIGURE 5.
Materials irradiated in the MARIA reactor until 2016 (NCBJ).

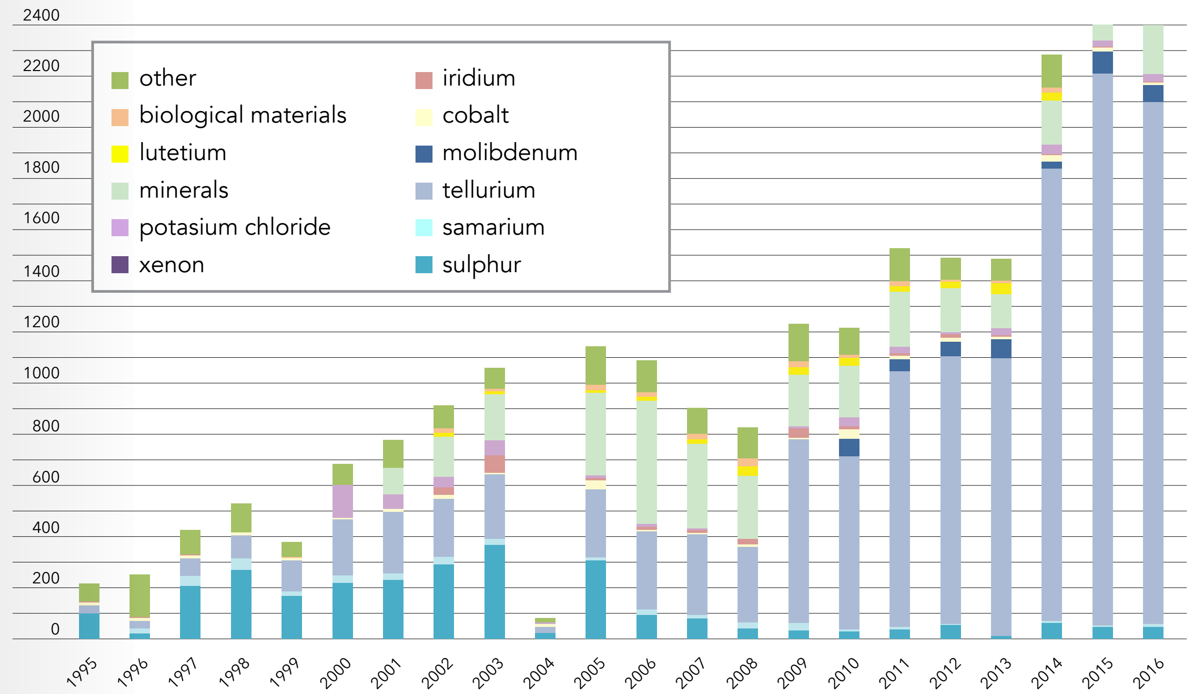


FIGURE 6.
Summary of the MARIA reactor operation cycles in 2016
(NCBJ. Developed and prepared by Andrzej Frydrysiak – DOM EJ2).

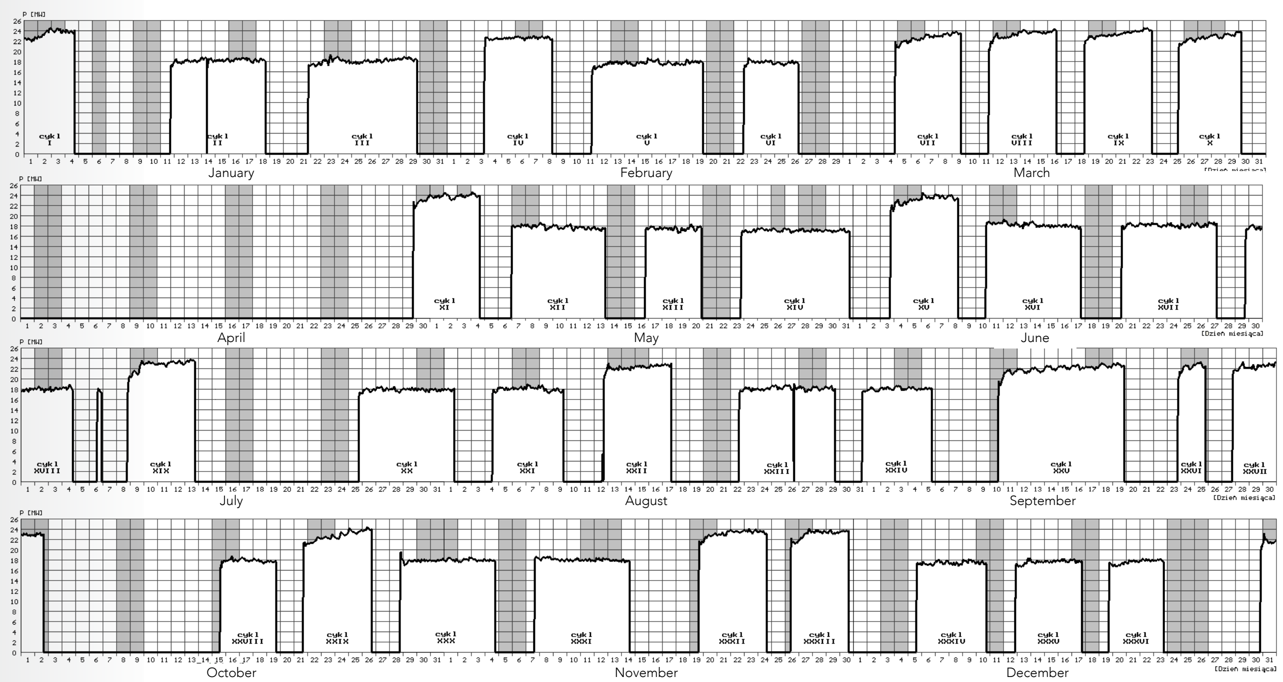


TABLE 3.
General information concerning operation of the MARIA reactor in 2016

Quarter	I	II	III	IV	total
Number of cycles	10	7	10	9	36
Time of operation at nominal power [h]	1 361	1 032	1 347	1 122	4 862
Reactor power [MWt]	0.3-24	0.3-25	0.5-25	17-25	-
Number of fuel elements in the core	26	25/26	26	26	-
Unplanned shutdowns and trips	1	0	1	0	2
Causes					
Human error	0	0	0	0	0
Leakage	0	0	0	0	0
Instrumentation error	0	0	1	0	1
Loss of electrical power	1	0	0	0	1
Malfunctions/defects and non-conformity found	3	2	3	0	8
Repair and maintenance works conducted	5	7	7	10	29
Tests, inspections and checks conducted	21	36	22	45	124

with the EK-10 symbol, which had been used at the initial stage of the EWA reactor's operation in the years 1958–1967, was encapsulated in the hot cell.

Spent nuclear fuel storages

The category of nuclear facilities also includes wet spent nuclear fuel storages, i.e. facilities no. 19 and 19A operated since January 2002 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.

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.

The following decisions were issued in 2016, amending the above licenses:

- Decision no 1/2016/NCBJ of 3 April 2016 - Amendment of license no 2/2015/NCBJ concerning the technology of encapsulation of spent MR nuclear fuel designated for shipment in 2016,
- Decision no 2/2016/NCBJ of 3 April 2016 - Amendment of license no 2/2015/NCBJ concerning the technology of encapsulation of spent MR nuclear fuel designated for shipment in 2016,
- Decision no 3/2016/NCBJ of 5 September 2016 - Amendment of license no 2/2015/NCBJ, permitting for loading of spent fuel in capsules to TUK-19 containers,
- Decision no 1/2016/Maria of 9 September 2016 - 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 2/2016/Maria of 18 November 2016 - Amendment of license no 1/2015/Maria associated with placing in service of fuel and molybdenum channel tubes made of E110 alloy.

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. The license was amended in 2016 by the following decision:

- Decision no 1/2016/ZUOP of 5 September 2016 in association with planned shipment of spent nuclear fuel from Poland to the Russian Federation.

Regulatory inspections

In 2016, Nuclear Regulatory Inspectors from PAA's Nuclear Safety Department performed 14 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:

- 9 inspections at the National Centre for Nuclear Research,
- 4 inspections at the Radioactive Waste Management Plant, including at the National Radioactive Waste Repository in Różan (KSOP),

• 1 inspection associated with shipment from Poland of spent nuclear fuel from the MARIA research reactor.

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 2015,
• proper functioning of the neutron counting instruments and the safety interlock system,
• proper functioning of the process inspection system apparatus,
• radioactive waste management,
• technical condition of the fuel channel cooling system, the pool cooling system, the stabiliser system and the core emergency flooding system,
• operation of power generators and accumulator batteries,
• operation of warning and emergency signalling,
• keeping proper order at all workstations in a nuclear facility and supervision over external units performing outsourced works for a nuclear facility.

In addition, the inspectors conducted the inspections related to provision of physical protection of nuclear facilities and verification of the NCBJ emergency plan.

The inspections conducted in the Radioactive Waste Management Plant (ZUOP) were related to:
• status of radiological protection of the facilities operated by the ZUOP,
• functioning of the system of physical protection of transport and reloading of spent nuclear fuel,
• carrying out the processes of radioactive waste disposal and radioactive waste storage,
• keeping records of incoming and stored radioactive waste.

The inspection carried out at the KSOP in Różan which belongs to the ZUOP, was 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,
• measurement of ionising radiation dose rate in selected points of the KSOP,
• status of operation of the facilities of the National Radioactive Waste Repository in Różan.

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 authorities cooperate with other public administration authorities through a coordination system. The cooperating authorities include the Office of Technical Inspection, the National Fire Service, environmental protection inspection authorities, building control authorities, State Sanitary Inspection authorities, the National Labour Inspectorate and the Internal Security Agency (ABW).

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 authorities 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 2016, activities within the framework of the coordination system included:

• continuation of collaboration between PAA and ABW in assessment of documentation of the physical protection system at the NCBJ, participation of the ABW in organisation and conducting of the International Physical Protection Advisory Service Review Mission of the International Atomic Energy Agency, which took place in Poland from 22 February to 4 March 2016. During the Mission, the Polish legal and regulatory framework for physical protection of nuclear materials and facilities was reviewed, as well as the physical protection systems of the MARIA research reactor, the RWPM, as well as the National Radioactive Waste Repository;
• consideration of the opinion of the District Building Control Inspector in Maków Mazowiecki in the procedure concerning issue of license for storage of radioactive waste in facility no 8a of the National Radioactive Waste Repository in Różan;
• collaboration with the Office of Technical Inspection (OTI), concerning experience of the OTI with implementation of the integrated management system, taking into account, in particular, the standard ISO/IEC 17020:2012, concerning requirements for various types of entities, conducting inspections;
• joint participation of the UDT and the PAA in a workshop concerning the issues of supervision of commissioning of nuclear power plants; the workshop was organised by NEA/OECD Working Group on Regulation of New Reactors in Gyeongju city in Korea.

Fot. PAA

NUCLEAR POWER PLANTS IN NEIGHBOURING COUNTRIES

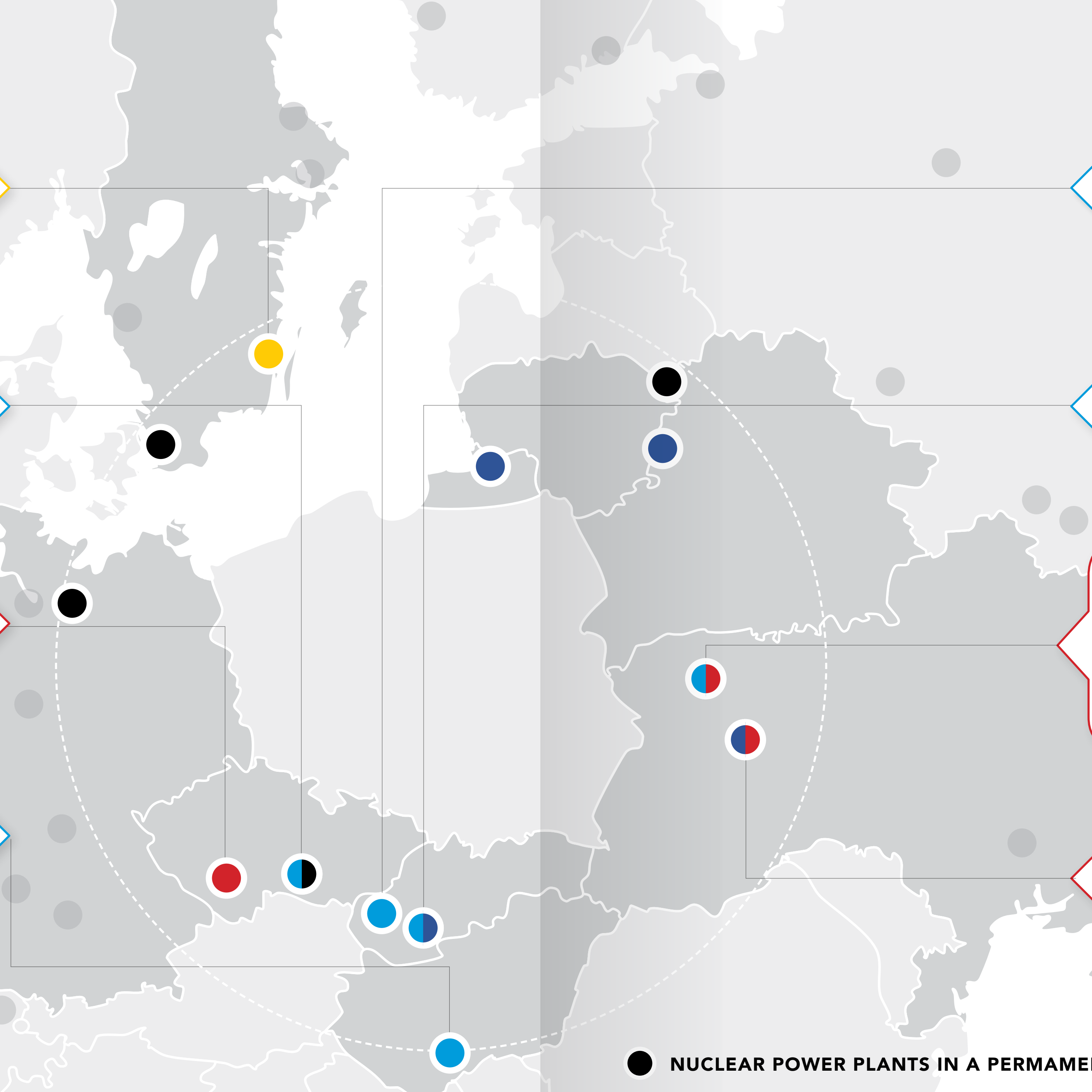
In a distance not larger than 300 km from Polish borders, there are 8 nuclear power plants operating 23 power reactor units with the total capacity of ca. 15 GWe

