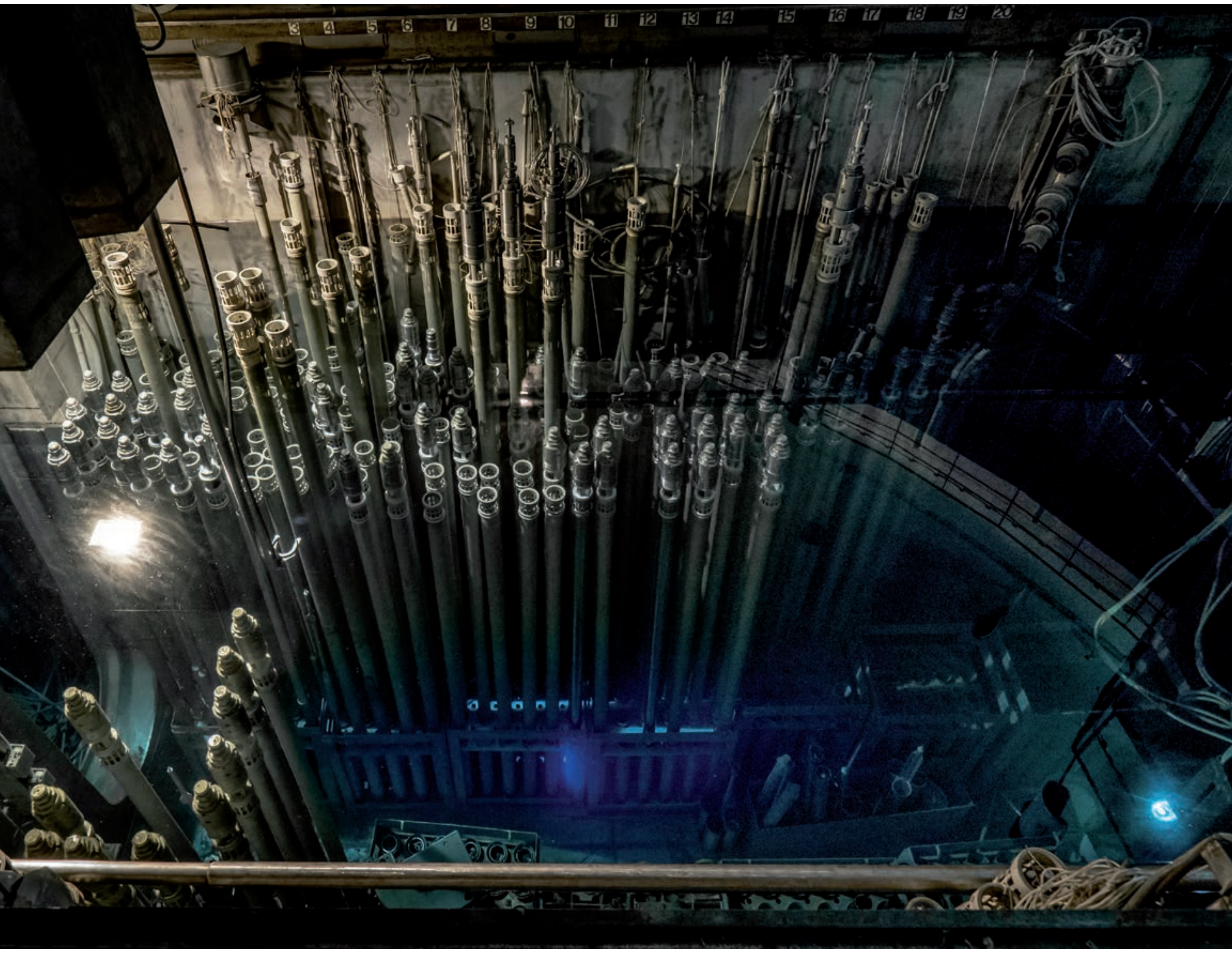


ANNUAL REPORT

Activities of the President
of the National Atomic Energy Agency
and assessment of nuclear safety
and radiological protection in Poland in 2019

2019

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 2019

WARSAW 2020

NATIONAL
ATOMIC ENERGY
AGENCY

Photo on the cover:
NCBJ

DTP, print, and binding:
Grafpol Agnieszka Blicharz-Krupińska

Contents

Contents
Foreword 5

1. National Atomic Energy Agency 6
- Role of the President of the National Atomic Energy Agency
- Organizational structure
- Staffing
- Council for Nuclear Safety and Radiological Protection
- Budget
- Assessment of the PAA's operations
- National Atomic Energy Agency and the Polish Nuclear Power Programme

2. Infrastructure for nuclear regulatory activities in Poland 12
- Definition, structure and functions of nuclear safety and radiological protection system
- Basic provisions of law on nuclear safety and radiological protection

3. Supervision of the use of ionizing radiation sources 21
- Tasks of the PAA President in terms of regulatory oversight of activities connected with exposure to ionizing radiation
- Users of ionizing radiation sources in Poland
- Register of sealed radioactive sources

4. Supervision of nuclear facilities 28
- Nuclear facilities in Poland
- Licenses issued
- Regulatory inspections
- Functioning of the coordination system for inspection and supervision of nuclear facilities
- Nuclear power plants in neighboring countries

5. Safeguards 38
- Legal basis for safeguards
- Users of nuclear materials in Poland
- Inspections of nuclear material safeguards

6. Transport of radioactive materials 42
- Transport of radioactive sources and waste
- Transport of nuclear fuel

7. Radioactive waste 45
- Management of radioactive waste
- Radioactive waste in Poland

8. Radiological protection of population and workers in Poland 50
- Exposure of population to ionizing radiation
- Control of exposure to ionizing radiation
- Granting of personal licenses in the area of nuclear safety and radiological protection

9. National radiological monitoring 66
- Nationwide monitoring
- Local monitoring
- International exchange of radiological monitoring data
- Radiation emergencies

10. Assessment of the radiation situation in Poland 79
- Radioactivity in the environment
- Radioactivity of basic food processing products and other foodstuffs

11. International cooperation 94
- Multilateral cooperation
- Bilateral cooperation

List of acronyms 103

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

The report on the activities of the President of the National Atomic Energy Agency and assessment of nuclear safety and radiological protection in Poland has been prepared on the basis of art. 110 section 13 of the Atomic Law Act (Journal of Laws of 2019 item 1792, and 2020, item 284 and 322). In accordance with the statutory obligation, this report has been presented to the Prime Minister.

Vision

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

Mission

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

I am pleased to present the Report on Activities of the President of the National Atomic Energy Agency (PAA) as well as the information concerning evaluation of the status of nuclear safety and radiological protection in Poland in 2019.

The basic conclusion drawn from this report is the confidence that the activities, based on ionising radiation sources, which are supervised by the President of the PAA do not pose any threat to Polish citizens or to the natural environment. The Agency's priority is to ensure that such sources are used in the safest way possible and the activities connected to them do not have any negative impact on the society and on the environment.

In the previous year, the PAA's inspectors conducted 763 on-site inspections in organizational entities that use ionising radiation sources – in industry, medicine, and research centres. Moreover, in 2019 the experts carried out 8 inspections of the MARIA research reactor and 3 inspections in the Radioactive Waste Disposal Facility. The security of nuclear materials was inspected 30 times by the nuclear regulatory inspectors.

The President of the PAA issued 696 decisions regarding licenses to conduct exposure-related activities involving ionising radiation, which increased the amount of the supervised activities up to 6612, as of end of December 2019 (4.7% increase compared with the previous year). The President of the PAA granted 658 authorizations to take up positions of substantial importance for ensuring nuclear safety and radiological protection in entities that conduct the exposure-related activities. Furthermore, 127 persons obtained a radiation protection officer license.

One of the basic duties of the President of the PAA is also taking actions towards enhancing the radiation surveillance system in the country. In the previous year, 5 stations of early detection of radioactive contamination were launched, and in 2020, 15 new stations are planned to be added to the network along the eastern border of the country.

Meanwhile, the PAA's staff systematically evaluates the provisions of the Act – Atomic Law Act, in order to adapt them to the current level of knowledge in the field of nuclear safety and radiological protection. In September 2019 important amendments to the Act came into force raising the standards of ensuring safety of the personnel, patients, and the society from the effects of ionising radiation.

Last but not least, the PAA continues preparation to properly fulfil the tasks designated by the Polish Nuclear Power Programme. In the previous year, the efforts were primarily focused on perfecting the internal procedures within the scope of evaluating the safety of the first Polish nuclear power plant. I am fully convinced that thanks to those actions the nuclear supervision system will be fully capable of conducting efficient and proper evaluation.

I encourage you to study the Report!

Dr. Łukasz Młynarkiewicz
President of the National Atomic Energy Agency

1 National Atomic Energy Agency

7 Role of the President of the National Atomic Energy Agency
8 Organizational structure
9 Staffing
9 Council for Nuclear Safety and Radiological Protection
10 Budget
11 Assessment of the PAA's operations
11 National Atomic Energy Agency and the Polish Nuclear Power Programme

Fot. PAA

Role of the President of the National Atomic Energy Agency

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

The scope of activities of the PAA President includes tasks which involve ensuring nuclear safety and radiological protection of Poland, 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 ionizing radiation exposure of people and natural environment, including inspections conducted in this scope and issuance of decisions on licenses and authorizations connected with the said activity;

3. Promulgation of technical and 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 providing 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 relating to radiological protection, nuclear safety, nuclear security and safeguards;

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

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

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

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

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

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

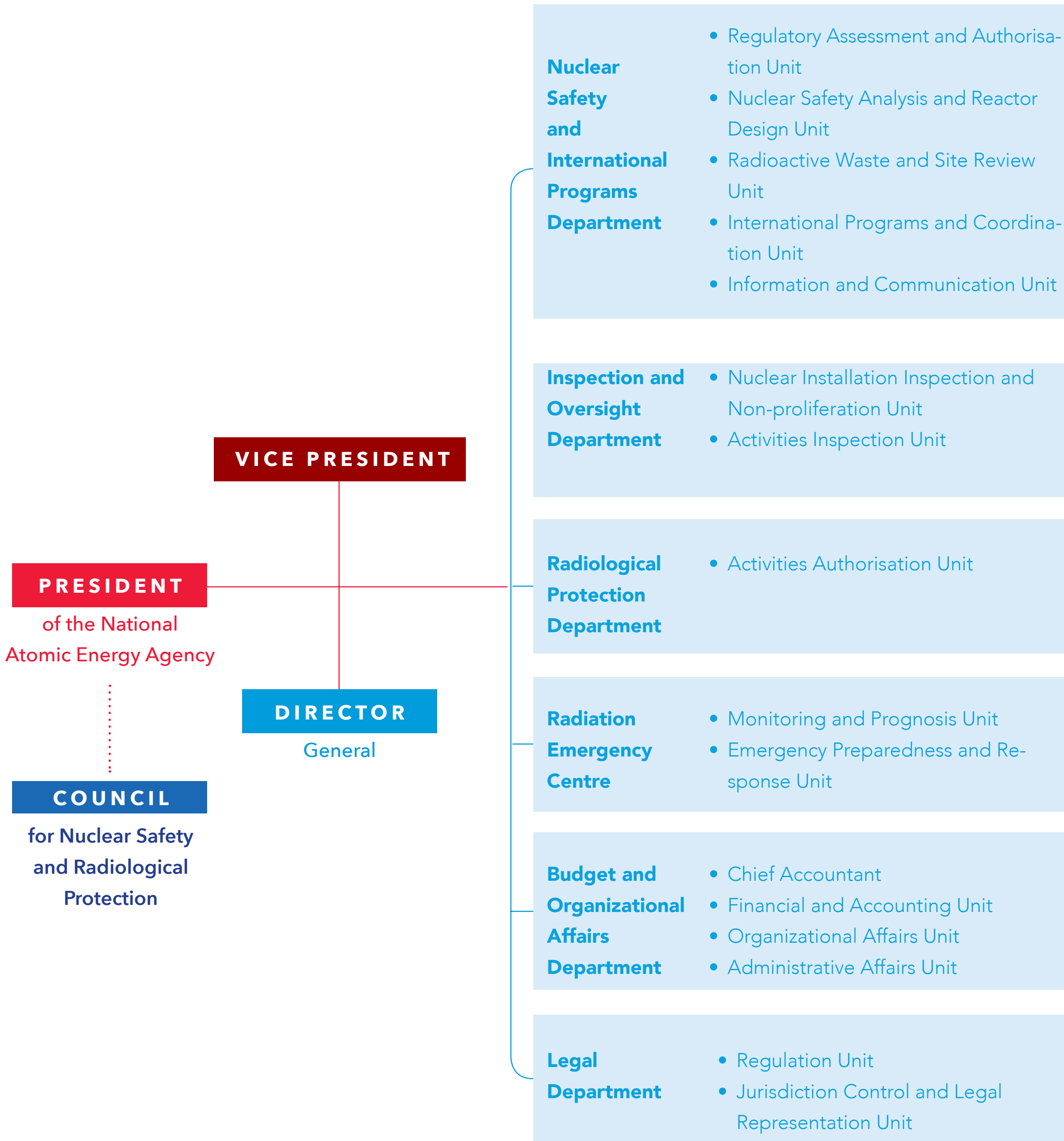
12. Issuing opinions on draft legal acts developed by authorized bodies;

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

Organizational structure

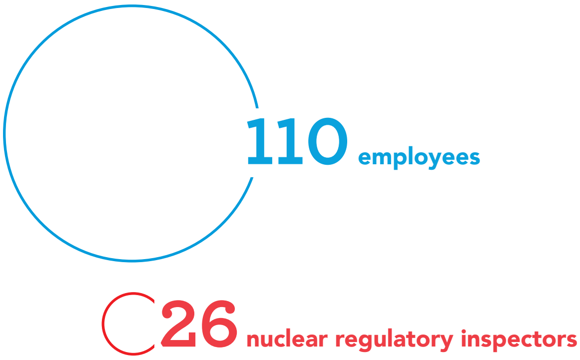
FIG. 1.

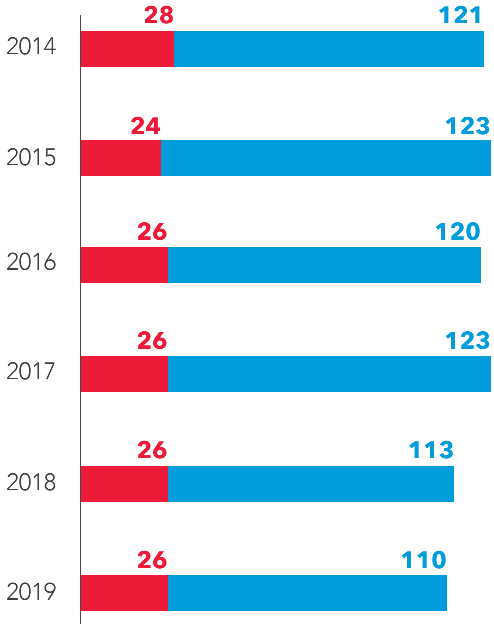
Organizational structure of the PAA
(as of 18 January 2019)



Staffing

The average annual employment level at the PAA in 2019 was 110 persons (number of jobs: 106.34). These numbers were calculated based on the employment level without persons on unpaid and parental leave. As of 31 December 2019, the PAA employed 26 nuclear regulatory inspectors were employed, including 2 persons on unpaid leaves.





Council for Nuclear Safety and Radiological Protection

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

Tasks of the Council

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

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

Members of the Council

Members of the BJiOR Council as of the end of 2019:

Professor **JANUSZ JANECZEK**
Chairman of the Council

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

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

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

TOMASZ NOWACKI Ph.D.
Member of the Council

Budget

FIG. 2.

The PAA's budgetary expenses in 2019 amounted to PLN 34.4 million, including:

Assessment of the PAA's operations

Audits carried out by Supreme Audit Office

In 2019 the PAA was audited by the Supreme Audit Office (NIK) in the scope of state budget implementation in 2018 in section 68 – National Atomic Energy Agency.

The Supreme Audit Office positively assessed the state budget implementation in 2018 in section 68 – National Atomic Energy Agency.

National Atomic Energy Agency and the Polish Nuclear Power Programme

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

The National Atomic Energy Agency (PAA) 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 activities conducted in these facilities, perform safety inspections and assessments, issue licenses and impose potential sanctions.

As a part of its preparation for the exercise of the role of nuclear oversight for the nuclear power plants planned to be built in Poland, the PAA, in cooperation with the International Atomic Energy Agency and United States Nuclear Regulatory Commission (US NRC), has prepared a long-term Advanced Licensing Exercise Project (ALEP)[1]. Its objective is to prepare and improve the system for safety assessment developed by the PAA and issue of decisions concerning permits for construction of nuclear power plants.

In the spring of 2019, the President of the PAA officially initiated the second stage of the ALEP project, throughout which the PAA team carried out a simulation of controlled assessment and issuance of permission for the construction of nuclear power plant for the duration of 3 months. The outcomes of the carried out simulation were analysed and discussed during the workshop with partnering experts from the U.S. Nuclear Regulatory Commission (NRC) as well as with IAEA.

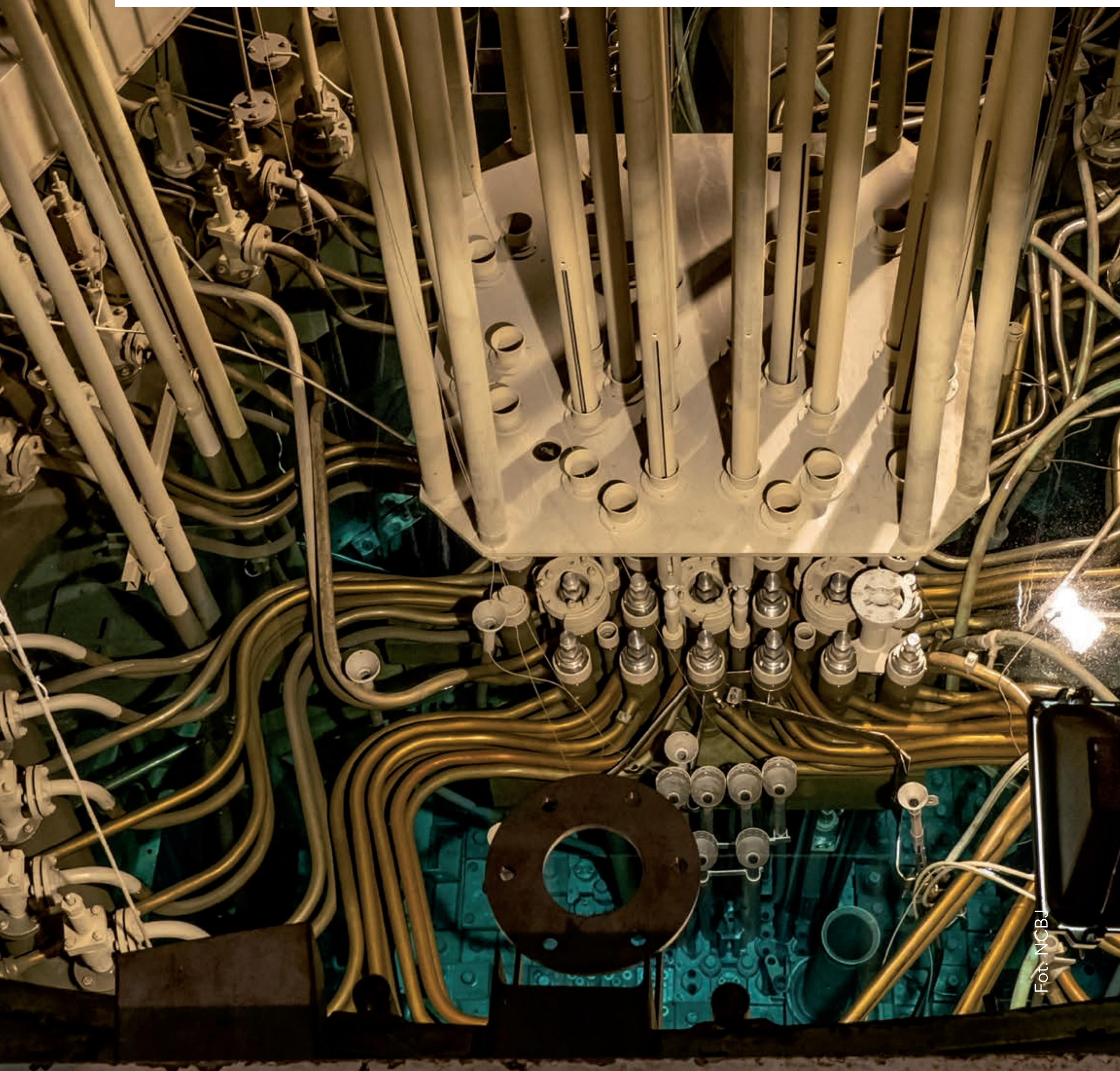
The participants of the project are 30 PAA employees, supported by experts - retired employees of the American and British nuclear regulatory bodies.

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

2 Infrastructure for nuclear regulatory activities in Poland

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

15 Basic provisions of law on nuclear safety and radiological protection



Fot. NCBJ

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

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

LEGAL BASIS

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

The nuclear regulatory authorities in Poland are:

- President of the PAA,
- nuclear regulatory inspectors.

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

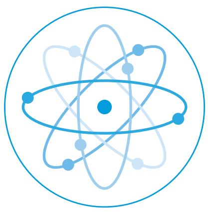
- supervision of activities involving nuclear material and ionizing radiation sources realized through:
  - regulatory safety verification of applications, granting licenses for performing such activities or registration of submissions and notification of the related activity,
  - control over the manner in which activities are performed and applying sanctions in the case of breaching 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 ionizing 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;
- recognizing and assessing the national radiation situation through coordination (including standardization) of works performed by local stations and units measuring the level of radiation dose rate, content of radionuclides in the chosen elements of natural environment and in drinking water, foodstuffs and feeding stuffs;
- maintaining services prepared to recognize and assess the national radiation situation and to respond in cases of radiation emergencies (in cooperation with other competent authorities and services operating under the national emergency response system);
- performing tasks aimed at fulfilment of obligations resulting from membership in international organizations as well as 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.

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

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

- Determining conditions which are required to ensure nuclear safety and radiological protection;
- Safety Assessment as a basis for granting and formulating the conditions of licenses and taking other administrative decisions;
- Issuing licenses for performance of activity which involves the exposure, consisting in (as per the status on 23 September 2019):
  - 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,
  - launching and use of equipment generating ionizing radiation,
  - launching of laboratories where ionizing 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 of 2020, item 186), trade in such products, import into and export from the territory of the Republic of Poland of consumer and medical products to which radioactive substances have been added, intentional administration of radioactive substances to people and animals for purposes of medical or veterinary diagnostics, therapy or scientific research;
- Granting personal authorizations related to the performance and supervision of those activities;
- Controlling the aforementioned activities from the perspective of compliance with the criteria specified in the applicable regulations and with requirements of the licenses granted;
- Imposition of sanctions forcing compliance with the above requirements as a result of the implemented administrative proceedings
- In the scope of activities connected with nuclear materials and facilities, the PAA President's supervision also involves approvals and inspections of physical protection systems as well as activities envisaged in the obligations of the Republic of Poland relating to nuclear safeguards.

.



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

Basic provisions of law on nuclear safety and radiological protection

The 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 licenses for activities connected with exposure to ionizing radiation (i.e. licenses for activities in the subchapter "Definition, structure and functions of the nuclear safety and radiological protection system"), obligations of heads of organizational units conducting activities which involve radiation and prerogatives of the President of the National Atomic Energy Agency (PAA) 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 ionizing radiation, their optimization and establishing dose limits for workers and the entire population;
- procedure for obtaining the required licenses concerning the performance of such activities as well as the mode and method of controlling the performance of such activities,
- activities where naturally occurring radioactive material is used,
- protection against exposure to radon in the workplace and in residential buildings,
- patient radiological protection requirements,
- principles of subjecting people to exposure to non-medical imaging,
- keeping records and inspection of ionizing radiation sources,
- siting, designing, construction, commissioning, operation and decommissioning of nuclear facilities,
- keeping records and inspection of nuclear material,
- physical protection of nuclear material and nuclear facilities,
- management of high-activity radioactive sources,
- classification of radioactive waste and methods of radioactive waste and spent nuclear fuel management;
- classification of workers and their workplaces based on the degree of exposure involved in the work performed and designation of protection measures suitable to counteract this exposure;
- training and issuing authorizations to be employed at particular positions considered important for ensuring nuclear safety and radiological protection,
- assessment of the national radiation situation,
- procedures applied in cases of radiation emergencies,
- elaboration of the system of managing radiation events,
- proceeding in situations of an existing threat,
- civil liability for nuclear damages.

