BULGARIAN NUCLEAR REGULATORY AGENCY



ANNUAL REPORT 2024

In fulfilment of one of our legal obligations, with this Annual Report of the Bulgarian Nuclear Regulatory Agency (BNRA), I present to the attention of interested parties the information for 2024 regarding the state of nuclear safety and radiation protection at nuclear facilities and sites with sources of ionizing radiation in the Republic of Bulgaria.

The results of the regulatory control, carried out by the BNRA inspectors, show that during the past year the nuclear facilities in the Republic of Bulgaria were operated in accordance with the existing requirements of the issued licenses. They also confirm that the state of nuclear safety and radiation protection was maintained in compliance with the international standards and criteria, and at the required level. Data from environmental radiation monitoring confirm the effectiveness of the protective barriers that prevent the spread of radioactive substances during the operation of nuclear facilities. The natural radiation background in the country has not been affected by the operation of the nuclear facilities and the sites with sources of ionizing radiation.



One of the landmark events of the year was the full-

scope peer review mission conducted by the International Atomic Energy Agency (IAEA) — the Integrated Regulatory Review Service (IRRS) mission. The aim of the mission was to assess the effectiveness of the national regulatory infrastructure regarding nuclear safety, radiation protection, emergency planning, and the safe transport of radioactive material. The mission comprised 16 experts from 15 IAEA Member States from various fields of nuclear safety and radiation protection. The mission found that Bulgaria has a comprehensive and robust regulatory framework for nuclear and radiation safety in accordance with the IAEA safety standards. The IRRS team noted that the BNRA has a culture of continuous improvement and is an experienced and competent regulator that fulfils its legal obligations without allowing external influence. The IRRS mission identified seven areas of good performance, 15 recommendations, and 29 suggestions to be considered in future regulatory practice. The Bulgarian Nuclear Regulatory Agency has developed an Action Plan for their implementation.

Regarding the Kozloduy NPP's plans for nuclear fuel diversification, in April 2024, we issued a permit for the phased transition of Unit 5 to the use of Westinghouse RWFA-type nuclear fuel. The transition will take place over four consecutive fuel campaigns (four years), in compliance with the conditions specified in the issued permit. During the scheduled annual maintenance of the unit in 2024, the first fuel assemblies were loaded.

Despite the personnel shortage in the nuclear sector in the country, the BNRA leadership continues to make efforts to ensure the necessary administrative capacity to support the regulatory functions of the Agency. There is a particularly acute need for young and well-prepared engineering personnel, and in this regard, with the help of the government, important steps have been taken to address this issue.

The main priority of the Bulgarian Nuclear Regulatory Agency is to ensure nuclear safety and radiation protection in the Republic of Bulgaria. In achieving this, the Agency adheres to the fundamental principles of transparency, impartiality in its work, and open dialogue with all interested parties. The BNRA public communication throughout the year was aimed at strengthening trust and establishing the Agency image as an independent regulatory body with effective mechanisms for public accountability.

In conclusion, I would like to emphasize that over the past year, the Agency provided transparent, timely, accurate, and objectively presented information to assure the public that the BNRA is staffed by recognized experts in the field.

Mr. Tsanko Bachiyski Chairman of BNRA

TABLE OF CONTENTS

I. NUCLEAR FACILITIES

KOZLODUY NPP POWER UNITS	4
1. Unit Operation – Compliance with Licence Requirements. Implementation of	
Integrated Programme Measures	4
1.1. Maintenance and Repair – Main Conclusions Resulting from the Oversight,	
Including the Inspections Conducted after the Units' Planned Annual Outages	5
1.2. Surveillance and Testing Programmes – Performance Assessment	6
1.3. Water Chemistry	7
1.4. Ageing Management	7
1.5. Operational Events and Implementation of Corrective Measures	7
2. Operating Procedures Efficiency. Performance Indicators	8
3. Status of the Safety Systems	9
4. Status of the Containment, Filtered Venting System, Hydrogen Combustion System - Tests,	
Surveillance and Maintenance Programmes	. 10
5. Emergency Preparedness – Emergency Drills and Exercises	. 10
6. Radiation Protection	. 11
7. Physical Protection	. 13
SPENT FUEL STORAGE FACILITIES	
1. Operation of the Storage Facilities – Compliance with Licence Requirements	. 14
2. Spent Nuclear Fuel Management. Implementation of the Strategy for Managing the Spent	
Nuclear Fuel and Radioactive Waste	. 15
3. Radiation Protection	. 16
4. Physical Protection	. 16
STATE ENTERPRISE RADIOACTIVE WASTE	. 16
1. Safety in Managing Radioactive Waste from Kozloduy NPP	. 16
2. Fulfilment of the Licences Conditions	. 16
3. Plasma Melting Facility	. 19
4. Radiation Protection	. 20
5. Physical Protection	. 20
NEW NUCLEAR FACILITIES PROJECTS	. 20
1. Units Seven of Kozloduy NPP – Licensing Procedure Stage	. 20
2. Units Eight of Kozloduy NPP – Licensing Procedure Stage	. 21
3. National Repository for Low and Intermediate Level Radioactive Waste	. 21
RESEARCH REACTOR	. 22
SUMMARY	. 22

II. ACTIVITIES INVOLVING SOURCES OF IONISING RADIATION	23
III. ADMINISTRATIVE CAPACITY	25
1. HUMAN RESOURCES	25
1.1. Human Resource Development	26
1.2. Training and Qualification	28
1.3. Knowledge Management	28
1.4. Knowledge Exchange Networks	29
2. FINANCIAL RESOURCES	29
2.1. Revenues	29
2.2. Expenditures	30
3. PUBLIC RELATIONS AND ACCESS TO PUBLIC INFORMATION	30
IV. BNRA ACTIVITIES	32
1. Regulatory Framework Development	32
2. Inspections at Nuclear Facilities	33
3. Inspections at Sites with Sources of Ionising Radiation	36
4. Licences and Permits for Performing Activities at Nuclear Facilities	37
5. Licences and Permits for Performing Activities Involving Sources of	
Ionising Radiation	39
6. Nuclear Material Accounting and Control	42
7. Emergency Preparedness	42
8. Nuclear Harmonisation ans Standardisation Initiative	43
9. Second Topical Peer Review Organised by the EC on Fire Safety	44
10. Interaction and Coordination with other State Bodies for Specialised Control	44
11. International Cooperation	45
APPENDIX 1	51
APPENDIX 2	52
ABBREVIATIONS	54

I. NUCLEAR FACILITIES

KOZLODUY NPP POWER UNITS

1. Unit Operation - Compliance with Licence Requirements. Implementation of Integrated Programme Measures.

In 2024, Units 5 and 6 of Kozloduy NPP were operated within their designated design modes in the design and in compliance with the operating licenses issued by the Bulgarian Nuclear Regulatory Agency (BNRA). After their planned annual outages, the two units entered the 31st and 30th fuel cycles, respectively.

In connection with the amendments to the Safe Use of Nuclear Energy Act introduced at the end of March 2024, the licences for operation of Units 5 and 6 were amended in mid-2024, and the new licences are not limited by time (indefinite). The amendments made do not change the scope and extent of existing regulatory oversight of the facilities. The requirement for the licensees to carry out periodic safety reviews at least once every ten years is maintained. In its nature, this review covers all aspects of the safety of the facilities and aims to establish their compliance with the existing regulatory requirements, licensing conditions, safety standards and internationally recognised good practices. The results of this review are grounds for the issuance of an order by the BNRA Chairman for their approval. The order also determines the period for the next periodic safety requirements, the Chairman shall reasonably refuse to issue an order for approval, which shall constitute grounds for revoking the licence concerned. With the amendments to the licences for operation of the units made in June and July, the deadlines for the submission of the results of the upcoming periodic reviews have been set.



Photo Kozloduy NPP

The scope of the regulatory oversight carried out during the period encompasses activities pertaining to modifications in safety-related structures, systems and components (SSCs), amendments to the documents used as a basis for the issued operating licences, monitoring performed through inspections and verifications, and daily operational oversight of the facilities. The main objective of regulatory oversight is to maintain the status of the nuclear safety and radiation protection of the units in compliance with the requirements of the regulations, the International Atomic Energy Agency (IAEA) standards, as well as with internationally recognised good practices.

In connection with maintaining the designs of the units in a condition that prevents the evolution of deviations from normal operation into accidents, a number of reviews and evaluations of the documents submitted for modifications to safety-related SSCs were carried out at the BNRA during the period. As a result, the necessary authorisations have been issued by the BNRA to implement the relevant modifications. The effectiveness of the implemented design modifications is confirmed by the steady trend in the number of events which occurred at the units.

The implementation of the integrated programme measures aimed at improving the level of safety at Units 5 and 6 continued in 2024. The measures included in the programmes arise from the performed periodic safety reviews and lifetime extension projects. As at end of the year, 58 out of 66 measures for Unit 5 and 33 out of 48 measures for Unit 6 have been implemented from the integrated programmes.

The results of the overall regulatory oversight show that over the review period the units were operated in compliance with the requirements of the licences issued and the status of nuclear safety and radiation protection is maintained at the required level.

Compliance with Licence Requirements

To confirm that the terms and conditions of the issued licences and permits and the recommendations and instructions made by the BNRA inspectors are met, the Regulator carries out a review and assessment of the documents certifying their fulfilment. The reviews and assessments performed in 2024 were mainly related to:

 \succ reporting on the implementation of the integrated programmes aimed to improve the level of safety at Units 5 and 6;

> update of the units' safety analysis reports;

> periodic updates on the status of nuclear safety and radiation protection, indicators for safe operation, radioactive discharges, etc.

The results of the performed reviews and assessments reaffirm that Unit 5 and Unit 6 are operated in line with the licence terms and conditions and safety operation requirements.

1.1. Maintenance and Repair - Main Conclusions Resulting from the Oversight, Including the Inspections Conducted after the Units' Planned Annual Outages.