8 NUCLEAR POWER PLANTS OPERATING

14 VVER-440 REACTORS

6 VVER-1000 REACTORS

3 BWR REACTORS



		PL	
SWEDEN	Oskarshamn NPP	298 km	3 BWR units: 492 MWe, 661 MWe, 1450 MWe
CZECH REP.	Dukovany NPP	119 km	4 VVER-440 units: 500 MWe, 500 MWe, 500 MWe, 500 MWe
CZECH REP.	Temelin NPP	192 km	2 VVER-1000 units: 1080 MWe, 1080 MWe
HUNGARY	Paks NPP	300 km	4 VVER-440 units: 500 MWe, 500 MWe, 500 MWe, 500 MWe
SLOVAKIA	Bohunice NPP	138 km	2 VVER-440 units: 505 MWe, 505 MWe
SLOVAKIA	Mochovce NPP	133 km	2 VVER-440 units: 470 MWe, 470 MWe
UKRAINE	Rivne NPP	134 km	2 VVER-440 units: 420 MWe, 415 MWe; 2 VVER-1000 units: 1000 MWe, 1000 MWe
UKRAINE	Khmelnytskyi NPP	184 km	2 VVER-1000 units: 1000 MWe, 1000 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

NUCLEAR POWER PLANTS IN A PERMAMENT SHUTDOWN STAGE

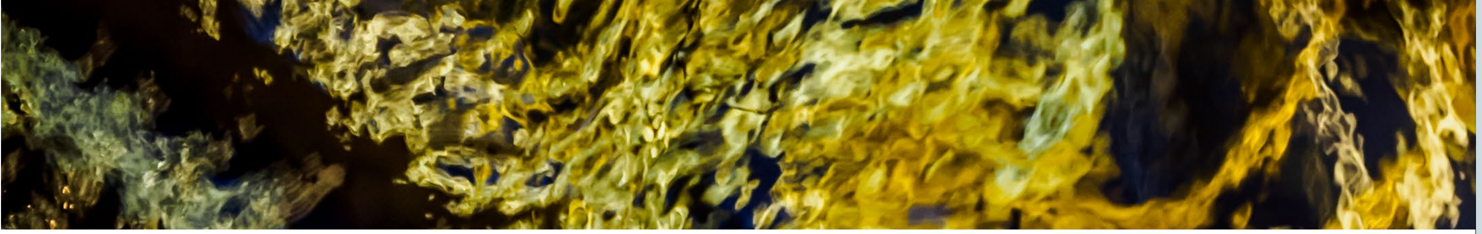
Ignalina NPP (Lithuania) – 2 type RBMK 1300 MWe units, shut down in 2004 and 2009

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

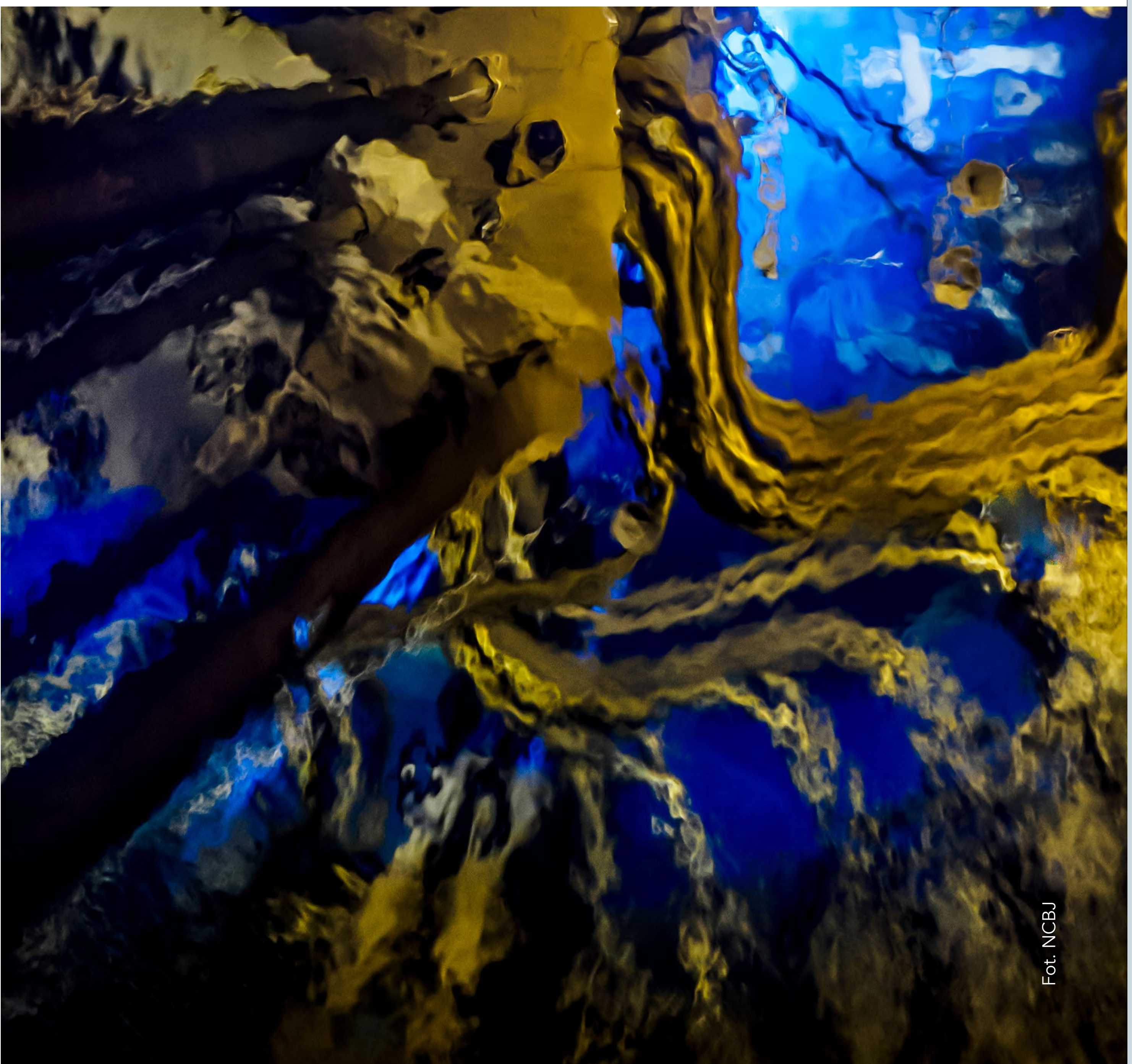
Bohunice NPP (Slovakia) – 2 type WWER-440 440 MWe units, shut down in 2006 and 2008

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

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



5 Safeguards



Fot. NCBJ

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 (OJ L 54 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.

Balance of nuclear material in Poland (status as of 31 December 2016).

plutonium **2,4 kg**

High enriched uranium **7,5 kg**

Low enriched uranium **330,5 kg**

Natural uranium **3 918 kg**

Depleted uranium **21 801 kg**

Thorium **276 kg**

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.

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.

Users of nuclear materials in Poland

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**);
- 31 medical and research facilities using small quantities of nuclear material and 95 industrial, diagnostic and service facilities equipped 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.

Inspections of nuclear material safeguards

In 2016, 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. The EURATOM inspectors participated in 22 inspections, whereas the IAEA inspectors participated in one inspection in WPLC. Moreover, the IAEA inspectors carried out a so called "short notice inspection" and one inspection without any notice, in which the PAA inspector participated.

During the short notice inspection, the IAEA inspectors informed that a complementary access would be conducted at the Faculty of Physics and Applied IT Sciences of AGH University of Science and Technology in Krakow. The aim of the complementary access, which took place on 23 November 2016, was to confirm that were no undeclared activities performed and no undeclared nuclear material on the premises. In particular, it was confirmed that the Faculty held the structural components of WANDA reactor (UR-100), shipped to the Faculty of Physics of the AGH in 1985, the construction of which was never completed. As a result of the access, it was confirmed that unused structural components of the reactor were held on the premises of the AGH. At the same time, IAEA requested updating of information in accordance with Article 2.3a (iii) of the Additional protocol and concerning the WANDA reactor.

The purpose of inspections conducted in 2016 at the WPLD were also aimed at verification of progress in implementation of recommendations of the European Commission, based on the audit conducted on 14 - 16 July 2015. During the audit, representatives of the European Commission assessed management of the accounting and control system, registration of movement of nuclear material (isotope transport containers) and data processing. As a result of the audit, a number of conclusions were formed, which, upon their implementation, will improve the internal records and control of nuclear material at the Radioisotope Centre POLATOM.

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.

6 Transport of radioactive material

Transport of radioactive sources and waste

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** (International Maritime Dangerous Goods Code)
- **ICAO** Technical Instructions
- **IATA DGR** (International Air Transport Association – Dangerous Goods Regulation).

In accordance with the international regulations, radioactive material is categorised under Class 7 on account of the ionising radiation being the predominant threat involved. 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)

In 2016, 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.

transport of radioactive substances and nuclear material to Poland. These attempts are prevented by the National Border Guard having 317 fixed radiation portal monitors installed at border crossing points and 1,265 mobile signalling and measurement devices at their disposal.

In 2016, the National Border Guard units performed the inspections as follows:

- shipments of radioactive sources:
  - regarding import to Poland – 799 inspections,
  - regarding transit through and transport out of Poland – 2842 inspections
- shipments of materials containing naturally occurring radioactive isotopes:
  - regarding import to Poland – 4171 inspections,
  - regarding transit through and transport out of Poland – 9234 inspections,
- persons treated or diagnosed with radioactive isotopes – 991 inspections.

As a result of the inspections performed, the National Border Guard detained 12 shipments for further clarification due to the lack of required authorisations for import and transport of radioactive substances and exceedance of the admissible radioactive contamination thresholds.

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. It included state-of-the-art stationary devices, which supported the activities of the National Border Guard at one of the airports and on the eastern border of Poland, being the external border of the EU at the same time. Furthermore, the meetings of the National Board Guard with the experts from the Energy Department of the United States of America were held in connection with the preparation of further installations of stationary equipment on the eastern border and at seaports and airports in 2017.

Transport of nuclear fuel

Fresh and spent nuclear fuel is transported under an authorisation granted by the PAA President. In 2016, there was only one shipment of spent nuclear fuel performed in the territory of Poland.

Fresh nuclear fuel

In 2016, there were no shipments of fresh nuclear fuel.

Spent nuclear fuel

The final shipment of spent high enriched nuclear fuel (with the U-235 enrichment above 20%) from the MARIA research reactor to the Russian Federation took place. In the years 2009–2014, there were seven such shipments of spent high enriched nuclear fuel from Polish research reactors of EWA and MARIA. The entire process is associated with implementation of the Global Threat Reduction Initiative (GTRI) which consists in a transition of research reactors from using high enriched fuel produced in the former Soviet Union to low enriched fuel. Shipments are managed by the ZUOP. The PAA President, on the other hand, is responsible for issuing authorisations for the transport and supervises its performance.

Fot. ME

7

Radioactive waste

Fot. PAA

Handling of radioactive waste

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

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, 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).

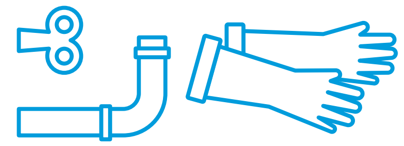
Processing and disposal of radioactive waste require reduction of its production quantity, its appropriate segregation, decrease of volume, solidification and packaging in a manner ensuring that all the measures undertaken and barriers provided effectively isolate the waste from people and the environment.

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

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 half-life.