In 2019, the following amendments to the Atomic Law Act came into force:

1. Art. 51 of the Act of 4 October 2018 on cosmetic products (Journal of Laws, item 2227) from 1 January 2019 replaced a term "cosmetics" contained in art. 4 (2) of the Act with the following term: "cosmetic products".
2. Art. 51 of the Act of 21 February 2019 amending certain acts in relation to ensuring application of the Regulation of the European Parliament and Council (EC) 2016/679 from 27 April 2016 on protection of individuals with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (general regulation on data protection) – Journal of Laws item 730 - on 4 May 2019 added to Art. 86c of the Act – Atomic Law Act par. 2– 5, introducing restrictions in information obligations and principles of securing personal data in case of collecting data from a data subject, stemming from Art. 13 of the Regulation of The European Parliament and Council (EU) 2016/679. In line

with these provisions, in case of collecting, verifying and processing of information of radiation events by the President of the PAA as well as the information regarding any attempts of illegal import into the territory of the Republic of Poland or export from its territory of radioactive substances, the required information must be placed within the Public Information Bulletin on the website of the publishing entity of the President of the PAA, on the website of the President of the PAA as well las in the generally accessible location of the headquarters of PAA, whilst the collected personal data must be secured against abuses or non-compliant with the law access or transfer of third parties.

3. Art 1 of the Act of 13 June 2019 – amending the Act – Atomic Law Act and the Act on Fire Protection (Journal of Laws of 2019, item 1593 and of 2020 item 284) introduced a number of changes targeted at implementing into the national law of the provisions from the Council Directive 2013/59/Euratom of 5 December 2013 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 of EU L13 from 17.01.2014, p. 1 with later amendments) and Directive of the Council 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations (Official Journal of EU L 219 from 25.7.2014, p. 42).

The work on the draft Act began in 2016. In years 2016-2018 the draft was subject to arrangements, consultations, and reviewing. The Council of Ministers approved the draft Act on 15 January 2019, and on 13 June 2019 it was enacted by the Polish Parliament. The Polish Senate adopted the Act unamended on 12 July 2019. The Act came into force on 23 September 2019, with the exception of art. 2 amending the Act of 24 August 1991 on fire protection (Journal of Laws of 2019 item 1372, with later amendments), which ultimately came into force on 1 January 2020.

The Atomic Law Act Amendment introduced, among others, the following solutions aimed at implementing Council Directive 2013/59/Euratom:

1) establishing the reference level for:
   a) a)external exposure of humans to indoors gamma radiation emitted from building materials,
   b) effective dose received by the members of emergency teams,
   c) the annual average activity concentration of radon in the air,
   d) the exposure of members of the public in case of radiological emergency and in the existing exposure situations;
2) adapting the value of effective dose limits and equivalent doses to the requirements of Council Directive 2013/59/Euratom as well as to the requirements for including specific radiation doses in dose limits;
3) extending the obligation of using the dose constraints for the members of the public, while granting the appropriate authorities with competences to determine dose constraints on a level that is lower than proposed by the heads of organizational entities carrying out activities related to ionising radiation exposure;
4) extending the obligation of training for the members of emergency teams in the field of radiation protection;
5) extending the information obligation for the outside workers that are under the threat of exposure during work in controlled or supervised areas;
6) introducing a new system of continuous training in the field of radiation protection of the patient for people conducting or supervising the diagnostic examination or treatment using ionising radiation;
7) extending the obligation of obtaining authorization for carrying out activities involving the activation of the material causing the increase of activity of consumer product;
8) prohibition of businesses that may pose a threat of exposure caused by activating materials added to toys or adornments resulting in the increase of the activity of said materials, import or export of such toys or adornments is also prohibited;
9) establishing a list of acceptable situations of non-medical imaging with a distinction between non-medical imaging using medical radiological

equipment and using other types of radiological equipment;

10) introducing notifications as another, right after licence and registration, form of regulating the activities related to the ionising radiation exposure, in minor cases;
11) identifying businesses that use naturally occurring radioactive materials leading to the occupational exposure or exposure of the members of the public in cases where the exposure is unavoidable from the perspective of radiation protection, and it is necessary to notify the appropriate entity.
12) determining the scope of the issues covered by the obligation of consulting a radiation protection expert;
13) introducing the obligation of measurement of radon concentration or the concentration of potential alpha energy of short-lived radon decay products in workplaces localized on ground floors or in basements, in workplaces related to groundwater treatment localized in areas where annual average activity concentration of radon in the air inside of a significant number of buildings may exceed the reference level amounting to 300 Bq/m3, and in workplaces localized underground; introducing a set of responsibilities concerning radiation protection of the personnel working in such workplaces and establishing rules of qualification for the exposure categories for those workers;
14) establishing the rules of radiation protection of the members of aircraft crews exposed to the effective dose that may exceed 1 mSv per year and exposed to the effective dose that may exceed 6 mSv per year;
15) implementing proper requirements for new ways of using ionising radiation, including medical exposure;
16) establishing additional requirements for conducting medical experiments and clinical examinations with the use of ionising radiation;
17) establishing requirements for conducting health screening with the use of ionising radiation;
18) introducing the obligation to state reasons for endangering the carers and comforters of the patients undergoing medical exposure;
19) introducing the obligation to use diagnostic reference levels for medical radiological procedures, and mandatory periodic reviews of said levels;
20) extending the responsibility for medical exposure to include all people participating in conducting a medical radiological procedure with the accordance to the operations performed by those people;
21) regulation of the procedures for developing and announcing the exemplary medical radiological procedures and the detailed medical radiological procedures;
22) placement of an obligation on health care units to submit to internal and external audits and determining costs and methods of conducting such audits;
23) establishing specific requirements for the equipment and control of physical parameters of radiological devices;
24) imposing an obligation of conducting the evaluation of the exposure of members of the public on the heads of organizational entities, and establishing requirements for determining doses for members of the public;
25) establishing requirements for organizational entities that have permission, based on a licence, for discharging liquid or gaseous radioactive waste into the environment;
26) placement of an obligation onto heads of organizational entities of proper selection and appropriate use of dosimetric equipment as well as testing its serviceability, maintenance, and calibration;
27) placement of an obligation on the heads of organizational entities of developing a system of managing radiological emergencies, carrying out comprehensive hazard analyses and including the conclusions drawn from said analyses in developing emergency response plan – imposing the same obligation on regional governors and the minister for internal affairs in relation to radiological emergencies on regional and national level;
28) adapting the list of the entities authorized to supervise and control the nuclear safety and radiological protection to the requirements resulting from the Directive, through broadening the scope of competence of nuclear regulatory authorities and health inspection authorities, and granting the competences in said scope to directors of the regional mining authorities in relation to the activities they are responsible for, and to the President of the Civil Aviation Authority in the scope of the activities related to operating the aircrafts in which the effective

dose of ionising radiation, resulting from the cosmic radiation, that members of the aircraft crews are exposed to, may exceed 1 mSv per year;

29) adapting the range of tasks of national contact points to the tasks resulting from the Directive;
30) adapting the scope of obligations and powers of an radiation protection expert to the range of tasks specified in the Directive, and determining the duties accessible to unauthorized personnel of organizational entities, trained by the radiation protection expert and appointed in writing by the head of a given organizational entity;
31) adapting the scope of control of radioactive sources and the methods of its registration to the requirements of the Directive;
32) placement of an obligation on the heads of organizational entities to immediately notify the President of the National Atomic Energy Agency (PAA) about loss, theft, significant leakage, unauthorized use of radioactive source, and release of the radioactive substance from that source;
33) introducing a requirement of placing specified conditions of conducting activities related to a high activity source which must be listed in the permission;
34) placing an obligation on the President of the National Atomic Energy Agency (PAA) to carry out cyclical campaigns on the retrieval of orphan sources;
35) placing an obligation on the heads of organizational entities of registering and analysing any accidental exposures, as well as submitting the conclusions from the analyses to the appropriate authority; in case of cooperation with a health inspection authority a head of organizational entity is obliged to keeping the record of accidental exposures and informing the National Centre of Radiation Protection in Health Care about any accidental exposures, their reasons, consequences, and the undertaken preventive measures;
36) determining a general content of on-site, regional, and national emergency plans and implementing statutory requirements for the emergency plans to include, among others, a strategy to manage existing exposure after radiological emergency; one of the steps of said strategy shall be the actual procedure of the transition from the phase of response to an emergency exposure situation to an existing exposure situation;
37) placing an obligation onto organizational entities, governors, and the minister for internal affairs of conducting periodic alert exercises in order to review and update the emergency plans;
38) adding regulations for identifying the existing exposure situations, introducing an obligation to immediately notify an appropriate authority about the existence of an emergency, and determining the steps of the strategy for managing existing exposure situation after radiological emergency, the strategy should include the reference levels and main goals to be achieved;
39) placing an obligation on the minister responsible for health care matters to develop a national action plan addressing long-term risks from radon exposure in buildings designed for permanent residence of people, to determine the content of the plan and the mode of its preparation and announcement;
40) placing an obligation on the Chief Sanitary Inspector to conduct activities aimed at identifying areas where the annual average activity concentration of radon in the air may exceed the reference level in a significant number of buildings

The issues related to the implementation of Council Directive 2013/59/Euratom, that had not been regulated in Polish law, are mostly the issues regarding radon exposure in residential buildings and workplaces, the issues regarding activities using naturally occurring radioactive materials (NORM) or implementing, through the Directive, an additional form of regulating the activities connected with exposure by using notifications (aside from hitherto required licences and registration).

The solutions of Council Directive 2014/87/Euratom implemented in the Act include, among others:

1) regulating the scope of responsibility of the licence holder for the contractors and subcontractors whose actions may have a direct impact on the nuclear safety of the nuclear installation, and for the appropriate human resources of the contractors and subcontractors;
2) introducing a requirement of designing, siting, constructing, commissioning, operating and decommissioning of nuclear facilities shall be done with particular regard to preventing accidents, and in case of emergency taking place – mitigating its

consequences and avoiding early or large radioactive releases;

3) introducing management systems that are focused on nuclear safety and aimed at encouraging the personnel to question safety procedures and report safety-related issues as soon as they appear;
4) introducing the obligation to perform regular and systematic evaluations of safety of nuclear facilities within the scope determined in the Directive;
5) introducing periodic self-assessments and mutual international evaluation of chosen aspects of safety of nuclear facilities.

The main goal of the Atomic Law Act amendment is also regulating other issues that need improvement within the field of nuclear safety and radiation protection, with particular regard to the report from the mission of Integrated Regulatory Review Service (IRRS) carried out in 2013 in Poland by the International Atomic Energy Agency. Such issues include:

1) comprehensive regulation of the issues related to emergency response and planning for emergencies, specifically:
   a) extension of regulations regarding reporting radiological emergencies to appropriate authorities,
   b) extension of regulations regarding development of emergency response plans,
   c) introducing the obligation of designating emergency planning zones around nuclear facilities,
   d) introducing the obligation to launch and maintain radiological monitoring inside and outside of the premises of organizational entities classified as I or II of hazard category;
2) implementing statutory basis for adopting strategies for nuclear safety and radiological protection of the country by the Council of Ministers;
3) implementing statutory regulation of the conditions of dismissal of the President of the National Atomic Energy Agency (PAA) as well as the terms of his term of office;
4) amendments of certain regulations regarding the decommissioning fund and radioactive waste, including:
   a) a) introducing the obligation to storage the radioactive waste from nuclear facilities in solid state, which will enhance the safety of radioactive waste management,
   b) imposing the Radioactive Waste Management Plant (ZUOP) and the municipality with the National Radioactive Waste Repository (KSOP) on its premises, with the obligation to provide the residents with information about the repository,
   c) broadening the competences of the minister responsible for energy with the power to grant the KSOP status to disposal sites, and to supervise the decommissioning fund. Also, the order to suspend the operations in a nuclear power plant, imposed by the President of the National Atomic Energy Agency (PAA) in case of not contributing financially to the decommissioning fund, is now subject to the motion of the minister responsible for energy;
5) amendment of the laws regarding physical protection of nuclear facilities, particularly introducing the regulations concerning development, agreement, enactment and use of design basis threat (DBT).

Implementing regulations to the Atomic Law Act

The Regulation of the Council of Ministers of 17 September 2019 amending the Regulation regarding the model of quarterly report on the amount of financial contribution to the decommissioning fund (Journal of Laws, item 1897) came into force on 22 October 2019. According to the said regulation the new model of quarterly report, constituting an appendix to the Regulation of 27 December 2011 of the Council of Ministers regarding the model of quarterly report on the amount of financial contribution to the decommissioning fund (Journal of Laws of 2012, item 43), now requires a legible signature of the head of organizational unit, name and surname necessary, instead of the previously used stamp. The regulation meets the requirements of the government document passed on 28 June 2018, titled "Information on the deregulation of the obligation of using stamp/stamps by citizens and entrepreneurs", that was adopted by the Council of Ministers.

2019 was also the year of undertaking actions towards developing draft implementing acts; the necessity behind the issuance of the said acts results from the Polish Parliament's enactment of the act amending the act – Atomic Law Act and the Act on Fire Protection. As of 31 December 2019 the Council of Ministers was in the process of agreement, reviewing and consulting of the following draft regulations:

1) Regulation on the list of building materials for which the activity concentration of the radioactive isotopes potassium K-40, radium Ra-226, and thorium Th-232 is determined, the specific requirements for carrying out the determinations and indicating the radioactive concentration index value, exceeding of which shall be reported to appropriate authorities;
2) Regulation amending the Regulation regarding the basic requirements for the controlled and supervised areas;
3) regulation on the ionising radiation protection of the outside workers exposed to it during their work on a controlled or supervised area;
4) Regulation amending the Regulation regarding the detailed conditions of the safe work with ionising radiation sources;
5) Regulation on cases where the activity related to ionising radiation exposure does not fall under the obligation of obtaining a licence, registration or notification, and cases where such activity can be performed only after obtaining a licence, registration or notification;
6) regulation on cases where the activity related to ionising radiation exposure coming from natural radioactive isotopes does not require sending a notification;
7) Regulation on the radiation protection experts;
8) Regulation on the indicators determining the doses used for the evaluation of the ionising radiation exposure;
9) Regulation on the requirements for the registration of individual doses;
10) Regulation amending the Regulation regarding the radioactive waste disposal and spent nuclear fuel.

The draft Regulation of the Minister of Climate regarding the model of the nuclear regulatory inspector service card was at the same stage of development.

Moreover, the draft regulations of the Council of Ministers were developed and submitted for the List of legislative and program works of the Council of Ministers. The draft regulations concern:

1) operational intervention levels for immediate intervention measures and other intervention measures;
2) documents required for submitting an application for a licence to carry out activity related to ionising radiation exposure or for registration of conducting such activity;
3) the scope of the program of the radiation monitoring of discharges of radioactive substances to the environment developed and implemented by the organizational entities classified as I or II of hazard category;
4) radiation emergency plans;
5) position of significance in order to ensure nuclear safety and radiological protection,
6) securing the radioactive sources;
7) the scope of the analysis of the dangers resulting from the activities related to ionising radiation exposure and the forms of presenting the conclusions drawn from such analyses;
8) nuclear regulatory inspectors

Other acts

The regulations indirectly related to the issues regarding nuclear safety and radiological protection are also included in other acts, especially:

- Act of 19 August 2011 on transport of hazardous products (Journal of Laws of 2020, item 154),
- Act of 18 August 2011 on marine safety (Journal of Laws of 2019, item 1452, as amended
- Act of 21 December 2000 on technical supervision (Journal of Laws of 2019, item 667, as amended).

3

Supervision of the use of ionizing radiation sources

22 Tasks of the PAA President in terms of regulatory oversight of activities connected with exposure to ionizing radiation
22 Users of ionizing radiation sources in Poland
26 Register of sealed radioactive sources

Fot. NCBJ

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

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

Users of ionizing radiation sources in Poland

The number of registered organizational units conducting activity (one or more) involving exposure to ionizing radiation subject to regulatory supervision of the PAA President amounts to 4373 (status as of 31 December 2019).

The number of registered activities involving exposure to ionizing radiation amounts to 6621 (status as of 31 December 2019).

Issuance of licenses, collection of submissions and notifications

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

BASIS FOR ISSUANCE OF THE LICENSE

Pursuant to Article 5 (1) of the Act of 29 November 2000 on Atomic Law (Journal of Laws of 2019, item 1792, as amended); The type of documentation is specified in the Regulation of the Council of Ministers of 30 June 2015 concerning the documents required when submitting an application for issue of a license for conducting an activity associated with exposure to ionizing radiation or when reporting conduct of such an activity (Journal of Laws, item 1355), Additional information mentioned in art. 5 paragraph 1b point 3 of the Act – Atomic Law Act, if the content of the attached documents is insufficient to prove that the conditions of conducting exposure-related activities required by law were fulfilled.

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

In addition, 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 ionization radiation exposure does not require a license, decisions are issued on acceptance of notification of activity involving exposure to ionizing radiation or notifications in this regard. These cases have been listed in the Regulation of the Council of Ministers of 6 August 2002 concerning cases, in which activity involving exposure to ionizing radiation is not subject to the license or registration obligation and cases, in which it may be conducted on the basis of a registration (Journal of Laws item 1153, as amended) and Art 4 (5) of the Act from 13 June 2019 – amending the Atomic Law Act and the Act on Fire Protection.

Regulatory inspections

Inspections in organizational units, other than in those that have nuclear facilities and radioactive waste repositories, were conducted by nuclear regulatory inspectors from the Radiological Protection Department (DNK) and the Department of Radiological Protection (DOR) of the PAA – working in Warsaw, Katowice, and Poznań. In 2019, 763 such inspections were carried out, including 6 repeated inspections (second inspection in the same year), of which 370 inspections were conducted by inspectors from DNK and DOR from Warsaw, 326 – from Katowice, and 67 – from Poznań. Before each inspec-

FIG. 3.
The number of licenses for conducting operations in conditions of exposure to ionizing radiation and amending annexes to licenses granted by the President of the PAA in the years 2009-2019

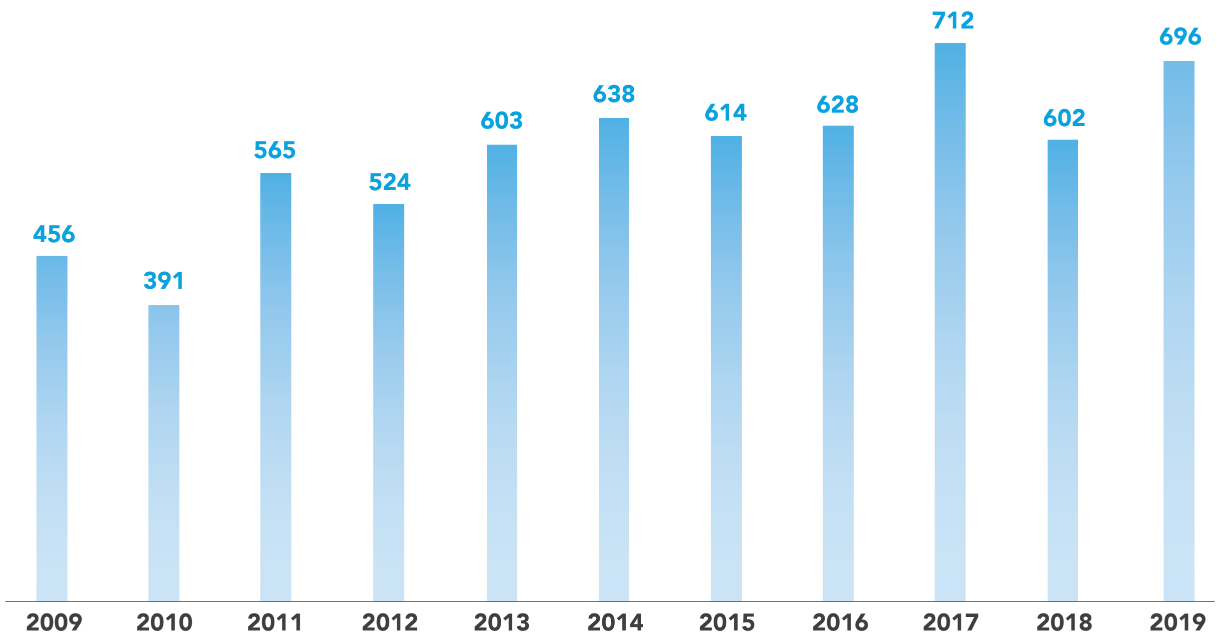


FIG. 4.
Number of inspections conducted by PAA inspectors in the years 2009–2019

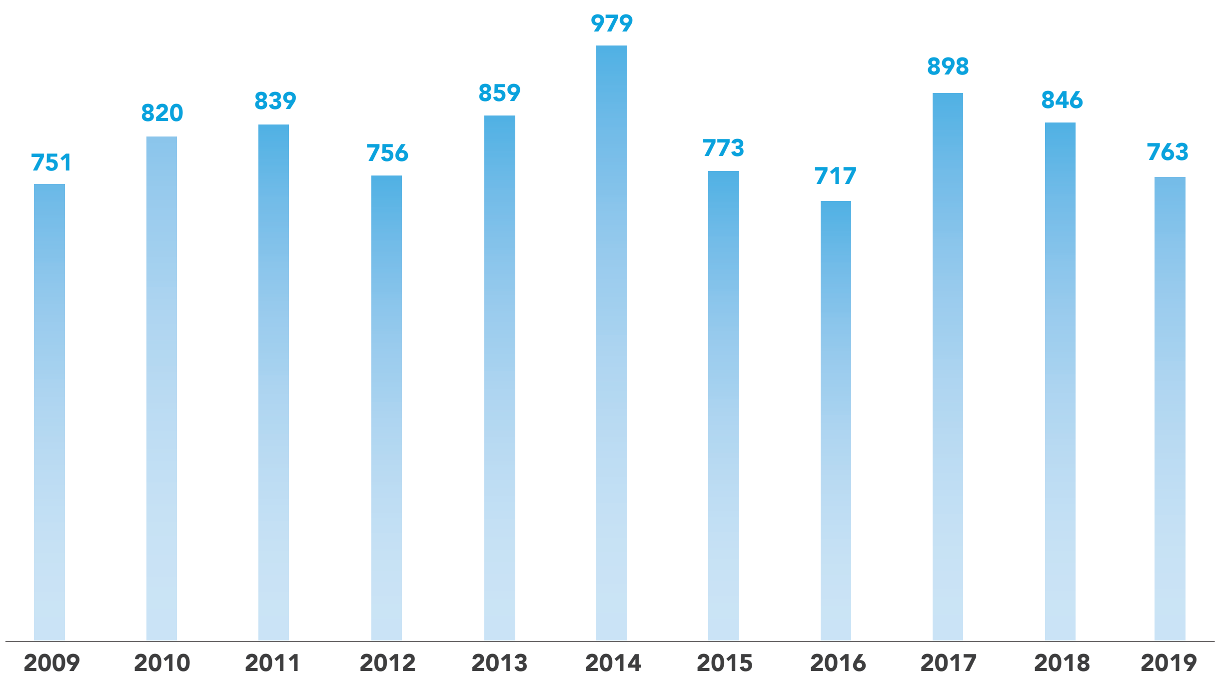


TABLE 1.
Ionizing radiation source users in Poland in numbers (as of 31 December 2019)

Type of operations	Symbol	Number of units	Number of types of operation
Class I laboratory	I	2	2
Class II laboratory	II	94	115
Class III laboratory	III	119	231
Class Z laboratory	Z	133	230
Isotope sensor installer	UIC	366	366
Equipment installer	UIA	199	251
Isotope device	AKP	533	690
Manufacture of isotope sources and devices	PRO	24	29
Trade in isotope sources and devices	DYS	82	90
Accelerator	AKC	79	221
Isotope applicators	APL	38	54
Telegamma therapy	TLG	4	4
Radiation device	URD	36	38
Gamma graphic apparatus	DEF	98	99
Storage facility of isotope sources	MAG	177	211
Work with sources outside registered laboratory	TER	76	88
Transport of sources or waste	TRN	497	510
Chromatograph	CHR	231	285
Veterinary X-ray apparatus	RTW	1,312	1,383
X-ray scanner	RTS	606	834
X-ray defectoscope	RTD	206	228
Other X-ray apparatus	RTG	450	662
Ad hoc checks			
Total:			6,621

NUMBER OF AUTHORIZATIONS ISSUED IN 2019			INSPECTIONS	
licenses	annexes	registration decisions	Number of inspections 2019	Inspection frequency
0	0	0	2	annually
13	16	0	51	every 2 years
6	3	4	26	every 3 years
7	5	1	39	every 4 years
6	3	0	8	ad hoc inspections
32	37	0	87	every 3 years
16	34	11	91	every 3 years
3	1	0	11	every 3 years
7	9	1	15	ad hoc inspections
38	5	0	75	every 4 years
5	1	0	28	every 2 years
0	1	0	4	every 2 years
1	1	0	14	every 3 years
3	11	0	41	every 2 years
24	8	1	63	every 3 years
9	2	1	18	every 3 years
4	2	0	11	ad hoc inspections
0	0	2	1	ad hoc inspections
141	2	0	6	ad hoc inspections
80	42	0	11	ad hoc inspections
14	8	0	72	every 2 years
79	17	4	79	ad hoc inspections
			10	ad hoc inspections
488	**208**	**25**	**763**	

tion started, a detailed analysis was performed of the collected documentation pertaining to the inspected organizational unit and its operations for the purpose of preliminary evaluation of presence of possible "critical points" in such operations and the quality assurance system in place in such unit.