In 2024, the maintenance and repair of the Units 5 and 6 SSCs were performed in line with predesigned time-schedules and in accordance with established instructions and programmes. All planned activities were carried out in full scope, meeting the expected quality requirements. The main findings of the inspections of the preparedness of the units for start-up and operation after the planned annual outages are:

- the planned repairs of the equipment and the activities for the non-destructive testing of the equipment are performed in volume and quality, which ensure the operability of the systems and constructions;

- the design modifications resulting in enhancement of safety have been implemented in the required volume and quality;

- the performed functional tests of the systems important for safety certify their readiness for operation in accordance with the design characteristics.

The results of the regulatory oversight carried out during the period, including on-site inspections,

confirm the successful implementation of the maintenance and repair activities.

1.2. Surveillance and Testing Programmes - Performance Assessment.

The equipment surveillance programme in place at Units 5 and 6 regulates the activities aimed to ensure the reliability of SSCs and the compliance of the equipment condition with the design criteria under long-term operation conditions. The implementation of the programme activities leads to the preventive detection of signs of SSCs degradation, and afterwards results in prevention of deviations in the equipment performance in terms of its intended characteristics.

Regarding the identified defects in some of the peripheral guide tubes of the Unit 6 Protective Tube Unit (PTU) and pursuant to BNRA's recommendations, an annual periodic inspection of the facility is performed. The inspection results do not show evidence of progression of the existing defects or the development of new ones. In this regard, a project has been prepared to further strengthen and mitigate potential consequences should the defects progress.

As a result of the in-service inspection of the heat exchanger tubes of Unit 6 third steam generator carried out in 2024, leaks were detected in four tubes of the steam generator tube bundle, which were subsequently plugged. As at the end of the year, the number of plugged tubes since the start of operation of the steam generator was 19. The facility's design margin allows for the steam generator to be operated without restrictions with up to 220 heat exchanger tubes plugged out of a total of 11,000. A specific programme has been prepared and is being implemented in order to meet the recommendations of the BNRA aimed at increasing the reliability of the steam generator. The programme contains a number of measures aimed at identifying the causes of the leaks and enhancing the efficiency of preventive control carried out.

The implementation of the surveillance and testing programmes is within the scope of the BNRA daily operational oversight at the site of Kozloduy NPP performed by the BNRA inspectors permanently working at the site. The major part of this oversight includes daily walkdowns, conversations with the employees, monitoring the test results of SSCs' compliance with the adopted success criteria.



1.3. Water Chemistry.

The purpose of the maintained water chemistry of the coolant in the primary and secondary circuit is to limit structural material corrosion processes and reduce deposits on heat-exchanging surfaces.

Ensuring the equipment corrosion resistance and minimising the deposits on the heat-exchanging surfaces of the fuel and steam generators are directly related to maintaining optimal water chemistry levels. This prevents corrosion and corrosion-erosion damage to the steam generators, equipment and piping in the primary and secondary circuits.

The water chemistry parameters are continuously monitored by measuring and trending a number of chemical indicators, the values of which shall meet the specified standards. The quality of the maintained water chemistry is evaluated based on two independent indicators: the chemical index (ChI) and the complex chemical index (CChI).

In 2024, the calculated value of the average annual ChI of the primary and secondary circuit of Units 5 and 6 was equal to 1, which is optimal value of this indicator. The CChI is determined by comparing the measured values of the chemical indicators and their threshold values. The CChI is determined monthly, quarterly and annually, with the average values for the Units in 2024 being well below the maximum permissible value of 1.



1.4. Ageing Management.

Ageing management activities are carried out in accordance with the requirements of regulatory documents and applicable IAEA safety standards. A methodology is applied at Kozloduy NPP to identify the SSCs falling into the scope of the ageing management process. For this purpose, documents have been developed to regulate the operation, maintenance, repair, testing, surveillance and inspection of the individual SSCs to ensure their reliability.

Regulatory oversight carried out during the year includes assessments performed in the process of issuing permissions for modifications, the review of information submitted to the BNRA in fulfilment of licence conditions and on-site inspections. The results show a steady trend in terms of registered failures for reasons related to equipment ageing processes. This trend demonstrates the effectiveness of the programmes in place to manage the equipment ageing process.

1.5. Operational Events and Implementation of Corrective Measures.

In 2024, five events were reported to the BNRA, including three at Unit 5 and two at Unit 6. All events were reported in a timely manner in accordance with the regulatory requirements. The events were mainly related to the actuation of safety system trains and equipment failures. The information about the events

can be found on the Agency's website (www.bnra.bg). A list of the events is available in Appendix No.1 to the report.

A working group has been set up at the BNRA whose main objective is to review the analyses submitted by Kozloduy NPP in relation to the reported events. As a result of this review, it has been finally determined that the level of the events on the seven-level International Nuclear and Radiological Event Scale (INES) is "Below Scale/Level 0". The events that occurred over the past year did not lead to any breaches of the limits and conditions for safe operation of the units. Radiation background at the plant remained unchanged. The permissible staff and public radiation exposure levels were not exceeded.



Over the year, 18 operational events were also analysed at Kozloduy NPP, which do not fall within the regulatory criteria for reporting to the BNRA. Corrective measures were identified for the analysed evens aimed to prevent their recurrence. The implementation of the measures is subjected to regulatory oversight which falls within the scope of the on-site inspections. As a result, it was found that they are being implemented within their time frames.

2. Operating Procedures Efficiency. Performance Indicators.



A self-assessment performance indicator system is applied at Kozloduy NPP. The results are used in assessing the operating procedures efficiency. The application of this approach provides the necessary information for the status of the management process through taking into account the extent of achieving objectives, principles and implemented tasks.

In connection with the conditions of the licences for operation of the Units, information on the current values of the indicators and identified corrective measures in the event of a negative trend is periodically submitted to the BNRA. The information is subject to a review and an assessment by the BNRA. As a result, it was identified that the trend regarding the values of the indicators related to the safety systems operability and the equipment maintenance efficiency remains steady below the permissible limits.

In 2024, in terms of physical barriers' reliability, it should be noted that in the period from 1 April 2024 to 15 June 2024, a primary to secondary circuit leak was registered in Unit 6 third steam generator. At the end of this period, a maximum leakage value of 2.978 l/h was reached, with a permissible value of 4 l/h according to the Technical Specifications for safe operation. The unit was shut down preventively and the leak was fixed. No leaks were registered in the remaining period until the end of the year.

During the 29th fuel campaign of Unit 6, a leak (gas leak type) was detected in the fuel rod cladding of two fuel assemblies. After the unit's shutdown for the 2024 Outage, the leaking fuel assemblies were removed from the core and are stored in the spent fuel pool. The identified leaks did not cause any exceedance of the normal operation limits prescribed in the Technical Specifications for Safe Operation.



3. Status of the Safety Systems.

The safety systems' status is verified via periodic tests. The test results show that the main parameters characterising the safety systems availability to perform their design functions are within the permissible limits and no deviations resulting in inoperability of these systems were found.

The number of unplanned actuations of the systems triggered by an actual parameter is related to the determination of the risk related to the impact on the safety systems during operation. When safety systems are actuated, it is taken into account whether the triggering signal is an actual change in a certain parameter, or it is a spurious signal. In 2024, one event involving unplanned actuation of the safety systems as a result of a real change in a parameter was registered at Unit 6. The indicator's steady trend of low levels in the recent years demonstrates that the units' SSCs are kept in good condition and the necessary level of safety is maintained.



Over the review period, no events involving a reactor scram were registered at any of the units.

The regulatory oversight did not find any deviations resulting in the systems' inoperability. Safety systems were found to be well resilient in preventing deviations from normal operation and their evolving into accidents.

4. Status of the Containment, Filtered Venting System, Hydrogen Combustion System - Tests, Surveillance and Maintenance Programmes.

The planning and implementation of activities related to monitoring and assessment of the current status, determination of the remaining lifetime and limitation of the unit containment structure material ageing are carried out in accordance with approved ageing monitoring and management programmes. The data on the operational condition of the containments, the results of the visual inspections carried out and the prestressed and deformed condition, as well as the implementation of the testing, surveillance and maintenance programmes, are periodically submitted to the BNRA. As a result, no deviations from the criteria and requirements set out in the approved programmes have been identified.

The operability of the containment filtered venting pressure reduction system is maintained through the performance of various activities, such as annual visual inspections, technical qualification, including the results of the welding joints' non-destructive testing, and hydraulic tests to confirm the strength. The systems used to measure hydrogen content and the passive autocatalytic recombiners, as well as the system monitoring the concentration of hydrogen, oxygen, carbon oxide and steam are maintained and operated in accordance with established procedures. As a result of the regulatory oversight carried out, no deviations from the requirements to the systems included in the procedures were identified.

5. Emergency Preparedness - Emergency Drills and Exercises.

The National Full-Scale Exercise PROTECTION 2024 was conducted in 2024 at Kozloduy NPP. The main objectives of the exercise were rehearsing the off-site emergency plan of Kozloduy NPP in the event of a terrorist attack on the plant leading to a severe radiation accident, as well as the actions of all institutions with temporary responsibilities under the plan.

In connection with the preparation and maintenance of the required knowledge and skills of the emergency team members, a number of drills and exercises related to the actions of the teams in the event of severe accidents, terrorist attacks, as well as the elimination of the consequences of events such as fires, earthquakes and floods, were held in the past year. Four of the drills were conducted jointly with Kozloduy

NPP with the main objective being to exercise interaction between emergency teams of the BNRA and the NPP. The assessment of the joint drills' results show that the success criteria have been met and the set objectives have been achieved. With a view of maintaining the necessary level of emergency preparedness, the personnel and team members underwent special training in accordance with the developed plans and schedules.

The regulatory oversight in the field over the review period demonstrates that the emergency preparedness is maintained at the required level and complies with the approved plans and regulatory requirements. The personnel performing functions under the on-site emergency plan has the necessary knowledge and skills.