LIQUID FORM

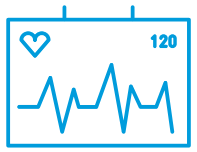
– mainly constitutes aqueous solutions and suspensions of radioactive substances.

GASEOUS FORM

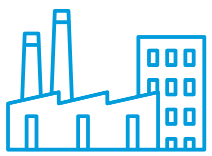
– is produced as a consequence of operation of the MARIA research reactor. It mainly comprises radioactive noble gases, iodine, caesium and tritium.

INFOGRAPHIC

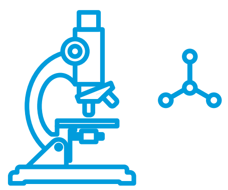
Radioactive waste is generated as a result of activities with radioactive sources in:



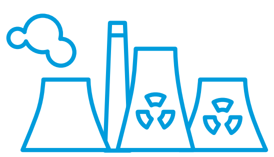
MEDICINE



INDUSTRY



SCIENTIFIC RESEARCH



OPERATION OF A RESEARCH REACTOR

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

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 processing.

ZUOP renders its services against payment, however, the revenue generated from this activity covers only a part of costs incurred by this enterprise. In 2016, 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 the only near-surface type repository in Poland, 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 Różan repository has been in operation since 1961, and it is the only facility of this type in Poland.

Due to the fact that the disposal space is running short, the repository is scheduled to be prepared for closure in the years 2021–2024 and for ultimate closure in 2025-2029 (as stipulated in the National Plan for Radioactive Waste and Spent Nuclear Fuel Management).

In 2016, ZUOP received 278 orders covering collection of radioactive waste from 176 institutions. Quantities of radioactive waste collected and processed by ZUOP (including the waste generated at ZUOP) have been provided in Table 4.

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

- Low-level waste (solid) – 29.75 m^3
- Intermediate-level waste (solid) – 0.16 m^3
- Low-level waste (liquid) – 18.59 m^3
- Intermediate-level waste (liquid) – 0.00 m^3
- Alpha radioactive waste (liquid) – 0.63 m^3
- smoke detectors – 23,805 pcs.
- disused sealed radioactive waste – 1,285 pcs.

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

In 2016, the National Radioactive Waste Repository received 218 drums of 200 litres with processed radioactive waste as well as 12 hobbocks of 50-litre containing 7663 disused radioactive sources. Additionally, 1 non--standard package was delivered to the repository. Disused radioactive sources which are not subject to processing (there were 86 containers with 143 disused radioactive sources and 69 shielding containers with 616 disused radioactive sources) are sealed in separate containers. Processed solid waste was delivered to the repository in the quantity of 46.34 m^3 with the total activity of 1,813 GBq (as at 31 December 2016).

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 author-

TABLE 4.

Quantities of radioactive waste collected by ZUOP in 2016

Sources of waste	Solid waste [m^3]	Odpady ciekłe [m^3]
From outside of the Świerk Nuclear Centre (medicine. industry. scientific research)	5.47	0.43
National Center for Nuclear Research /Radioisotope Centre POLATOM	18.16	0.16
National Center for Nuclear Research + MARIA research reactor*	5.13	18.00
Radioactive Waste Management Plant	1.15	0.00
Total:	29.91	18.59

* Total number of waste from the MARIA research reactor and the National Centre for Nuclear Research.

INFOGRAPHIC

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

Low-level waste (solid) 29.75 m^3

Intermediate-level waste (solid) 0.16 m^3

Low-level waste (liquid) 18.59 m^3

Intermediate-level waste (liquid) 0.00 m^3

Alpha radioactive waste (liquid) 0.63 m^3

smoke detectors
23,805 pcs.

disused sealed radioactive waste
1,285 pcs.

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

ising 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 2016, Nuclear Regulatory Inspectors from PAA's NSD performed two inspections on radioactive waste management at ZUOP, including:

- one inspection at KSOP in Różan, comprising measurements of ionizing radiation dose rate in selected points of the repository, review of documentation of the waste received for disposal, review of the functioning of physical protection system and observance of principles of radiological protection and the status of operation of the repository facilities;
- one inspection of ZUOP facilities within the area of the nuclear centre in Świerk which covered technological processes of radioactive waste processing, in particular the concentration of waste in the evaporator, as well as the status of radiological protection of facilities managed by ZUOP.

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. In the case of one non-conformity found during the inspection of the KSOP, administrative proceedings were initiated.

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.

LOW LEVEL | INTERMEDIATE LEVEL | HIGH LEVEL

- 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

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.

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

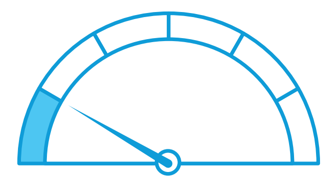
The basic national normative act which specifies the aforementioned limits is the Regulation of the Council of Ministers of 18 January 2005 on ionising radiation dose limits (Journal of Laws of 2005, no. 20, item 168).

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

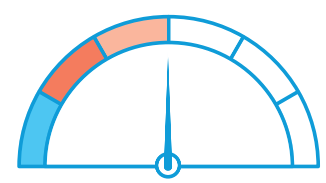
A dose limit for the entire population expressed in terms of an effective dose amounts to 1 mSv in a calendar year. This dose may be exceeded in the given calendar year on a condition that, within the period of the next five years, its total value does not exceed 5 mSv.

The value of an effective dose, to which a statistical Pole is exposed consists of three components:

- 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.



1 year = 1 mSv



5 years < 5 mSv

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

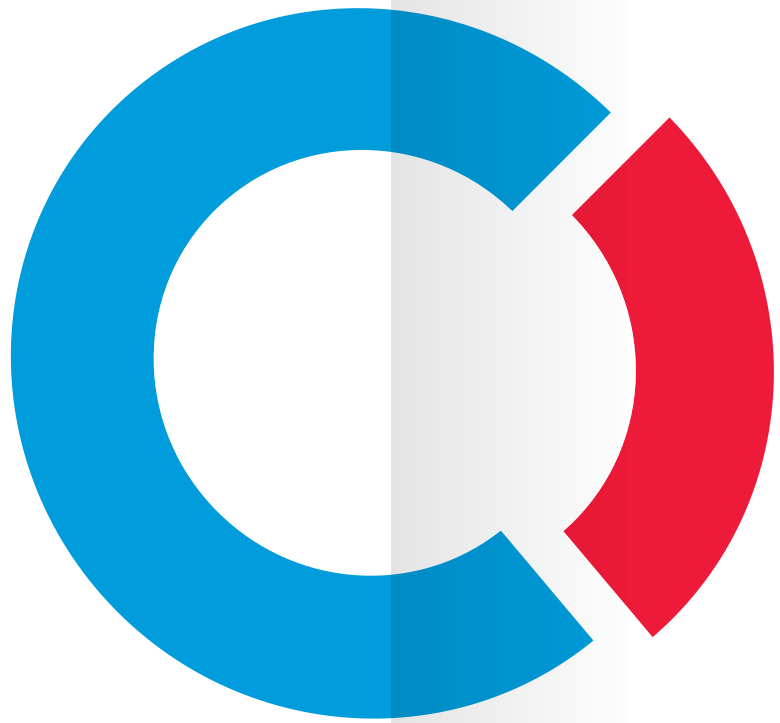
3.55 mSv

the annual effective dose of ionising radiation, received by a statistical inhabitant of Poland n 2016

NATURAL SOURCES

68.6%

2.432 mSv



RADON
33.9% **1.201 mSv**

GAMMA RADIATION
13.1% **0.463 mSv**

COSMIC RADIATION
11.0% **0.390 mSv**

INTERNAL RADIATION
8.1% 0.277 **mSv**

THORON
2.8% **0.101 mSv**

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

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

0.005 mSv
exposure to radionuclides in foodstuffs (corresponds to 0.5% of a dose limit for the population)

ARTIFICIAL SOURCES

31.4%

1.113 mSv

MEDICAL DIAGNOSTICS
31.1% **1.201 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:

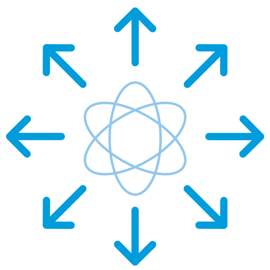
- mammography tests **0.02 mSv**
- single X-ray examination **1.2 mSv**
- chest X-ray **0.11 mSv**
- spine and lungs X-ray **3 mSv - 4.3 mSv**

DEFECTS
0.15% **0.005 mSv**

OTHERS
0.15% **0.006 mSv**

INFOGRAPHIC

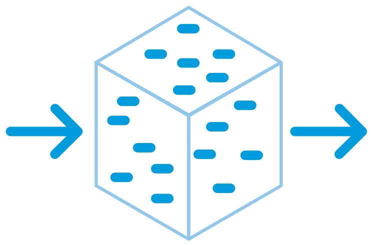
Basic terms and units in radiological protection



RADIOACTIVITY

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

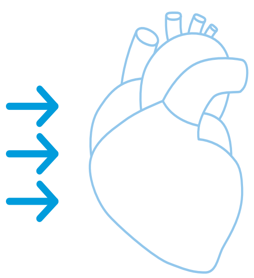
Bq
BEKEREL



ABSORBED DOSE

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

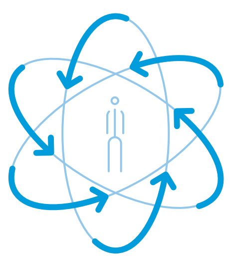
Gy
GREJ



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
SIWERT



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
SIWERT

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 2016 amounted to the average of 3.55 mSv. The percentage share of various radiation sources in this exposure has been presented in infographic.

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.

Exposure from natural sources comprises 68.6% of the total effective dose and amounts to ca. 2.432 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 2016 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. In mammography tests, the annual effective dose received by a statistical inhabitant of our country amounts to 0.02 mSv.

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:

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

The range of variability for the aforementioned amounts as regards individual examinations may even reach two orders of magnitude, and may result from the quality of instruments and examination conditions which may depart significantly from standard examination conditions.

Moreover, the foregoing data may change in the future due to the fact that the X-ray equipment which does not meet requirements provided for in Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionising radiation in relation to medical exposures and repealing Directive 84/466/Euratom, is subject to successive replacement.

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.

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 artificial radionuclides – mainly isotopes of caesium and strontium, whereas the exposure to radionuclides in foodstuffs has been estimated at ca. 0.005 mSv (which corresponds to 0.5% 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 "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 2016, 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 "Control of exposure to ionising radiation at work") came to ca. 0.002 mSv in 2016, which corresponded to 0.2% of the dose limit.

In 2016, 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. 0.005 mSv, i.e. 0.5% of a dose limit for artificial radioactive isotopes for the entire population, which is 1 mSv per annum, and only 0.14% 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 2016, 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.

The principles applicable to exposure control are included in Chapter 3 of the Atomic Law, dedicated to nuclear safety, radiological protection and protectionof 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 2016 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 Krakow,
- Radiological Protection Unit, of the J. Nofer Institute of Occupational Medicine in Łódź,
- Department of Dose Control and Calibration of the Central Laboratory for Radiological Protection in Warsaw,
- 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 – Laboratory of Radiometry of the Central Mining Institute in Katowice.

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 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 are obliged to send data concerning exposure of subordinate category A workers to the central register of individual doses maintained by the PAA President. 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 a few 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. The control of individual doses in Poland (according to data provided by the aforementioned authorised laboratories) in 2016 covered 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 the end of April 2017, the total number of 5,697 persons were reported, and data of 2,384 from among those reported were updated within the past

TABLE 5.
Statistics on individual annual effective doses of workers classified under category A of exposure to ionising radiation in 2016

Annual effective dose received [mSv]	Number of employees*
< 6	1548
6 ÷ 15	37
15 ÷ 20	10
20 ÷ 50	3
> 50.0	0

* According to notifications to the central register of doses submitted until 30 April 2017.

four years. In 2016, data of 1,469 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). In year 2016, doses exceeding 6 mSv were received by 50 persons, among whom only three 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. Under the conditions of routine work, the head of the organisational entity must not allow for exceedance of the maximum dose limit of 50 mSv/24 months. In cases of the dose limit exceedance, working conditions and reasons for the exposure to radiation were analysed in detail.

The data summary 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 5.

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 2016, came to 97%, and the percentage of individuals who exceeded the limit of 20 mSv per annum was below 1‰. Consequently, only ca. 3% of persons exposed at work, who had been classified under category A, received doses established for workers of this category.

In 2016, the Central Register of Doses received the reports on three cases of exposure to radiation under circumstances referred to in article 16, section 1 (incidental exposure), of the Atomic Law. Two of these cases were associated with exceedance of the annual dose limit due to close contact with consignments containing preparations for medical diagnostics using isotopes during their shipment.

The third concerned a dosimeter reading, indicating exposure of a single worker above the limit dose (>40 mSv per annum) while performing an industrial radiography test.

Annual doses were also exceeded in two cases in association with routine work at a radioactive material production plant.
All cases of annual dose limit exceedance are subject to detailed explanatory investigation conducted by Nuclear Regulatory Inspectors.

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(basic source of hazard),
- 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.