Periodical and ad hoc inspections

In order to ensure the appropriate frequency of inspections, depending on the risk caused by the given group of activities, inspection cycles were agreed by groups of activities. Based on risk assessment and inspections' results from the last few years, activities were identified which do not require direct supervision such as routine inspections due to the strengthened safety culture of the involved personnel.

Ad-hoc inspections in entities performing the relevant activities are only conducted occasionally, as the need be, whilst supervision of such activities is mostly based on the analysis of: activity reports, records of individual radioactive sources and declarations of shipment submitted.

Furthermore, with respect of license applications for the conduct of activities related to the exposure to ionizing radiation, inspections were performed by inspectors from the Department of Radiological Protection.

Data regarding inspections performed by nuclear regulatory inspectors in 2019 are presented in Table 1.

Register of sealed radioactive sources

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

Heads of organizational units performing activities involving the use or storage of sealed radioactive sources or equipment featuring such sources under the corresponding authorization are required to submit copies of records of radioactive sources to the PAA President. Such documents include record sheets containing the following data about sources: radioactive isotope name, activity level according to the source certificate, date when the activity was established, certificate number and source type, container type or device name and place of the source use or storage.

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

The register contains data of 27,131 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. dates of receipt and shipment of the given source) and associated documents..

27,131

RADIOACTIVE SOURCES IN THE REGISTER

In Poland, sources are classified into three categories, depending on the purpose of the source, its activity and the radioactive isotope placed in it:

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

The register contains 1,442 sources of cat. 1 which are in use.

Category 2 – covers 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 2,486 sources of category 2 which are in use.

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

The register contains 7,846 sources of category 3 which are in use.

TABLE 2.
Selected radioactive isotopes and sources containing them which are in use (as of 31 December 2019)

	Number of sources in the register		
Isotope	cat. 1	cat. 2	cat. 3
Co-60	798	1,272	1,883
Ir-192	304	75	2
Cs-137	85	276	2,273
Se-75	225	18	4
Am-241	10	374	803
Pu-239	2	100	99
Ra-226	-	75	59
Sr-90	-	44	777
Pu-238	1	79	22
Kr-85	5	48	177
Tl-204	-	-	96
other	12	125	1,651
total	1,442	2,486	7,846

1,442
CATEGORY 1 SOURCES

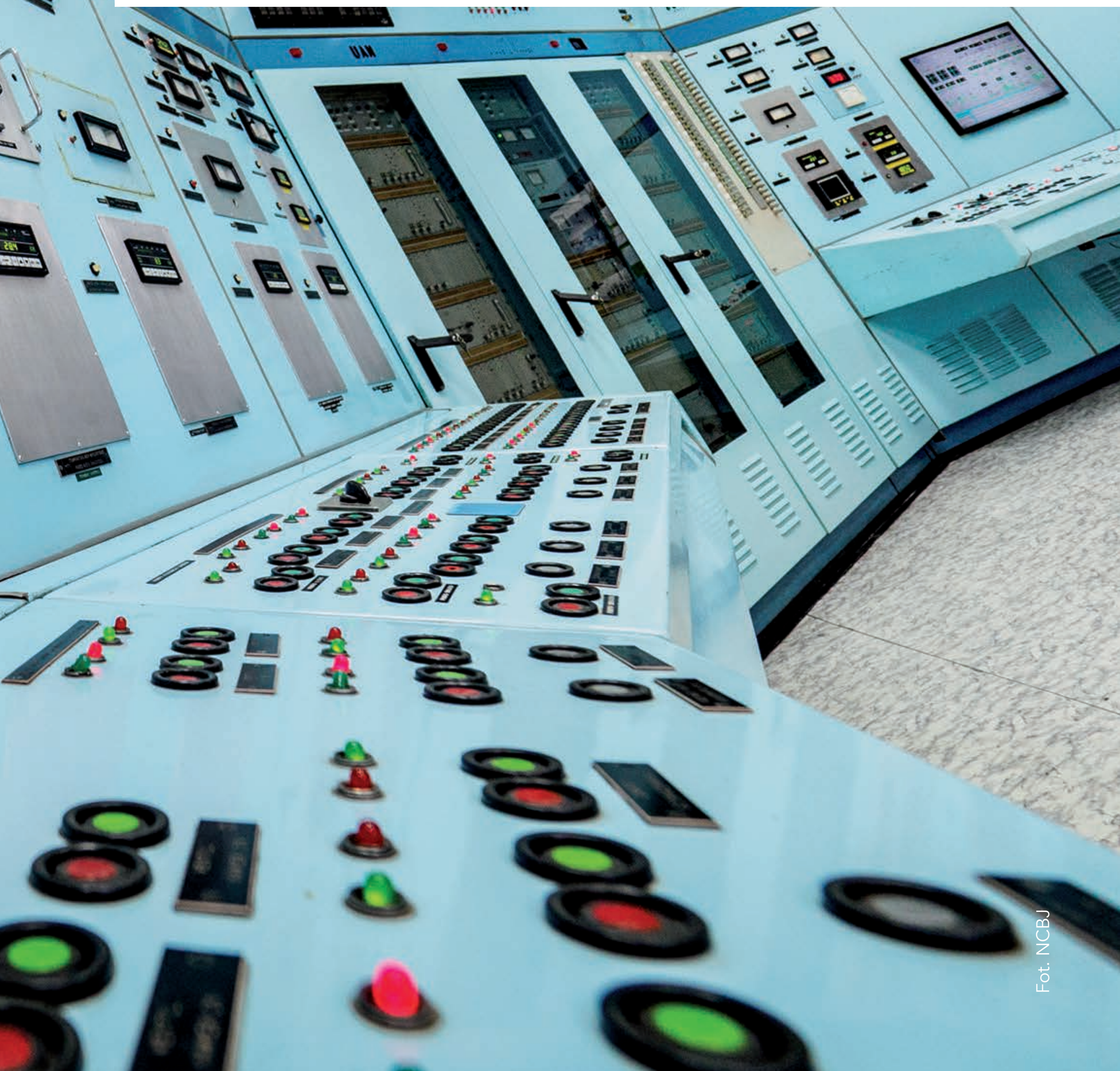
2,486
CATEGORY 2 SOURCES

7,846
CATEGORY 3 SOURCES

4

Supervision of nuclear facilities

29 Nuclear facilities in Poland
34 Licenses issued
34 Regulatory inspections
35 Functioning of the coordination system for inspection and supervision of nuclear facilities
36 Nuclear power plants in neighboring countries



Fot. NCBJ

Nuclear facilities in Poland

Nuclear facilities in Poland include:

- the MARIA research reactor,
- the EWA reactor (in the course of decommissioning),
- spent nuclear fuel storages.

These objects are located in Świerk near Otwock in two organizational units:

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

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

The MARIA reactor

The MARIA research reactor is historically the second nuclear reactor built in Poland apart from critical assemblies of ANNA, AGATA and MARYLA) and at present, it is the only working nuclear reactor in the country. It is a high-flux pool-type reactor with the nominal thermal power of 30 MW_t and the maximum flux density of thermal neutrons in the core of $3{,}5 \cdot 10^{18} n/(m^2 \cdot s)$. The MARIA reactor was commissioned in 1974, and in the years 1985–1993, the reactor was shut down for the necessary modernization which included installation of a passive core cooling system using water from the reactor pool. From April 1999 to June 2002, gradual conversion of the reactor core was conducted in 106 consecutive reactor fuel cycles, leading to the decrease of fuel enrichment from 80% to 36% of the U-235 isotope content (HEU – High Enriched Uranium). As a part of implementation of the Global Threat Reduction Initiative (GTRI) programme, in 2014, the MARIA reactor was adapted to work using low enriched uranium (LEU) fuel with enrichment below 20%.

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

In 2019 the reactor operation schedule was adapted to:

- include irradiation of uranium plates required for production of molybdenum isotope (Mo-99);
- irradiation of target materials for the Radioisotope Centre, namely tellurium dioxide, potassium chloride, sulphur, lutetium, cobalt and iron – intended for production of radioisotopes used in nuclear medicine. Figure 6 provides statistics concerning the irradiation of target materials (from 1997 up to and including 2019);
- conduct of tests with uranium core plates in the form of microspheres UO_2;
- irradiation of holmium targets in the form of microspheres 165Ho-PLLA MS, which are used in the procedure of selective brachytherapy.

In 2019, the MARIA reactor was in service for 4,087 hours, working in 34 fuel cycles, as illustrated in Figure 7.

In 2019, the MARIA reactor was in service for 4,087 hours, working in 34 fuel cycles, as illustrated in Figure 7.

Unscheduled outages were mainly caused by minor device and apparatus malfunctions not constituting a threat to nuclear safety. The number of conducted maintenance works has also increased.

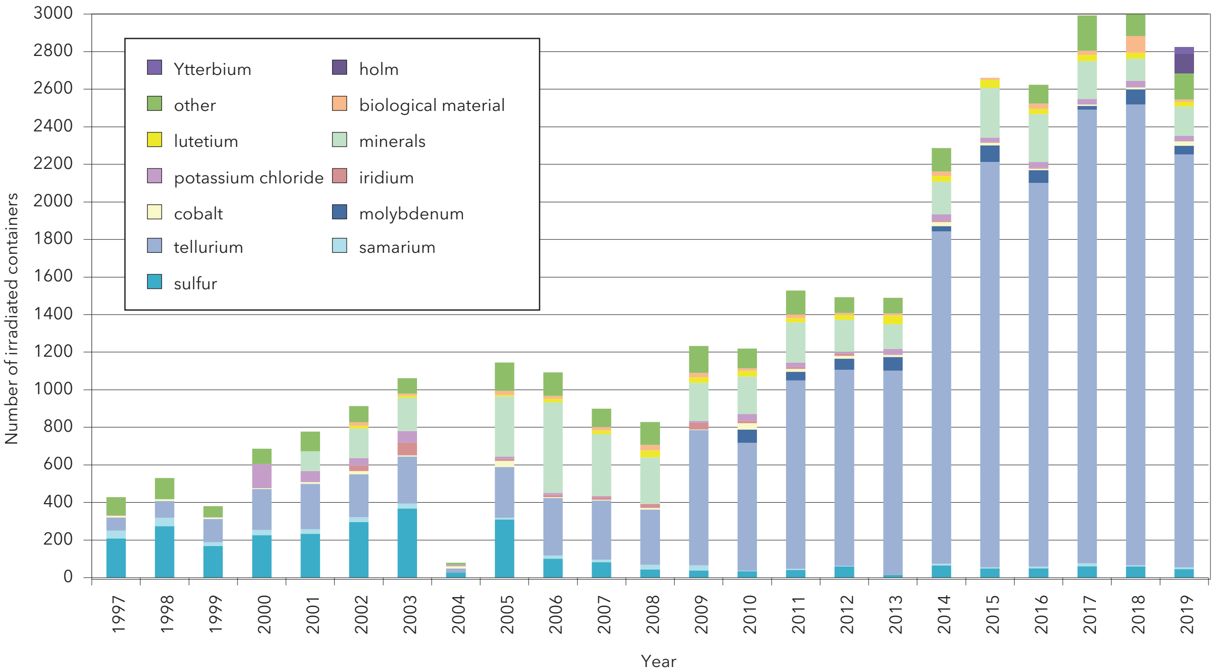
The MARIA research reactor has also been used for physical studies, mainly of condensed matter, using six horizontal channels (H-3 to H-8). In 2019, the horizontal channels were closed because they are being prepared together with the physical hall (where research is conducted on the use of those channels), for a modernization. In the coming years, as a part of the modernization, modern research equipment obtained from another foreign research reactor is planned to be installed.

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

Summary of general information regarding the operations of the reactor has been shown on the infographic on pages 32-33.

FIG. 6.

Materials irradiated in the MARIA reactor until 2019 (data: NCBJ)



The EWA reactor in the process of shut down

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

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

Currently, the building of the former EWA reactor houses:

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

Spent nuclear fuel storages

Nuclear facilities also include wet spent nuclear fuel storages, i.e. facilities no. 19 and 19A operated by the Radioactive Waste Management Plant.

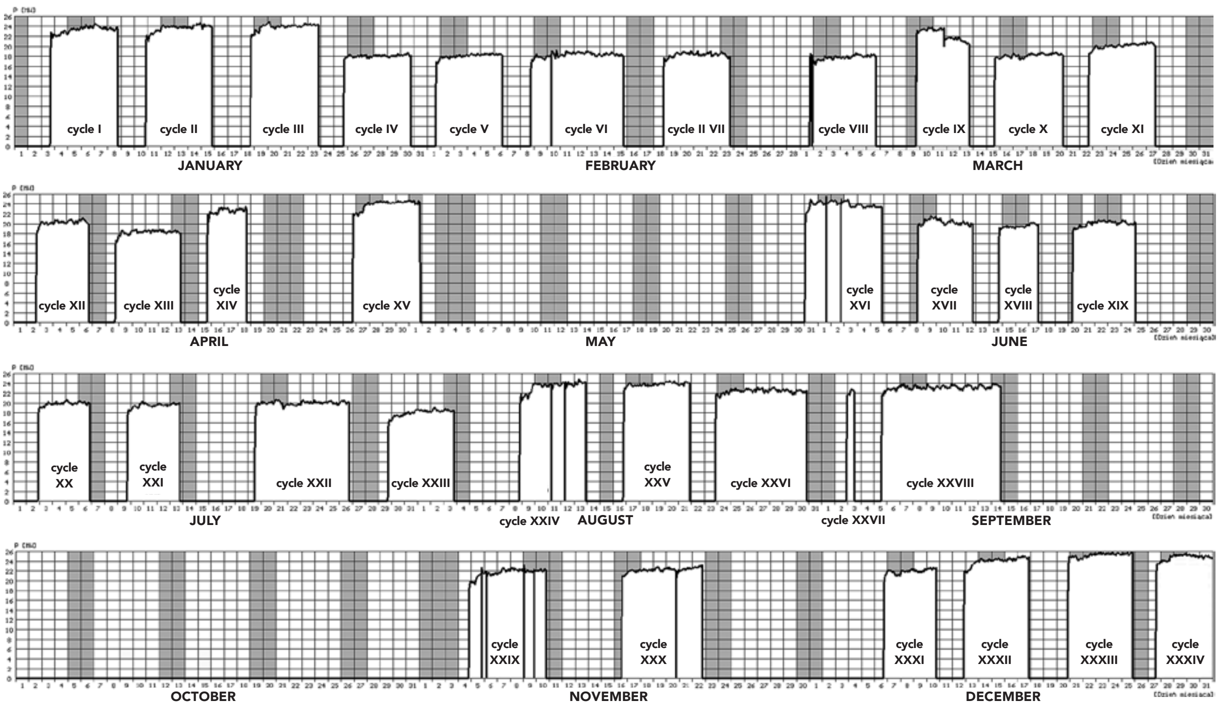
Facility no. 19 is used to store the encapsulated spent low enriched nuclear fuel EK-10 from the EWA reactor, shipped to the country of origin (i.e. the Russian Federation) in September 2012.

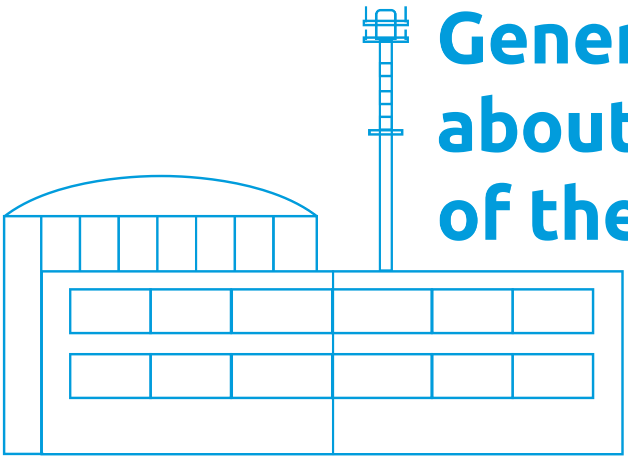
This facility is now used for storage of some solid radioactive waste (structural elements) from decommissioning of the EWA reactor and operation of the MARIA reactor, as well as disused high-activity gamma radiation sources.

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

FIG. 7.

Summary of the working cycles of MARIA reactor in 2019 – (Data: NCBJ), elaboration and completion: Andrzej Frydrysiak DOM EJ2





General information about operation of the MARIA reactor

Time of operation at nominal power [h]

4087

I. 1357
II. 840
III. 1134
IV. 756

Number of work cycles

I. 11
II. 8
III. 9
IV. 6

Average reactor power in cycles [MWt]

I. 17–24
II. 19–23
III. 18–23
IV. 22–25

17–25

Number of fuel elements in the core

25-26

per quarter in 2019

OFF

Unplanned shutdowns and trips

Human error	Equipment malfunction (I.)	Instrumentation error (II.)	Loss of electrical power
0	3	5	4

Malfunctions/defects and non-compliances found

Q1	Q2	Q3	Q4	Total
2	1	1	1	5

Repair and maintenance works conducted

Q1	Q2	Q3	Q4	Total
5	12	4	8	29

Tests, inspections and checks conducted

Q1	Q2	Q3	Q4	Total
15	38	29	34	116

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 from 3 April 2015 for storage of nuclear materials,
- License no. 2/2015/NCBJ of 3 April 2015 for storage of spent nuclear fuel.

In 2019 decision no. 1/2019/MARIA was issued on 30 July 2019 amending license no. 1/2015/Maria related to modification of documentation on the basis of which reactor is subjected to use.

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

Regulatory inspections

In 2019, PAA nuclear regulatory inspectors conducted 12 inspections concerning nuclear safety, radiation protection, transportation and physical protection of nuclear material and nuclear facilities. The inspections did not show any threat to nuclear safety and radiological protection; however, in some cases the regulatory inspectors identified breaches of provisions related to ongoing operation and violation of the terms and conditions of the license.

PAA conducted:

8

8 INSPECTIONS IN THE NATIONAL CENTRE FOR NUCLEAR RESEARCH (NCBJ)

3

3 INSPECTIONS AT THE RADIOACTIVE WASTE MANAGEMENT PLANT, INCLUDING: 1 INSPECTION AT THE NATIONAL RADIOACTIVE WASTE REPOSITORY (KSOP) IN RÓŻAN AND 2 INSPECTIONS AT THE RADIOACTIVE WASTE MANAGEMENT PLANT IN ŚWIERK NEAR OTWOCK

1

1 INSPECTION AT **STSI ETABLISSEMENT BELGIQUE**

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,
- the status of radiation protection of the reactor facility,
- the ways to eliminate the findings identified during previous regulatory inspections;
- the water treatment system,
- the reactor and lock basin,
- the heat exchangers,
- the warnings and alarms signalization system
- the fuel channels cooling system,
- the radioactive waste management,
- the instruments of the process control and neutron measurements system,
- the safety systems settings,
- functioning of the nuclear materials and nuclear facility physical protection system,
- emergency arrangements.

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

- the status of radiological protection of the facilities operated by the ZUOP,
- carrying out the processes of treatment of radioactive waste,
- the technical condition of the ZUOP facilities,
- radioactive waste inventory database (a computer database),
- verification of the ways to eliminate the findings identified during previous regulatory inspections.

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

- the procedures for transport of radioactive waste at the KSOP,
- compliance of current operation with applicable regulations,
- receipt of waste at the KSOP repository and radiological measurements at the repository,
- physical protection at the KSOP,
- verification of the ways to eliminate the findings identified during previous regulatory inspections.

The inspection of STSI ETABLISSEMENT BELGIQUE concerned transport, storage and reloading of nuclear materials designated for irradiation in the MARIA research sector and their physical protection.

In the course of the inspections, 18 irregularities were identified –10 at the MARIA research reactor, 7 at the ZUOP, and 1 at the KSOP. In 2019, the PAA President initiated 13 procedures ordering remedy of the shortcomings from 2018 ordering removal of irregularities detected in the course of the above stated inspections.

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

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

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

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

In 2019, activities within the framework of the coordination system included:

- continued collaboration between PAA and the Internal Security Agency in supervision of the physical protection system of the MARIA reactor,
- joint participation of the Internal Security Agency and the PAA experts in the Security in the Transport of Radioactive Material for Operator Workshop on 16-20 September 2019 in Warsaw.