6. Radiation Protection.

The principles, standards, and requirements for radiation protection are set out in the Act on the Safe Use on Nuclear Energy (ASUNE), the Regulation on Radiation Protection, and the Regulation for Ensuring the Safety of Nuclear Power Plants. Radiation protection in the operation of Kozloduy NPP Units 5 and 6 is ensured through the implementation of a set of technical and organisational measures to limit exposure under all possible operating conditions and to optimise radiation protection, which includes:

- physical barriers to prevent the uncontrolled spread of radioactive substances;

- zoning of areas and premises, classification of workplaces and access regimes, analysis and assessment of workplace conditions in the controlled and supervised areas in terms of radiation protection;

- radiation monitoring in the different areas and workplaces, individual dosimetry monitoring of occupationally exposed persons;

- Recruitment, and maintenance of qualifications of occupationally exposed persons, specialised training, briefings and initial and subsequent periodic medical surveillance;

- monitoring and evaluation of potential exposure of members of the public;

- maintenance and application of internal documents and rules for the purpose of radiation protection of occupationally exposed persons and members of the public.

Occupational Exposure

Kozloduy NPP performs systematic individual dosimetric monitoring of occupationally exposed persons. Appropriate methods for monitoring and assessment of occupational exposure and measurement instrumentation of an approved type and subject to metrological control are used. The maximum annual individual effective dose in 2024 was 8.19 mSv which is below the regulatory limit of 20 mSv for occupationally exposed persons. The average annual individual effective dose for occupationally exposed persons is 0.14 mSv.

The collective dose was estimated at 0.34 man.Sv and is below 0.47 man.Sv which is the average collective dose for occupationally exposed persons at Kozloduy NPP over the past decade. This is the result of the effective application of the optimisation principle – keeping occupational exposure as low as reasonably achievable.



Collective effective dose at Kozloduy NPP, 2014-2024

Radioactive Discharges and Environmental Monitoring

Kozloduy NPP carries out radiation monitoring of discharges to the environment and controls the quantity and activity of gaseous and liquid discharges.

The dose limit for the annual individual effective dose from internal and external exposure of the population according to the Regulation on Ensuring the Safety of Nuclear Power Plants is 0.15 mSv. The Kozloduy NPP Units 5 and 6 Technical Specifications for operation set the administrative levels of gaseous and liquid radioactive discharges to the environment, which correspond to an annual effective dose for a member of the public of 0.10 mSv per year (0.05 mSv per year each from gaseous and liquid radioactive discharges).

The results from the monitoring of the atmosphere discharges in 2024 compared with the permitted annual levels are presented in the table below:

	Gaseous discharges	Permitted annual activity levels based on regulations	Gaseous discharges compared to the permitted annual levels (%)
Radioactive noble gases (RNG)	1.09 TBq	3,500 TBq	0.03
Iodine-131	0.019 GBq	32 GBq	0.06
Radioactive long-lived aerosols (LLA)	0.0053 GBq	29 GBq	0.018
Carbon-14	0.589 TBq	27 TBq	2.18
Tritium	0.605 TBq	180 TBq	0.34

The activity of gaseous discharges to the atmosphere in 2024 was negligible compared to the permitted annual limits. This fact is evidence that the design ventilation and air-cleaning systems are effective.

The activity of the liquid radioactive emissions released with the non-reusable and waste water into the Danube in 2024 was 0.12 GBq (without tritium) and the activity of the discharged tritium was 24.30 TBq. These values are much lower than the permitted annual levels specified in the Technical Specifications of Units 5 and 6.

The extent and scope of the monitoring of radioactive emissions to the environment is in accordance with the requirements of Art. 35 of the EURATOM Treaty and Recommendation 2000/473/Euratom, taking into account IAEA recommendations and international good practices in this field. The results of the monitoring are verified by the specialised oversight bodies: the National Centre for Radiobiology and Radiation Protection (NCRRP) of the Ministry of Health and the Executive Environment Agency (EEA) of the Ministry of Environment and Water.

The Bulgarian Nuclear Regulatory Agency exercises independent oversight of Kozloduy NPP radioactive discharges. The radiochemical analyses of samples from the gaseous and liquid discharges are performed by the Institute for Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences (INRNE – BAS). The results obtained confirm the results submitted by Kozloduy NPP specialised laboratories. In accordance with Art. 36 of the EURATOM Treaty, the BNRA submits annual reports to the European Commission on the radioactive discharges of the nuclear facilities at the Kozloduy NPP site to the environment.

The results of the environmental monitoring and the radioactive emission monitoring during the operation of Units 5 and 6 are used to estimate doses from external and internal exposure of the public and of representative individuals. The annual individual effective dose to members of the public due to radioactive emissions is conservatively estimated at 0.005 mSv for 2024. This value is much lower than the regulatory dose constraint of 0.15 mSv for members of the public.

7. Physical Protection

The physical protection system for each of the nuclear facilities located at the Kozloduy NPP site is an integral part of the site-wide physical protection system. Its functioning and efficiency are reviewed and evaluated comprehensively for all facilities. The regulatory oversight carried out in 2024 shows that the physical protection system in place at Kozloduy NPP fulfils its main functions, meets the established requirements and provides the necessary countermeasures against the identified potential threats as defined in the design basis threat



Photo Kozloduy NPP

SPENT FUEL STORAGE FACILITIES - SPENT FUEL STORAGE FACILITY, DRY SPENT FUEL STORAGE FACILITY

1. Operation of the Storage Facilities - Compliance with the Licence Requirements.

The scope of the amendments made to the ASUNE at the end of March 2024 also includes the licences for operation of the Spent Fuel Storage Facility (SFSF) and the Dry Spent Fuel Storage Facility (DSFSF). In this respect, the licences of both facilities were amended similarly to the licences of Kozloduy NPP Units 5 and 6.

During the review period, information on the safety status of the facilities was periodically submitted to the BNRA in accordance with the conditions set out in the two licences. The regulatory oversight carried out, including both the review and assessment of the incoming information and the performance of on-site inspections, shows that the SFSF and DSFSF operate in compliance with the safety requirements of the ASUNE and its implementing by-laws.

In compliance with the requirements in the licence for operation of the DSFSF, activities related to the periodic safety review (PSR) of the facility started in 2024. The results of the periodic safety review and the planned safety improvement measures arising thereby shall be submitted to the BNRA no later than April 2025.

As at the year-end, a total of 124 baskets containing 948 WWER-1000 reactor fuel assemblies and 1,268 WWER-440 reactor fuel assemblies were stored under water at the SFSF. Nineteen Constor 440/84 casks containing a total of 1,596 WWER-440 reactor fuel assemblies were stored at the DSFSF. Over the year, a total of 24 spent fuel assemblies were transported from Unit 5 and Unit 6 for storage in the SFSF.



Dry Spent Fuel Storage Facility, Photo Kozloduy NPP

2. Spent Nuclear Fuel Management. Implementation of the Strategy for Spent Nuclear Fuel and Radioactive Waste Management.

The Republic of Bulgaria has been implementing an open nuclear fuel cycle in which once the nuclear fuel has depleted its lifetime in the reactor, it is then moved for initial and then interim storage on-site, after which it is transported abroad for reprocessing and long-term storage.



Spent Fuel Storage Facility, Photo Kozloduy NPP

The Strategy for Spent Nuclear Fuel and Radioactive Waste Management, adopted in 2015, envisages a steady decrease in the amount of spent nuclear fuel stored at the plant site through annual shipment of at least 50 tonnes of heavy metal in the form of spent nuclear fuel for technological storage and reprocessing. The draft of the Strategy for Spent Nuclear Fuel and Radioactive Waste Management takes into account the changes in geopolitical factors that have occurred in recent years, the transition of Unit 5 to a new type of nuclear fuel (RWFA) and analyses the possibilities for expanding the capacity for dry storage of spent nuclear fuel on-site.

Last year, no spent nuclear fuel was shipped for technological storage and further reprocessing outside of the country.

3. Radiation Protection.

In 2024, Caesium-137 was registered in the gaseous discharges through the SFSF ventilation stack with a total activity of 0.0224 MBq which is 0.01% of the reference level. The SFSF and DSFSF radiation monitoring results show that the measured values of the monitored radiation parameters do not exceed the reference levels.

The individual annual effective dose in 2024 was below the authorised limit of 0.10 mSv for occupationally exposed persons in the SFSF and DSFSF.

4. Physical Protection

The physical protection of the facilities is an integral part of the physical protection of Kozloduy NPP. Regulatory oversight, including on-site facility inspections, is part of the Kozloduy NPP comprehensive system for physical protection.

STATE ENTERPRISE "RADIOACTIVE WASTE"

1. Safety in Managing Radioactive Waste from Kozloduy NPP.

The management of RAW from Kozloduy NPP is carried out in accordance with Art. 12 of the Regulation on Safe Radioactive Waste Management, in compliance with a Comprehensive Programme, which describes and justifies the activities undertaken and planned for the management of all RAW generated until their disposal or regulatory clearance.

As at 31 December 2024, 22 m³ solid and 1659 m³ liquid RAW, 120 m³ spent ion exchange resins and 55 m³ sediments were stored at Kozloduy NPP site.

In 2024, the following amounts of RAW were generated:

- Metal RAW 30 t;
- Non-metal solid RAW 692 m³;
- Liquid RAW 305 m^3 .

The solid and liquid RAW storage facilities at Kozloduy NPP site have sufficient capacity to ensure the normal operation of Units 5 and 6.

Radioactive materials intended for subsequent regulatory clearance are stored safely and marked appropriately. Established procedures are applied for their regulatory clearance. In 2024, metal components with total weight of 151 t from Kozloduy NPP were granted regulatory clearance by orders of the BNRA Chairman.

2. Fulfilment of the licence conditions.

The RAW management is carried out by the SE RAW in compliance with the conditions of the licences and permits issued for activities under the ASUNE. Structures, systems and components important to safety in the management of RAW from nuclear facilities and nuclear applications are maintained in operable condition. The professional recruitment of the personnel of the SE RAW is based on the requirements of the job descriptions and in accordance with the personnel recruitment and qualification system. Competent and qualified personnel is provided. The final volume of conditioned RAW for subsequent disposal is reduced to the lowest reasonably achievable level. A programme has been developed prescribing specific technical and organisational measures for safety analyses and assessments, prevention of incidents and accidents, and enhancement of safety in the management of RAW at the Kozloduy NPP site. There are no deviations from the dose constraints for occupationally exposed persons at the SE RAW, including from the reference levels defining the work environment.