According to the Central Mining Institute (WUG), the headcount of miners at hard coal mines in total amounted to: 106,456 miners, in copper ore mines and zinc and lead mines: 20,921 workers (data for December 2016).

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 6. 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

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 2016:

1.
Regulation of Minister of Economy of 28 June 2002 on occupational safety and hygiene, movement and special fire safeguards in underground mining facilities (Journal of Laws, No 124 of 2006, Item 863 as amended) regulating principles of supervision over protection against radiation hazards of natural radioactive substances and the method of the performance of measurements and assessment of radiation hazards in the underground mining plant;

2.
Regulation of Minister of Interior and Administration of 14 June 2002 on natural hazards in mining facilities (Journal of Laws No 94 of 2003, Item 841 as amended) distinguishing the following excavations:

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.

TABLE 6.
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 > 2.5	0.5 < K ≤ 2.5
Specific activity of radium isotopes present in sediments (C_{RaO}). kBq/kg	C_{RaO} > 120	20** < C_{RaO} ≤ 120

* The foregoing values correspond to doses of 1 mSv and 6 mSv, provided that the effects from particular hazard sources are not accumulated and the annual working time is 1,800 hours.
** If specific activity of radium isotopes present in sediments exceeds 20kBq/kg, an effective committed dose should be obligatorily assessed for the persons who work at this workplace.

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 (based on measurements conducted in the working environment) by the Central Mining Institute (GIG) in Katowice.

Work organization methods which prevent the exceedance of the 20 mSv dose limit were introduced in underground mining facilities, in headings exposed to radiological hazard (where workers are likely to receive an annual effective dose exceeding 1 mSv).

Table 7. contains a collation of the mines where (based on confirmed cases of exceedance of individual radiation hazard rates) 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.

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 2016, the Central Mining Institute conducted 2,992 measurements of potential alpha energy of short-lived radon decay products, 779 measurements of exposure to external gamma radiation in underground mining facilities, 585 analyses of radioactivity of mine water sampled in underground headings of hard coal mines as well as 166 analyses of concentration of radionuclides found in samples of mine water sediments.

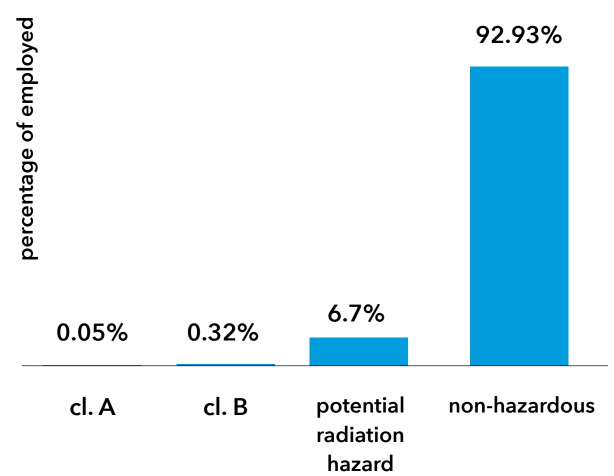
In 2016, measurements of individual doses of gamma radiation were conducted in eleven hard coal mines. In other mining facilities, no such measurements were undertaken. The employees subject to the examinations, namely 91 persons, were mainly involved in removal of radioactive mine sediments or worked 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 out that under disadvantageous circumstances 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 2 mines with active class A headings (the hazard being applicable to 0.05% of all working miners) and 17 mines with class B headings (the hazard being applicable to 0.32% of all working miners). In mine headings with slightly increased natural radiation background (yet below the level corresponding to class B), 6.7% of the total number of miners employed work, whereas 92.93% of miners work in headings where the radiation level remains on the level of natural surface background. In 2016, the maximum dose came to 7.6 mSv for the total annual working time of 1,800 hours, and ca. 3.2 mSv for the working time of 750 hours. 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.

TABLE 7.
Number of hard coal mines featuring headings with r adiological hazard (Central Mining Institute)

Hazard class	A	B
Number of mines	2	17
Hazard due to short-lived products of radon decay	-	16
Hazard due to radiation γ (environmental dosimetry)	1	4
Hazard due to radioactive sediments	2	3
External radiation γ (individual dosimetry)	1	5

FIGURE 7.
Percentage share of hard coal miners working in headings classified under individual radiation hazard classes.



In 2016, the maximum additional annual effective dose connected with individual hazard sources amounted to:
- for short-lived radon decay products – E_α = 4.5 mSv (assuming the annual working time of 1,800 hours),
- for environmental gamma radiation measurements E_γ = 4.4 mSv (assuming the annual working time in water galleries of 750 hours);
- and expressed as an effective committed dose E_{Ra} = 0.53 mSv for absorption of radium isotopes into human organism (with regard to actual working time).

In accordance with the requirements of the Atomic Law concerning controlled and supervised areas, underground headings classified under category B (supervised area) should be reclassified to category A (controlled area) in cases when there is the possibility of contamination spread, e.g. during the performance of works connected with removal of sediments or effluents.

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. In 2016, 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 individual 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.

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 2016, training courses were attended in total by 580 persons. Information on entities, which conducted the training courses, can be found in Table 8.

In 2016, 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.

Having passed the examination and fulfilled all the remaining conditions required to obtain the relevant authorisations, 180 persons were granted authorisations of a radiation protection officer and 392 persons received authorisations enabling them to be employed at positions of special importance for ensuring nuclear safety and radiological protection, including:
- 276 persons – authorisations of an operator of ac celerators for medical applications and of teleradiotherapy devices and/or devices used in brachytherapy involving radioactive sources,
- 116 persons – authorisations of an accelerator operator applied in applications other than medical.

Moreover, 10 persons were granted authorisations to be employed at work positions associated with performance of tasks of significance for ensuring of nuclear safety and radiological protection in organisational entities performing activities comprising commissioning, operation or decommissioning of nuclear facilities including:
- 3 persons – research reactor operator,
- 1 person – research reactor dosimetrist,
- 1 person – research reactor manager,
- 1 person – research reactor shift manager,
- 1 person - head of the Radioactive Waste Management Plant and head of a radioactive waste repository,
- 1 person - expert for record keeping of nuclear materials,
- 2 persons - spent nuclear fuel storage operator.

In 2016, the total number of 582 persons received authorisations of a radiation protection officer and authorisations to be employed at positions of special importance for nuclear safety and radiological (Figure 8).

LEGAL BASIS

Legal basis: 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)

This regulation has been in force since 20 September 2016. It has replaced the regulation of the Council of Ministers of 10 August 2012 on positions important for ensuring nuclear safety and radiological protection and on radiation p rotection officers (Journal of Laws of 2012 item 1022)

The amendment was due to entry into force of the act of 5 August 2015 on amendment of acts regulating the conditions of access to pursuing of certain professions (Journal of Laws of 2015, item 1505)

According to the new regulations, data is applicable to specific fields of expertise within a single position being of significance for ensuring nuclear safety and radiological protection.

TABLE 8.
Entities which conducted nuclear safety and radiological protection safety training in 2016

Type of authorisations	Entity name	Number of training courses held	Number of training participants	Number of authorisa-tions received**
Radiological protection officer	Central Laboratory for Radiological Protection in Warsaw	2	43	180
	Chief Technical Organisation in Katowice	2	36	
	Association of Radiation Protection Officers in Poznań	1	29	
	National Defence University in Warsaw	1	13	
Accelerator operator	Central Laboratory for Radiological Protection in Warsaw	5	81	392
	Association of Radiation Protection Officers in Poznań	10	341	
	National Center for Nuclear Research,	3	17	
	Oncology Centre, Division in Kraków	1	16	
	Oncology Centre, Division in Katowice	1	44	

* Including persons who attended training before 2015 or were authorised to take examination without an obligation to attend training.

FIGURE 8.
Number of persons who were granted authorisations of a radiation protection officer or received authorisa-tions enabling them to be employed at positions of special importance for ensuring nuclear safety and radiological protection in 2016

9

National radiation monitoring

Fot. NCBJ

In Poland, continuous radiation 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 the nuclear regulatory body 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.

Results of the national radiation 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 - am-

TABLE 9.
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 alfa 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		●

FIGURE 9.
The radiation monitoring system in Poland

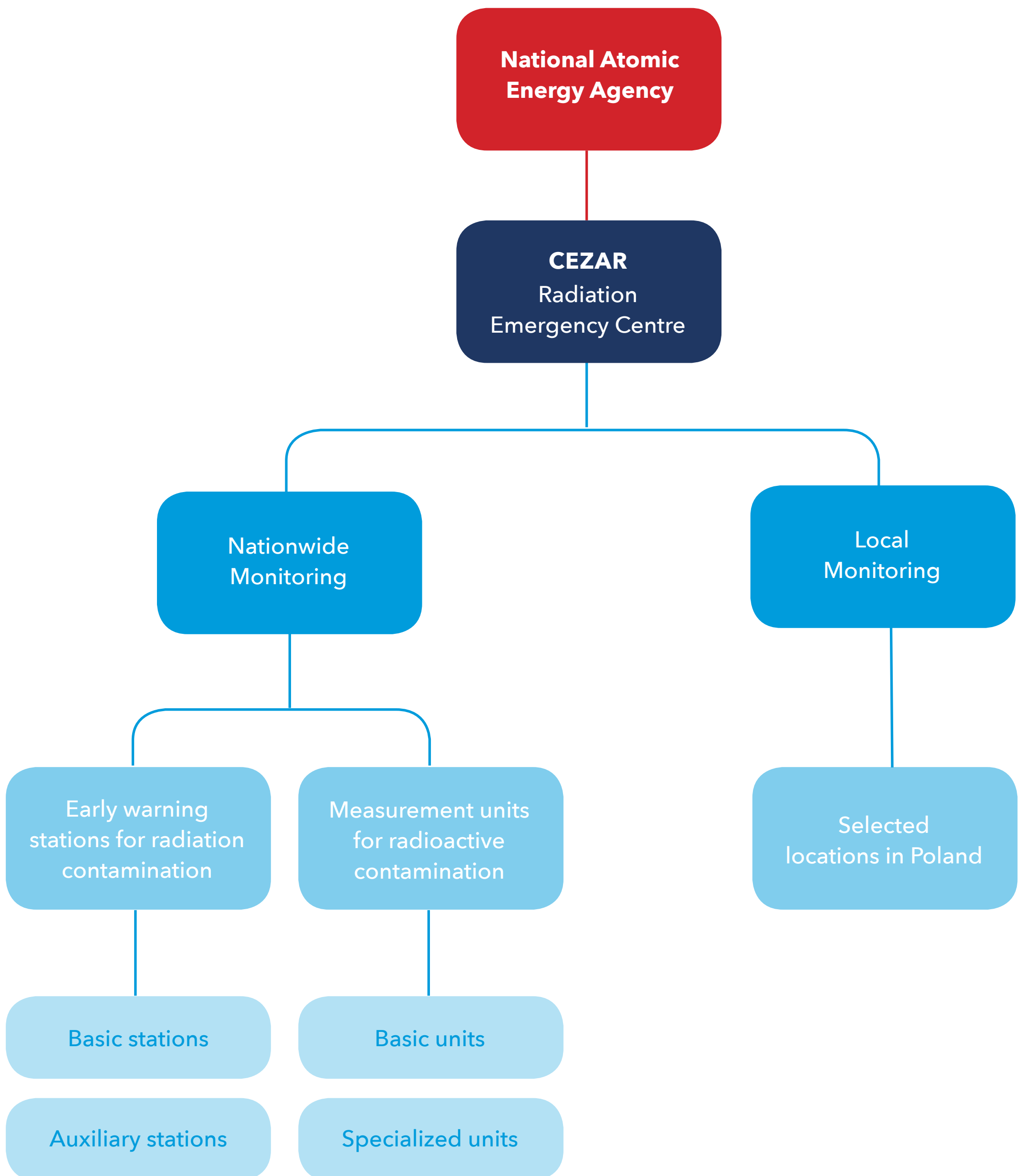


FIGURE 10.
Locations of early warning stations for radioactive contamination

FIGURE 11.
Locations of basic units monitoring radioactive contamination in Poland

bient 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 basic and auxiliary stations, as they are referred to (Figure 10).

Basic stations:
- 15 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 (IMWM) 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.

Locations of basic monitoring units have been shown in Figure 11.

Local monitoring

Nuclear Centre in Świerk

Radiation monitoring on the premises and in the vicinity of the Świerk nuclear centre was conducted in 2016 by the Laboratory of Dosimetry of the National Centre for Nuclear Research, and additionally, in the close vicinity of the Centre – by the Central Laboratory for Radiological Protection in Warsaw, commissioned by the PAA President.