NUCLEAR POWER PLANTS IN NEIGHBOURING COUNTRIES

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

SWEDEN

Oskarshamm NPP

PL — 298 km

1 BWR unit
1,450 MWe

CZECH REPUBLIC

EJ Dukovany NPP

PL — 119 km

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

CZECH REPUBLIC

Temelin NPP

PL — 192 km

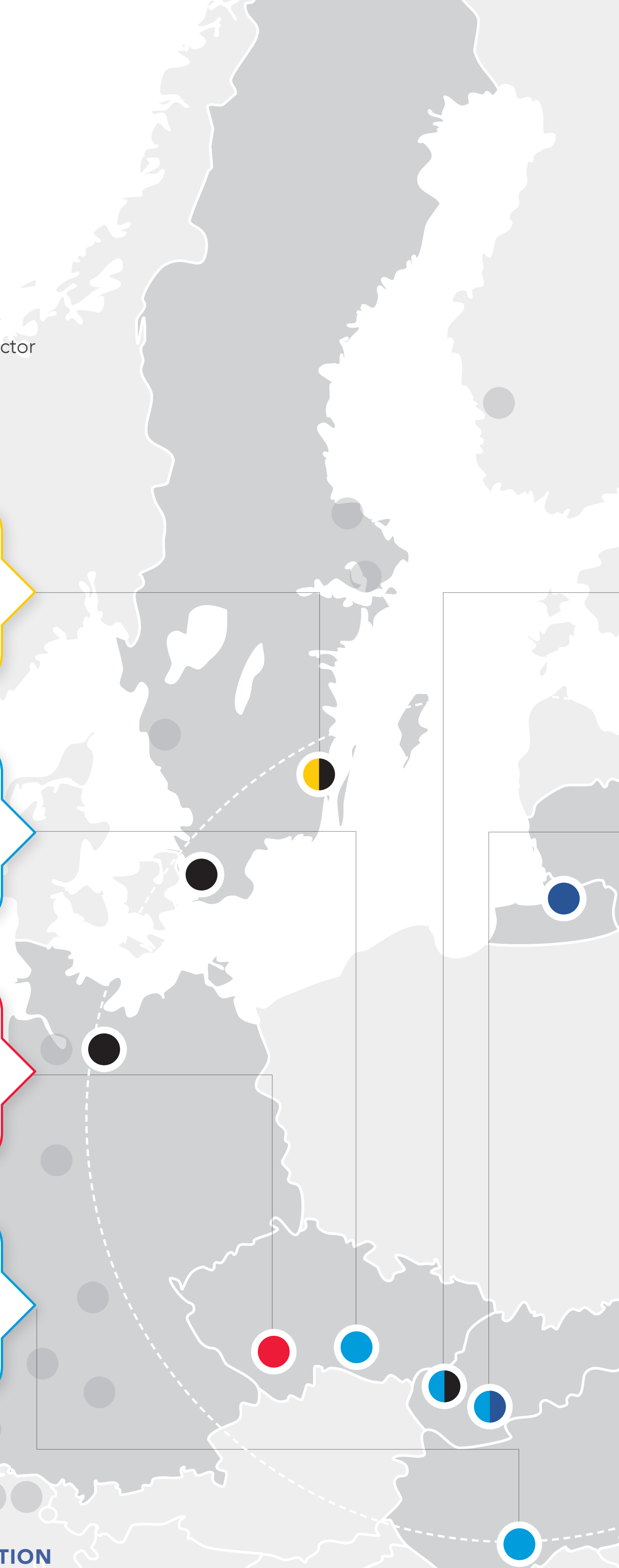
2 WWER-1000 units
1,080 MWe
1,080 MWe

HUNGARY

Paks NPP

PL — 300 km

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



NUCLEAR REACTORS UNDER CONSTRUCTION

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

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

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

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

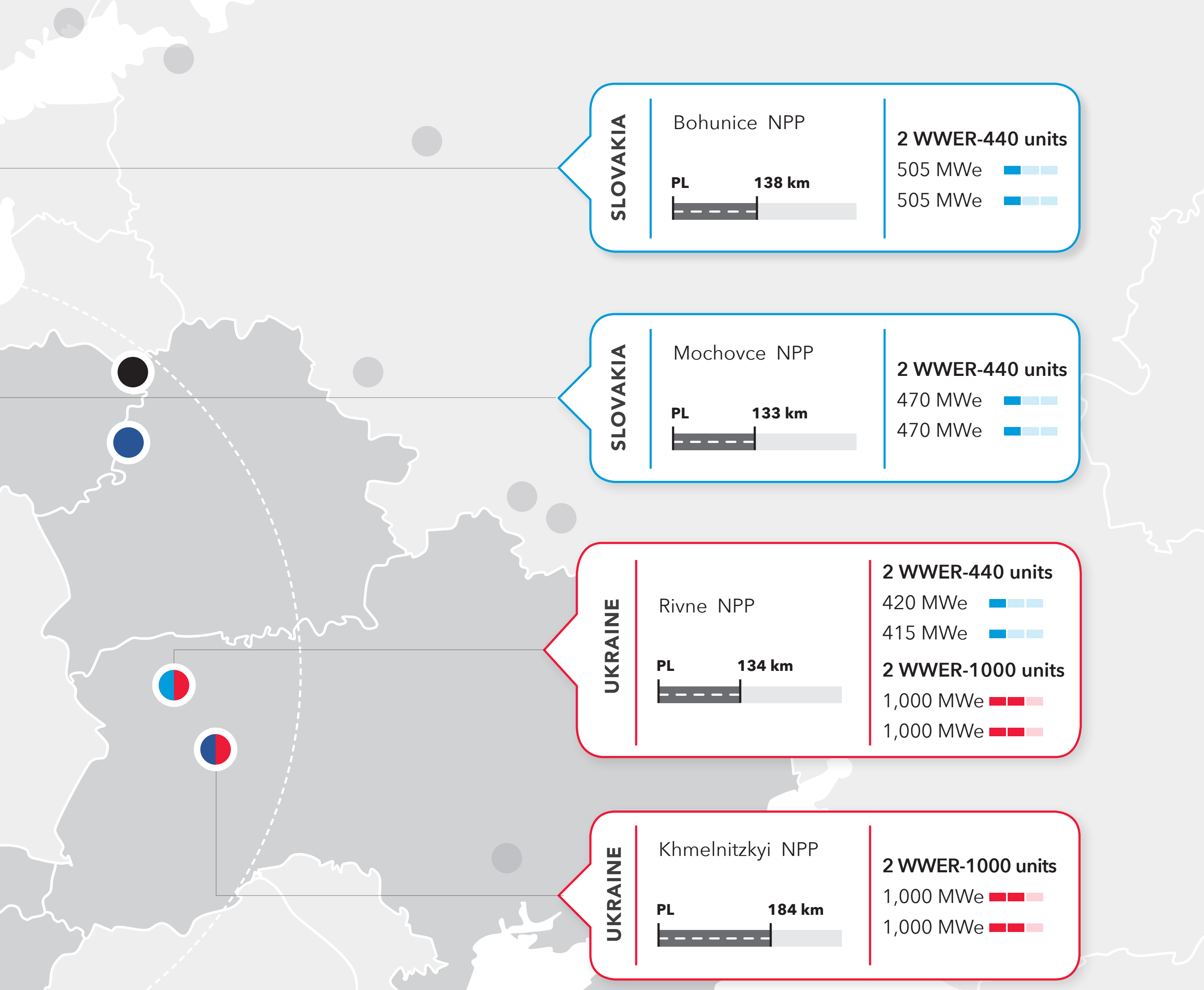
SOME NPP'S FURTHER THAN 300 KM AWAY FROM POLAND

8
NUCLEAR POWER PLANTS IN OPERATION

14
WWER-440 TYPE REACTORS

6
WWER-1000 TYPE REACTORS

1
BWR TYPE REACTOR



NUCLEAR POWER PLANTS AT A PERMANENT SHUTDOWN STAGE

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

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

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

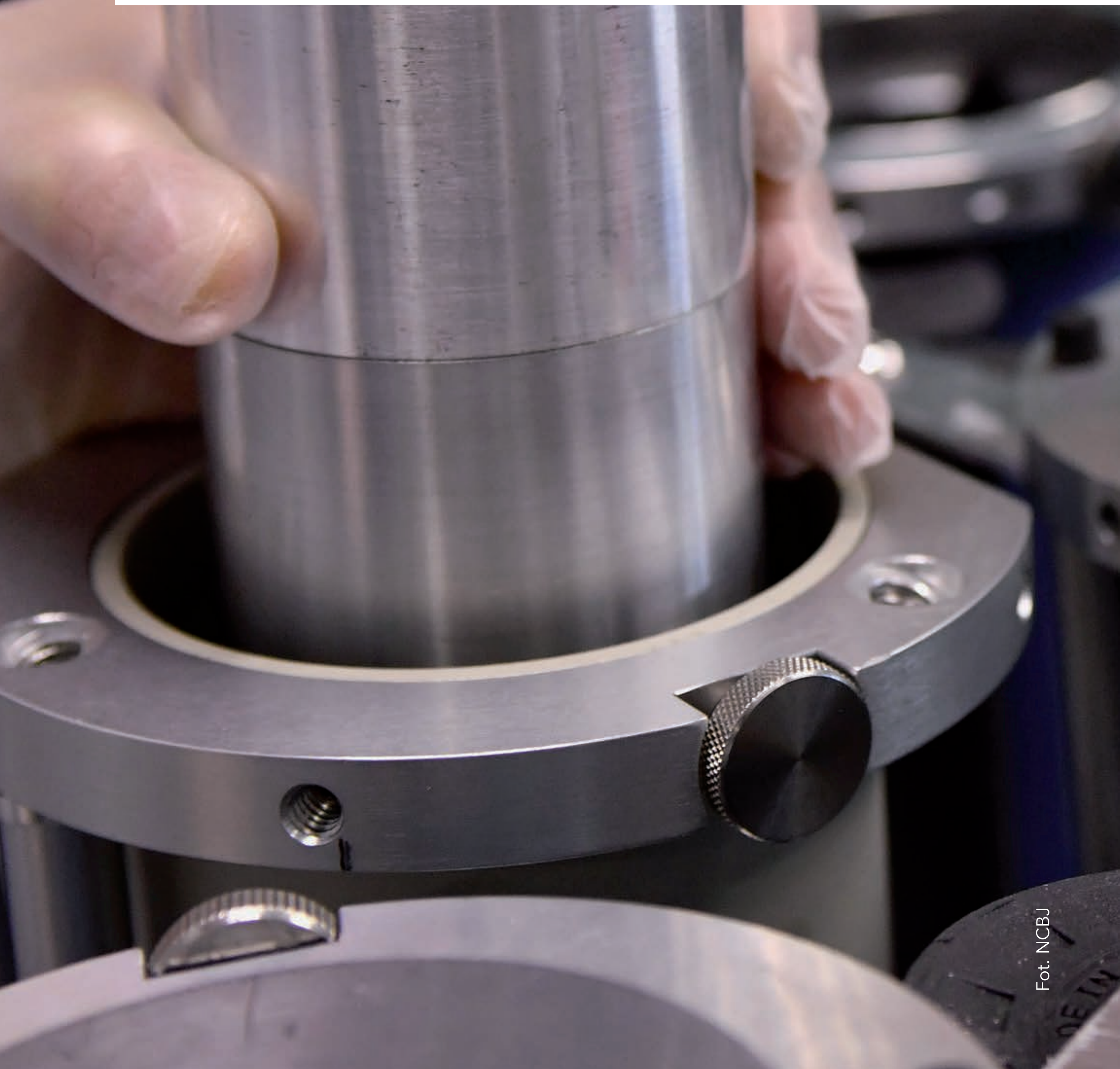
Barsebäck NPP (Sweden)
2 BWR type reactors with the capacity of 615 MWe decommissioned in 1999 and 2005

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

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

5 Safeguards

39 Legal basis for safeguards
40 Users of nuclear materials in Poland
41 Inspections of nuclear material safeguards



Fot. NCBJ

Legal basis for safeguards

LEGAL BASIS

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

- Treaty establishing the European Atomic Energy Community (Euratom Treaty) of 25 March 1957. In Poland, the provisions of the Treaty have been binding since Poland's accession to the European Union;
- Article III of the Treaty 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/Add. 8). The Protocol came into force on 1 March 2007;
- Commission Regulation (Euratom) no. 302/2005 of 8 February 2005 on the application of Euratom safeguards (EU OJ L54 of 28 February 2005).

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

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

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

Users of nuclear materials in Poland

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

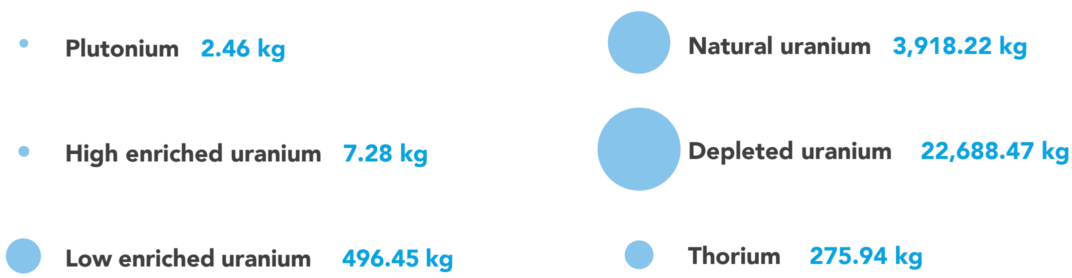
- The Radioactive Waste Management Plant (ZUOP), responsible for spent nuclear fuel storages, the shipment warehouse and the National Radioactive Waste Repository in Różan (WPLG material balance area **WPLG**;
- MARIA Reactor Operations Division and the associated research laboratories of the NCBJ **WPLC**;
- POLATOM Radioisotopes Centre at the NCBJ **WPLD**;
- Institute of Chemistry and Nuclear Technology in Warsaw **WPLF**;
- 27 medical and research facilities using small quantities of nuclear material and 86 industrial, diagnostic and service facilities equipped mainly with depleted uranium shields. All facilities comprise the material balance area "Locations Outside the Facilities" **WPLE**.

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

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

INFOGRAPHIC

Balance of nuclear material in Poland, in kg
(as of 31 December 2019)



Inspections of nuclear material safeguards

In 2019, nuclear regulatory inspectors from the PAA, unassisted or acting together with IAEA and EURATOM inspectors, performed 30 routine safeguards inspections in all material balance areas in Poland. EURATOM inspectors participated in 7 inspections and IAEA inspectors – in 4 inspections. In addition, IAEA inspectors carried out at the WPLC a so-called "short notice inspection," which was also attended by EURATOM and PAA inspectors

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

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

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

As a result of one inspection it was noted that a head of organizational entity using nuclear materials for non-nuclear purposes did not provide the National Atomic Energy Agency (PAA) with information on the amount and chemical composition of the nuclear materials (three collimators containing depleted uranium), the date of the import or receival, their origin or the way of using.

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

6 Transport of radioactive materials

43 Transport of radioactive sources and waste
44 Transport of nuclear fuel

Fot. IAEA

Transport of radioactive sources and waste

LEGAL BASIS

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

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

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

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

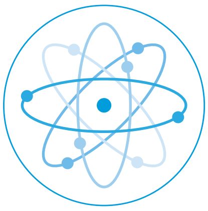
Radioactive material is transported in accordance with transport regulations SSR-6 developed by the International Atomic Energy Agency. They provide grounds for international organizations preparing the aforementioned international modal regulations or they are directly implemented to the national legal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

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

Within the context of transport of radioactive materials, it is especially important to prevent any attempts of illegal (i.e. without required permit or notification) import of radioactive substances and nuclear materials into Poland. Such attempts are mostly combated by the National Border Guard that have **344 stationary radiometric devices**, so called radiation portal monitors installed at the border crossing points, **over 1400 portable signalling and measuring devices** and **2 vehicles that allow the measurement of ionising radiation in the area**.

As a result of the inspections carried out, due to exceeding of the acceptable limits of radioactive contamination, in 1 case the National Border Guard prohibited to continue transport.

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, supplying them with equipment.



In 2019, 45,581 shipments of radioactive materials were performed, and 51,406 parcels were carried in road, railway, inland, sea, and air transport in the territory of Poland. Also, the Radioactive Waste Management Plant (ZUOP) performed 11 shipments of radioactive waste to the National Radioactive Waste Repository in Różan..

2 spectrometers were shipped for identification of radioactive isotopes and 77 ionising radiation signalling units. Since 2010, 124 radiation portal monitors have been installed and the organizational entities of the National Border Guard have been equipped with 508 handheld radiometric devices.

Moreover, the National Border Guard participated in trainings and workshops related to safety and physical protection of the radioactive materials transport as well as maintaining and using the stationary radiometric devices; the trainings and workshops were organized with the cooperation with the Ukrainian authorities and the U.S. Department of Energy.

Transport of nuclear fuel

Fresh and spent nuclear fuel is transported under an authorization granted by the PAA President. In 2019, no shipment of fresh or spent nuclear fuel was planned to be transported within the territory of Poland.

INFOGRAPHIC

Number of inspections conducted by the units of National Border Guard.

In 2019, National Border Guard posts conducted the following number of inspections:

	for import to Poland	for transit, export from Poland	transfer at an airport
TRANSPORT OF RADIOACTIVE SOURCES	810 inspections	3771 inspections	157 inspections
TRANSPORT OF MATERIALS CONTAINING NATURAL RADIOACTIVE ISOTOPES	12 546 inspections	14 620 inspections	138 inspections
TRANSPORT OF OTHER UNDECLARED ITEMS (E.G. OBJECTS CONTAINING ELEMENTS PAINTED WITH RADIUM PAINT)	2 inspections	6 inspections	8 inspections
PERSONS AFTER TREATMENT OR EXAMINATIONS USING RADIOACTIVE ISOTOPES	1227 inspections		

7 Radioactive waste

46 Management of radioactive waste
47 Radioactive waste in Poland

Fot. NCBJ

Management of radioactive waste

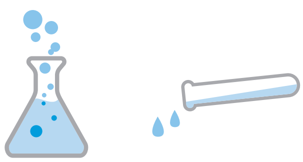
In Poland, radioactive waste is generated as a result of the use of radioisotopes in medicine, industry and scientific research and in the course of operation of research reactor. This type of waste may occur in gaseous, solid and liquid form.

INFOGRAPHIC

Radioactive waste may occur in the following forms:

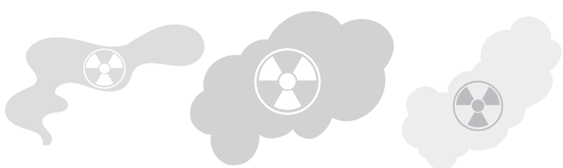
SOLID WASTE

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



LIQUID WASTE

mainly constitutes aqueous solutions and suspensions of radioactive substances.



GASEOUS WASTE

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

There are 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 disused 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 which due to the period of half-life degradation of radioactive isotopes contained within them may be divided into short and long-lived.

Radioactive waste containing nuclear materials and spent nuclear fuel, that becomes a high-level waste in the moment of the decision to dispose of it, falls under specific, separate regulations regarding the rules of conduct 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 **stored** (temporarily) in a way which ensures protection of people and the environment under normal conditions and in cases of radiation emergency, including protection of radioactive waste against leakage, dispersion or release. The means that can be used for these purposes are dedicated facilities or compartments (radioactive waste storage facilities) featuring equipment for mechanical or gravitational ventilation as well as purification of air released from such compartments.

Disposal of radioactive waste 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 geological ones, and in the process of their licensing as to the compliance with nuclear safety and radiological protection requirements, this being covered by duties of the PAA President, a detailed specification is prepared regarding types of radioactive waste under particular categories which may be disposed of at the given facility.

Radioactive waste in Poland

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

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

TABLE 3.
Quantities of radioactive waste collected by ZUOP in 2019.

Sources of waste	Solid waste [m^3]	Liquid waste [m^3]
From outside of the Świerk Nuclear Centre (medicine, industry, scientific research)	9.28	0.78
National Centre for Nuclear Research OR POLATOM	20.54	0.19
National Centre for Nuclear Research + MARIA research reactor*	5.51	26
Radioactive Waste Management Plant	3.32	0.00
Total:	38.65	26.97

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

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

The ZUOP renders its services against payment, however, the revenue generated from this activity covers only a part of costs incurred by this enterprise. In 2019, the lacking funds were covered from a subsidy granted by the relevant Minister of Energy[2].

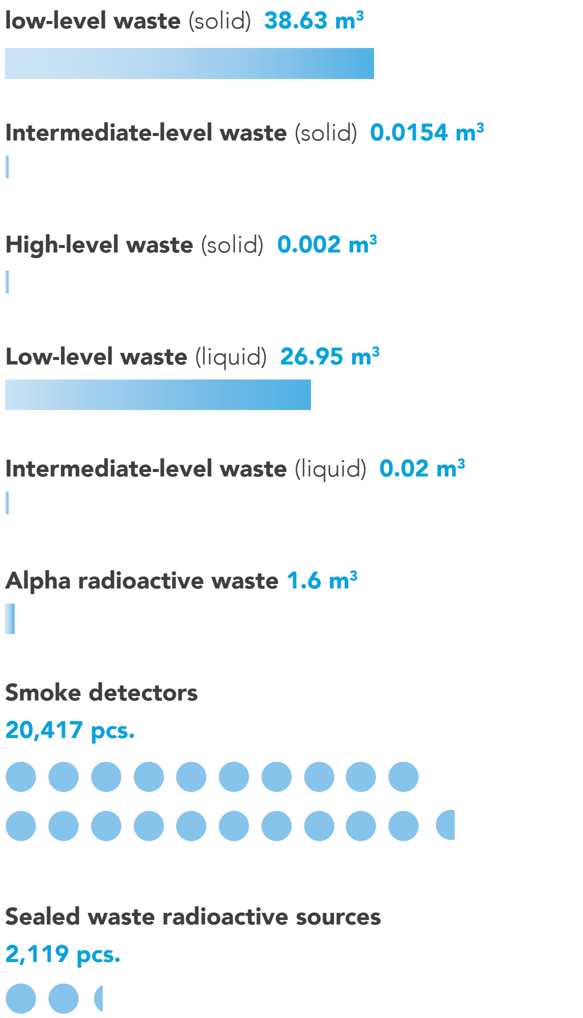
The National Radioactive Waste Repository (KSOP) in Różan (Maków District) is the site of radioactive waste disposal in Poland. The KSOP is a near-surface type repository, intended for disposal of short-lived, low and intermediate-level radioactive waste (with the half-life of radionuclides being shorter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

In 2019, the ZUOP received 280 orders for collection of radioactive waste from 173 institutions. Table 3 shows the quantities of radioactive waste collected and processed (including the waste generated at ZUOP).

2. Until 14 November 2019 – Minister of Energy, until 15 November 2019 – Minister of National Assets.

FIG. 8.

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



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

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

In 2019, the National Radioactive Waste Repository received 144 drums of 200 litres capacity with processed radioactive waste. Additionally, 3 large-size containers were delivered to the repository. Disused sealed radioactive sources which are not subject to processing are sealed in separate containers (there were 318 containers with 9046 disused radioactive sources and 18 shielding containers with 845 disused radioactive sources). Processed solid waste was delivered to the repository in the quantity of 35.67 m3, with the total activity of 2964.03 GBq (as at 31 December 2019).

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

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

- License no. D-14177 of 17 December 2001 authorizing to perform activity related to the use of nuclear energy and consisting in transport, processing and storage of radioactive waste on the premises of the Świerk centre, collected from organizational entities conducting activity involving the use of nuclear energy from the entire territory of Poland,
- License no. 1/2002/KSOP – Różan of 15 January 2002 for exploitation of KSOP in Różan
- License no. 1/2016/ZUOP of 15 December 2016 authorizing to perform activity involving exposure, consisting in storage of radioactive waste in facility 8a within the boundaries of the National Radioactive Waste Repository in Różan,
- License no. D-19866 of 4 July 2016 authorizing to carry out the activities referred to in Article 4 (1) (1a) of the Act – Atomic Law of storing radioactive waste generated in the class III isotope laboratory launched on the basis of License no. D-18527 and radioactive waste collected from other organizational units on the basis of License no. D-14177 in the Radioactive Waste Forwarding Warehouse (building 35A and 35B on the premises of the Radioactive Waste Treatment Plant of the State Enterprise in Otwock-Świerk at 7 Andrzeja Sołtana Street).

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

In 2019, Nuclear Regulatory Inspectors from the PAA performed three inspections concerning radioactive waste management at the ZUOP, including:

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

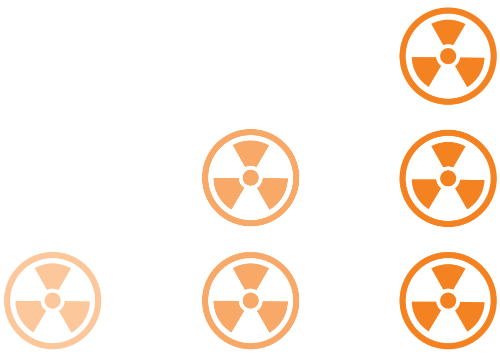
Conclusions and remarks from the inspections completed were implemented by the ZUOP management on an ongoing basis, whereas all shortcomings and irregularities found by Nuclear Regulatory Inspectors were eliminated in accordance with provisions of the applicable inspection reports or follow-up statements.

INFOGRAPHIC

Classification 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

SHORT-LIVED

LONG-LIVED

NUCLEAR MATERIAL AND SPENT NUCLEAR FUEL

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

SPENT SEALED RADIOACTIVE SOURCES

constituting an additional category of radioactive waste are classified by activity level into three subcategories: low-active, medium-active and high-active.

8 Radiological protection of population and workers in Poland

51 Exposure of population to ionizing radiation
57 Control of exposure to ionizing radiation
63 Granting of personal licenses in the area of nuclear safety and radiological protection

Fot. NCBJ

Exposure of population to ionizing radiation

For persons from the entire population, a dose limit, referred to as the effective dose, amounts to 1 mSv during a single calendar year.

For persons working professionally in exposure to ionizing radiation as well as students and apprentices aged 18 years and above the dose limit amounts to 20 mSv during a calendar year. In the case of employees, this dose may be exceeded up to 50 mSv per year, provided that the approval for such exceeding is granted by the President of the PAA or other authority competent to grant permits or to receive notifications of business activity.

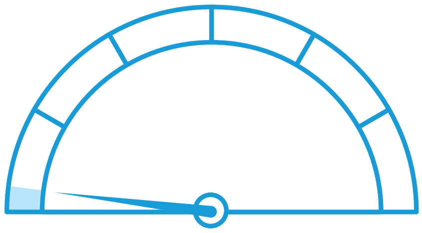
The dose limit for students, pupils and apprenticeships at the age from 16 to 18 amounts to 6 mSv. Pupils, students and apprenticeships below the age of 16 are bound by the dose limit as for the entire population.

The dose limit consists of three elements:

- the presence of artificial radionuclides in food and the environment, originating from nuclear explosions and radiation accidents,
- the use of consumer goods that emit radiation or contain radioactive substances,
- professional activity related to the use of ionizing radiation sources.

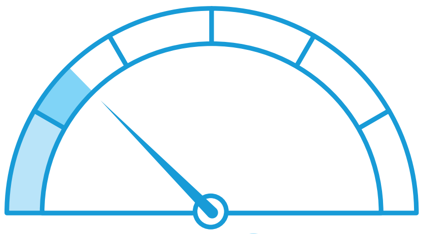
Human exposure to ionizing radiation is caused by two main sources:

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



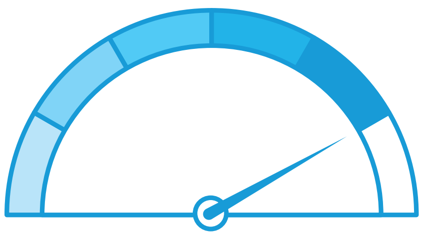
1 mSv

for persons from general population



6 mSv

for students, pupils and apprenticeships at the age of 16 -18



20 mSv

for employees
for students, pupils and apprenticeships at the age of 18 and more

INFOGRAPHIC

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

3.86 mSv

the annual effective dose of ionizing radiation, received by a statistical inhabitant of Poland in 2019.

NATURAL SOURCES

63.5%

2,45 mSv

RADON

31.1% **1.2 mSv**

GAMMA RADIATION

12.3% **0.48 mSv**

COSMIC RADIATION

10.1% **0.39 mSv**

INTERNAL RADIATION

7.3% **0.28 mSv**

THORON

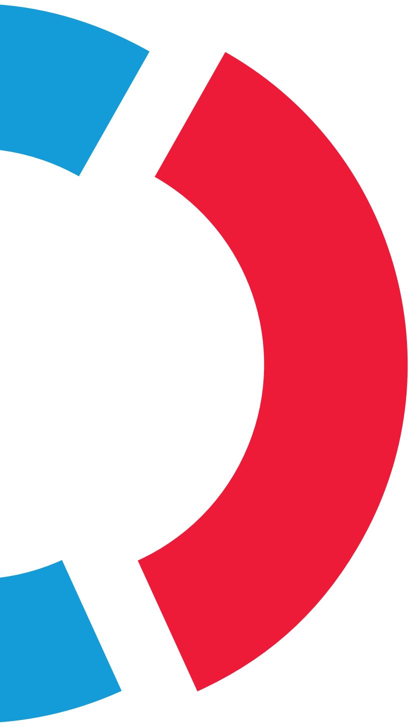
2.6% **0.1 mSv**

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.

ok. 0.001 mSv
the exposure dose to ionizing radiation from household goods (TV, isotope smoke detectors, ceramic tiles).