> Specialised Division "Decommissioning – Units 1–4" (SD D)

Specialised Division "Decommissioning Units 1–4" (SD D) performs all the activities related to the decommissioning of the shutdown Units 1–4 of Kozloduy NPP.

Dismantling activities

In 2024, equipment weighing a total of 2,368 tonnes, including eleven steam generators from Kozloduy NPP Units 1–4, was dismantled. In 2024, nine of the dismantled steam generators were transported for temporary storage in the turbine hall at a purpose-built site for the temporary storage of decontaminated bulky equipment.

Decontamination activities in the Controlled Area

In 2024, preliminary decontamination of 271 t dismantled equipment was carried out in the Controlled Area in order to meet the criteria for its transfer to the Size Reduction and Decontamination Workshop.



Dismantled Steam Generators from Units 1-4, Photo SE RAW Size Reduction and Decontamination Workshop

In 2024, the Size Reduction and Decontamination Workshop treated radioactive materials weighing 802 t, 703 t of which were decontaminated to the levels for regulatory clearance. The amount of the

secondary RAW is acceptable: 25 t solid RAW and 51 m3 liquid RAW.

Management of materials and waste from the decommissioning of Kozloduy NPP Units 1-4

The total amount of the radioactive materials stored in the Controlled Area is 550 t. 663 t of radioactive materials are stored in 51 ISO containers on the site for temporary storage in the turbine hall. Ten steam generators with total weight of 1620 t are stored in the area for temporary storage of decontaminated bulky equipment from the Controlled Area of Kozloduy NPP Units 1–4.

In 2024, the BNRA Chairman issued 47 orders for regulatory clearance of materials with total weight of 2,384 t.

> Specialized Division "Radioactive Waste – Kozloduy" (SD RAW – Kozloduy)

The SD RAW – Kozloduy processes and conditions the solid and liquid low- and intermediate-level radioactive waste generated during the operation of Kozloduy NPP Units 5 and 6 and from Kozloduy NPP Units 1– 4 decommissioning activities.

The conduct of operations of the facility is carried out in accordance with the requirements of the Technical Specifications for safe operation.

In 2024, 95 m3 of solid non-metal RAW, 202 t of metal RAW and 116 m3 of liquid RAW were processed and conditioned, resulting in a total of 93 packages of conditioned RAW intended for interim storage and suitable for subsequent disposal at the National Disposal Facility for Low- and Intermediate Level Radioactive Waste (NDF).



Production Line in Specialised Division RAW, Photo SE RAW

> Specialised Division Permanent Repository for Radioactive Waste – Novi Han (SD PRRAW – Novi Han)

Specialized Division Permanent Repository for Radioactive Waste – Novi Han carries out activities on management of RAW from nuclear applications in Bulgaria:

- Pre-treatment of solid radioactive waste, including collection, segregation, decontamination and fragmentation;

- Storage of untreated and treated radioactive waste, including low-level radioactive waste;
- Storage of disused sealed sources of ionising radiation;
- Treatment and conditioning of solid RAW, packaging in drums, and compacting;



Hot Cell in Specialised Division Permanent Repository for Radioactive Waste - Novi Han, Photo SE RAW

Radioactive sources declared as RAW are accepted in accordance with the Regulation on the Conditions and Procedure for Delivery of Radioactive Waste to the State Enterprise Radioactive Waste. In 2024, SD PRRAW – Novi Han accepted for storage and subsequent management 2,100 RAW packages containing a total of 3,491 radioactive sources.

The "hot cell" at the SD PRRAW – Novi Han site is used for receiving inspection of disused sealed radioactive sources with a maximum activity of 500 TBq. The terms and conditions of the licence issued for the operation of the "Hot cell" facility are complied with.

3. Plasma Melting Facility.

The plasma melting facility (PMF) is designed for high-temperature treatment of short lived low- and intermediate-level RAW. In 2024, the implementation of the planned preliminary tests continued. 557 m³ of RAW were treated, bringing the volume of the treated RAW to 6.12 m³ solid non-compactible RAW packaged in 36 cylindrical moulds. The secondary liquid RAW was 0.85 m³, no secondary solid RAW was generated.

4. Radiation Protection.

The radiation protection in the Kozloduy NPP Units 1-4 decommissioning and the operation of the RAW management facilities is ensured in accordance with the principles, standards, and requirements for radiation protection as per the Regulation on Radiation Protection and Regulation No. 32 on the conditions and procedure for performing individual dosimetry control of persons working with sources of ionising radiation.

Occupational Exposure.

The SE RAW performs systematic individual dosimetry monitoring of occupationally exposed persons in the respective administrative units.

Appropriate methods and measurement instrumentation are used for the occupational exposure assessment and monitoring. The instrumentation is of an approved type and subject to metrological control.

In 2024, for the decommissioning activities of Units 1–4, the maximum annual individual effective dose was 3.83 mSv, which is two times lower than the dose constraint of 8 mSv for occupationally exposed persons. The average annual individual effective dose for occupationally exposed persons is 0.18 mSv.

A maximum annual individual effective dose of 0.63 mSv was registered in 2024 for the RAW management activities at the SD RAW – Kozloduy. The average annual individual effective dose for the relevant occupationally exposed persons is 0.25 mSv.

The maximum annual individual effective dose at the SD RAW – Novi Han in 2024, registered for activities related to the management of RAW from nuclear applications, is 4.29 mSv. The average annual individual effective dose for the relevant occupationally exposed persons is 0.11 mSv.

The collective dose to occupationally exposed persons at the SD Decommissioning Units 1–4, SD RAW – Kozloduy, and SD RAW – Novi Han registered in 2024 is 0.13 man.Sv.

Radioactive Discharges and Environmental Monitoring

During the decommissioning of Kozloduy NPP Units 1–4 and the operation of the RAW management facilities, radioactive discharges to the environment are monitored.

The results of the radiation monitoring of the gaseous discharges to the atmosphere showed that in 2024 the annual individual effective dose for members of the public resulting from the decommissioning activities at Units 1–4 was much lower than 10 μ Sv, which was below the negligible radiation risk level. The total activity of the long-lived aerosols discharged in 2024 was over 100 times lower than the investigation level of 6 GBq.

In 2024, the total activity of non-reusable water discharges registered via gamma-spectrometric measurements was 0.022 GBq, which was over 1000 times lower than the investigation level.

5. Physical Protection

The regulatory oversight carried out shows that the physical protection system of the specialised division fulfils its main functions and complies with existing requirements.

NEW NUCLEAR FACILITIES PROJECTS

1. Unit Seven of Kozloduy NPP - Licensing Procedure Stage.

The licensing procedure for the construction of Unit 7 of Kozloduy NPP was launched after the BNRA granted a permit to Kozloduy NPP - New Build in 2013, for determining the location of a nuclear facility (site selection). In the period 2013 - 2015, the necessary surveys of potential sites were carried out, as a result of which Site 2 was identified as the most suitable for the construction of a new nuclear power plant. In February 2020, the selected site was approved by an order of the Chairman of the BNRA, which obliged the licensee to periodically reassess the characteristics of the selected site at least once every ten years, applying up-to-date methodologies and data to determine the parameters of external impacts of natural

and technogenic origin and their effects on safety. On the basis of this requirement, Kozloduy NPP – New Build is expected to submit the results of a reassessment of the site characteristics to the BNRA in order to confirm that the current safety requirements are met.

In order to proceed with the licensing procedure for the construction of Unit 7, it is necessary to submit an application to the BNRA for the issuance of a design permit, accompanied by the required documents to demonstrate the scope of the design activities and to specify the safety standards to be applied in the design of the nuclear facility.



AP1000 Nuclear Power Plant, Photo Westinghouse

2. Unit Eight of Kozloduy NPP - Licensing Procedure Stage.

Following the decision of the Council of Ministers, adopted in October 2023, granting consent in principle under Article 45(1) of the ASUNE for the construction of Unit 8 of Kozloduy NPP, the licensing procedure for the construction of the unit can start with the submission of an application to the BNRA for a site selection permit. The application must contain all the documents provided for in the Regulation on the Procedure for Issuing Licences and Permits, including a conceptual description of the nuclear facility and terms of reference for preliminary studies which includes information on their scope and content.

3. National Repository for Low and Intermediate Level RAW.

The Specialised Division "National Radioactive Waste Repository" of the State Enterprise Radioactive Waste is responsible for the fulfilment of the conditions of the construction permit for the repository for the disposal of low- and intermediate-level short-lived radioactive waste.

The repository is a multi-barrier engineering facility of near-surface type intended for the disposal of conditioned RAW generated during the operation of the country's nuclear facilities and from nuclear applications of sources of ionising radiation for business, medical, scientific and control purposes.

In 2024, practically all planned construction activities have been completed and the documentation for obtaining an act establishing the suitability to accept the construction project according to the requirements of the Spatial Planning Act has been prepared.



National Disposal Facility, Photo SE RAW

RESEARCH REACTOR

The facility has been shut down and its site has been cleared of nuclear fuel. The performed activities are reduced to maintaining the systems related to radiation protection and site monitoring.

SUMMARY

The regulatory oversight carried out in the past year provides grounds to draw the following general conclusions regarding the state of nuclear safety and radiation protection in the nuclear facilities on the territory of the country:

 \succ The nuclear facilities are operated in compliance with the requirements of the ASUNE and its implementing regulations, as well as in accordance with the terms of the licences and permits issued.

 \succ The nuclear facilities are maintained in full compliance with the requirements of the defence-indepth concept. The physical barriers and levels of protection meet the existing requirements.

> Recommendations and prescriptions made as a result of ongoing and subsequent regulatory oversight are addressed by licence and permit holders within the specified time frames.

 \succ The licensees maintain a training and qualification system that ensures sufficient staff with the necessary qualifications and experience for the safe operation of the facilities.