The monitoring was performed in the manner described below:
- on-line (measurement every 2 minutes) gamma radiation fields are controlled at the entrance gate to the Centre and in selected places of its premises, as well as radioactive concentration in the utilities released to

7

MAJOR ACCIDENT

Fukushima, Japan, 2011

Signifi cant release of the radioactive material to the environment

Chernobyl, Ukraine, 1986

Signifi cant release of the radioactive material to the environment

6

SERIOUS ACCIDENT

Kyshtym, Russian Federation, 1957

Signifi cant 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

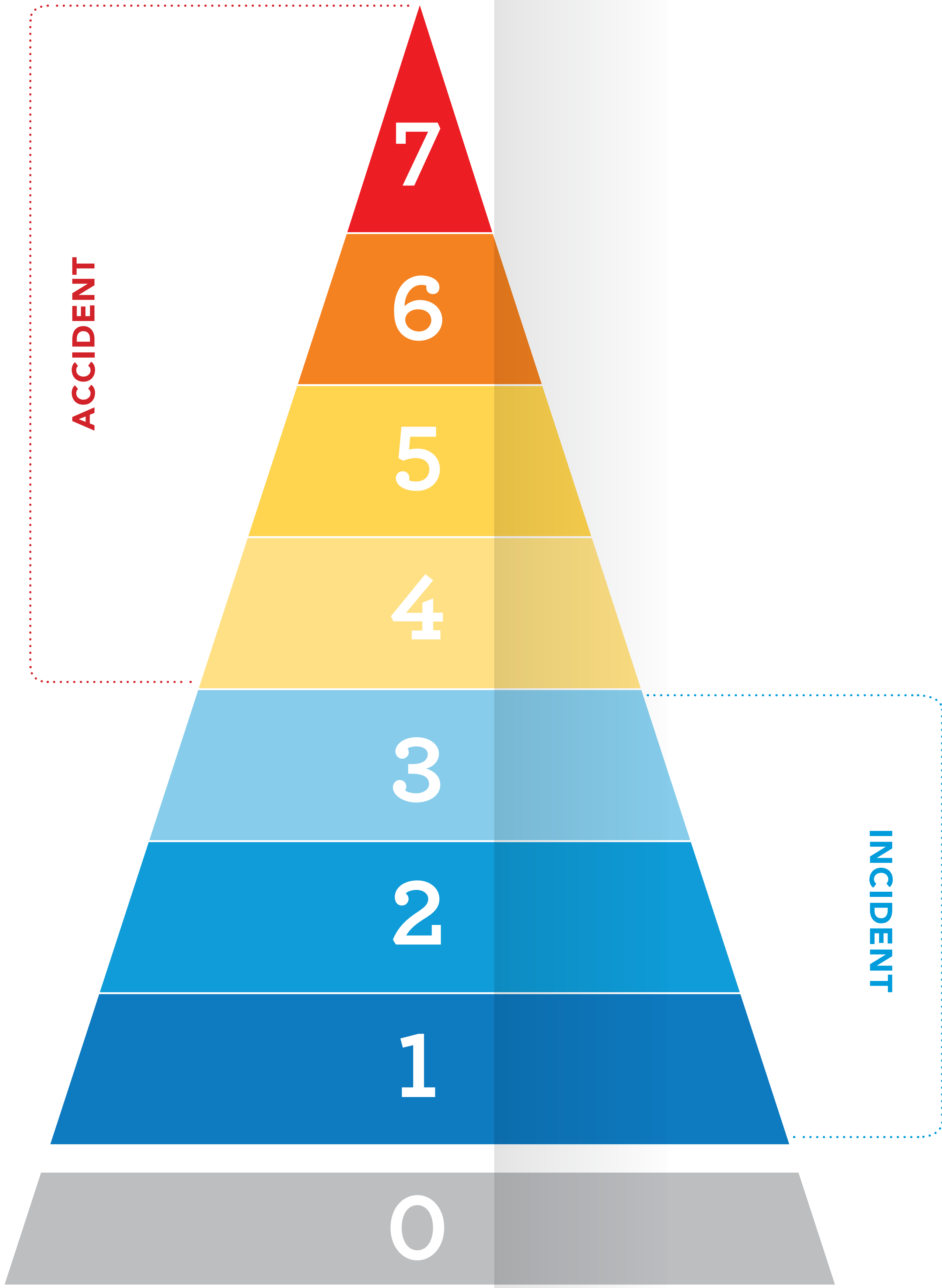
ACCIDENT WITH LOCAL CONSEQUENCES

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 131I 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 simultane-ous loss of their fl y wheel systems during reactor scram

0

BELOW SCALE

No radiation safety signifi cance.

Having compared the data from 2016 and from the preceding years, one may draw a conclusion 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 2016 was much lower than the applicable limits.

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 the following radioactive isotopes specified in Table 9.

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)

Radiation 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. "Assessment of the national radiation situation".

Areas of former uranium ore extraction and processing plants

Since 1998, the PAA division in Jelenia Góra (Office for Handling Claims of Former Workers of Uranium Ore Plants) has been implementing the "Programme of radiation monitoring of areas degraded due to uranium ore extraction and processing". In 2016 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 "Assessment of the national radiation situation – Environmental radioactivity of natural radionuclides increased due to human activity".

International exchange of radiation monitoring data

The European Union measurement data exchange system based on routine radiation 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 Radiation Emergency Centre 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).

The EURDEP system operates continuously, however:
- under normal conditions, data are updated at least once every 24 hours,
- under emergency conditions, data update should be provided at least every 2 hours,
- submitting data to the EURDEP central database should be conducted automatically ensuring that the normal and the emergency modes can be switched over (based on appropriate instructions).

Poland provides its measurement results once every hour, regardless of the mode of operation.

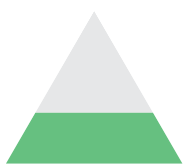
Exchange of data from early warning stations operating under the system of the Council of the Baltic Sea States

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.
The frequency of data updates under normal circumstances may differ from country to country, and it depends on individual frequency of data collection. In cases of emergency, it is recommended that data update should be made on a 2-hour basis.

FIGURE 12.
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)

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 population. In cases of radiation emergency, intervention measures are taken as scheduled separately for emergencies occurring within the area of the given organisational entity (on-site emergencies) and for those whose results reach beyond the organisational entity ("regional" and "national" emergency, 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.

The Radiation Emergency Centre (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). CEZAR 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: emergency service of the PAA President[2], 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, being on duty for 7 days a week and 24 hours a day. The Centre conducts regular national radiological assessment, and in the event of radiation emergency, it makes use of computer-aided decision support systems (RODOS and ARGOS).

2. Jointly with Radioactive Waste Management Plant (under an agreement concluded between the PAA President and ZUOP).

Radiation emergencies outside the country borders

No radiation emergencies recorded in 2016 outside the country borders resulted in a threat to humans and the environment in Poland.

In 2016, 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, 33 notifications were submitted with regard to minor incidents which mainly concerned unplanned exposure of workers to ionising radiation during the use of radiation sources, incidents on premises of nuclear power plants or related to ionizing radiation sources. 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.

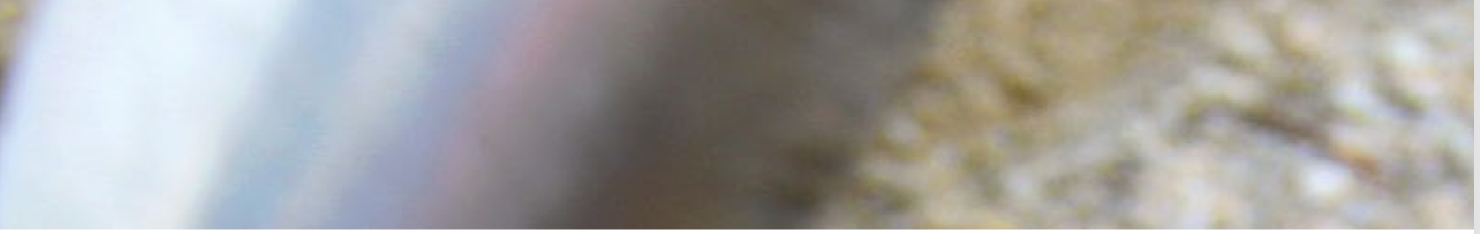
Radiation emergencies in the country

No radiation emergencies recorded in 2016 in Poland resulted in a threat to humans and the environment.
The Radiation Emergency Centre's duty officers received 3 notifications of radiation emergency within the territory of Poland (see Table 10). There was no need to deploy the dosimetry team of the PAA President; however, it was deployed in to support the local services in association with events other than radiation emergencies as defined in the Atomic Law Act. The PAA CEZAR duty officers rendered consulting services in 10,516 cases (which were not connected with mitigation of the hazard and of consequences of radiation emergency incidents), and in the majority of cases (10,380), the consultancy was provided to National Border Guard units in relation to detection of an increased radioactivity level. The consultations concerned such matters as, for instance, transit carriage or import to Poland, for domestic recipients, of ceramic, minerals, charcoal, refractory brick, propane-butane, electronic and mechanical components, chemicals, radioactive sources (9,426 cases in total), as well as crossing the border by nuclear medicine patients (954 cases). Furthermore, officers on duty from the PAA President's emergency service provided consulting and advisory services in 136 cases to other state authorities and individuals.

TABLE 10.
Notifications on radiation emergency in 2016

Notifications pertained to:	
collision of a vehicle transporting radioactive materials	1
unsealing of a ionising radiation source on the premises of the organisational entity	1
loss of ionising radiation sources	1
TOTAL	3

No radiation emergencies recorded in 2016 in Poland resulted in a threat to humans and the environment.



10 Assessment of the national radiation situation

Radioactivity in the environment

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 2016 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 11, imply that in Poland, the average 24-hour values varied in 2016 between 68 and 141 nSv/h, with the annual average of 93 nSv/h.

In the vicinity of the Świerk nuclear centre, gamma radiation exposure dose rates, taking into account the earth component only, were between 47.5 and 59.8 nGy/h (the average value being 54.9 nGy/h), whereas in the vicinity of the National Radioactive Waste Repository – from 60.13 to 80.73 nGy/h (with the average of 68.95 nGy/h). The foregoing values do not differ significantly from dose rate measurement results obtained in other regions of the country.

Atmospheric aerosols

In 2016, 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 the -137 radionuclide. Its average concentrations in the period analysed varied from below 0.08 to 93.57 μBq/m³ (the average being 1.07 μBq/m³).

FIGURE 13.

Annual average concentration of Cs-137 [μBq/m³] in aerosols in **Poland** in the years 1998-2016 (PAA, data provided by CLOR).

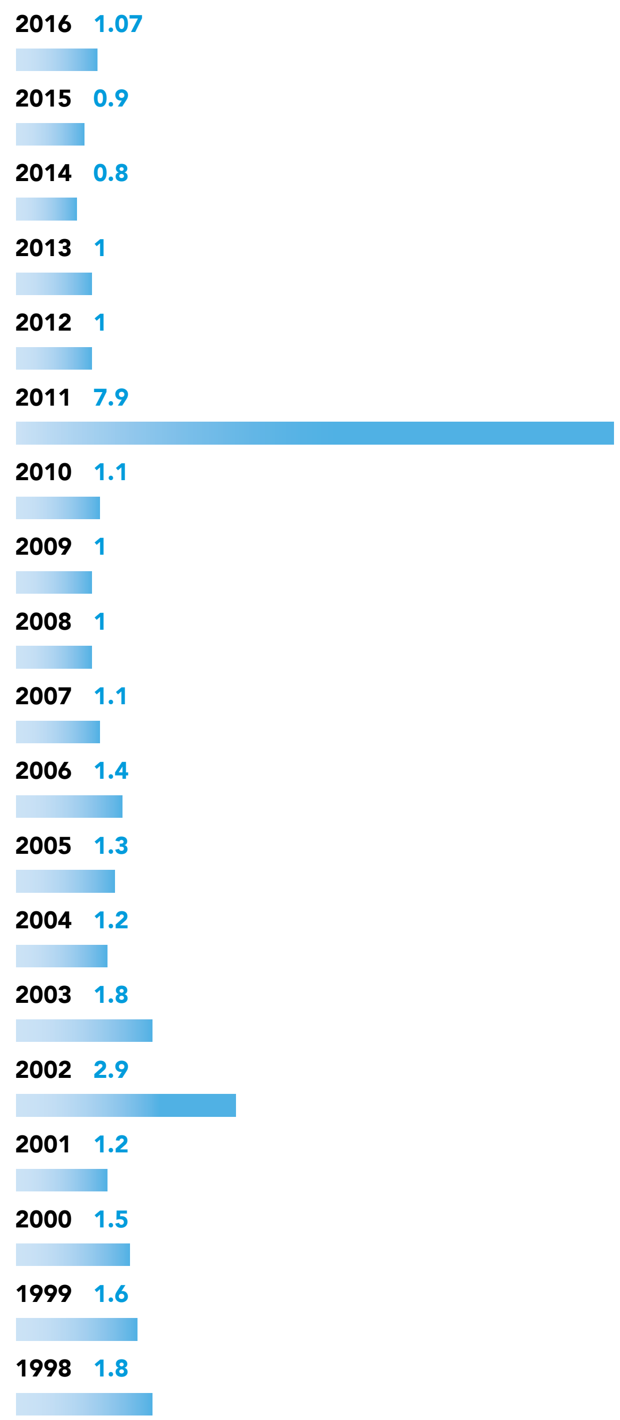


TABLE 11.
Dose rate values obtained from early warning stations for radioactive contamination in 2016 (PAA)

Stations*	Municipality (location)	Range of average daily dose rate [nSv/h]	Annual average rate [nSv/h]
PMS	Białystok	88-110	94
	Gdynia	101-115	105
	Kielce	79-102	85
	Koszalin	82-98	89
	Kraków	109-132	114
	Łódź	85-106	89
	Lublin	68-105	88
	Olsztyn	84-100	90
	Sanok	101-138	115
	Suwałki	79-102	86
	Szczecin	95-107	98
	Toruń	83-98	88
	Warszawa	89-111	93
	Wrocław	83-100	88
	Zielona Góra	86-100	90
Institute of Meteorology and Water Management	Gdynia	81-97	87
	Gorzów	81-94	86
	Legnica	89-113	97
	Lesko	85-126	104
	Mikołajki	89-123	101
	Świnoujście	73-83	76
	Warszawa	69-107	80
	Włodawa	69-101	80
	Zakopane	92-141	118

* Symbols of stations as specified in Chapter "National radiation monitoring"

Average values of the I-131 radionuclide concentration in the same period varied between less than 0.03 to 2.87 μBq/m³ (the average being 0.61 μBq/m³), whereas average values of the natural Be-7 radionuclide concentration came to a few millibecquerels per m³.