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



ARTIFICIAL SOURCES

36.5%

1.41 mSv

MEDICAL DIAGNOSTICS

36,3% **1.4mSv**

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

- computer tomography **0.9 mSv**
- conventional radiography and fluoroscopy **0.2 mSv**

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

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

DEFECTS

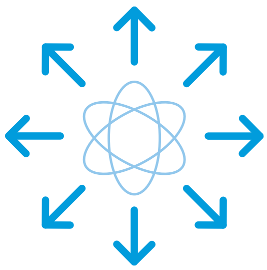
0.1% **0.005 mSv**

OTHER

0.2% **0.005 mSv**

INFOGRAPHIC

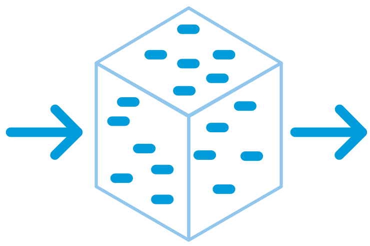
Basic terms and units used in radiological protection.



RADIOACTIVITY

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

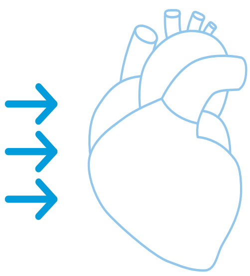
Bq
BEKEREL



ABSORBED DOSE

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

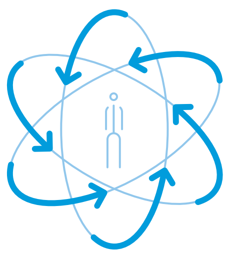
Gy
GREJ



EQUIVALENT DOSE

Specifies the dose absorbed by a tissue or an organ, taking into account the type and energy of the radiation.
Allows to specify biological effects of radiation exposure on the tissue.

Sv
SIWERT



EFFECTIVE DOSE

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

Sv
SIWERT

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

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

LEGAL BASIS

The basic national normative act which specifies the aforementioned limits was until 22 September 2019 the Regulation of the Council of Ministers of 18 January 2005 on ionizing radiation dose limits (Journal of Laws, item 168), Currently it is Annex no. 4 to the Atomic Law Act.

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

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

The annual effective dose of ionizing radiation, received by a statistical inhabitant of Poland, has remained at a similar level in the last several years. The value including radiation from natural and artificial sources of ionizing radiation (including those used in medical diagnostics) amounted to **in 2019 on average 3.86 mSv**. The percentage share in this hazard of other radiation sources is shown in the infographic on pages 52-53[3].

Exposure to natural ionizing radiation sources

Exposure to natural sources comprises **63.5%** of the total effective dose and amounts to approx. **2.45 mSv/year**.

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

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

The exposure of a statistical inhabitant of Poland in 2019 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 **1.4 mSv**.

This overall dose predominantly includes doses received during computer tomography examination (**0.9 mSv**) as well as conventional radiography and fluoroscopy (**0.2 mSv**). These doses are far lower in other diagnostic examinations.

An average effective dose received in a single X-ray examination comes to 1.2 mSv, and with the most popular tests, these amounts are as follows[4]:

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

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

3. 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.

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

Annual effective dose

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

- the presence of artificial radionuclides in food and the environment, originating from nuclear explosions and radiation accidents,
- The use of consumer goods that emit radiation or contain radioactive substances,
- professional activity associated with use of ionizing radiation sources.

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

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

The exposure to ionizing radiation from household goods came in **2019 to approx. 0.001 mSv, which constitutes 0.1%** of the dose limit for the population. The said amount was mainly established based on measurements of radiation emitted by TV picture tubes and isotope smoke detectors as well as gamma radiation emitted by artificial radionuclides used to stain ceramic tiles or porcelain. The calculated value also includes the dose from cosmic radiation received by passengers during air travels. In connection with the increasing popularity of LCD screens and monitors replacing cathode ray tubes, the dose received by a statistical Pole from these devices is continuously decreasing.

The exposure of a statistical Pole in their professional activities involving ionizing radiation sources (more information about this problem is given in Chapter VIII.2 "Control of exposure to ionizing radiation") was equal **in 2019 to approx. 0.002 mSv, which constitutes 0.01% of the dose limit (in the case of exposure at work).**

The total exposure of a statistical inhabitant of Poland to artificial ionizing radiation sources **in 2019** , with the exception of medical exposure (with the predominant share in the exposure attributed to Cs-137 present in the environment as a consequence of nuclear explosions and the Chernobyl disaster), amounted to approx. **0.01 mSv, that is 0.1%** of the dose limit for artificial radioactive isotopes for the entire population, which is equal 1 mSv per year, and **only 0.25%** of the dose received by a statistical inhabitant of Poland from all ionizing radiation sources.

In light of the radiological protection regulations adopted worldwide and in Poland, the radiation exposure of a statistical inhabitant of Poland in 2019 resulting from use of artificial ionizing radiation sources, should be considered as low.

Control of exposure to ionizing radiation

Occupational exposure to artificial ionizing radiation sources

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

LEGAL BASIS

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

In accordance with the principles of ionizing radiation exposure control, the responsibility for compliance with the relevant requirements rests firstly with a head of the organizational entity which is responsible for the assessment of doses received by workers subordinated to them. This control must be performed based on the results of environmental measurements or individual dosimetry conducted by a specialized and authorized radiometric laboratory. Both measurements and the assessment of individual doses were performed in 2019 by the following accredited laboratories:

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

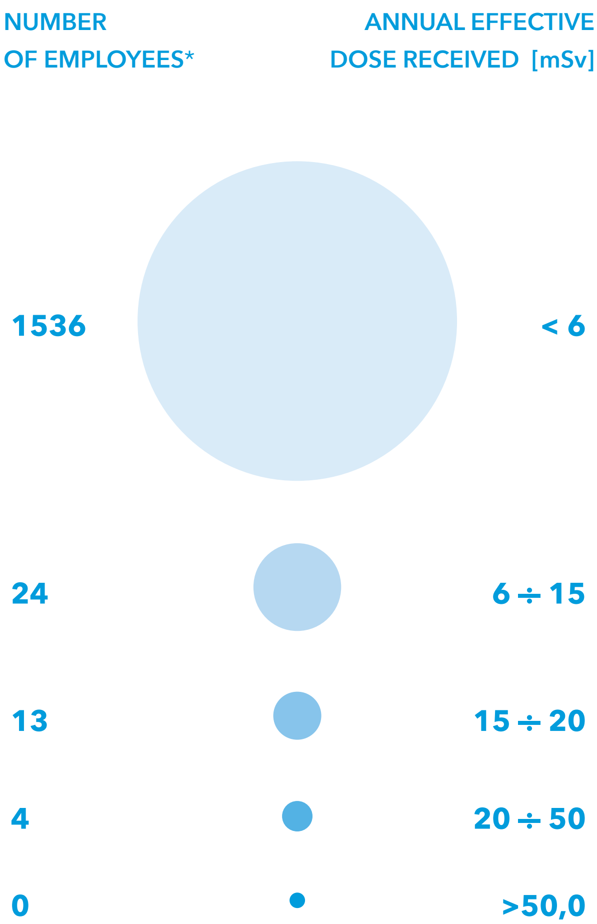
Provisions of the Atomic Law Act have introduced the obligation to maintain a register of doses and to apply personal dosimetry is applicable only to workers classified under category A of ionizing radiation exposure, i.e. those who, according to the head's opinion, may be, under normal occupational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

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

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

INFOGRAPHIC

Statistics on individual annual effective doses for workers classified under category A of exposure to ionizing radiation in 2019.



* As per the central register of doses submitted on or before 30 April 2020.

LEGAL BASIS

Detailed information on the procedure of recording, reporting and registration of individual doses is included in the Regulation of the Council of Ministers of 23 March 2007 on the requirements for registration of individual doses (Journal of). Laws, item 913),

There are tens of thousands of people working in contact with ionizing radiation sources in Poland. However, only a small part of them has been classified as category A workers, working under conditions of actual exposure to ionizing radiation. Control of individual doses in Poland in 2019 covered approx. 50,000 persons. For 95% of the group analysed, the dose control is performed in order to confirm that the use of ionizing radiation sources is not hazardous and should not cause any health detriment. Workers of this group are classified under category B of exposure to ionizing radiation. Medical personnel working at diagnostic X-ray laboratories (approx. 40,000 people working in approx. 10,000 diagnostic centres with X-ray laboratories) constitutes the largest group of persons classified under category B.

Approx. 1.5 thousand are potentially endangered persons who must be covered by the personal dosimetry scheme for external exposure or/and assessment of internal doses (committed doses from radioactive substances which, under working conditions, could penetrate the body as a result of an intake) are classified annually under category A of exposure to ionizing radiation.

PAA President's Central Register of Doses

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

Since the creation of the central register of doses (2002) until 15 April 2019, more than 6,500 persons were reported and the data of 2,520 persons from among those reported were updated within the past four years. In 2019, data of 1,576 persons was updated.

Owing to appropriate radiological protection, 1,536 persons classified under category A received effective annual doses that did not exceed 6 mSv (being the lower exposure limit assumed for category A workers), and doses exceeding 6 mSv were received by 41 persons, of whom only four persons were found to have exceeded the annual dose of 20 mSv (the dose limit that may be received during a calendar year as a result of routine work with ionizing radiation). In cases where the dose limit was exceeded, the working conditions and the reasons for the exposure to radiation were analysed in detail.

A summary of the data for year 2019 concerning exposure to ionizing radiation of workers classified under category A, who were entered into the central register of doses by individual organizational entities is presented in the infographic on page 58.

The data implies that, in 2019, in the group of category A workers, the percentage of individuals who did not exceed the lower limit specified for this exposure category, i.e. 6 mSv per year, was equal to 97.4% and the percentage of individuals who did not exceed the limit of 20 mSv per year – to 99.8%. Consequently, only approx. 2.6% of persons exposed at work who had been classified under category A received doses established for workers of this category.

In 2019, the Central Register of Doses received reports on two cases of exposure to radiation in the circumstances referred to in article 16 (1) (incidental exposure) The Act – Atomic Law Act. All cases where the limit dose was exceeded were associated with use of isotope defect scopes during industrial radiography tests. The largest doses: above 30 mSv during the year - were recorded in the case of industrial radiography technicians who simultaneously transported high-level sources of Ir-192 in defectoscopes. High doses absorbed in the hands and eyes of surgeons performing hours-long surgical procedures in X-ray radiation, especially during operations on main blood vessels and the heart are an issue as well. Since the introduction of the new 2013/59/Euratom directive, a new yearly limit dose per lens of the eye, equal to 20 mSv/year. This value is so restrictive that it is quite often exceeded in intervention surgery procedures; however, appropriate dosimeters for integrating measurement of the equivalent dose in eye lenses are still used rather rarely. In 2019 there were several such measured cases of an equivalent dose received in eye lenses that exceeded 20 mSv. Such a dose can lead to a deterministic radiation effect in the form of opacity of the lens or cataract.

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

Exposure to radon

Radon (Rn) is a radioactive noble gas that occurs naturally in the environment. It is present in every building and apartment in different concentrations depending on the geological structure of the area on which it is founded. The materials used for construction are also important. Radon flows with the air sucked in from the ground through gaps in the foundations, building walls, drains, leaks around sewage pipes, building materials, etc.

In nature, isotope Radon-222 (marked with the symbol Rn-222) is the most common, it constitutes about 80% of all isotopes and is also considered the most dangerous for the environment. Its short-lived decay products are responsible for almost half the dose of ionizing radiation received by Polish residents from natural sources.

Radon does not directly affect our body. However, its short-lived derivatives can penetrate as dust into our respiratory system. Radioactive decay may occur there. In this way, they can increase the risk of lung cancer.

According to the Act of 29 November 2000 - Atomic Law (Journal of Laws from 2019 item 1792 and 2020 items 284 and 322) the reference level for average annual radioactive concentration of radon in rooms intended for people is 300 Bq/m^3.

In 2019, the provisions of the Act of 13 June 2019 amending the Act entered into force – Atomic Law and fire protection (Journal of Laws, item 1593), which has also introduced a number of changes in the area of protection against radon exposure, including:

- setting reference levels for the average annual radon concentration in the air,
- introducing the obligation to measure radon concentration or alpha potential energy concentration of short-lived decay products in workplaces located at ground floor or basement level and in workplaces

related to groundwater treatment in areas where the average annual radioactive concentration of radon in air in a significant number of buildings may exceed reference level,
- imposing on the President of the National Atomic Energy Agency (PAA) an obligation to monitor measures to prevent radon penetration into new buildings and to conduct information campaigns in this regard.

LEGAL BASIS

In the scope of radiologic hazards, in addition to executive acts to the Atomic Law, in 2019 implementing acts to the Act of 9 June 2011 were in force. - Geological and mining law (Journal of Laws of 2019 item 868, with later amendments):

- Regulation of the Minister of Energy of 23 November 2016 regarding detailed requirements for conducting underground mining plants operations (Journal of Laws of 2017 item 1118, with later amendments),
- Regulation of the Minister of the Environment of 29 January 2013 on natural hazards in mining plants (Journal of Laws of 2015 items 1702 and 2204, of 2016 item 949 and of 2017 item 1247), defining excavations:
  - class A, located in controlled areas as defined by the provisions of the Atomic Law, in which the working environment creates the potential exposure by the employee to an annual effective dose exceeding 6 mSv,
  - class B, located in controlled areas as defined by the provisions of the Atomic Law, in which the working environment creates the potential exposure by the employee to an annual effective dose exceeding 1 mSv but not exceeding 6 mSv.

Control of exposure to natural ionizing radiation sources in mining

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

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

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

The total employment at hard coal mines according to WUG data of 31 December 2019 was 107,130 miners.

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

The following aspects of the radiation hazard are studied:

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

TABLE 4.

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

Hazard indicator	Class A*	Class B*
Potential energy concentration α of short-lived products of radon decay (Cα), μJ/m^3	Cα > 2.5	0.5 < Cα ≤ 2.5
Radiation kerma rate γ (K), μGy/h	K > 3.1	0.6 < K ≤ 3.1
Specific activity of radium isotopes present in sediments (C_{RaO}), kBq/kg	$C_{RaO} > 120$	$20 < C_{RaO} \leq 120$

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

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

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

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

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

The analysis included the number of mines with radiologically hazardous workings, the working type, the hazard source, and the headcount of the mining crew. Based on the information acquired by the State Mining Authority, it was possible to determine the share of miners working in headings potentially exposed to radiation hazard. This particularly applies to sites possibly containing water and sediments with increased concentration of radium isotopes, increased concentrations of potential alpha energy and dose rates of gamma radiation higher than average.

In 2019, the Central Mining Institute conducted 3,760 measurements of potential alpha energy of short-lived radon decay products, 803 measurements of exposure to external gamma radiation in underground mining facilities, 598 analyses of radioactivity of mine water sampled in underground headings of hard coal mines, as well as 152 analyses of concentration of radionuclides found in samples of mine water sediments.

In 2019, measurements of individual doses of gamma radiation were conducted in ten hard coal mines. In other mining facilities, no such measurements were undertaken. The employees subject to the examinations,

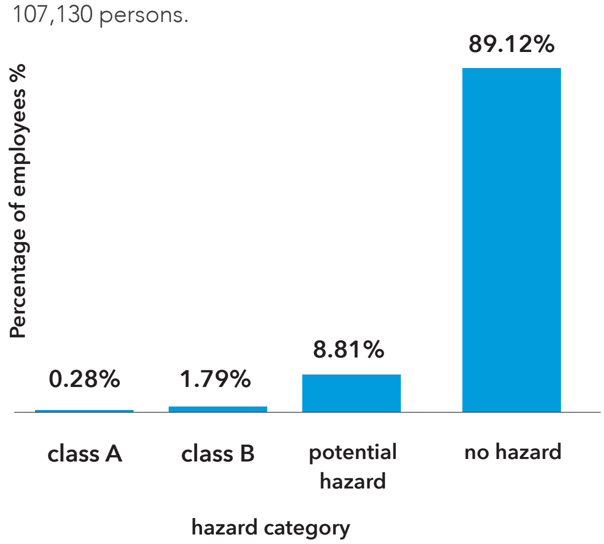
TABLE 5.

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

Hazard indicator	A	B
Number of mines	4	22
Radiation threat from short-lived products of radon decay	1	12
Threat of γ radiation	3	7
External γ radiation (individual dosimetry)	-	3

FIG. 9.

The percentage of hard coal miners working in headings classified under individual radiation hazard classes. The total employment at hard coal mines according to data from 31 December 2019: own crew: 76,852 persons; external service companies: 30,278 persons – in total: 107,130 persons.



namely 84 persons, were mainly involved in removal of radioactive mine sediments or worked at locations where such sediments may accumulate. One of the persons subject to individual examination worked on the surface. In three hard coal mines, the annual dose estimated, based on results of individual dose measurements, exceeded 1 mSv but was lower than 6 mSv (category B). No dose exceeding 6 mSv (category A) was measured in 2019.

Based on the radiation hazard monitoring conducted, it was found that under disadvantageous circumstances (lack of a proper ventilation system) it may occur in nearly every single mine heading. The hazard assessment performed by the Central Mining Institute for coal mines has demonstrated that there are three mines with active class A headings (the hazard affects 0.28% of all working miners) and 22 mines with class B headings (the hazard affects 1.79% of all working miners). In mine headings with slightly increased natural radiation background (yet below the level corresponding to class B), 8.81% of the total number of miners employed work, whereas 89.12% of miners work in headings where the radiation level remains on the level of natural surface background.

The estimated (maximum) dose per miner in 2019 was equal to 25.3 mSv, taking into account the measurement uncertainty and assuming that the annual working time is equal to 1800 hours and the background radiation is equal to 0.1 μGy/h. With the realistic assumption that the working time is equal to 750 hours, the maximum dose is approximately 10.5 mSv.

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

In 2019, the maximum additional annual effective dose associated with individual hazard sources was equal to:

- for short-lived radon decay products E_{α} = 13.1 mSv (assuming the annual working time of 1,800 hours),
- for environmental gamma radiation measurements E_{γ} = 10.5 mSv (assuming the annual work time in water galleries of 750 hours),
- and expressed as an effective committed dose E_{Ra} = 0.70 mSv for absorption of radium isotopes into human organism (with regard to declared annual work time of 213 hours).

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

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

In 2019, 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.

No mine exceeded the 20 mSv dose during the year. This is a limit dose for persons whose vocational activity involves the radiation hazard.

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

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

LEGAL BASIS

Article 7 para. 3 and 10 and art. 12 paragraph 1 of the Act of 29 November 2000 - Nuclear Law and the Regulation of the Council of Ministers of 2 September 2016 on the position of significance for ensuring nuclear safety and radiological protection as well as radiation protection experts (Journal of Laws, item 1513).

The required training courses are conducted by organizational entities authorized to conduct such activity by the PAA President, having at their disposal the sufficient staff of instructors and the necessary technical equipment enabling practical classes to be conducted in accordance with the course syllabus developed for each such entity, in line with the type of training approved by the PAA President. In 2019, training courses were attended in total by 818 persons. Information on entities, which conducted the training courses in 2019 can be found in Table 6.

In 2019, there were two examination boards appointed by the PAA President pursuant to Article 7 (1) and Article 12a (6) of the Atomic Law Act:

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

TABLE 6.
Entities that conducted training for persons applying for authorizations enabling employment in positions of significant importance to ensuring nuclear safety and radiological protection in 2019

Authorization type	Entity name	Number of training courses held	Number of training courses participants	Number of obtained authorizations*
Radiation Protection Expert	Central Laboratory for Radiological Protection	2	47	127
	Polish Federation of Engineering Associations	2	49	
	Association of Radiation Protection Officers	2	22	
Positions of significant importance for ensuring NS&RP	Association of Radiation Protection Officers	11	311	658
	Central Laboratory for Radiological Protection	5	108	
	Institute of Nuclear Physics	1	30	
	National Centre for Nuclear Research	8	195	
	Oncology Centre in Gliwice	2	56	

* Including persons who attended training before 2019 or were authorized to take examination without an obligation to attend training.

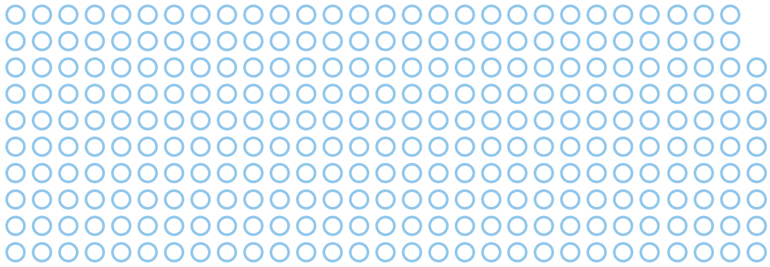
INFOGRAPHIC

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

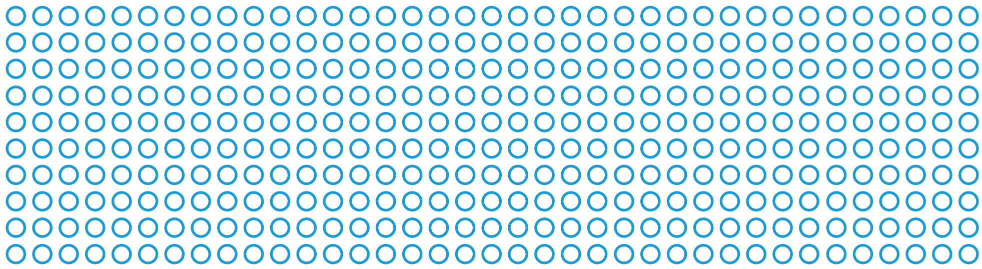
Having passed the examination and fulfilled all the remaining conditions required to obtain the relevant authorizations, 127 persons were granted authorizations of a radiation protection officer and 658 persons received authorizations enabling them to be employed in positions of special importance for ensuring nuclear safety and radiological protection, including:

658 persons

288 persons
obtained authorizations authorizations of a radiation protection expert applicable to purposes other than medical



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



Moreover, authorizations to hold positions of significant importance to ensuring nuclear safety and radiological protection in an organizational entity performing operations consisting in construction, start-up, operation, or decommissioning of nuclear facilities were granted to 8 persons including:

8 persons

2 persons
operator of sealed nuclear fuel storages

1 person
specialist for registry of nuclear materials

3 persons
research reactor dosimetrist

1 person
operator of sealed nuclear fuel storages and specialist for registry of nuclear materials

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

In 2019, the total number of persons who received authorizations of a radiation protection officer and authorizations to be employed in positions of special importance for nuclear safety and radiological protection was

793 persons

9 National radiological monitoring

69 Nationwide monitoring
72 Local monitoring
74 International exchange of radiological monitoring data
74 Radiation emergencies

Fot. PAA

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

There are two types of monitoring:

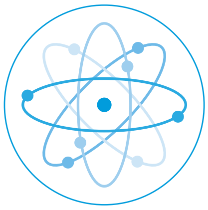
- nationwide monitoring – making it possible to obtain data necessary to assess the radiological situation of the entire country under normal conditions and in cases of radiation emergency. It serves as a basis for examination of long-term changes in the environment and foodstuff radioactivity.
- local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

Monitoring measurements are conducted by:

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

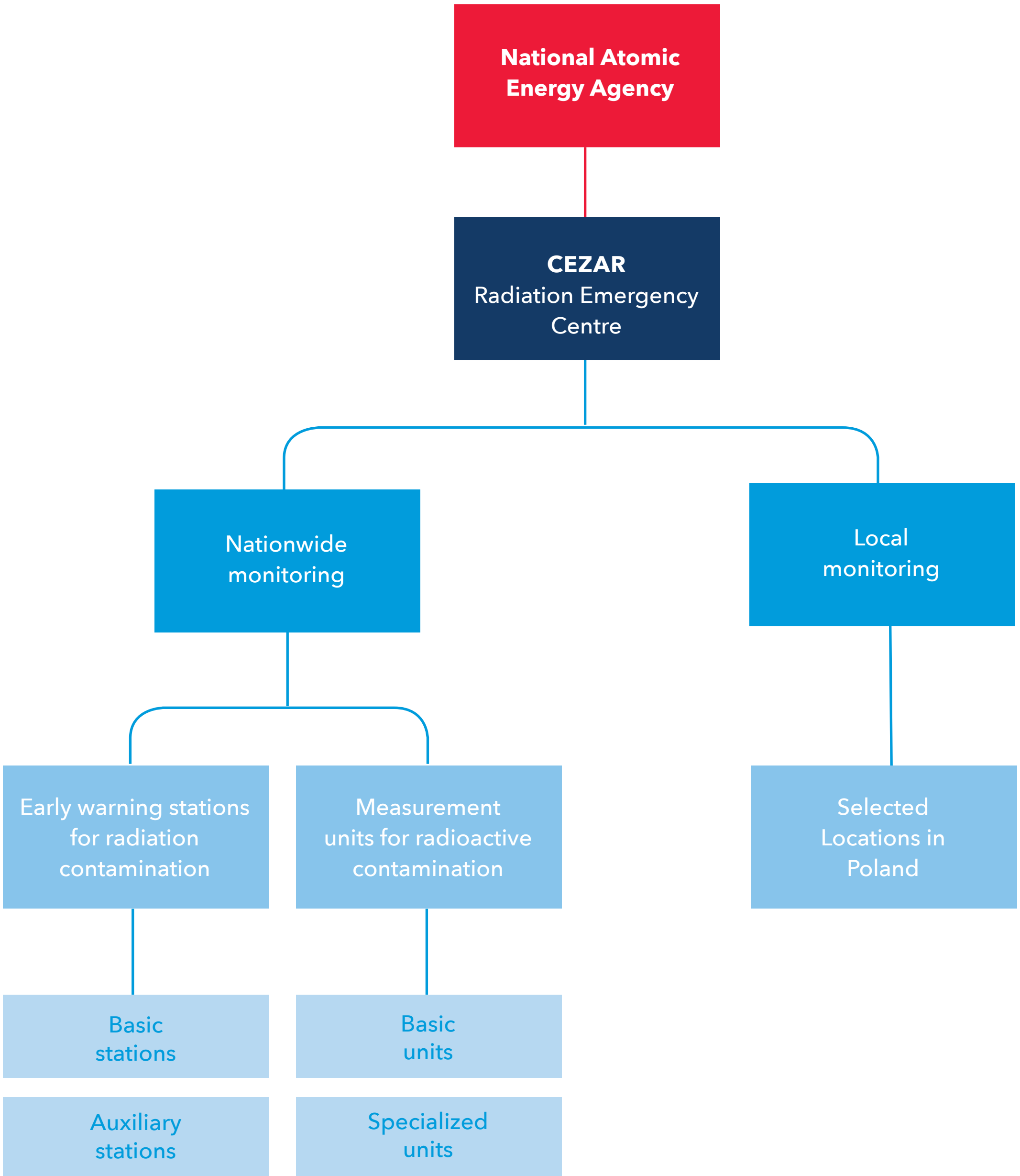
The PAA Radiation Emergency Centre (CEZAR) is responsible for coordination of a network of measurement stations and units.