> Radiation protection during the operation of Units 5 and 6 and the SNF storage facilities and during the decommissioning of Units 1 to 4 of Kozloduy NPP and the management of RAW in the country are ensured in accordance with the regulatory requirements and the conditions of the licences and permits

issued.

> Occupational exposure is kept as low as reasonably achievable in accordance with the principle of optimisation. The radiation characteristics of the working environment comply with radiation protection standards.

> The maximum annual individual effective dose recorded in 2024 was more than twice lower than the regulatory limit of 20 mSv/a for occupationally exposed persons.

> The results of environmental radiation monitoring confirm the effectiveness of protective barriers preventing the spread of radioactive substances during the operation of nuclear facilities in the country.

> The assessment of the exposure of members of the public due to radioactive emissions from nuclear installations shows that the annual individual effective dose is below 10 μ Sv which corresponds to the negligible radiation risk level in planned exposure situations.

II. ACTIVITIES INVOLVING SOURCES OF IONISING RADIATION

According to the ASUNE, the use of sources of ionising radiation (SIR) is permitted for business, medical, veterinary, scientific purposes or control functions. In regulating these activities, a graded approach is applied, as presented in the guidance document "Application of a graded approach to activities with sources of ionising radiation - PP-25/2023".

Activities with use of SIR are carried out after obtaining a licence, permit or registration certificate, or after submitting a notification of the relevant activity in the cases specified in the ASUNE.

A licence, permit or registration certificate for a SIR activity is issued by the Chairman of the Nuclear Regulatory Agency when the applicant concerned has fulfilled the following general requirements:

- the applicant has submitted all the necessary documents and complied with the instructions for further submission of documents and the analysis and assessment of the documents confirm compliance with the requirements of the ASUNE and its implementing regulations;

- the applicant has complied with all conditions of previous licences, permits and other acts issued under the ASUNE and related to the safety of the requested activity;

- the applicant has the necessary administrative acts required under the ASUNE for the relevant activity.

The requirements for ensuring radiation protection of occupationally exposed persons and members of the public in situations of planned exposure are laid down in the Regulation on Radiation Protection. Holders of a licence, permit or registration certificate, including notifiers, are fully responsible for the safety when performing the relevant authorised SIR activities.

The Nuclear Regulatory Agency maintains public registers with the following data:

- Licences and permits issued by the Chairman of the Agency, as well as their amendment, renewal, suspension and revocation;

- Registration certificates issued by the Chairman of the Agency, as well as their suspension and revocation;

- Notifications submitted for the performance of SIR activities.

In the end of 2024, there were 1,291 active licences for activities involving sources of ionising radiation, distributed in areas as follows:

- ➢ for medical and veterinary purposes 1,096;
- for business and scientific purposes 114;
- \succ for control functions 32;

- ➢ for transportation of radioactive substances 36;
- ➢ for working with SIR to provide services 11;
- ➢ for production of SIR 2.

In the end of 2024, there were 394 active licences for activities involving SIR, as follows:

- > construction, installation and preliminary testing of a facility with SIR 306;
- ➢ import and export of SIR 37;
- > temporary storage of radioactive substances -44;
- > decommissioning of facilities with radioactive substances -5;

> modification of design structures, systems and components, related to the radiation protection at facilities with SIR - 2;

Medical radiological equipment for radiotherapy is used in 24 medical institutions in the country - 44 charged particle accelerators, 7 devices for high-dose brachytherapy and one "gamma-knife". The number of diagnostic and therapeutic X-ray machines listed in the relevant licences is 2,917 with 114 angiography machines and 394 CT machines. Bulgaria is one of the countries in the European Union with the highest number of CT scanners per capita.



EDGE (Varian) medical linear accelerator at the Deva Maria University Hospital, Bourgas

For non-destructive testing, 79 gamma flaw detectors (107 in storage) and 101 X-ray flaw defectors (28 in storage) are used. Two gamma-ray irradiators are used for business and scientific purposes. Six gamma-ray irradiators are used for metrological purposes. Ten charged particle accelerators are used for control functions.

A total of 6,095 sources of ionising radiation are covered by existing licences and authorisations.

Control of compliance with the regulatory requirements of authorised activities under the ASUNE, as well as control of compliance with the licences and permits issued, is carried out through documentary and/or on-site inspections.

The radiation protection infrastructure in the country for the operation of SIR facilities is in full compliance with internationally applied standards and criteria.

III. ADMINISTRATIVE CAPACITY

1. HUMAN RESOURCES

The provision and maintenance of the necessary human resources with appropriate education and qualifications in the nuclear field is one of the most essential requirements laid down both in national legislation and in international conventions and European Union legislation.

The Nuclear Regulatory Agency strengthens and builds up its administrative capacity in a targeted and consistent manner. A key priority for the Agency is to maintain an efficient and competent administration - a guarantor of compliance with established rules and regulations on nuclear safety and radiation protection.

National Strategy for Human Resource Development in the Nuclear Sector 2022-2032

The Nuclear Regulatory Agency, as the lead institution, continued to coordinate and monitor the implementation of the strategy. To this end, working meetings were organised with experts from the Ministry of Energy, the Ministry of Education and Science, the Employment Agency, Sofia University "St. Kliment Ohridski", Technical University - Sofia, INRNE-BAS, Kozloduy NPP and SE RAW, in order to discuss a number of aspects of the activities included in the first 3-year plan for the implementation of the strategy.

As a result of the implementation of the plan in 2024, a number of important regulatory changes have been implemented or proposals for changes have been made and work is ongoing. Practical steps have also been taken. For example, in November 2024, the National Programme for the Improvement of Qualifications in Nuclear Technology and Nuclear Engineering was adopted by Decision No 770 of the Council of Ministers.

School on Nuclear Regulation

From 26 to 28 September 2024, the first edition of the School on Nuclear Regulation was held in Borovets. It was attended by 18 students from Bulgarian universities, lecturers from Sofia University "St. Kliment Ohridski", Technical University - Sofia and Plovdiv University "St. Patriarch Evtimiy", as well as experts from Kozloduy NPP, SE RAW, and Kozloduy NPP - New Build.

The school, organised by the Nuclear Regulatory Agency in partnership with the Centre for Nuclear Competence - Kozloduy, is an initiative to train students and professionals from the nuclear sector in the field of nuclear regulation in a format that provides an opportunity to acquire theoretical and practical knowledge and competencies.

In addition to BNRA staff, leading national and international experts with extensive experience in Bulgarian, European and international institutions such as the International Atomic Energy Agency, the European Commission, the US Nuclear Regulatory Commission and the Greek Atomic Energy Commission were also involved. Apart from theoretical knowledge, the students had the opportunity to work on practical case studies in groups mentored by the lecturers and representatives of the nuclear sector.



1.1. Human Resource Development.

In spite of the staff shortage in the nuclear sector in the country, the BNRA management continues its efforts to provide the necessary administrative capacity to ensure the regulatory functions of the Agency. The need for young and trained engineers is particularly acute. In 2024, five competitions for vacancies were advertised and two civil servants were appointed. Thus, at the end of 2024, the number of staff was 100. More than 90% of all those working in the BNRA have a university degree. More than half of the Agency's employees have a rank higher than the minimum required for the post, with an average professional experience in specialised administration of more than 20 years.



The past year saw the start of the resolving of one of the most pressing issues related to the remuneration of the regulator's administration. A first step was taken to improve the financial working conditions in the Agency. The Council of Ministers supported the efforts of the BNRA management and took a decision which increased the salaries by 30%.



Internship Programmes

In 2024, the BNRA continued to offer internship programmes for students from Bulgarian universities.

In the framework of the centralised campaign for student internships in the state administration, two students from the Faculty of Physics of Sofia University "St. Kliment Ohridski" and the Faculty of Law of Veliko Tarnovo University "St. St. Cyril and Methodius" conducted internships in the International Cooperation, Radiation Protection and Nuclear Safety Directorates. The internships lasted 1 week and took place in July and August 2024.

Four students from the Faculty of Energy and Mechanical Engineering, the Department of Thermal Power Engineering and Nuclear Power Engineering at the Technical University of Sofia and from the Faculty of Chemistry and Pharmacy and the Faculty of Physics of Sofia University "St. Kliment Ohridski" joined the one-month paid internship program at the Nuclear Regulatory Agency. In October 2024, the students undertook internships in the Safety Assessments and Analyses, Radiation Protection and Nuclear Safety Directorates, where they had the opportunity to get a close look at all aspects of the Agency's activities as well as at the work of the regulatory authority inspectors. In the specialised directorates where they were assigned, the young people were tasked to work on an internship case study which they presented and defended to BNRA colleagues at the end.



1.2. Training and Qualification.

Specialised training is provided to maintain and improve the qualifications of the staff of the BNRA. A systematic approach to training based on internationally recognised methodology is applied.

The training process includes three main areas:

> Training by the Institute of Public Administration (IPA)

In 2024, the staff of the Nuclear Regulatory Agency refreshed and enriched their knowledge by participating in courses organised by the IPA in the field of public policies, administrative services, digital competence and cyber security. In addition, with the assistance of IPA, the targeted course "Conflict of Interest" was organised and conducted specifically for the BNRA.

> Specialised Training

In 2024, 8 lecture training courses were held in accordance with the approved annual plan for specialised training, 4 of which were conducted by external lecturers.

> Training Provided by International Organisations (IAEA, Bilateral Cooperation Agreements), as well as Participation in International Meetings, Projects, Seminars, Conferences, etc.

During the past year, 69 BNRA employees participated in 66 training courses, seminars and other forums. In addition, BNRA experts participated in 14 international events in virtual format.

1.3. Knowledge Management.

Knowledge management, i.e. the process of acquiring, preserving and transferring knowledge, is paramount to ensuring that the Agency's core mission is fulfilled. Considering this, in 2024, the BNRA management adopted a dedicated Knowledge Management Policy Statement that recognises that employee knowledge and skills are the Agency's most valuable asset and should be viewed as an investment in the success of future activities. At the same time, the BNRA management accepts the responsibility to continuously develop and upgrade the knowledge management process.