Figures 13 and 14 show the annual average concentration of Cs-137 in atmospheric aerosols in the years 1998-2016, across the entire territory of Poland and in Warsaw, respectively.

In 2016, weekly concentrations of the Cs-137 isotope in the air on the premises of KSOP did not exceed the detection threshold of 0.13 Bq/week.

Measurements of concentration of radioactive isotopes in the air were conducted in 2016 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 2016 on the premises of the Centre have been provided in Table 12.

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.

The measurement results provided in Table 14 imply that the content of artificial Sr-90 and Cs-137 radionuclides in the total annual fallout in 2016 remained on the level observed in previous years.

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 2016 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

FIGURE 14.
Annual average concentration of Cs-137 [μBq/m³] in aerosols in **Warsaw** in the years 1998-2016 (PAA, based on data provided by the Central Laboratory for Radiological Protection).

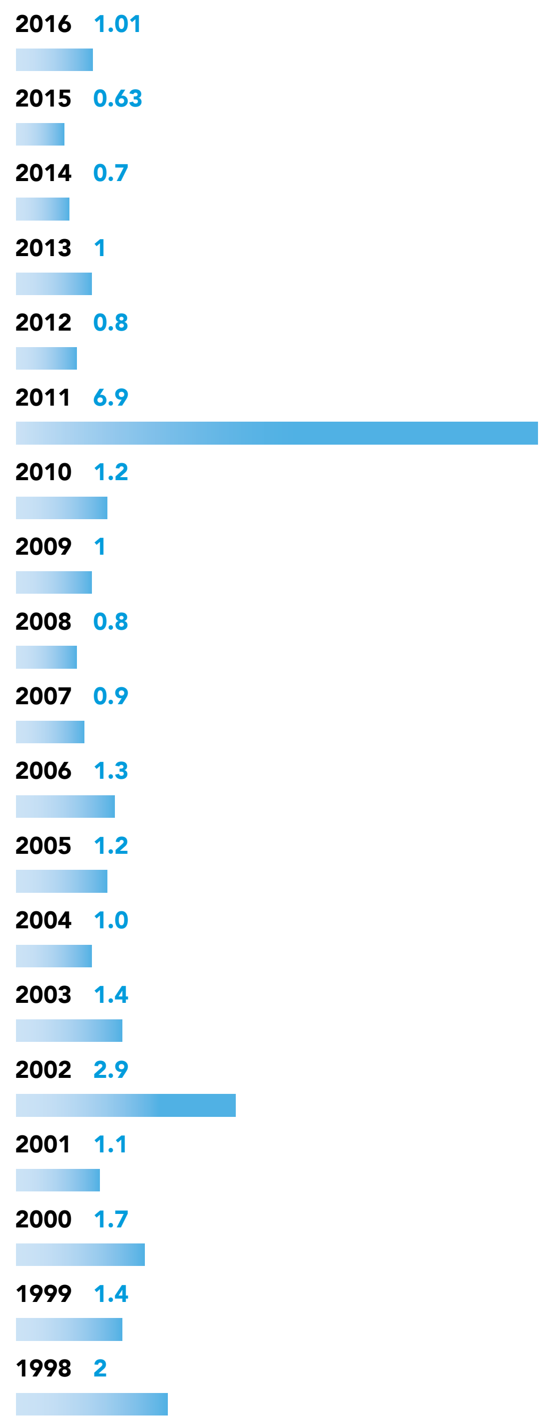


TABLE 12.
Collation of results of weekly measurements of radionuclide concentrations in atmospheric aerosols on the premises of the Świerk Nuclear Centre in 2016

	Be-7 [mBq/m^3]	K-40 [μBq/m^3]	I-131 [μBq/m^3]	Cs-137 [μBq/m^3]
Average	2.71	15.1	8.25	1.00
Minimum value	1.00	8.60	0.62	0.25
Maximum value	5.67	38.00	258.00	5.71

TABLE 13.
Concentrations of Cs-137 and Sr-90 in river and lake water in Poland in 2016 [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	0.92 - 4.24	1.94 - 4.23	1.23 - 4.87
	Average	2.20	2.96	2.39
Sr-90	Range	2.03 - 4.96	2.43 - 11.56	1.87 - 9.01
	Average	3.61	4.27	3.72

conducted by CLOR). Average concentrations of the aforementioned three isotopes remained on the level of 22.5 mBq/dm^3 for Cs-137, 3.47 mBq/dm^3 for Ra-226 and 3361 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 2016 at check points located in the vicinity of the Nuclear Centre in Świerk came to:
- Świder river: 1.20 mBq/dm^3 (upstream of the Centre) and 1.40 mBq/dm^3 (downstream of the Centre),
- water from a sewage treatment plant in Otwock discharged to the Vistula river: 4.97 mBq/dm^3.

Concentrations of tritium in open water samples collected in 2016 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: 1.0 Bq/dm^3

Waters - local monitoring
Measurements of concentrations of radioactive isotopes in waters in local monitoring in 2016 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 2016 was, respectively: 2.38 and 5.24 mBq/dm^3 for Cs-134 and Cs-137 and 4.1 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 and 0.8 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 7.38 Bq/dm^3 on average. In 2016, the concentration of tritium was also examined in the vicinity of the National Radioactive Waste Repository in Różan, and it amounted to 4.11 Bq/dm^3 on average.

Areas of former uranium ore extraction and

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

TABLE 14.
Average activity of Cs-137 and Sr-90 and average beta activity in total annual fallout in Poland in the years 1997-2016 (Chief Inspectorate of Environmental Protection, measurements conducted by the Institute of Meteorology and Water Management)

Year	Activity [Bq/m^2] Cs-137	Sr-90	Beta activity [kBq/m^2]
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
2007	0.5	0.1	0.31
2006	0.6	0.1	0.31
2005	0.5	0.1	0.32
2004	0.7	0.1	0.34
2003	0.8	<0.1	0.32
2002	0.8	<1.0	0.34
2001	0.6	<1.0	0.34
2000	0.7	<1.0	0.33
1999	0.7	<1.0	0.34
1998	1.0	<1.0	0.32
1997	1.5	<1.0	0.35

TABLE 15.
Concentrations of caesium and plutonium in bottom sediments of rivers and lakes in Poland in 2016 [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	The scope	0.24-15.28	0.46-14.45	1.36-109.00
	Average	4.86	3.90	16.03
Pu-239,240	The scope	0.001-0.0120	0.006-0.0167	0.002-0.0418
	Average	0.035	0.030	0.051

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/dm³, whereas the beta activity should not exceed 1,000 mBq/dm³. 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 58 water samples in areas where uranium ore plants used to operate, and the following results were obtained[3]:

- public intakes of drinking water:
  - — total alpha activity - from 4.3 to 58.7 mBq/dm³,
  - — total beta activity - from 25.9 to 266.1 mBq/dm³.
- waters flowing out of mine headings (adits, rivers, ponds, springs, wells):
  - — total alpha activity - from 6.6 to 675.3 mBq/dm³,
  - — total beta activity - from 26.6 to 3247.8 mBq/dm³.

Concentration of radon in water from public intakes within the area managed by the Association of Municipalities of the Karkonosze Region was 0.2 to 275.2 Bq/dm³. 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 389.0 Bq/dm³ in water flowing out of adit no. 17 of the "Podgórze" mine.

The Commission Recommendations 2001/928 EURATOM on radon present in water stipulate that, for public intakes with radon concentration exceeding 100 Bq/dm³, the Member States should individually establish what is referred to as reference levels of radon concentration, and for concentrations exceeding 1,000 Bq/dm³, it is necessary that specific countermeasures be undertaken for the sake of radiological protection. In 2016, none of the results obtained in radon concentration measurements in water exceeded the threshold of 1,000 Bq/dm³.

Bottom sediments
In 2016, the concentration of radionuclides in samples of dry mass of bottom sediments from rivers, lakes and the Baltic Sea remained on the same levels as observed in previous years. The measurement results have been presented in tables 15 and 16.

Soil

Concentrations of both radionuclides in soil are determined based on cyclic measurements conducted every two years. The last completed measurement cycle was conducted in the years 2014-2015. In 2014, samples of soil were taken at 254 fixed check points spread across the country. In 2015, spectrometric measurements of these samples were conducted and the concentrations of artificial (Cs-137, Cs-134) and natural radioisotopes were determined. Summary report was published by Central Radiological Protection Laboratory in 2016.

In 2016, a new project "Monitoring of Cs-137 concentration in the soil in years 2016-2017" was commenced. In 2017, a summary report will be prepared, describing deposition of Cs-137 in the surface layer of the soil and natural radionuclide concentrations on the basis of a full set of measurements of samples collected in October of 2016.

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 0.05 kBq/m² to 8.62 and kBq/m² and it amounts on the average to 1.33 kBq/m².

The average soil deposition of Cs-137 in individual regions of Poland has been shown in Fig. 15, whereas the average deposition of this radionuclide in soil for the entire country in years 1988-2014 has been illustrated by Fig. 16.

Average values of surface contamination of soil with Cs-137 in 2016 in the vicinity of the Nuclear Centre in Świerk and of the National Radioactive Waste Repository in Różan equalled 7.4 Bq/kg and 32 Bq/kg respectively.

TABLE 16.
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 2016 [Bq/kg of dry mass] (PAA, based on data provided by the Central Laboratory for Radiological Protection)

		Layer thickness 0-19 cm
Cs-137	kBqm²	60.00
Pu-238	Bqm²	1.64
Pu-239, 240	Bqm²	65.90
K-40	kBqm²	40.00
Sr-90	Bqm²	2.71

FIGURE 15.
Average deposition of Cs-137 (10 cm thick soil layer) in 2014 in individual provinces (PAA, data: GIOŚ, measurements: CLOR)

FIGURE 16.
Average deposition of Cs-137 (10 cm thick soil layer) in Poland in the years 1998-2014 (PAA, data: GIOŚ, measurements: CLOR)