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



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

FIG. 10.
Nationwide monitoring system in Poland



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

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

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

Nationwide monitoring

Early warning stations for radiation contamination

The purpose of measurement stations operating in the early warning network for radioactive contamination is to provide information necessary for ongoing assessment of the radiological status of Poland and to enable early detection of radioactive contamination in the event of radiation emergency. The system consists of the so-called basic and auxiliary stations (see the infographic on page 70).

Basic stations:

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

Since 2016, the PAA has been enlarging the PMS stations network. In 2019, in addition to the 13 old type stations, there were also 11 new stations in operation, which were equipped with new, specially designed spectrodosimetric probes (TDSG3) and independent weather probes. Further expansion of the entire network is planned for the coming years.

- **11 stations of ASS-500 type** owned by the Central Laboratory for Radiological Protection of which[5], perform:
  - continuous sampling atmospheric aerosols on the filters,
  - perform spectrometric determination of content of individual radioisotopes on a weekly basis

- **9 stations of the Institute of Meteorology and Water Management (IMiGW)** which perform:
  - 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 (once a month).

Auxiliary stations:

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

Facilities conducting measurements of radioactive contamination of the environment and foodstuffs

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

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

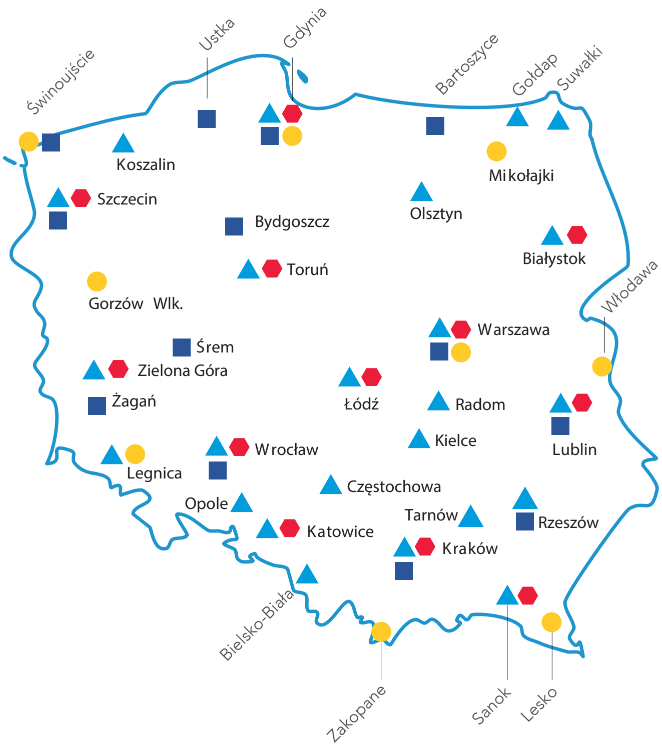
The location of the basic stations is shown in the infographic on page 71.

5. Until 28 October 2019 one additional ASS-500 station belonging to the PAA was in place

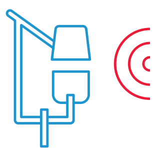
Nationwide monitoring
of the radiation situation

Number of measurement stations

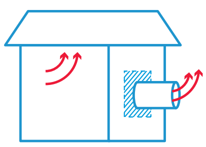
▲ PMS stations	24
● ASS-500 stations	12
● IMiGW stations	9
■ MDN stations	13



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

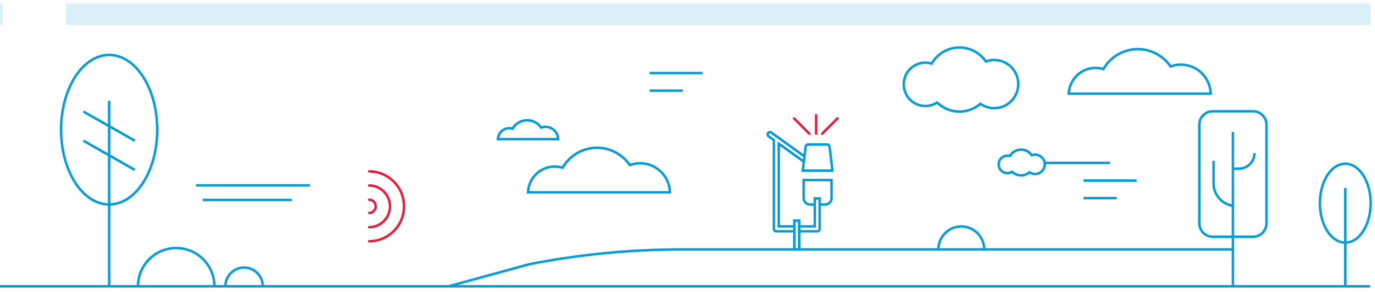


● **ASS-500 stations** – – – Highly-effective Aerosol Sampling Stations ASS-500 are designed to monitor air pollution with radioactive particles. The station pumps air through a special filter at the average rate of approx. 500 m³/h. All the particles contained in the pumped air gather on the filter. Afterwards, it undergoes a detailed laboratory analysis. This type of station allows detecting even smallest traces of radioactive isotopes present in the air in normal, situations the filter is changed once a week.



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

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



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

The current monitoring results of doses of ionizing radiation power can be found
https://paa.gov.pl/strona-455-sytuacja_radiacyjna.html
https://remap.jrc.ec.europa.eu/Advanced.aspx

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

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

The data obtained in 2019 and in the previous years confirm that there is no negative impact of operation of the nuclear centre in Świerk and of the KSOP on the natural environment and the radioactivity of wastewater and drained rainwater removed from the site of the nuclear centre in Świerk was much lower in 2019 than the limits in place.

Nuclear centre in Świerk

Radiological monitoring on the premises and in the vicinity of the Świerk nuclear centre was conducted in 2019 by the Laboratory of Dosimetry of the National Centre for Nuclear Research, and additionally, in the close vicinity of the Centre – by the Central Laboratory for Radiological Protection in Warsaw, commissioned by the PAA President. The monitoring was performed in the manner described below:

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

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

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

- 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 the selected locations chosen, as well as the content of iodine isotopes in gaseous form and radioactive noble gases.

National Radioactive Waste Repository in Różan (KSOP)

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

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

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

In the vicinity of the KSOP the following were measured:

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

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

Areas of former uranium ore extraction and processing plants

Since 1998, at the former uranium ore plants, the "Programme of radiological monitoring of areas degraded due to uranium ore extraction and processing" has been implemented. In 2019 the following measures were undertaken under the program in question:

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

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

International exchange of radiological monitoring data

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

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

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

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

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

Poland provides the following measurement results once an hour:

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

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

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

Radiation emergencies

Principles of proceeding

In accordance with the definition laid down in the Atomic Law, radiation emergency is a hazardous situation or event related to ionizing radiation sources which requires urgent actions to be undertaken for the sake of limiting serious undesired consequences for human health and for the safety and quality of life, property or environment or limiting the risk which such events might cause. We classify radiological emergencies based on the extent of the effects:

- limited to the area of the organizational unit (on-site),
- going beyond the organizational unit (Regional level),
- beyond the voivodship or with transboundary effects (National level).

INFOGRAPHIC

Classification of radiological emergencies

On-site

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

Regional level

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

National level

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

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

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

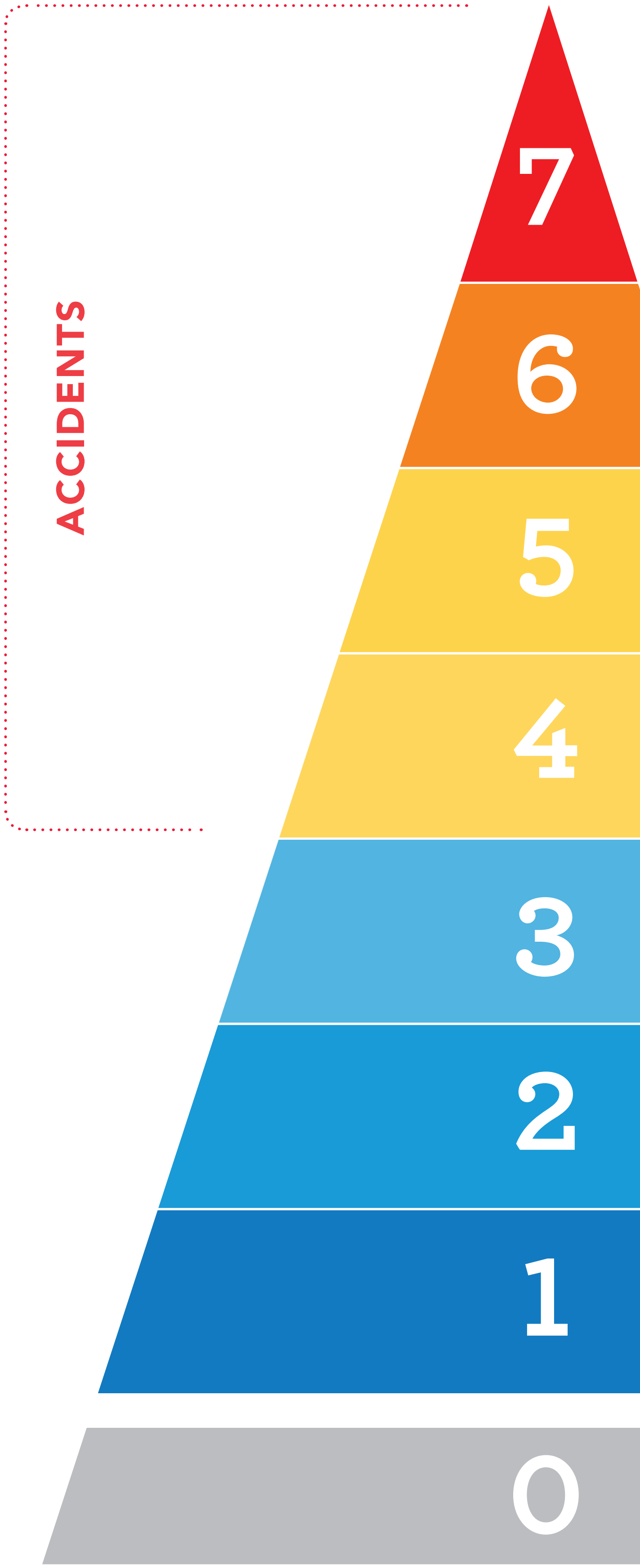
The Radiation Emergency Centre of the PAA (CEZAR) performs a number of functions, such as: emergency service of the PAA President[6], the function of a National Contact Point (NCP) for the International Atomic Energy Agency (the Unified System for Information Exchange in Incidents and Emergencies – USIE), for the European Commission (the European Community Urgent Radiological Information Exchange – ECURIE), for the Council of the Baltic Sea States, NATO and states bound with Poland by virtue of bilateral agreements on early notification and cooperation in cases of radiation emergency - it is on duty for 7 days a week and 24 hours a day. The Centre conducts assessments of the domestic radiation conditions on a regular basis, and, in the event of occurrence of a radiation emergency, uses computer decision support systems (RODOS and ARGOS).

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

THE INES SCALE

The International Nuclear and Radiological Event Scale is intended to demonstrate the impact of ionizing radiation events on safety. Events are classified at levels from 0 (no safety impact, below scale) to 7 (most serious nuclear accidents).

Introduced for use in 1990, it is regularly updated and developed. The scale is widely used by member countries of the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency (NEA OECD).



7

MAJOR ACCIDENT

Fukushima, Japan 2011

Significant release of the radioactive material to the environment

Chernobyl, Russian Federation, 1986

Significant release of the radioactive material to the environment

6

SERIOUS ACCIDENT

Kyshtym, Russian Federation, 1957

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

5

ACCIDENT WITH WIDER CONSEQUENCES

Goiania, Brazil, 1987

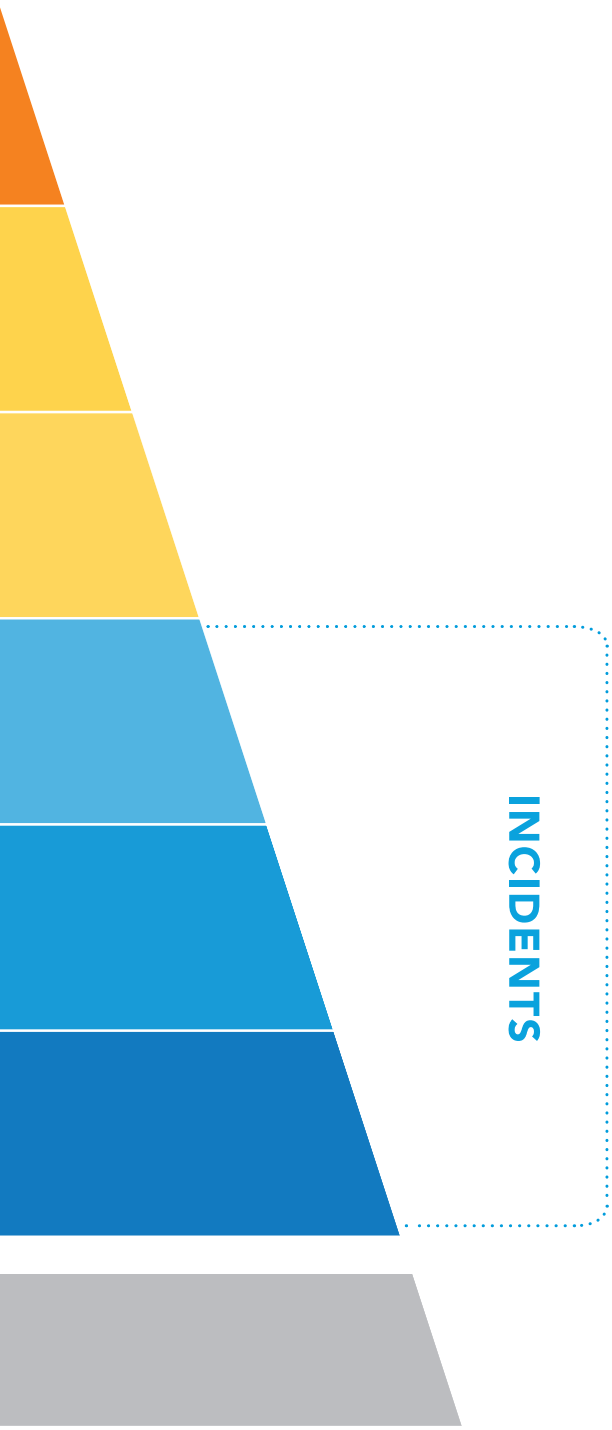
Four people died after being overexposed from an abandoned and ruptured high activity source

NPP Three Mile Island, USA, 1979

Severe damage to the reactor core 2

INFOGRAPHIC

INES Scale



4

ACCIDENT WITH LOCAL CONSEQUENCES

Stamboliysky, Bulgaria, 2011

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

New Delhi, India, 2010

Irradiation of a person as a result of contact with radioactive material in scrap

3

SERIOUS INCIDENT

Fleurus, Belgium, 2008

Release of radioactive iodine into the environment from the radioelements production facility

Lima, Peru 2012

Industrial radiography worker irradiation

2

INCIDENT

EJ Laguna-Verde-2, Mexico 2011

Overexposure of a practitioner in interventional radiology exceeding the annual limit

Paris, France 2013

Exceeding of annual dose limit of radiation by a doctor-specialist of emergency radiology

1

ANOMALY

EJ Rajasthan-5, India 2012

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

NPP Olkiluoto-1 Finland, 2008

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

0

BELOW THE SCALE

No radiation safety significance

No radiation emergency recorded in 2019 in Poland posed a threat to human health and the environment in the country.

No radiation emergencies recorded in 2019 outside Poland's borders resulted in a threat to humans and the environment in Poland.

TABLE 8.

Notifications of radiological events in the country in 2019

The notifications concerned:	NUMBER OF NOTIFICATIONS	INES LEVEL
Loss of control over the source of radioactive materials by an organizational unit	1	1
Failure of an X-ray machine resulting in the possible exposure of the personnel	1	0
Failure of an defectoscope resulting in the possible exposure of the personnel	2	1
TOTAL	**4**	

Radiation emergencies in Poland

Duty employees of the CEZAR received 4 notifications of radiation emergencies within the territory of Poland, concerning among others possible exposure of personnel on ionizing radiation.

The Dosimetry Team of the PAA President travelled to a radioactive emergency site four times to support local activities of relevant authorities in situations that are not radiation emergencies in the meaning of the provision of the Atomic Law Act.

CEZAR duty officers rendered consulting services in 13,191 cases (which were not connected with mitigation of the consequences of radiation emergency incidents), and in the majority of the cases (13,130), the consultancy was provided to National Border Guard units in relation to detection of an increased radioactivity level. The consultations concerned such matters as transit carriage or import to Poland, for domestic recipients, of ceramic materials, minerals, charcoal, refractory brick, propane-butane, electronic and mechanical components, chemicals, radioactive sources (11,999 cases in total), as well as crossing the border by nuclear medicine patients having used radiopharmaceutics (1,131 cases). Furthermore, CEZAR officers on duty provided consulting and advisory services in 61 cases to other institutions and individuals.

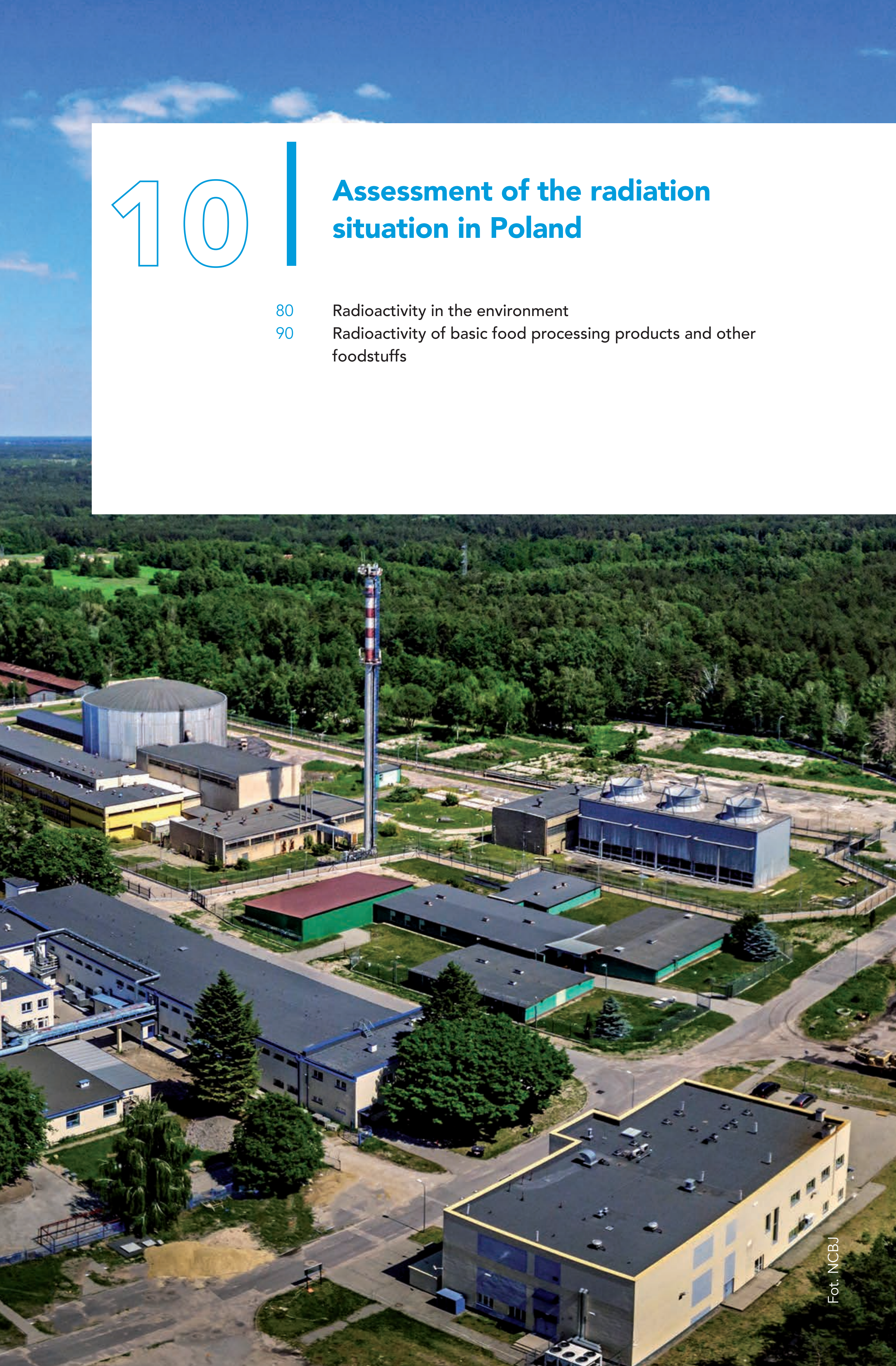
Radiation events outside of Poland

In 2019, the National Contact Point received one notification concerning accident which was classified at level 3 in the seven-point international INES scale. It concerned a serious exposure to ionizing radiation of workers performing industrial radiography in Iran.

However, 34 notifications were submitted with regard to minor incidents associated with ionizing radiation sources or nuclear facilities, which mainly concerned unplanned exposure of workers to ionizing radiation. Moreover, the National Contact Point, via the USIE and the ECURIE system, received several dozen organizational and technical reports or notifications related to international exercises.

10 Assessment of the radiation situation in Poland

80 Radioactivity in the environment
90 Radioactivity of basic food processing products and other foodstuffs



Fot. NCBJ

In 2019, level of gamma radiation in Poland and in the vicinity of the Nuclear Centre in Świerk and the National Radioactive Waste Repository did not differ from the level measured in the previous year.

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

Gamma radiation dose rate

In 2019 the level of gamma radiation in Poland and in the vicinity of the Nuclear Centre in Świerk and the National Radioactive Waste Repository did not differ from the level measured in the previous year. The differences in the dose rate values (even for the same municipality) result from the local geological conditions affecting the level of earth radiation.

The values of the ambient dose rate equivalent, including cosmic radiation and radiation generated by radionuclides present in the soil (the Earth component) presented in Table 9 show that in Poland, the average 24-hour values in 2019 were in the range of 52 to 140 nSv/h, with the annual average of 91 nSv/h.

In the vicinity of the Świerk nuclear centre, gamma radiation exposure dose rates, taking into account the earth component only, were between 31 and 44 nGy/h (the average value being 40 nGy/h). The measured values were in the range of 43 to 55 nGy/h (the average being 49 nGy/h) in the vicinity of KSOP. These values do not differ significantly from dose rate measurement results obtained in other regions of the country

.