In line with the adopted policy statement, in 2024, a BNRA Knowledge Management Procedure has been developed and is about to be implemented.



1.4. Knowledge Exchange Networks.

Participation in global networks for exchange of experience and knowledge enables the BNRA employees to enhance their competences, learn from the experience of their colleagues, exchange best practices and professional ideas. This often leads to concrete proposals for improving various aspects of the BNRA's activities,

At the national level, the BNRA employees have traditionally participated in the events organised by NGOs in the sector - BULATOM, Bulgarian Nuclear Society, Bulgarian Energy and Mining Forum, Union of Physicists, etc. The following permanent thematic expert groups have been established and are functioning in the BNRA: Nuclear Power Plants Events Analysis Group, Risk Committee and Communications Policy Implementation Group.

2. FINANCIAL RESOURCES

Annually, the budget of the BNRA is determined by the State Budget of the Republic of Bulgaria Act for the respective year.

2.1. Revenues.

The revenues generated by the Nuclear Regulatory Agency come from fees charged for issuing licences and permits under the ASUNE in accordance with the Tariff of Fees Collected by the Nuclear Regulatory Agency under the Safe Use of Nuclear Energy Act.

The 2024 State Budget of the Republic of Bulgaria Act allocated BNRA's revenues at BGN 10,100,000.

For the period from 01 January 2024 to 31 December 2024, the BNRA budget received revenues from

state fees amounting to BGN 11,497,725; revenues from interest, fines and sanctions amounting to BGN 13,311; other non-tax revenues amounting to BGN 8,389.

The total amount of revenues reported in the budget of the BNRA on a cash basis for the period was BGN 11,519,425.

The over-execution of the revenue for 2024 from state fees is the result of fees collected for permits issued which could not be foreseen, for a design modification in order to improve the safety of Kozloduy NPP, as well as fees for permits issued for the transit of fresh nuclear fuel across the country's territory.

2.2. Expenditures.

Under the State Budget of the Republic of Bulgaria Act for 2024, functional area "Regulation of Nuclear Safety and Radiation Protection of the Republic of Bulgaria", budget programme "Regulation and Oversight of Nuclear Safety and Radiation Protection of the Republic of Bulgaria", the BNRA expenditures were set to BGN 8,233,000, including personnel costs amounting to BGN 4,408,300.

By Decree No. 127 dated 29 April 2024 of the Council of Ministers, pursuant to Article 109(5) of the Public Finance Act, additional expenditure amounting to BGN 375,931 was approved in the budget of the Nuclear Regulatory Agency for 2024 to increase the staff remunerations. On the basis of the decree, changes have been made to the budget of the BNRA, increasing staff expenditure by BGN 375,931.

By Decree No. 341 dated 07 October 2024 of the Council of Ministers, pursuant to Article 109(5) of the Public Finance Act, additional expenditure amounting to BGN 26,940 was approved in the budget of the Nuclear Regulatory Agency for 2024 to increase capital expenditure. On the basis of the decree, changes have been made to the budget of the BNRA, increasing capital expenditure by BGN 26,940.

By Decree No. 388 of 07 November 2024 of the Council of Ministers, on the basis of Article 109(5) of the Public Finance Act, internal offset changes were made to the budget of the Nuclear Regulatory Agency for 2024 by increasing the personnel expenditure at the expense of the current maintenance expenditure by BGN 300,000 for the increase of staff remuneration.

Following the adjustments made to the budget of the BNRA as of 31 December 2024, according to the updated revised plan, the total amount of the expenditure was BGN 8,635,871, including staff expenditure amounting to BGN 5,084,231 and capital expenditure amounting to BGN 26,940.

The reported expenditure for 2024 went to cover the Agency's current maintenance costs, remuneration of the staff, social and health insurance contributions, expert assistance used in the "Regulation of Nuclear Safety and Radiation Protection of the Republic of Bulgaria" functional area, membership fee of the Republic of Bulgaria paid to the International Atomic Energy Agency, acquisition of fixed tangible assets, etc. Expenditure totalled BGN 8,347,686.

3. PUBLIC RELATIONS AND ACCESS TO PUBLIC INFORMATION

The main priority of the Nuclear Regulatory Agency is to ensure nuclear safety and radiation protection in the Republic of Bulgaria. In its implementation, the Agency follows as basic principles transparency, impartiality in its work and open dialogue with all interested parties. The BNRA's public communication during the year was aimed at enhancing its credibility and strengthening its image as an independent regulatory body with functioning mechanisms for reporting its activities to the public.

In carrying out its activities over the past year, the Agency provided transparent, timely, accurate and objectively presented information to assure the public that the BNRA employs acknowledged experts in the industry.

In 2024, a survey was commissioned to provide real initial information on the visibility and public image of the Nuclear Regulatory Agency. It was important that the BNRA's communications policy could be aligned with the findings of the survey. According to the survey, 80% of the Bulgarians interviewed were convinced of the need for a specialised institution to work on nuclear regulatory issues and to inform

the public in a timely manner about problems and dangers related to nuclear energy. In order to achieve greater public visibility, the recommendations of the survey have been taken into account and are reflected in the updated BNRA Communication Plan for 2025 the implementation of which is pending.

The main communication channels used by the BNRA in its public communication in 2024 were the official website and the regulator's social media accounts - Facebook page and a profile in the LinkedIn professional network. The website and the social media profiles published news, up-to-date information and draft regulatory documents, job advertisements with the regulator. Important events relevant to nuclear and radiation safety of activities and facilities, as well as to the Agency's work, were covered.

In February 2024, the BNRA held its traditional annual press conference at which its Chairman presented to journalists the key highlights of the regulator's activities during the past year.

Driven by increased public interest, in April, the Nuclear Regulatory Agency and Kozloduy NPP gave a joint briefing on the phased transition of Kozloduy NPP Unit 5 to a new type of nuclear fuel.



In October, the traditional training seminar for journalists was organised, where the Agency's management met with media representatives and discussed topical issues related to the development of nuclear energy and the regulatory framework in the sector.

In the past year, three applications for access to public information were registered with the Nuclear Regulatory Agency, all of which were granted the requested information within the statutory deadline. All registered requests for access to public information were filed by natural persons.



IV. BNRA ACTIVITIES

1. Regulatory Framework Development.

On 14.03.2024, the National Assembly adopted the Act on Amendment and Supplement to the Safe Use of Nuclear Energy Act, which was promulgated in the State Gazette, No. 27 of 29.03.2024.

In connection with the amendments, licences, which are not limited in time, are introduced for certain types of nuclear facilities where nuclear material is used, handled or stored. The requirement to carry out a periodic safety review (PSR) every 10 years is retained, but within the scope of the current licence. The conduct of a PSR is a fundamental requirement of the Nuclear Safety Directive, the conventions on the safe use of nuclear energy and IAEA standards. The framework foresees revocation of the licence in case of failed or not conducted PSA.

The Transitional and Final Provisions of the Act regulate the pending cases (the proceedings on the extension of the licences for the operation of nuclear facilities in which nuclear material is used, handled or stored that have been initiated and not completed before the entry into force of this Act shall be completed in accordance with the procedure laid down in this Act) and set the relevant time limits. The requirement is introduced to align the regulations issued for the implementation of the ASUNE with this amendment to the law within one year of its entry into force. For nuclear installations, for the decommissioning phase and under certain conditions, the possibility of issuing a general licence is provided.

In 2024, the Council of Ministers adopted Decree No 387 amending and supplementing the Nuclear Regulatory Agency's Rules of Procedure, which aims at streamlining the Agency's activities through changes in the functions of directorates.



The review and updating of regulatory guides continued during the year. By orders of the Chairman of the BNRA, three guides were put into effect and published, namely the Guide on the Content and Format of Documents Required for the Issuance, Renewal, Amendment and Termination of Licences and Permits for SIR Activities, the Guide on Exemption from Regulation of Buildings and Sites of Nuclear Facilities, the Guide "Probabilistic Safety Analyses of Nuclear Power Plants".

2. Inspections at Nuclear Facilities.

In accordance with the BNRA's inspection activities plan, a total of 25 inspections were conducted at the nuclear facilities in 2024. A list of the inspections is provided in Appendix No. 2.

Results of the major inspections conducted at Kozloduy NPP:

Preparedness of Units 5 and 6 for Start-Up and Operation after the Outages

In 2024, Units 5 and 6 were inspected to determine their preparedness for start-up and operation following annual refuelling outages. The scope of the inspections included maintenance activities carried out, design modifications, implementation of measures of the integrated safety improvement programmes of the units, non-destructive examination of equipment, etc. The housekeeping and the condition of the premises and equipment, as well as the readiness of the systems for start-up and operation after the preventive and corrective maintenance were also inspected.

The inspections did not reveal any non-compliance with requirements or deviations that would prevent the safe start-up and operation of the units.



Ageing Management of Units 5 and 6 Primary Mechanical, Electrical and I&C Equipment

During the year, two inspections were carried out covering the organisation and implementation of activities related to the maintenance, control and ageing management of electrical equipment, instrumentation and control systems, and primary mechanical equipment. A review of the methodologies and programmes governing ageing management activities was carried out. The purpose of the review was to verify that the documents comply with existing requirements in terms of their scope, sufficiency, completeness, and maintenance of their current status. As a result of the inspections carried out, it was established that the necessary organisation was in place and the implementation of the activities complied with the requirements. Recommendations were made aimed at improving the performance effectiveness.

Readiness of the SFSF for Amendment of the Operating Licence

The purpose of the inspection was to assess the circumstances contained in the application submitted by Kozloduy NPP and the documents attached to it for the amendment to the operating licence of the SFSF.

In the framework of the inspection, it was found that the general requirements for the issuance of a licence contained in the Regulation on the Procedure for the Issuance of Licences and Permits for the Safe Use of Nuclear Energy have been met, and the conditions of the current licence have been fulfilled. In this respect, the implementation of activities to improve the safety of the facility, the updating of the operating documentation as well as the planned activities for the forthcoming period until the next PSR of the facility were verified. It was found that the licence amendment application was accompanied by the documents required by the law and the regulation, the necessary amendments to the licence could be made, including its conditions and annexes, the fulfilment of the licence conditions and the conditions for the safe operation of the SFSF were confirmed, and the necessary measures to improve the safety of the facility were envisaged.