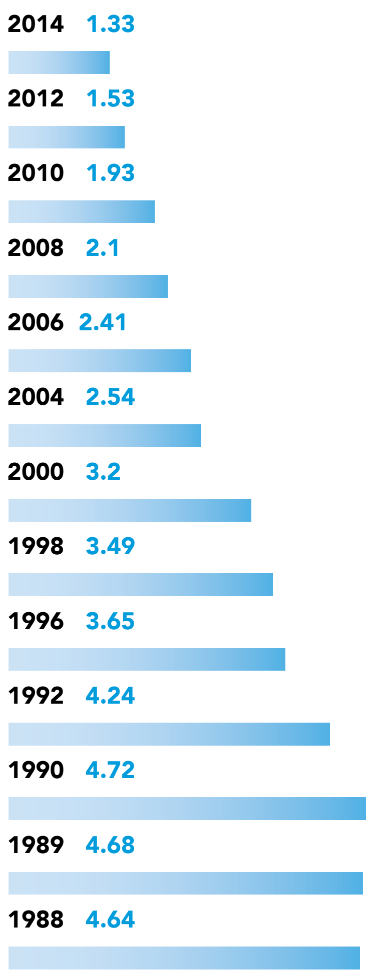
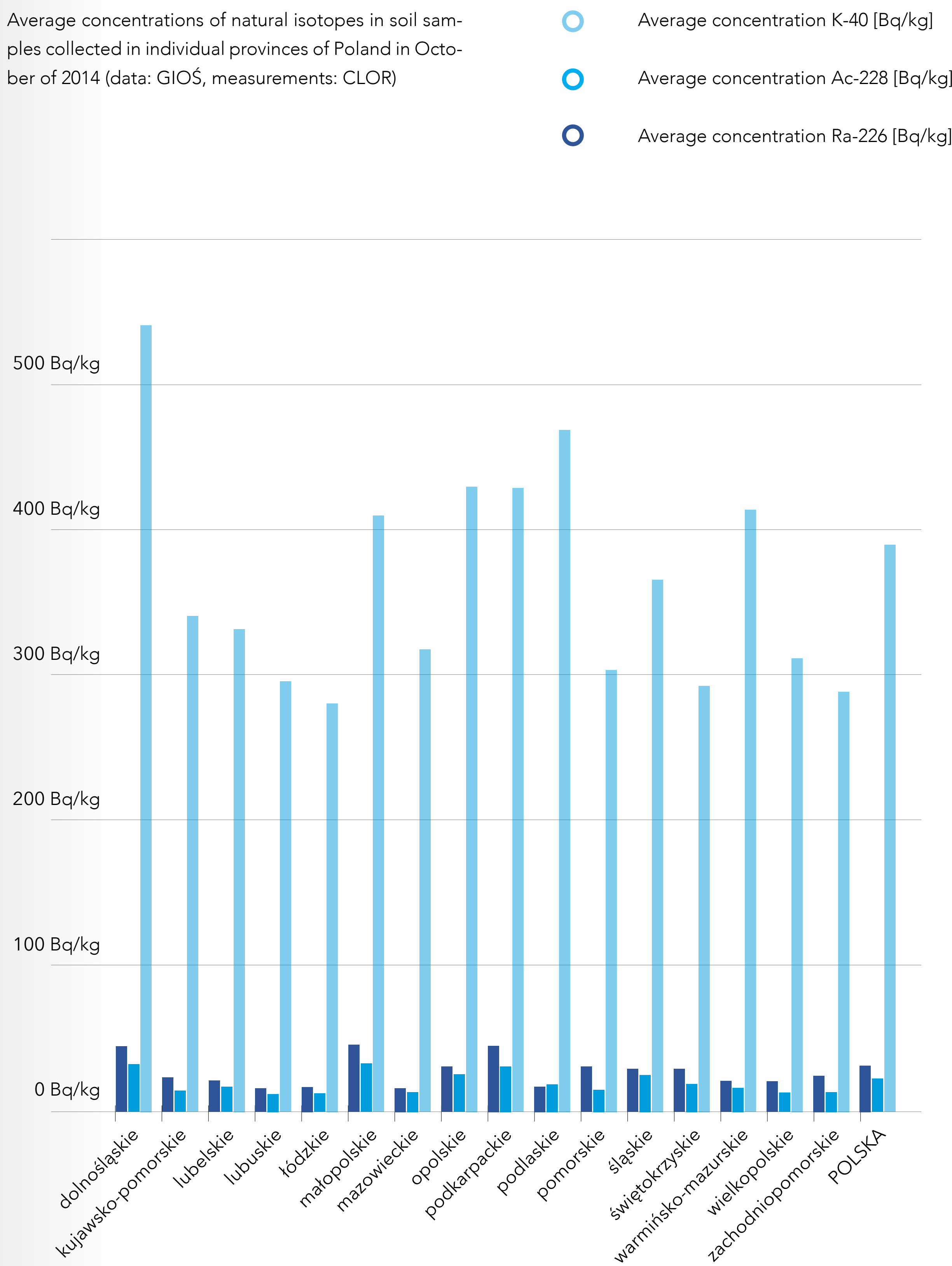


TABLE 17.
Average concentrations of natural isotopes in soil samples collected in individual provinces of Poland in October of 2014 (data: GIOŚ, measurements: CLOR)



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.

Average concentrations of natural radioactive isotopes in soil

The average concentration ranges for natural radionuclides are as follows:

- for Ra-226: average 31.9 Bq/kg ; range: 4.6 ÷ 128.0 Bq/kg,
- for Ac-228: average 22.9 Bq/kg ; range: 2.4 ÷ 91.4 Bq/kg,
- for K-40: average 390 Bq/kg ; range: 45 ÷ 1065 Bq/kg.

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. 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 2016, concentrations of Cs-137 in liquid (fresh) milk ranged from 0.01 to 0.81 Bq/dm³ and amounted to ca. 0.4 Bq/dm³ on average (see infographic pp.94).

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 2016 were as follows (annual average concentration of Cs-137):

- meat from animal farms – ca. 0.63 Bq/kg,
- poultry – ca. 0.54 Bq/kg,
- fish – ca. 0.77 Bq/kg,
- eggs – ca. 0.42 Bq/kg.

The time distribution of the Cs-137 activity in the years 2006-2016 in different types of foodstuffs has been shown in Infography p.94. The data obtained imply that, in 2016, the average activity of the caesium isotope in meat, poultry, fish and eggs remained on the same level as in the previous year. Compared to the year 1986 (the Chernobyl disaster), the said activities were more than a dozen times lower in 2016.

Vegetables, fruits, cereals and mushrooms

Results of measurements of artificial radioactivity in vegetables and fruits conducted in 2016 imply that the concentration of the Cs-137 isotope in vegetables ranged from 0.04 to 1.19 Bq/kg, with the average value being 0.39 Bq/kg (Fig. 21), and in fruits in came to 0.10-0.77 Bq/kg on the average value of 0.33 Bq/kg (Fig. 22). In long-term comparisons, the results from 2016 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 2016 ranged from 0.03 to 0.69 Bq/kg (the average value being 0.4 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 2016 ranged from <0.97 to 9.21 Bq/kg (the average value being 3.9 Bq/kg) for the Nuclear Centre in Świerk and from 0.46 to 49.6 Bq/kg (the average value being 11.37 Bq/kg) for KSOP.

In 2014, 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

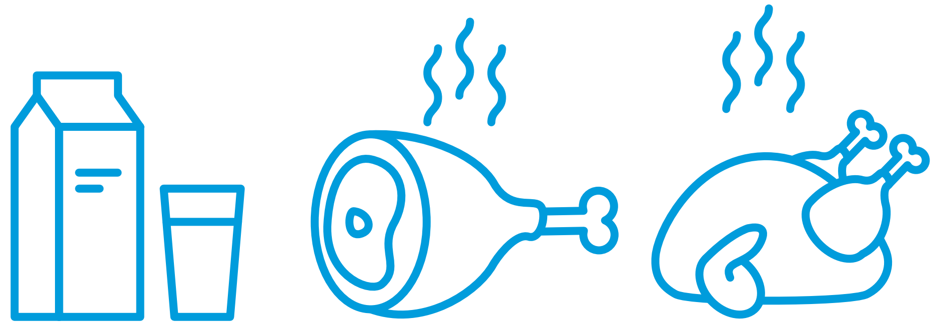
highest permitted concentration of the Cs-137 and Cs- 134 isotopes in milk, dairy products and infant food.

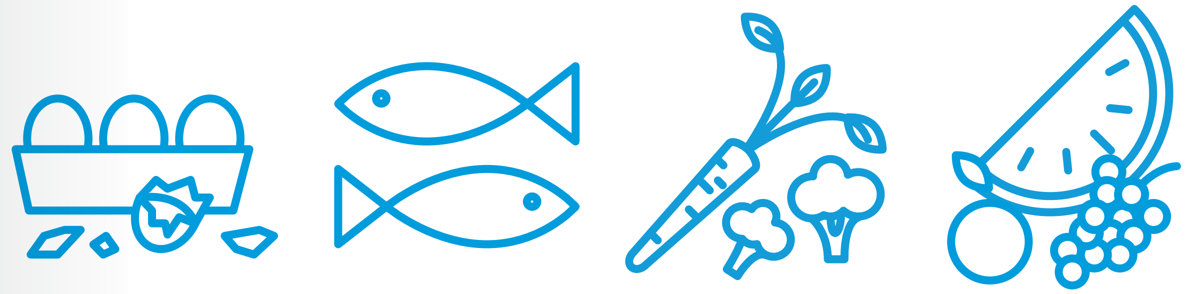
600 Bq/kg

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.





average concentration Cs-137	MILK	MEAT	POULTRY	EGGS	FISH	VEGETABLES	FRUITS
2016	**0.40 Bq/dm^3**	**0.63 Bq/kg**	**0.54 Bq/kg**	**0.42 Bq/kg**	**0.77 Bq/kg**	**0.39 Bq/kg**	**0.33 Bq/kg**
2015	0.50	0.77	0.60	0.40	0.77	0.41	0.27
2014	0.50	0.83	0.73	0.45	0.86	0.46	0.50
2013	0.60	0.95	0.90	0.60	1.10	0.50	0.60
2012	0.60	0.90	0.70	0.50	1.00	0.50	0.40
2011	0.49	0.64	0.60	0.45	1.00	0.49	0.40
2010	0.48	0.83	0.58	0.43	1.00	0.47	0.35
2008	0.60	0.85	0.52	0.42	0.70	0.45	0.37
2009	0.60	0.70	0.52	0.39	0.84	0.54	0.28
2007	0.70	0.64	0.67	0.43	0.96	0.46	0.25
2006	0.50	0.73	0.42	0.39	0.67	0.35	0.26
2005	0.60	1.00	0.60	0.40	1.00	0.60	0.40

Data: sanitary and epidemiological stations

11 International cooperation

Fot. IAEA

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

The goal of international cooperation in which PAA has become involved, is to pursue the mission of a nuclear regulatory body, i.e. ensuring nuclear safety and radiological protection of the country. PAA strives to accomplish this goal by entering international legal acts and implementing international standards, by the exchange of information on nuclear safety with the neighbouring countries, as well as through capacity building and implementation of good practises, which is achieved by sharing experience and know-how with foreign partners. The international cooperation in question is pursued by means of participation of PAA's representatives in the activities of international organizations and associations, as well as their involvement in bilateral cooperation.

Multilateral cooperation

In 2016, 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 2016 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, a representative of the European Commission, providing advisory support to the European Commission.
- the Working Party on Atomic Questions – B.07 WPAQ. Since the second half of year 2016, supervision and participation in meetings of the WPAQ has been taken over from the PAA by the Ministry of Energy. It was due to evolution of the topics discussed by the WPAQ towards the broadly understood issues of use of nuclear energy.

On the basis of the EURATOM Treaty, in 2016, inspections of nuclear materials were conducted in Poland by EURATOM inspectors, which were also attended by the PAA inspectors.

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 2016, the fee amounted to: EUR 2 521 395 and USD 373 363 USD to the regular budget of the IAEA, and EUR 748 280 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 (in which PAA representatives are involved) 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 on behalf of strengthening of nuclear safety and radiological protection

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 2016, upon an invitation from the Government of the Republic of Poland, IAEA conducted two such missions:
• the IPPAS (International Physical Protection Advisory Service) mission for a review of the Polish legislative and regulatory framework with regard to physical safety of nuclear materials and the associated facilities, as well as safeguards applied during transport of nuclear materials,
• a mission to verify implementation of the recommendations of the e Integrated Nuclear Infrastructure Review (INIR); the INIR mission confirmed compliance of Poland with all of the requirements expected for the preliminary stage of preparation for launching of a nuclear energy programme.

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 26 to 30 September 2016, a 60th anniversary General Conference of IAEA was held.

The GC was attended by a Delegation of the Republic of Poland, with the Head of the Delegation being Minister Andrzej J. Piotrowski - Undersecretary of State at the Ministry of Energy, and Alternate to the Head of Delegation being Andrzej Przybycin, acting President of the National Atomic Energy Agency (PAA).

During the Conference, a special Polish exhibition was prepared, entitled **POLSKA Safe and Innovative**. It was prepared by the National Atomic Energy Agency in cooperation with the Permanent Mission of the Republic of Poland to the Unite Nations Office in Vienna, National Centre for Nuclear Research, Institute of Chemistry and Nuclear Technology, the Central Laboratory for Radiological Protection, the Ministry of Energy and PGE EJ 1 company.

PAA conducted a number of consultations with international partners during the GC, within the framework of activity on behalf of strengthening of global nuclear safety. On 28 September 2016, an agreement was signed between the President of the PAA and the United States Nuclear Regulatory Commission (US NRC) on technical information exchange and cooperation in the field of nuclear safety. The agreement, concluded for the period of five years, is a continuation of an analogic agreement signed in 2009. It will facilitate development of competences of the PAA as a nuclear regulatory authority in implementation of the Polish Nuclear Power Programme. The main benefits from the agreement signed with the United States are training courses and on-the-job training visits for the PAA employees, as well as the possibility of use of computation codes for safety analyses.

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.

At the PAA, there is a team established 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 NLO and the NLA is to support domestic organizations in taking advantage of the possibility of participating in technical cooperation projects.

In 2016, the PAA coordinated participation of the national expert and research organisations in more than 250 meetings, trainings and conferences organised by the IAEA.

A significant component of expert cooperation are special national projects, implemented in association with Poland's priorities in the area of nuclear safety and radiological protection. In years 2016-17, Poland has been implemented 3 such projects in the fields of:

- strengthening of readiness of the nuclear regulatory authorities to issue licenses for new nuclear facilities,
- strengthening of the national infrastructure for the purpose of launching of the nuclear power programme,
- modernisation of systems of MARIA research reactor.

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 strategy of expert cooperation with the IAEA for years 2016-21

On 9 June 2016, the Permanent Representative of Poland to the UN and international organisations in Vienna, Ambassador Adam Bugajski and the Deputy Director General of the IAEA - Dazhu Yang signed the National Programme Framework for technical cooperation between Poland and the IAEA for years 2016-2021. The strategy has been developed by the PAA with the domestic nuclear and radiological sector institutions. In total, until year 2021, thanks to the Programme, Poland may obtain even EUR 2 million for undertakings associated with peaceful use of nuclear energy.