TABLE 9.
Dose rate values obtained from early warning stations for radioactive contamination in 2019 (PAA)

Stations*	Town (location)	Scope of the daily average rate [nSv/h]	Average annual rate [nSv/h]
PMS	Białystok	84-115	91
	Bielsko Biała	83-113	93
	Częstochowa	60-81	65
	Gdynia	101-119	106
	Gołdap	64-83	69
	Katowice	79-118	89
	Kielce	78-106	87
	Koszalin	84-109	90
	Kraków	115-132	120
	Legnica	71-103	80
	Łódź	85-103	91
	Lublin	97-118	104
	Olsztyn	80-92	86
	Opole	66-86	73
	Radom	52-78	57
	Rzeszów	83-110	92
	Sanok	105-140	117
	Suwałki	66-94	84
	Szczecin	88-102	93
	Tarnów	75-107	82
	Toruń	81-96	87
	Warszawa	85-102	90
	Wrocław	81-100	86
	Zielona Góra	86-102	91
Institute of Meteorology and Water Management	Gdynia	74-95	87
	Gorzów	68-96	87
	Legnica	86-115	99
	Lesko	88-132	106
	Mikołajki	86-121	104
	Świnoujście	73-101	78
	Warszawa	76-97	83
	Włodawa	74-102	80
	Zakopane	73-136	110

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

Atmospheric aerosols

In 2019, the artificial radioactivity of aerosols in the near-surface atmosphere, determined based on measurements performed by early warning stations for radioactive contaminations (ASS-500), primarily demonstrated, similarly to the several preceding years, presence of detectable amounts of the Cs-137 radionuclide. Its average concentrations in the period analysed varied from below 0.08 to 5.57 μBq/m3 (the average being 0.55 μBq/m3). The average values of the I-131 radionuclide concentration in the same period varied between less than 0.05 to 5.24 μBq/m3 (the average being 0.59 μBq/m3), whereas average values of the natural Be-7 radionuclide concentration came to a few millibecquerels per cubic meter.

Figures 11 and 12 show the average annual concentration of Cs-137 in atmospheric aerosols in the years 2010-2019, in the entire territory of Poland and in Warsaw, respectively.

In 2019, weekly concentrations of the Cs-137 isotope in the air on the premises of the KSOP did not exceed the detection threshold of 0.13 μBq/m³ per week.

Measurements of concentration of radioactive isotopes in the air were conducted in 2019 within the territory and in the vicinity (Wólka Mlądzka) of the National Centre for Nuclear Research in Świerk on a weekly basis. The measurement results obtained in 2019 on the premises of the Centre are presented in Table 10.

FIG. 11.

Average annual concentration of Cs-137 in aerosols in Poland in the years 2010-2019 (μBq/m³; PAA, based on data provided by the Central Laboratory for Radiological Protection)

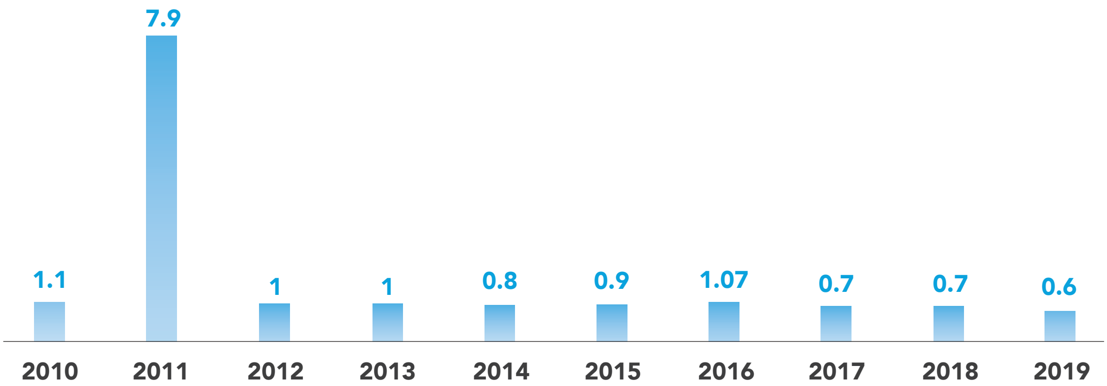


FIG. 12.

Average annual concentration of Cs-137 in aerosols in Warsaw in the years 2010-2019 (μBq/m³; PAA, based on data provided by the Central Laboratory for Radiological Protection))

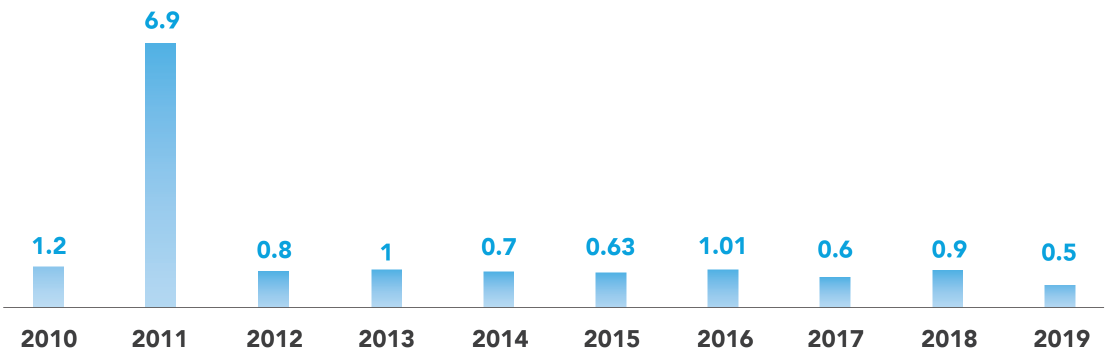


TABLE 10.

Summary of results of weekly measurements of radionuclide concentrations in atmospheric aerosols on the premises of the Świerk Nuclear Centre in 2019.

	Be-7 [mBq/m^3]	**K-40** [μBq/m^3]	**I-131** [μBq/m^3]	**Cs-137** [μBq/m^3]
Average	3.3	22	5.6	1.3
Minimum	0.9	15	0.7	0.5
Maximum	6.4	36	43	4.8

Total fallout

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

The results of the measurements presented in Table 11 indicate that the content of artificial Sr-90 and Cs-137 radionuclides in the total annual fallout in 2019 remained on the level observed in previous years.

TABLE 11.

Average activity of Cs-137 and Sr-90 and average beta activity in total annual fallout in Poland in the years 2008– 2019 (Chief Inspectorate of Environmental Protection, measurements conducted by the Institute of Meteorology and Water Management)

Year	**Activity** [Bq/m^2]		**Beta activity** [kBq/m^2]
	Cs-137	Sr-90	
2008	0.5	0.1	0.30
2009	0.5	0.1	0.33
2010	0.4	0.1	0.33
2011	1.1	0.2	0.34
2012	0.3	0.1	0.32
2013	0.3	0.2	0.31
2014	0.5	0.1	0.32
2015	0.6	0.1	0.31
2016	0.5	0.1	0.31
2017	0.3	0.2	0.32
2018	0.4	0.1	0.33
2019	0.3	0.2	0.31

TABLE 12.

Concentrations of radionuclides Cs-137 and Sr-90 in waters of rivers and lakes of Poland in 2018 [mBq/dm^3 (CEPI, measurements conducted by CLRP)

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

Waters and bottom sediments

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

Open waters

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

In 2019, radioactivity of surface waters of the southern zone of the Baltic Sea was measured for the following isotopes: Cs-137, Ra-226, and K-40 (measurements conducted by the Central Laboratory for Radiological Protection). The average concentrations of the aforementioned three isotopes remained on the level of Cs-137 – 23.4 Bq/ dm^3 – water from the surface layer – and 18.8 Bq/dm^3 – water near the bottom 3.51 Bq/ dm^3 for Ra-226 and 3983 mBq/dm^3 for K-40 and are similar to the concentrations from the previous years.

The last measurement cycle of concentration of radionuclides in samples of water from rivers and lakes was carried out in 2018. The results of the measurements presented in Table 12.

The total content of Cs-134 and Cs-137 in samples of open waters taken in 2019 from the monitoring points in the vicinity of the Nuclear Centre in Świerk were equal to, on average:

- Świder river: 4.58 mBq/dm^3 (upstream of the Centre) and 1.66 mBq/dm^3 (downstream of the Centre);
- water from the wastewater treatment centre in Otwock discharged to the Vistula river: 3.99 mBq/ dm^3.

The concentration of strontium in open water samples collected from the surroundings of the National Nuclear Research Centre in Świerk was equal to 3.40 and 3.91 mBq/dm^3.

The concentrations of tritium in open water samples collected in 2019 at monitoring points located in the vicinity of the Nuclear Centre in Świerk was equal to:

- Świder river (upstream and downstream of the Centre): on average < 2.3 mBq/dm^3.
- water from the wastewater treatment centre in Otwock discharged to the Vistula river: 2.5 Bq/dm^3.

Waters - local monitoring

The results of measurements of concentrations of radioactive isotopes in waters conducted as a part of local monitoring in 2019 did not differ 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 2019 was equal to 4.46 mBq/dm^3 for caesium isotopes (Cs-134, Cs-137) and 20.8 mBq/dm^3 for Sr-90. The concentration of tritium (H-3) was also determined and was equal to less than 3.35 Bq/dm^3 on average.

National Radioactive Waste Repository in Różan (KSOP):

Concentrations of radioactive isotopes of Cs-137 and Cs- 134 in spring water in the vicinity of the National Radioactive Waste Repository in Różan were equal to 5.28 mBq/dm^3 on average.

In 2019, the concentration of tritium in ground water was also examined in the vicinity of the National Radioactive Waste Repository in Różan, and it was less than 1.03 Bq/dm^3 on average.

Areas of former uranium ore extraction and processing plants

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

Measurements of the alpha and beta activity were conducted for 62 water samples in former areas of uranium ore mining and the following results were obtained[7]:

- public drinking water intakes:
  - total alpha activity
    – from 1.0 to 94.5 mBq/dm^3,
  - total beta activity
    – from 12.1 to 296.6 mBq/dm^3.
- waters flowing out of mine workings (adits, rivers, ponds, springs, wells):
  - total alpha activity
    – from 8.2 to 590.8 mBq/dm^3,
  - total beta activity
    – from 37.3 to 3122.4 mBq/ dm^3.

The concentration of radon in water from public intakes and private wells in locations within the area managed by the Association of Municipalities was in the range of 1.9 to 728.9 Bq/dm^3. The concentration of radon in water flowing out of mining facilities, which displayed the highest total alpha and beta radioactivity, showed the highest value of 322.5 Bq/dm^3 in water flowing out of adit no. 17 of the "Podgórze" mine.

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

Bottom sediments

The last measurement cycle of concentration of radionuclides in samples of dry mass of bottom sediments from rivers and lakes was carried out in 2018. Concentrations of cesium and plutonium radionuclides in bottom sediments in rivers and lakes in Poland in 2018 and the Baltic Sea in 2019 remained on levels observed in the previous years. The results of the measurements presented in Tables 13 and 14.

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

TABLE 13.
Concentrations of cesium and plutonium radionuclides in bottom sediments in rivers and lakes in Poland in 2018 [Bq/kg of dry mass] (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

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

TABLE 14.
Concentrations of artificial radionuclides of Cs-137, Pu- 238, Pu-239, Pu-240 and Sr-90, and of the natural radionuclide of K-40 in bottom sediments from the southern Baltic Sea in 2019 (PAA, based on data provided by the Central Laboratory for Radiological Protection)

		Thickness of layer 0-19 cm
Cs-137	kBq/m^2	2.25
Pu-238	Bq/m^2	2.25
Pu-239, 240	Bq/m^2	79.4
K-40	kBq/m^2	46.3
Sr-90	Bq/m^2	199.17

Soil

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

The last measurement cycle was conducted in the years 2016-2017. In 2016, 264 samples of soil were taken at 254 fixed check points spread across the country. In 2017, spectrometric measurements of these samples were conducted and the concentrations of artificial (Cs- 137, Cs-134) and natural radioisotopes were determined[8]. The next measurement cycle is planned for the years 2019-2020.

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

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

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

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

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

For comparison, the average values of surface contamination of soil with Cs-137 in 2019 in the surroundings of the Nuclear Centre in Świerk and of the KSOP in Różan were equal, respectively, to 7.0 Bq/kg and 20.7 Bq/kg.

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

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

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

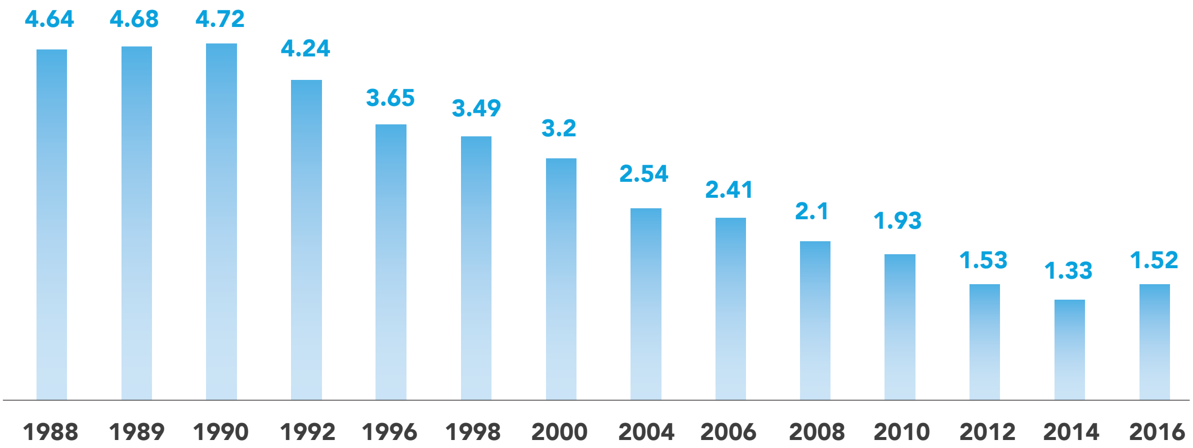


TABLE 16.
Average concentrations of natural radioactive isotopes in soil

The average concentration ranges for natural radionuclides are as follows:

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

TABLE 17.
Average, minimum and maximum deposition of Cs-137 in soil in individual provinces of Poland in samples collected in October 2016 (Chief Inspectorate of Environmental Protection; measurements conducted by the Central Laboratory for Radiological Protection)

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

Radioactivity of basic food processing products and other foodstuffs

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

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

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

Milk

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

In 2019, concentrations of Cs-137 in liquid (fresh) milk ranged from 0.29 to 2.86 Bq/dm^3 and were equal to approx. 0.41 Bq/dm^3 on average - see the infographic on pages 92-93.

Meat, poultry, fish and eggs

The results of the Cs-137 activity measurements conducted on different kinds of meat from animal farms (beef, veal, pork) as well as poultry, fish and eggs in 2019 were as follows (annual average concentration of Cs-137):

- meat from animal farms – approx. 1.11 Bq/kg;
- poultry - approx. 0.52 Bq/kg;
- fish - approx. 0.67 Bq/kg;
- eggs - approx. 0.56 Bq/kg.

The time distribution of the Cs-137 activity in the years 2005-2019 in different types of meat from animal farms (beef, pork), as well as in poultry, eggs and fish are shown in the infographic on pages 92-93. The data obtained indicates that in 2019 the average activity of the caesium isotope in meat, poultry, fish and eggs remained on the same level as in the previous year.

Vegetables, fruits, cereals, feed, and mushrooms

The results of measurements of artificial radioactivity in vegetables and fruits conducted in 2019 indicate that the concentration of the Cs-137 isotope in vegetables ranged from 0.12 to 1.25 Bq/kg, with the average value being 0.48 Bq/kg, and in fruits it was in the range of 0.19-0.4 Bq/kg with the average value of 0.31 Bq/kg (see the infographic on pages 92-93). In long-term comparisons, the results from 2019 remained on the same level as in the year 1985 and compared to the year 1986 they were more than ten times lower.

The values of activity of Cs-137 in cereals observed in 2019 ranged from 0.25 to 1.15 Bq/kg (the average value being 0.37 Bq/kg) and were similar to the amounts measured in 1985.

The values of activity of Cs-137 in cereals observed in 2019 ranged from 0.4 to 0.8 Bq/kg (the average value being 0.57 Bq/kg).

The average values of activity of the caesium isotope in grass in the vicinity of the Świerk Nuclear Centre and of the KSOP (with reference to dry mass) in 2019 remained within the range from <0.25 to 5.63 Bq/kg (the average value being 2.43 Bq/kg) for the Nuclear Centre in Świerk and from <0.15 to 3.18 Bq/kg (the average value being 0.92 Bq/kg) for the KSOP.

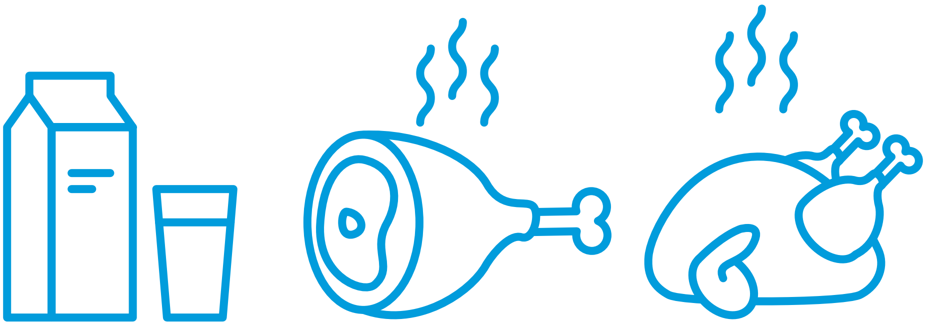
In 2019, the average activity of caesium in basic specimens of fresh mushrooms did not differ from the values measured in the previous years. It should be emphasized that in 1985, i.e. before the Chernobyl disaster, the activity of Cs-137 in mushrooms was also much higher than in other foodstuffs. At that time, this radionuclide was produced in the course of nuclear weapons tests (which is confirmed by an analysis of the proportion of the Cs-134 and Cs-137 isotopes in 1986).

RADIOACTIVITY OF FOOD

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

370 Bq/kg

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



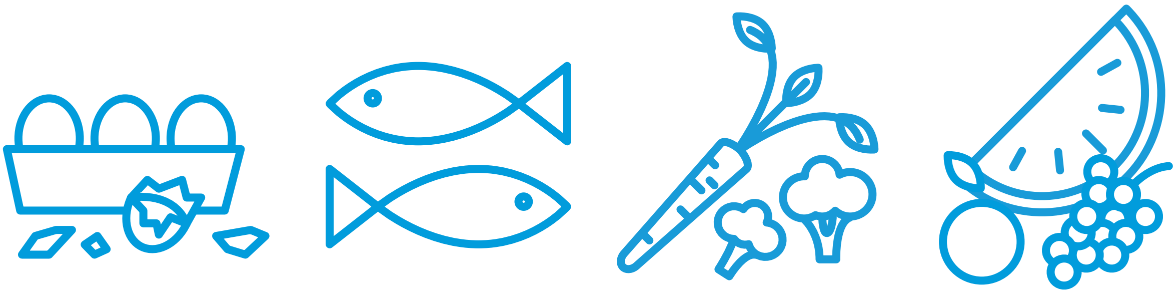
average concentration Cs-137	MILK	MEAT	POULTRY
2019	**0.41 Bq/dm³**	**1.11 Bq/kg**	**0.52 Bq/kg**
2018	0.52	1.09	0.47
2017	0.46	0.89	0.50
2016	0.40	0.63	0.54
2015	0.50	0.77	0.60
2014	0.50	0.83	0.73
2013	0.60	0.95	0.90
2012	0.60	0.90	0.70
2011	0.49	0.64	0.60
2010	0.48	0.83	0.58
2008	0.60	0.85	0.52
2009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

600 Bq/kg

total permissible content of isotopes of the Cs-137 and Cs- 134 isotopes in all food processing products and other foodstuffs.

Cs-137

it is taken into account in the given measurement results only the concentration of Cs-137 is presented because the concentration of Cs-134 is below 1‰ of their total activity.



EGGS	FISH	VEGETABLES	FRUIT
0.56 Bq/kg	**0.67 Bq/kg**	**0.48 Bq/kg**	**0.31 Bq/kg**
0.57	0.85	0.40	0.75
0.49	0.61	0.42	0.38
0.42	0.,77	0.39	0.33
0.40	0.77	0.41	0.27
0.45	0.86	0.46	0.50
0.60	1.10	0.50	0.60
0.50	1.00	0.50	0.40
0.45	1.00	0.49	0.40
0.43	1.00	0.47	0.35
0.42	0.70	0.45	0.37
0.39	0.84	0.54	0.28
0.43	0.96	0.46	0.25

Data source: sanitary and epidemiological stations

11 International cooperation

95 Multilateral cooperation
102 Bilateral 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 PAA. This duty is performed by the President in close collaboration with the Minister of Foreign Affairs, the Minister of Climate (until November 2019 - 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 support the mission of a nuclear regulatory body, i.e. ensuring nuclear safety and radiological protection of the country. PAA strives to accomplish this goal by entering international legal acts and implementing international standards by the exchange of information on nuclear protection between the neighbouring countries, as well as increasing their own competence in action by sharing experience and know-how with foreign partners. The international cooperation in question is pursued by way of the participation of PAA's representatives in the efforts undertaken by international organizations and associations, as well as their involvement in bilateral cooperation.

Multilateral cooperation

In 2019, the PAA President was involved in fulfilment of tasks resulting from Poland's multilateral cooperation under the framework of:

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

Cooperation with international organizations

European Atomic Energy Community (EURATOM)

PAA's involvement resulting from the membership of Poland in the Euratom Community and in 2019 focused mainly on activities conducted in two groups in the European Nuclear Safety Regulators' Group (ENSREG). It is composed of representatives of the senior management of European nuclear regulators from the Member States and a representative of the European Commission, providing advisory support to the European Commission.

In the fall of 2019, a six-year plan of national assessments concerning nuclear safety and mutual assessment to be performed by other member states with participation of the European Commission as an observer was elaborated and approved[9].

At the plenary meeting of ENSREG in November 2019 Poland was represented by the PAA President - Dr. Łukasz Młynarkiewicz. During the meeting, issues related to peer reviews in the field of nuclear aging management were discussed. The meeting was devoted also to the conduct of analyses of nuclear safety of power plants, the so called stress tests in the countries outside of the European Union.

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

International Atomic Energy Agency (IAEA)

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

- coordination of cooperation of national institutions with IAEA,
- participation in the elaboration of IAEA international safety standards,
- participation in development of the IAEA international safety standards;
- payment of Poland's membership fee in the IAEA from the budget of the PAA (in 2019, the fee amounted to: EUR 2,481,864 and USD 374,728 paid to the regular budget of the IAEA and EUR 697,075 paid to the Technical Cooperation Fund of the IAEA);
- implementation of own projects in collaboration with the IAEA.

9. National reports of member states http://www.ensreg. eu/tpr-national-action-plans

Cooperation in establishing the IAEA Safety Standards

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

- Nuclear Safety Standards Committee (NUSSC)[10];
- Radiation Safety Standards Committee (RASSC)[11];
- Waste Safety Standards Committee (WASSC)[12];
- Transport Safety Standards Committee (TRANSSC)[13];
- Nuclear Security Guidelines Committee (NSGC)[14];
- Emergency Preparedness and Response Standards Committee (EPRESC)[15].

IAEA General Conference

The General Conference (GC) is the highest statutory body of the IAEA. Its members are representatives of 171 (as for 05 February 2020) member states of the Agency. The General Conference 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.

The 63rd General Conference of the IAEA was held from 16 to 20 September 2019.

The conference was attended by Polish Delegation headed by Piotr Naimski, Secretary of State, Prime Minister's Chancellery, Government Plenipotentiary for Strategic Energy Infrastructure[16].

The Polish delegation voted to support the resolution specifying the value of the membership fee paid for the regular budget of the IAEA in 2020 (Poland's membership fee is equal to EUR 2,429,140 and USD 391,519); the President of the PAA also made a declaration that Poland would pay its membership fee for the Technical Cooperation Fund of the IAEA in 2019 (EUR 679,831).

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

- the Hungarian Atomic Energy Authority (HAEA) led by Mr. Szabolcs Hullán, the deputy Director General;
- the Canadian Nuclear Safety Commission (CNSC) led by Ms. Rumina Velshi, the President of the CNSC;
- the South-African National Nuclear Regulator (NNR) led by Mr. Bismark Tyobeka, the Director and Chief Executive Officer of the NRR;
- the Czech Nuclear Regulatory Authority (SÚJB) led by Ms. Dana Drabova, the President of the SÚJB.