On the basis of the results of the inspection, no non-compliances or deviations from the requirements have been identified that would preclude amendments to the operating licence for the SFSF.

Activities Related to the Delivery and Storage of Fresh Nuclear Fuel

The inspection was carried out to verify the organisation and performance of activities related to the delivery and storage of fresh nuclear fuel (FNF). The scope of the inspection covered the organisation and performance of activities related to the reception, handling, receiving inspection and storage of FNF. The maintenance of the condition of the fuel handling and storage facilities was verified. The housekeeping in the compartments was found good. The parameters in the fuel storage compartments were monitored according to the specified requirements. The conclusions were that the necessary organisation was in place to ensure nuclear safety and radiation protection during the fuel delivery and storage activities.

Extraordinary Inspection in connection with the Event at Unit 6 Related to Coolant Leak from the Primary Side through the Open Collectors of the Third Steam Generator

The inspection was carried out to establish the circumstances of the event. It was found that during the drainage work on the primary side to create the conditions for a non-destructive inspection of the third steam generator tube bundles, the primary pressure was allowed to rise. As a consequence, coolant was spilled onto the steam generator and the reactor. The increase of the primary pressure was due to operator action. The quantity of the spilled coolant did not lead to any changes in the radiation conditions or to the exposure of personnel. In order to prevent a recurrence of such an event, a recommendation was made to review the existing work programmes in order to clearly define the actions of the operating personnel.



State Enterprise Radioactive Waste

As pursuance of the annual inspection plan for 2024, five inspections were carried out in the specialised divisions of the SE RAW, covering the following topics:

- Acceptability criteria for the treatment of RAW and uniformity of RAW packaging for solid RAW

disposal, including RAW from decommissioning;

- Treatment and reception of sludges and sediments from Kozloduy NPP at the Specialised Division RAW - Kozloduy;

- Readiness for the relicensing of the Specialised Division Units 1-4;

- Construction and commissioning activities of the Permanent Repository for RAW;

- Methods for the treatment of RAW, practical aspects in applying the principle of taking into account the interrelationships between the different stages of RAW management and implementation of an Integrated programme for RAW management.

3. Inspections at Sites with Sources of Ionising Radiation.

Regulatory control - preventive, ongoing and follow-up - is conducted systematically, objectively and disinterestedly. A graded approach is applied to the frequency, scope, resources and methods of inspection. An open and constructive dialogue is maintained with all stakeholders, carrying out a day-to-day exchange of information and communication for radiation protection purposes. Feedback is maintained with holders of licences, permits and certificates of registration under the ASUNE for SIR activities, as well as with persons who have submitted notifications for SIR activities.

In 2024, 141 planned inspections for SIR activities were carried out. An additional 8 inspections were carried out to verify the readiness of new SIR sites to be commissioned in:

- Medical Center - Medical Complex Beroe (Stara Zagora) - Laboratory of Nuclear Medicine;

- Acibadem City Clinic University Multiprofile Hospital for Active Treatment (Sofia) - Premises for high-dose brachytherapy;

- St. Naum Multiprofile Hospital for Active Treatment of Neurology and Psychiatry (Sofia) - Nuclear Medicine Department;

- St. Ivan Rilski Chudotvorets Medical Center - 2010 (Plovdiv) - Laboratory of Nuclear Medicine;

- Multiprofile Hospital for Active Treatment - St. Ivan Rilski Medical Complex (Plovdiv) - Radiotherapy Department;

- Specialised Hospital for Active Treatment in Oncology - Haskovo - Bunker with linear accelerator to the Radiotherapy Department;

- Acibadem City Clinic University Multiprofile Hospital for Active Treatment (Sofia) - Bunker with linear accelerator and system for verification of radiotherapy to the Radiotherapy Department;

- Aviation Services Bulgaria (Sofia) - Storage facility for temporary storage of shipments from and for air transport with SIR.

In 2024, 4 inspections on compliance with regulatory requirements for radiation protection in activities with materials with increased content of natural radionuclides were carried out at the following sites:

- Gorubso Madan (Madan);
- Agropolichim (Devnya);
- Dura Tiles BG (Novi Pazar);
- Ecoengineering RM (Eleshnitsa, municipality of Razlog).

The results of the inspections carried out in 2024 were documented in the inspection reports in accordance with the requirements of the ASUNE. Depending on the nature of the irregularities and deviations from the regulatory requirements and the conditions of the administrative acts issued under the ASUNE, appropriate instructions and recommendations were given. Two prescriptions and two administrative violation acts were issued and handed over. A compulsory administrative measure was imposed on the basis of Article 150 of the ASUNE.



Compared to the previous two years, the number of inspections carried out on SIR activities increased by more than 30 %.

In 2024, inspections were carried out on the physical protection status of the following SIR sites: DG "National Metrology Centre" and DG "Measures and Measuring Instruments" at the Bulgarian Institute of Metrology (BIM), Lovech, storage facility for gamma flaw detectors at Bultest and Co and storage facility for gamma flaw detectors at NDT. It was established that the physical protection systems at the sites are maintained in accordance with the existing requirements.

4. Licences and Permits for Performing Activities at Nuclear Facilities.

Kozloduy NPP

Number of permits issued - 35, distributed as follows:

> for changes resulting in modifications of safety-related structures, systems, and components - 28, including 15 at Unit 5, 9 at Unit 6, and 4 at the SFSF and DSFSF;

> For changes resulting in amendments to the internal rules for the implementation of the activity, including procedures, programmes, technical specifications and other documents attached to the operating licences - 4;

➢ for transportation of nuclear material - 1;

➢ for transit of nuclear material - 2.

The key activities governed by the issued permits relate to the following:

- > Storage of RWFA type fresh nuclear fuel in the fresh nuclear fuel storage facility;
- > Phased transition of Unit 5 to operation of RWFA type nuclear fuel;

> Modernisation of the emergency and alarm protection instrumentation, automatic power regulator and reactor-power limiting device at unit 6;

> Replacement of systems important to safety (replacement of valves, pump units, electric motors and batteries);

> Activities to increase the power supply reliability at the SFSF - replacement of the emergency diesel generator, changes in the emergency power supply diagram and switchgear refurbishment;

> Activities related to the provision of the SFSF with power supply, which is not dependent on the SE RAW facilities.

In 2024, the BNRA reviewed and assessed 36 design modifications of SSC at the nuclear facilities,



which are not in the scope of the licensing regime but are related to safety.

The issuance of permits and licences for activities at nuclear facilities is preceded by a process of review and assessment of the documents accompanying the applications for compliance with statutory and regulatory requirements. The review and assessment of the information submitted considers both the regulatory requirements and the guidance of the BNRA regulatory guidance and the International Atomic Energy Agency (IAEA) safety standards.

The reviews and assessments carried out in 2024 mainly related to the application of the authorization regime referring to:

 \succ implementation of measures to improve safety and modifications of structures, systems and components important to safety in the nuclear facilities;

 \succ proposed changes to the operating limits and conditions of nuclear facilities, on the basis of which an operating licence has been issued;

> amendments to internal rules for the implementation of activities, including regulations, procedures, and programmes attached to the operating licences of the facilities.

As a result of the reviews and assessments carried out, 101 expert statements were prepared on the compliance of the submitted documents with the regulatory safety requirements, sixty of which were related to the application of the authorization regime referring to design modifications.



A substantial part of the resources invested in the reviews and assessments in 2024 were related to the phased transition of Kozloduy NPP Unit 5 to operation using RWFA type nuclear fuel, produced by Westinghouse. The reviews by the BNRA and external consultants (the French Institute for Radiation Protection and Nuclear Safety (IRSN) and Czech-Ukrainian consortium ESG EU) confirmed that the new RWFA nuclear fuel complies with the nuclear safety requirements and can be loaded in Kozloduy NPP Unit 5 reactor core. Based on these conclusions, at the end of April 2024, the BNRA Chairman issued a permit for a 4-year phased transition of the unit to operation with RWFA type nuclear fuel and the first fuel assemblies were loaded during the unit outage. The terms of the permit issued contain additional obligations on the licensee, which arise both from the results of the document review and from the need to carry out assessments, inspections and tests to confirm that the actual behaviour of the new fuel complies with the end of the current Unit 5 refuelling campaign (May 2025), a number of additional documents to the already submitted technical reports are to be submitted to the BNRA, related both to the need of considering the accumulated data from the operation of the fuel and to provide additional information necessary to assess the safety of the next core loading.

State Enterprise Radioactive Waste

The decommissioning licences for Kozloduy NPP Unit 1 and Unit 2 were renewed in 2024, and a general licence for their decommissioning was issued on the basis of paragraph 12 of the Act to amend and supplement the Safe Use of Nuclear Energy Act (promulgated in SG 27/2024). The licence validity is 10 years. The activities permitted under the licence in this period shall be carried out by the SE RAW Specialised Division - Decommissioning Units 1-4.

In 2024 a permit for making changes leading to modifications in the safety related structures, systems and components of Kozloduy NPP Units 1-4 and the internal rules for the conduct of work was issued.

The construction permit for the first stage of the National Radioactive Waste Disposal Facility has been renewed. The Commissioning Permit for the plasma melting facility for treatment and conditioning of solid radioactive waste with high volume reduction factor has also been renewed.

Specialised Training Licences and Certificate of Competency

The licence for conducting specialised training of the Institute for Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences was renewed throughout the past year.

In 2024, in compliance with the requirements of the ASUNE, the Qualification Examination Commission appointed by the BNRA Chairman held 16 sessions; as a result, issued 31 certificates of competency to individuals carrying out activities at nuclear facilities. 25 of them were issued for the operational personnel and 6 for management staff. 4 certificates of competency of qualified experts in radiation protection were issued. Information on the issued certificates is published in a public register maintained by the BNRA.