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 2016, one of the main fields of works of WENRA consisted of development of technical specifications for conducting in the EU member states of a review of activities in management of the issue of ageing of nuclear facilities as a result of many years of their operation. In October 2016, a plenary session of the WENRA, attended by the President of the PAA, adapted the technical specification developed. It should be noted that the review is to include MARIA research reactor, operating in Otwock-Świerk in Poland.

Heads of the European Radiological Protection Competent Authorities (HERCA)

PAA representatives participate in plenary works of heads of regulatory authorities and in 4 working groups of the HERCA. Moreover, representatives of Polish oncology centres participate in works of 2 HERCA working groups.

Council of the Baltic Sea States (RPMB)

Poland has been represented at 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. Meetings of the Group are attended by observers from the European Commission, France (IRSN) and the Department of Energy (USA).

The main tasks of the EGNRS include:
• Gathering of information on nuclear installations and radioactive waste repositories in the area of the Baltic Sea;

• Identifying radioactive sources, which may pose a potential threat in the area of the Baltic Sea;
• Identifying of potential nuclear and radiological exposure sources, which require immediate coordinated corrective action;
• Gathering of information and monitoring of various programmes, aimed at enhancing nuclear safety and radiological protection in the area of the Baltic Sea;
• Preparing of recommendations, launching and continuation of initiatives associated with issues concerning nuclear safety and radiological protection.

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)

PAA has been a member of the European Safeguards Research and Development Association (ESARDA) since 2009. It is an organisation of the EU countries constituting a forum for exchange of information and experience concerning safeguards of nuclear material, associated with meeting of obligations based on the Treaty on the Non-Proliferation of Nuclear Weapons and its derivative agreements. This Association cooperates with the International Atomic Energy Agency and the laboratories of the Joint Research Centre of the European Commission It incorporates scientific institutes, universities, industrial companies, specialists and administration authorities of the European Union countries.

Bilateral cooperation

Poland has signed agreements on cooperation and exchange of information with regard to nuclear safety and nuclear accidents with all of its neighbouring countries. The PAA President is responsible for implementation of bilateral agreements.

In 2016, the PAA continued to develop the network of cooperation with its foreign partners having experience in supervision of large nuclear facilities. In September, an agreement with the regulatory authority of the United States was extended, and an agreement with the Swiss regulatory authority was signed. Negotiations were in progress on closer cooperation with Finnish and Swedish regulatory authorities.

During the year, consultations were held at various international fora with bilateral partners; in particular, during the already mentioned General Conference of the IAEA.

Within the framework of implementation of bilateral cooperation programmes, the PAA organised bilateral meetings with the French, Spanish and Slovakian regulatory authorities in Warsaw in 2016. 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 on-the-job training visits of nuclear inspectors and analysts of the PAA in the nuclear regulatory authorities of the United States, the Czech Republic and Slovakia, which allowed them to get familiar with and to exercise in practice the tasks performed in supervision of large scale nuclear facilities.

Index of abbreviations

- **ABW** – Internal Security Agency – Agencja Bezpieczeństwa Wewnętrznego
- **ADN** – European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways – umowa europejska dotycząca międzynarodowego przewozu śródlądowymi drogami wodnymi towarów niebezpiecznych
- **ADR** – L'Accord européen relatif au transport international des marchandises Dangereuses par Route – Międzynarodowa konwencja dotycząca drogowego przewozu towarów niebezpiecznych
- **ASN** – Autorité de sûreté nucléaire – francuski Urząd Bezpieczeństwa Jądrowego
- **ASS-500** – Aerosol Sampling Station – stacje podstawowe wykrywania skażeń radioaktywnych powietrza stosowana do pomiaru skażeń promieniotwórczych w aerozolach atmosferycznych
- **BSS** – Basic Safety Standards – podstawowe normy bezpieczeństwa
- **RPMB** – Council of the Baltic Sea States (CBSS) – Rada Państw Morza Bałtyckiego
- **CEZAR**– Radiation Emergency Centre – Centrum ds. Zdarzeń Radiacyjnych PAA
- **CLOR** – Central Laboratory for Radiological Protection – Centralne Laboratorium Ochrony Radiologicznej
- **CNRA** – Committee on Nuclear Regulatory Activities – Komitet ds. działalności dozoru jądrowego
- **COAS** – Centre for Analysis of Contamination – Centralny Ośrodek Analizy Skażeń
- **CSNI** – Committee on the Safety of Nuclear Installations – Komitet ds. bezpieczeństwa instalacji jądrowych
- **DBJ PAA** – Nuclear Safety Department National Atomic Energy Agency – Departament Bezpieczeństwa Jądrowego Państwowej Agencji Atomistyki
- **DoE** – U.S. Department of Energy – Departament Energii Stanów Zjednoczonych Ameryki
- **DOR PAA** – Radiological Protection Department National Atomic Energy Agency – Departament Ochrony Radiologicznej Państwowej Agencji Atomistyki
- **DSS** – Decision Support Systems – Systemy Wspomagania Decyzji – SWD np.: ARGOS RODOS
- **ECURIE** – European Community Urgent Radiological Information Exchange – Europejski System wczesnego powiadamiania o zdarzeniach radiacyjnych
- **EGNRS** – Expert Group on Nuclear and Radiation Safety – Grupa ekspercka ds. bezpieczeństwa jądrowego i radiacyjnego
- **ENSRA** – European Nuclear Security Regulators Association – Europejskie Stowarzyszenie Regulatorów Ochrony Fizycznej
- **ENSREG** – European Nuclear Safety Regulators' Group – Europejska grupa organów regulacyjnych ds. bezpieczeństwa jądrowego
- **ESARDA** – European Safeguards Research and Development Association – Europejskie Towarzystwo Badań i Rozwoju Zabezpieczeń Materiałów Jądrowych
- **EURATOM** – European Atomic Energy Community – Europejska Wspólnota Energii Atomowej
- **EURDEP** – European Radiological Data Exchange Platform – System wymiany danych ze stacji wczesnego wykrywania skażeń
- **GIG** – Central Mining Institute – Główny Instytut Górnictwa
- **GIOŚ** – Chief Inspectorate of Environmental Protection – Główny Inspektorat Ochrony Środowiska
- **GTRI** – Global Threat Reduction Initiative – Program Redukcji Zagrożeń Globalnych
- **HERCA** – Heads of the European Radiological Protection Competent Authorities – Grupa Szefów Europejskich Urzędów Dozoru Radiologicznego
- **HEU** – Highly Enriched Uranium – uran wysokowzbogacony
- **IAEA** – International Atomic Energy Agency – Międzynarodowa Agencja Energii Atomowej (MAEA)
- **IAEA Safety Standards** – Międzynarodowe normy bezpieczeństwa MAEA
- **IATA – DGR** International Air Transport Association Dangerous Goods Regulation – Międzynarodowe Przepisy dotyczące transportu towarów niebezpiecznych drogą powietrzną Międzynarodowego Stowarzyszenia Transportu Lotniczego
- **ICAO** – International Civil Aviation Organization

– Organizacja Międzynarodowego Lotnictwa Cywilnego
- **IChTJ** – Institute of Nuclear Chemistry and Technology – Instytut Chemii i Techniki Jądrowej
- **IEA** – International Energy Agency – Instytut Energii Atomowej
- **IMDG Code** – International Maritime Dangerous Goods Code – Międzynarodowy morski kodeks dot. materiałów niebezpiecznych
- **IMiGW** – Institute of Meteorology and Water Management – Instytut Meteorologii i Gospodarki Wodnej
- **INES** – International Nuclear and Radiological Event Scale – Międzynarodowa skala klasyfikacji zdarzeń jądrowych i radiologicznych
- **IOR** – Radiation Protection Officer – inspektor ochrony radiologicznej
- **IPJ** – Institute for Nuclear Studies – Instytut Problemów Jądrowych
- **IPPAS** – International Physical Protection Advisory Service – Międzynarodowy Przegląd Ochrony Fizycznej
- **IRRS** – Integrated Regulatory Review Service –Międzynarodowy Zintegrowany Przegląd Dozoru Jądrowego
- **IRSN** – L'Institut de Radioprotection et de Sûreté Nucléaire – Institute for Radiological Protection and Nuclear Safety – francuski Instytut Ochrony Radiologicznej i Bezpieczeństwa Jądrowego
- **JRC** – European Comission's Joint Research Centre – Wspólne Centrum Badawcze Komisji Europejskiej
- **KG** – General Conference IAEA – Konferencja Generalna MAEA
- **KPK** – National Contact Point – Krajowy Punkt Kontaktowy
- **KSOP** – National Radioactive Waste Repository – Krajowe Składowisko Odpadów Promieniotwórczych
- **LEU** – Low Enriched Uranium – uran niskowzbogacony
- **LPD** – Dosimetric Surveys Lab – Laboratorium Pomiarów Dozymetrycznych
- **ME** – Ministry of Energy – Ministerstwo Energii
- **MF** – Ministry of Finance – Ministerstwo Finansów
- **MG** – Ministry of Economy – Ministerstwo Gospodarki
- **MON** – Ministry of National Defence – Ministerstwo Obrony Narodowej
- **MSWiA** – Ministry of the Interior and Administration – Ministerstwo Spraw Wewnętrznych i Administracji
- **NCBJ** – National Centre for Nuclear Research – Narodowe Centrum Badań Jądrowych dawniej
- **IEA – POLATOM** Institute of Atomic Energy – Instytut Energii Atomowej POLATOM
- **NEA OECD** – Nuclear Energy Agency of the Organisation for Economic Co-operation and Development – Agencja Energii Jądrowej Organizacji Współpracy Gospodarczej i Rozwoju
- **NIK** – Supreme Audit Office – Najwyższa Izba Kontroli
- **NLC** – Nuclear Law Committee – Komitet prawa atomowego
- **NOT** – Chief Technical Organisation – Naczelna Organizacja Techniczna
- **NSGC** – Nuclear Security Guidance Committee – Komitet ds. wytycznych w zakresie ochrony fizycznej
- **NUSSC** – Nuclear Safety Standards Committee – Komitet ds. norm w zakresie bezpieczeństwa jądrowego
- **PAA** – National Atomic Energy Agency – Państwowa Agencja Atomistyki
- **WCZK** – Provincial Centre for Crisis Management (PCCM) – Wojewódzkie centrum zarządzania kryzysowego
- **PMS** – Permanent Monitoring Station – stacje podstawowe wczesnego wykrywania skażeń promieniotwórczych do pomiaru mocy dawki promieniowania jonizującego
- **POL** – technical cooperation national project for Poland – Krajowe projekty pomocy technicznej IAEA
- **POLATOM** – Radioisotopes Centre – Ośrodek Radioizotopów POLATOM
- **PPEJ** – Polish Nuclear Power Programme – Program Polskiej Energetyki Jądrowej
- **PSG** – Border Guards Units – Placówki Straży Granicznej
- **RASSC** – Radiation Safety Standards Committee – Komitet ds. norm w zakresie ochrony radiologicznej
- **RCF** – Regulatory Cooperation Forum – Forum Współpracy Dozorowej
- **RID** – Reglement concernant le transport Internationale ferroviaire des marchandises Dangereuses – regulamin dla międzynarodowego przewozu kolejami towarów niebezpiecznych
- **SG** – Border Guard – Straż Graniczna
- **SIOR** – Association of Radiation Protection Officers – Stowarzyszenie Inspektorów Ochrony Radiologicznej
- **TLD** – thermoluminescent dosimeters – dawkomierze termoluminescencyjne
- **TRANSSC** – Transport Safety Standards Committee – Komitet ds. norm w zakresie transportu materiałów promieniotwórczych
- **UDT** – Office of Technical Inspection – Urząd Dozoru Technicznego
- **US NRC** – United States Nuclear Regulatory Commission – Komisja Dozoru Jądrowego Stanów Zjednoczonych Ameryki
- **USIE** – Unified System for Information Exchange in Incidents and Emergencies –Zintegrowany System Wymiany Informacji o Zdarzeniach
- **WASSC** – Waste Safety Standards Committee – Komitet ds. norm w zakresie odpadów promieniotwórczych
- **WENRA** – Western European Nuclear Regulators Association – Zachodnioeuropejskie Stowarzyszenie Dozorów Jądrowych
- **WGAMA** – Working Group on Analysis and Management of Accidents – Grupa robocza ds. ocen bezpieczeństwa
- **WGIP** – Working Group on Inspection Practices – Grupa robocza ds. praktyk inspekcyjnych
- **WGPC** – Working Group on Public Communication of Nuclear Regulatory Organizations – Grupa robocza ds. komunikacji społecznej urzędów dozoru jądrowego
- **WGRISK** – Working Group on Risk Assessment – Grupa robocza ds. ocen bezpieczeństwa
- **WGRNR** – Working Group on Regulation of New Reactors – Grupa robocza ds. regulowania nowych reaktorów
- **WHO** – World Health Organization – Światowa Organizacja Zdrowia
- **WPAQ** – Working Party on Atomic Questions – Grupa Robocza Rady UE ds. kwestii jądrowych
- **WPNEM** – Working Party on Nuclear Emergency Matters – Grupa robocza ds. zagrożeń jądrowych
- **ASW** – War Studies University – Akademia Sztuki Wojennej
- **ZUOP** – Radioactive Waste Management Plant – Zakład Unieszkodliwiania Odpadów Promieniotwórczych

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