Meetings and talks of Dr. Łukasz Młynarkiewicz, the President of PAA, with representatives of partner nuclear regulatory bodies concerned ongoing cooperation. An important topic of the talks was the organization of OJT (On-the-Job Training) trainings for PAA employees, which are aimed at preparing the Polish nuclear regulatory body to carry out the tasks set out in the Polish Nuclear Power Program (PPEJ). The delegation also presented the assumptions and status of work on the Advanced Licensing Exercise Project (ALEP) implemented by the PAA. ALEP is a tailored project of the PAA, implemented thanks to cooperation with the Regulatory Cooperation Forum (RCF), the International Atomic Energy Agency (IAEA) and the US Nuclear Regulatory Commission (US NRC).

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

- The meeting with Mr Jing Zhang from the Department of Technical Cooperation of the International Agency of Atomic Energy.
- In the Panel of International Forum of Nuclear Safety Group (INSAG) concerning implementing safety standards by member states of IAEA.

10. Nuclear Safety Standards Committee

11. Radiation Safety Standards Committee

12. Waste Safety Standards Committee

13. Transport Safety Standards Committee

14. Nuclear Security Guidelines Committee

15. Emergency Preparedness and Response Standards Committee

16. Speech of the Head of the Polish Delegation, Piotr Naimski https://www.iaea.org/sites/default/files/19/09/gc63-polan.pdf

- in the 63 Senior Regulator's Meeting, which discussed topics related to competence management for building an effective nuclear oversight and a gradual approach in nuclear oversight activities.
- in the meeting of the Regulatory Cooperation Forum. The forum was established on the initiative of the IAEA in order to provide support of countries that have advance nuclear power technologies to countries planning to develop or develop their nuclear energy sectors. The results of the nuclear power plant licensing simulation carried out by PAA as part of the ALEP project were presented.
- in the meeting of the National Liaison Officers, the country's official liaison with the IAEA in the field of Technical Cooperation Programme. The National Atomic Energy Agency (PAA) as the leading institution in the field of Poland's cooperation with the IAEA, coordinates the participation of national institutions in the Technical Cooperation Program.

Expert cooperation under the auspices of the IAEA

An important 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.

In 2019, the PAA coordinated participation of the national expert and research organizations in more than 310 meetings, training courses, and conferences organized by the IAEA.

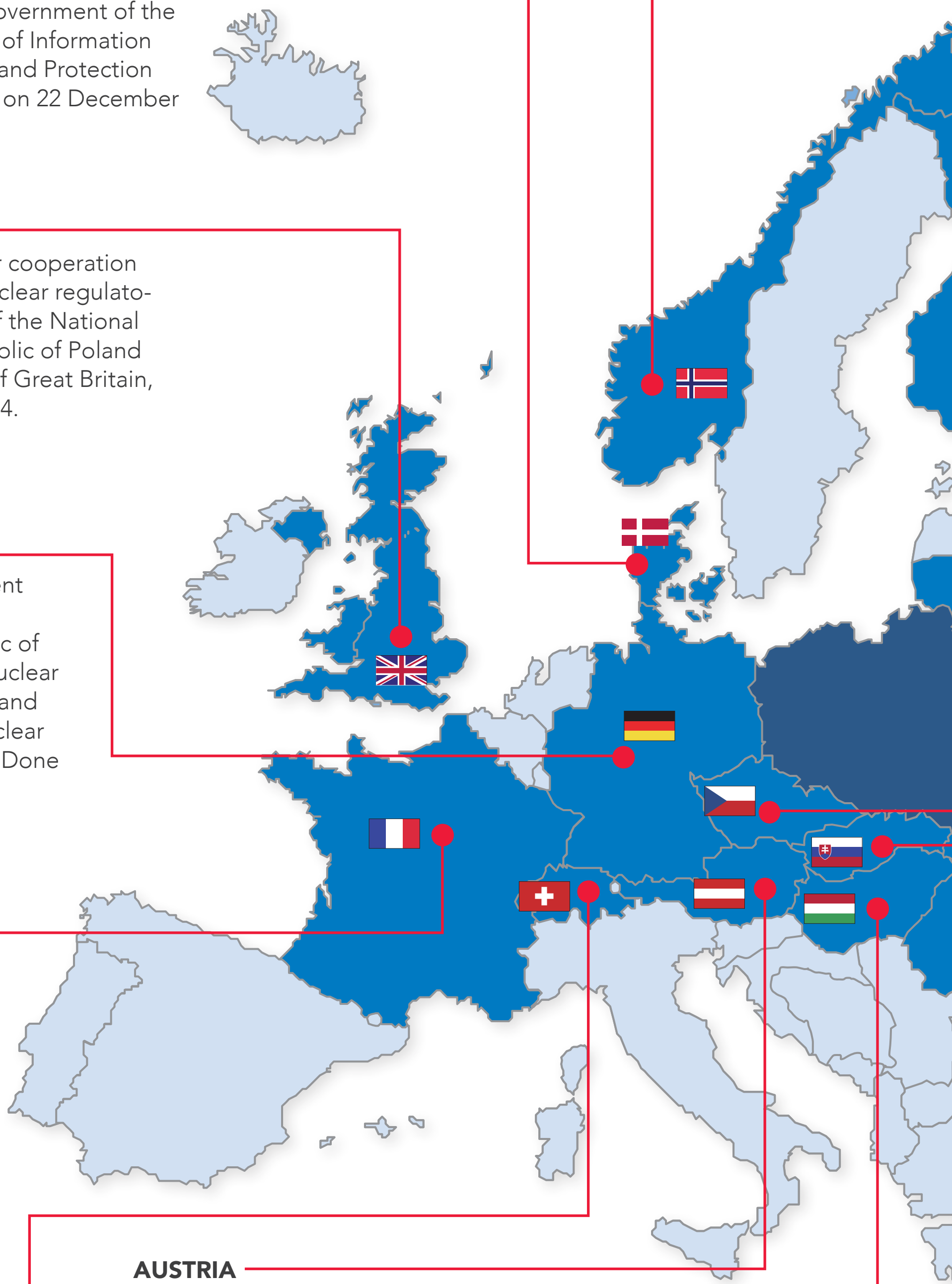
Polish institutions actively make use of expert support and the Technical Cooperation Program on projects that are important to the development of the Polish science, medicine, and power sector, as well as to ensuring nuclear safety and radiological protection of the country. The IAEA offers support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

In January 2019, at the invitation of PAA, an IAEA expert mission was carried out in the field of preparing PAA for the implementation of the internal audit program dedicated to nuclear supervision. Its purpose was to discuss the role and importance of internal audits in the work of the nuclear regulatory authority. During the meeting, the role of IAEA international standards and guidelines was presented, the key features of the audit program were discussed, and future PAA auditors were familiarized with best practices from other nuclear regulatory bodies in this area. Previous activities carried out in the field of preparation for the implementation of a special internal audit program were presented to IAEA experts. In order to ensure the efficient and effective implementation of nuclear regulatory tasks, the management of PAA has established a management system that is developed based on the international requirements of IAEA standards – in particular GSR Part 2. The project of implementing internal audits dedicated to nuclear supervision is carried out as part of continuous implementation and improvement of the integrated management system.

In mid-June, an international meeting was held under the auspices of the IAEA to exchange experience in the field of returning highly enriched spent nuclear fuel to the country of origin. The purpose of the event was to exchange experience on the implementation of return programs for highly enriched spent fuel from research reactors to China, the Russian Federation and the USA.

As part of cooperation with the IAEA, the two-year PAA Advanced Licensing Exercise Project (ALEP) project is being continued. In the spring, the PAA President officially launched the second stage of the ALEP project,

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



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

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

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

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

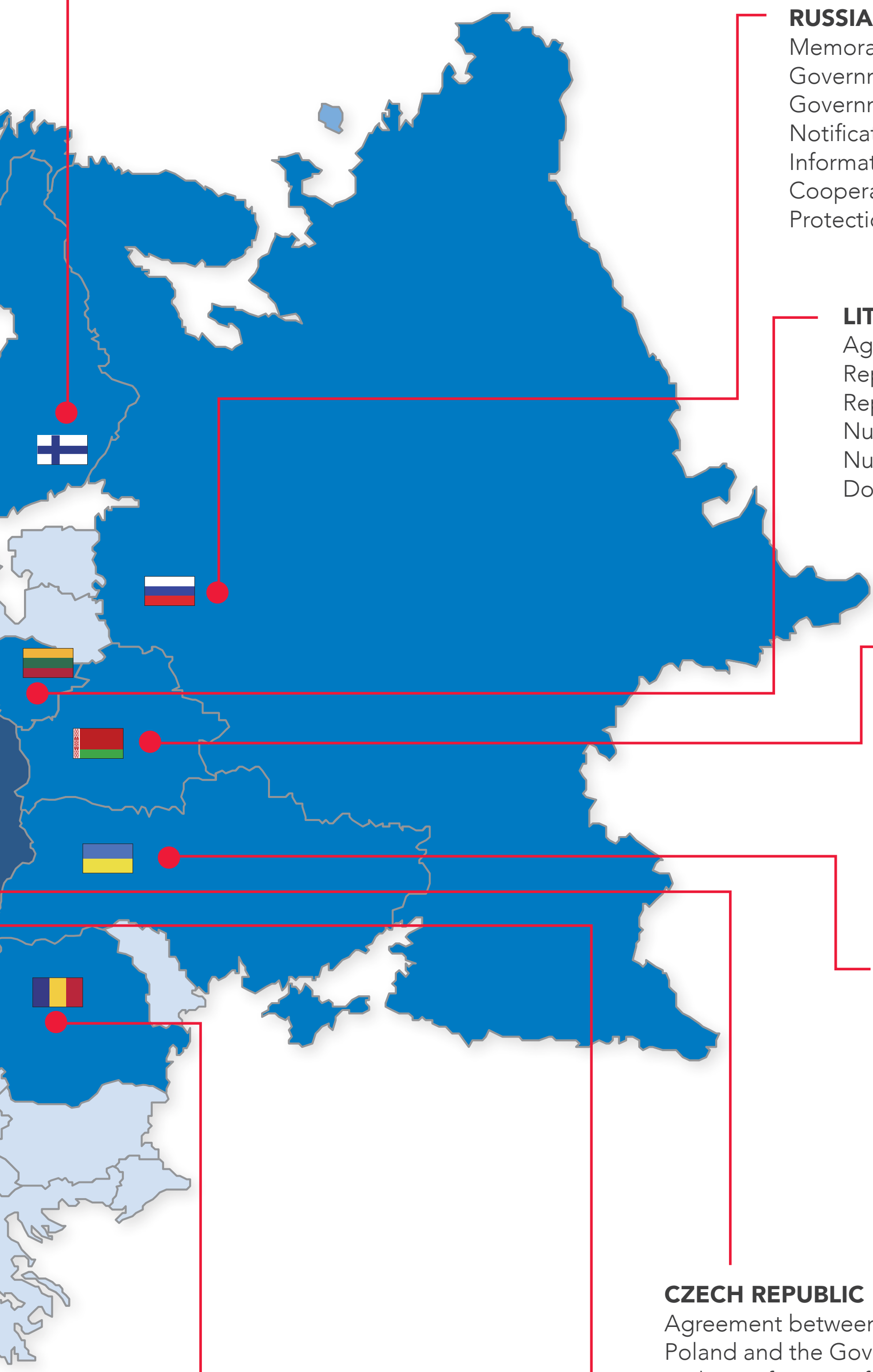
FRANCE
Agreement concluded between the President of the National Atomic Energy Agency in the Republic of Poland and the Office of the Nuclear Safety (l`Autorité de sûreté nucléaire) of the French Republic on the exchange of technical information and cooperation in the field of nuclear safety. Done at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

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

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

HUNGARY
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Radiation and the Hungarian Atomic Energy Authority, signed at Vienna 19 September 2017.

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



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

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

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

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

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

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

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

during which the PAA team simulated regulatory assessment and authorization for the construction of a nuclear power plant for 3 months. During the simulation a regulatory assessment was performed to review of the „virtual" application for nuclear power plant construction along with selected technical documentation. The regulatory assessment was performed by a team of several dozen PAA specialists based on the provisions of the Nuclear Law Act and executive regulations as well as using internal PAA procedures and instructions.

In September, the results of the simulations were analysed and discussed with experts from the American Nuclear Regulatory Commission (US NRC) and IAEA cooperating with PAA[17].

The carried out activities allowed to test the functionality of the national authorization system for a nuclear power plant and to gather experience and conclusions allowing to improve the system of national nuclear safety requirements.

In December, the IAEA experts developed the Integrated Nuclear Security Support Plan (INSSP) in the field of physical protection of nuclear materials and facilities as well as radioactive sources. The meeting, held on December 3-6, 2019, was attended by representatives of 15 Polish institutions. The purpose of the INSSP Integrated Action Plan is to identify the actions necessary to provide an effective national framework for physical protection, based on IAEA guidelines. The INSSP Action Plan also aims to facilitate the coordination of activities between domestic entities, the IAEA and foreign partners.

Cooperation with the Regulatory Cooperation Forum (RCF)

The Forum was established to support countries planning or developing nuclear energy by countries with developed nuclear energy programs.

Cooperation between PAA and RCF has resulted in projects that significantly support efforts to prepare for the implementation of the Polish Nuclear Energy Program. Thanks to the support of the Forum, PAA implements the OJT (On-the-Job Training) project, which aims to gain direct experience in exercising nuclear supervision over the location, construction, commissioning and operation of nuclear power plants. As part of the project, a number of on-the-job assignments for PAA employees were carried out at various foreign nuclear regulatory offices. The RCF also supports PAA in implementing the ALEP project.

In autumn 2019, a meeting with representatives of the RCF took place at the PAA headquarters, during which the President of the PAA, Dr. Łukasz Młynarkiewicz, presented the current state of development of regulatory infrastructure for the Polish Nuclear Power Program. The parties discussed the possibilities and plans for further cooperation between PAA and RCF in the next 2 years.

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 institution that leads actions in the framework of NEA is the Ministry of Climate (since November 2019 the Ministry of Energy). The PAA is involved in works of working groups and committees of the NEA in the fields of nuclear safety, nuclear regulatory activity, nuclear law and new reactors.

In December 2019, the President of the PAA, Dr. Łukasz Młynarkiewicz participated in the meeting of the Committee on Nuclear Regulatory Activities (CNRA). The Committee approved the work plans of individual working groups and discussed the issue of coordinating activities with international and regional organizations, including the International Atomic Energy Agency.

Cooperation within associations and other forms of multilateral cooperation

Western European Nuclear Regulators' Association (WENRA)

In 2019, WENRA's activity was implemented though working grups on harmonization of reference levels for nuclear power plants and research reactors and on radioactive waste.

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

In April 2019, the WENRA working group met for the first time in Poland. The seventh meeting of the Reference Level for Research Reactor task force was about creating benchmarks for research reactors based on existing requirements for nuclear power plants.

In the autumn, the President of the PAA, Dr. Łukasz Młynarkiewicz took part in the WENRA plenary meeting, to discuss issues related to the current work of the Association, as well as the strategy of its future activities. The subject of the meeting was also the issue of the relationship between nuclear safety and physical protection of nuclear facilities and materials.

Heads of the European Radiological Protection Competent Authorities (HERCA)

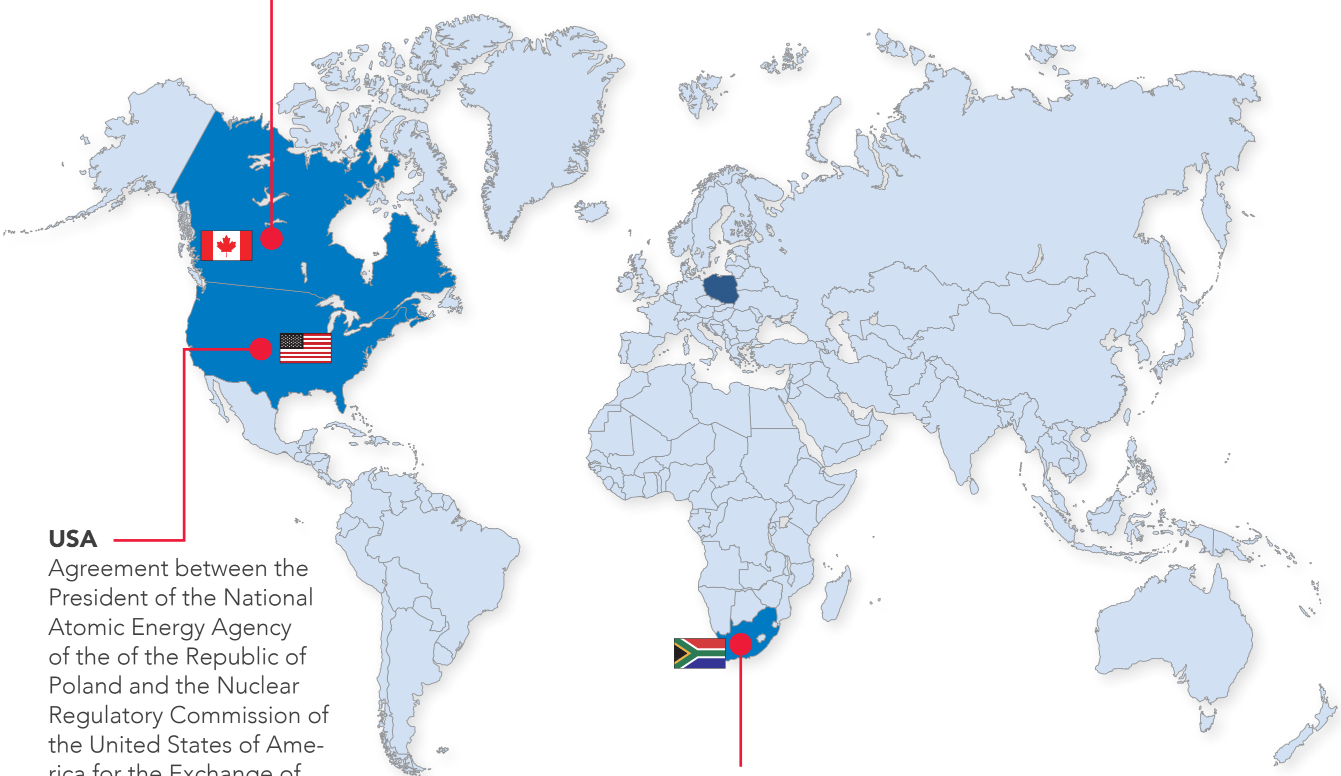
Representatives of Poland participate in plenary works of heads of the European regulatory authorities and in HERCA working groups, dealing with such issues as radiological protection in medicine, veterinary science, industry, as well as preparation for radiation emergencies.

Council of the Baltic Sea States (RPMB)

PAA represents Poland in the Council Working Group on Nuclear and Radiation Safety (Expert Group on Nuclear and Radiation Safety). The Group meets twice a year, and, additionally, organizes ad-hoc meetings on specific topics in sub-groups. Observers from the European Commission and others institutions specializing in nuclear safety and radiological protection (e.g. IAEA, IRSN France etc.) as

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

CANADA
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the Canadian Nuclear Safety Commission, signed in Vienna on 24 September 2014.



USA
Agreement between the President of the National Atomic Energy Agency of the of the Republic of Poland and the Nuclear Regulatory Commission of the United States of America for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters. Done in Vienna on 28 September 2016.

REPUBLIC OF SOUTH AFRICA
Memorandum of Understanding for cooperation and exchange of information for nuclear regulatory matters between the President of the National Atomic Energy Agency of the Republic of Poland and the National Nuclear Regulator of South Africa, signed at Centurion on 24 November 2017.

well as representatives of organizations involved in the subject of Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) may be present at the meetings of the Group.

European Nuclear Security Regulators Association (ENSRA)

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

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 organization of the EU countries constituting a forum for the exchange of information, knowledge and experience, dissemination of continuous development and improvement in the field of nuclear material safeguards, related to the fulfilment of obligations arising from the Treaty on the Non-Proliferation of Nuclear Weapons and derived international agreements. The organization cooperates with IAEA, Institute of Nuclear Materials Management (INMM) – USA and the laboratories of the Joint Research Centre (JRC) of the European Commission. It brings together scientific institutes, universities, industrial companies, specialists and state administration bodies responsible for securing nuclear materials of European Union countries. The organization has a steering committee that leads meetings attended by the representatives of all member organizations.

Bilateral cooperation

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

In 2019, PAA continued its cooperation with its foreign partners which already have experience in supervision of large nuclear facilities. In addition to the bilateral meetings mentioned above, which took place during the IAEA General Conference, PAA implemented a bilateral cooperation program:

- In January, a bilateral meeting with the delegation of the Belarusian nuclear regulatory authority Gosatomnadzor (GAN), headed by Zoya Trafimchik, deputy director of GAN took place in Gdansk. In addition, in October there was a technical visit of PAA representatives in Minsk regarding the licensing process of the nuclear power plant in Ostrowiec.
- In May, a bilateral meeting was held in Warsaw with a delegation of the Hungarian Atomic Energy Agency (HAEA) headed by Szabolcs Hullán, HAEA Deputy General Director.
- In June, a bilateral meeting with a delegation of the Czech Nuclear Regulatory Office (SUJB) took place in Wrocław, headed by Dana Drabova, the President of SUJB.
- In September, a bilateral meeting was held in Warsaw with the delegation of the American Nuclear Regulatory Commission (US NRC) headed by Kristine L. Svinicki, Chairwoman of the US NRC Committee.
- A bilateral meeting with the Austrian delegation took place in Vienna in October.

List of acronyms

- **ADN** – L'Accord européen relatif au transport international des marchandises dangereuses par voie de navigation intérieure - European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways
- **ADR** – L'Accord européen relatif au transport international des marchandises dangereuses par route - European Agreement concerning the International Carriage of Dangerous Goods by Road
- **ASN** – Autorité de sûreté nucléaire
- **ASS-500** – Aerosol Sampling Station
- **BSS** – Basic Safety Standards
- **CBRNE** – Chemical, Biological, Radiological, Nuclear, and Explosives
- **CEZAR PAA** – Radiation Emergency Centre of the PAA
- **CLOR** – Central Laboratory for Radiological Protection
- **COAS** – Center for Analysis of Contamination
- **DBJPM PAA** – Nuclear Safety and International Programs Department of the PAA
- **DNK PAA** – Supervision and Control Department of the PAA
- **DoE** – U.S. Department of Energy
- **DOR PAA** – Radiological Protection Department of the PAA
- **ECURIE** – European Community Urgent Radiological Information Exchange
- **ENSRA** – European Nuclear Security Regulators Association
- **ENSREG** – European Nuclear Safety Regulators' Group
- **ESARDA** – European Safeguards Research and Development Association
- **EURATOM** – European Atomic Energy Community
- **EURDEP** – European Radiological Data Exchange Platform
- **GIG** – Central Mining Institute
- **GIOŚ** – Central Environmental Protection Inspectorate
- **GTRI** – Global Threat Reduction Initiative
- **HERCA** – Heads of the European Radiological Protection Competent Authorities
- **HEU** – Highly Enriched Uranium
- **IAEA** – International Atomic Energy Agency
- **IATA** – DGR International Air Transport Association Dangerous Goods Regulation
- **ICAO** – International Civil Aviation Organization
- **IChTJ** – Institute of Nuclear Chemistry and Technology
- **IMDG Code** – International Maritime Dangerous Goods Code
- **IMiGW** – Institute of Meteorology and Water Management
- **INES** – International Nuclear and Radiological Event Scale
- **IOR** – radiation protection officer
- **IRSN** – L'Institut de Radioprotection et de Sûreté Nucléaire
- **JRC** – European Comission's Joint Research Centre
- **GC** – General Conference IAEA
- **NCP** – National Contact Point
- **KSOP** – National Radioactive Waste Repository
- **LEU** – Low Enriched Uranium
- **MND**– Ministry of National Defence
- **NCBJ** – National Centre for Nuclear Research
- **NEA OECD** – Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
- **NIK** – Supreme Audit Office
- **NUSSC** – Nuclear Safety Standards Committee
- **PAA** – National Atomic Energy Agency
- **PMS** – Permanent Monitoring Station
- **POLATOM** – Radioisotopes Centre
- **PPEJ** – Polish Nuclear Power Programme
- **RASSC** – Radiation Safety Standards Committee
- **RCF** – Regulatory Cooperation Forum
- **RID** – Reglement concernant le transport Internationale ferroviaire des marchandises dangereuses
- **RPMB** – Council of the Baltic Sea States
- **TLD** – thermoluminescent dosimeters
- **TRANSSC** – Transport Safety Standards Committee
- **UDT** – Office of Technical Inspection
- **USIE** – Unified System for Information Exchange in Incidents and Emergencies
- **WASSC** – Waste Safety Standards Committee
- **WENRA** – Western European Nuclear Regulators Association
- **WHO** – World Health Organization
- **ZUOP** – Radioactive Waste Management Plant

NATIONAL
ATOMIC ENERGY
AGENCY

ul. Bonifraterska 17
00-203 Warszawa, Poland
www.paa.gov.pl