A total of 2,937 certificates of competency were issued, certifying their holders have passed initial and continuing specialised training to perform activities in nuclear facilities and with sources of ionising radiation. Information on the issued certificates and e-signed copies of them are available in the BNRA's e-service system.

The regulatory control carried out during the period, including the inspections of the licence holders (Nikola Vaptsarov Naval Academy, Varna, Medical University - Varna and the Institute for Nuclear Research and Nuclear Energy), shows that the activities comply with the regulatory requirements and the conditions of the licences issued.

5. Licences and Permits for Activities Involving Sources of Ionising Radiation.

Regulatory decisions on the issuance of licences, permits and certificates for registration of activities with sources of ionising radiation, including the registration of notifications submitted under Article 56, para.2 of the Safe Use of Nuclear Energy Act, shall be taken by the BNRA Chairman. Regulatory decisions shall be taken following a regulatory review of documents submitted by an applicant for a specific activity in situations of planned exposure. The regulatory review includes a formal regularity review, a substantive

review, an analysis and an evaluation of the submitted documents. Reports shall be prepared on the results of the regulatory reviews in accordance with the 'Procedure for regulatory review of documents for activities with sources of ionising radiation'.

In 2024, a total of 1,071 reports from regulatory review of documents submitted to the BNRA by applicants for activities with sources of ionising radiation. A total of 245 licences for activities involving sources of ionising radiation (divided into review areas) were issued, as follows:

- 205 for medical and veterinary purposes;
- 32 for business and scientific purposes and for control functions;
- 8 for the transportation of radioactive substances.



By orders of the BNRA Chairman, 163 licences were amended and 30 licences for activities with sources of ionising radiation were terminated.

In 2024, a total of 406 permits for the following activities involving sources of ionising radiation were issued:

- temporary storage of radioactive substances – 20;

- modification of design structures, systems and components, related to the radiation protection at sites with SIR - 3;

- site construction, installation and pre-trials of sources of ionising radiation 271;
- single and transit transportation of radioactive substances 3;
- import and export of sources of ionising radiation 103;
- decommissioning of a site with radioactive substances 6.

By orders of the BNRA Chairman, 15 permits for activities involving sources of ionising radiation were amended.



The number of the licences issued for activities for using sources of ionising radiation was up 55% compared to the previous two years. For the same period, the number of the permits issued for activities involving SIR increased twice.

In 2024, 38 registration certificates were issued under Art. 56, para. 3 of the Safe Use of Nuclear Energy Act for work with sources of ionising radiation for the purpose of maintenance, installation, dismantling, measurements, construction and repair activities. 144 notifications for performing activities of insignificant radiation risk and activities involving materials with increased content of natural radionuclides were registered in the public register under Art. 27, para. 2 of the Safe Use of Nuclear Energy Act. Pursuant to Council Regulation (EURATOM) 1493/93 on shipments of radioactive substances between Member States, a total of 91 import declarations for radioactive sources were processed and certified.

Public registers are kept of all licences, permits and registration certificates issued by the BNRA Chairman, as well as all submitted notifications for performing activities under Art. 56, para. 2 of the Safe Use of Nuclear Energy Act.



A total of 1,132 administrative acts under the Safe Use of Nuclear Energy Act related to regulating activities involving sources of ionising radiation were issued. The number has increased with 40% compared to the previous two years.

6. Nuclear Material Accounting and Control.

The safeguards system under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is applied in accordance with the signed Agreement on Safeguards Implementation between the EURATOM countries, the IAEA, and Bulgaria. Taking into account the information sent in implementation of the Agreement and the Additional Protocol thereto, and on the basis of the performed inspections, assessments and analyses, the IAEA has concluded that Bulgaria meets the requirements of the NPT.

According to the Agreement, Bulgaria provides to the European Commission information on the nuclear materials control and accounting. After reviewing and verifying this information, he European Commission in turn submits it to the IAEA. Reports are prepared for the material balance areas subject to reporting - Kozloduy NPP, SD Decommissioning at the SE RAW, SD PRRAW - Novi Han, the line for regeneration and clean-up of ion-exchange resins - village of Eleshnitsa, the Institute for Nuclear Research and Nuclear Energy (INRNE), material balance area for the interim storage of RAW representing nuclear material for safeguards purposes, designated in accordance with the IAEA and EC requirements, related to the preparation for decommissioning of the SD PRRAW - Novi Han as well as the designated material balance area for sites with small quantities of nuclear material on the territory of the entire country, whose operator is the BNRA.

In 2024, the BNRA met on time its obligations under the Agreement to prepare and submit to the EC monthly and annual reports on the quantities of nuclear material in the material balance area, for which it is directly responsible. To this end, the BNRA organised the receipt of the necessary information from the licensees, its subsequent processing, as well as the submission of the updated declarations under the Additional Protocol of this area. The relevant declarations under the Additional Protocol were sent to the IAEA and the EC in a timely manner.

In 2024, 8 inspections were carried out at Kozloduy NPP jointly with the IAEA and EC inspectors to check the compliance with the Safeguards and the Additional Protocol. The inspections confirmed the conformity between the nuclear material declared in the reporting documents and the available nuclear material in terms of quantity, enrichment, type, and isotopic composition.

Over the review period, EURATOM's inspectors conducted a comprehensive documentary review of all sites in the material balance area, including sites with small quantities of nuclear material. IAEA, EURATOM and BNRA inspectors also performed four joint inspections on the territory of the city of Sofia, Plovdiv, Buhovo, and the village of Golyamo selo. It was found that the small quantities of nuclear material available on-site comply with the declared quantities and oversight performed on them meets requirements.

In connection with the decision of the Council of the EU to revise the currently effective Commission Regulation (Euratom) No 302/2005 on the application of Euratom safeguards, the BNRA is actively involved in the revision of the draft texts of the new Regulation. The main objectives of the revision include ensuring the effectiveness of safeguards in view of the changes that have taken place since 2005 in the nuclear sector and in information technology, as well as increasing consistency in the definitions used in the new Regulation and European Directives. New requirements on the formats and deadlines for declaring the main technical characteristics and provisions for the application of the concept of 'warranties by design' were imposed. An adaptation of the provisions in the Regulation has been made for the new types of installations expected to be commissioned in the near future (geological repositories, encapsulation plants, new types of reactors).

7. Emergency Preparedness

Pursuant to the Disaster Protection Act, a Unified Rescue System (URS) has been set up in the Republic of Bulgaria aimed mainly at performing activities ensuring public protection. The BNRA is part of this system, and in the event of a nuclear accident or radiological emergency, the BNRA Chairman participates in the National Task force (NT).

To fulfil its obligations as BNRA Chairman under the ASUNE and arising from the Convention on

Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and the National Disaster Protection Plan, the BNRA maintains an emergency response team. In case of a nuclear accident or radiological emergency, the main the main functions of the team are related to notifying the IAEA and the US, analysing the incoming data, forecasting the accident evolution, estimating the consequences, and producing justified proposals to the National Task force on applying protective measures. Over the review period, members of the emergency team underwent number of trainings on emergency planning and preparedness on a national level, protective measures and criteria for their implementation, bilateral agreements and notification of international organisations in order to maintain the required knowledge and skills.

In 2024, the BNRA and Kozloduy NPP emergency response teams conducted four joint trainings aimed at verifying the preparedness of the teams to perform their designated functions and test the communication devices. During the review period, the BNRA representatives participated in all exercises organised by the IAEA in the ConvEx series, as well as in the ECUREX 2024 exercise organised by the European Commission.

Throughout the past year, the BNRA registered 76 cases related to goods and materials elevated content of radioactive isotopes detected at border checkpoints or at the entrances of large metallurgical companies. In most cases, higher cargo activity levels resulted from the presence of natural radioactive isotopes such as K-40, Ra-226, and Th-232, with orphan sources found in 6 of them. One of the cases was related to illegal activities with disused radioactive sources containing the Am-241 isotope. The response in each case complied with the established inter-agency procedures, and none of these cases caused any radiation consequences or hazard for the public and the environment.



8. Nuclear Harmonisation and Standardisation Initiative (NHSI).

With the technology development over the past few years, significant progress has been made in designing new reactor technologies. There are already more than 80 small modular reactor (SMR) designs

in various stages of development worldwide. These reactors can use innovative safety technologies, including the broad use of passive systems and intrinsic safety features, various types of fuel and coolants and various approaches to practically all aspects of a reactor's lifetime such as construction, commissioning, operation, decommissioning, radioactive waste and spent fuel management. Similar to existing plants, the suppliers and operators of innovative design reactors should be able to demonstrate that the new design aspects meet safety requirements.

In 2022, the IAEADirector General Mr. Rafael Grossi announced the launch of the Nuclear Harmonisation and Standardisation Initiative (NHSI), consisting of two tracks - regulatory and industrial. The goal of the Initiative is to ensure effective global deployment of safe and secure advanced nuclear reactors, and the specific goals of the Regulatory Track are minimal repetition among regulatory reviews by different Member States, Minimal need for design changes arising from differences among Member States' regulations, and establishment of a common basis for the Member States' regulatory decisions while preserving their sovereignty. Ever since the Initiative's launch, the BNRA has been actively involved in Working Group 2 of the Regulatory Track, where it has its own representative. This working group is working on developing a process and reference framework for multinational pre-licensing regulatory reviews of a modern nuclear reactor by several regulators. Work on this document began in October 2022 and successfully completed in the end of 2024. The IAEA is expected to publish it as a part of its technical document series (TECDOC).

9. Second Topical Peer Review Organised by the EC on Fire Safety.

Council Directive 2014/87/Euratom of 2024 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations introduces an European system of topical peer reviews held once every six years to provide the EU Member States with a mechanism to review topics of strategic importance for nuclear safety, exchange experience, and identify measures to improve nuclear safety. The topical peer review process involves three phases: national self-assessment, submission of the national self-assessment reports and peer review; and publication of a report containing findings and proposals for corrective actions.

The European Nuclear Safety Regulators Group (ENSREG) organised the second topical peer review on Fire Safety with a scope covering the energy units under operation, under decommissioning, and waste spent fuel storage facilities on the site of the nuclear installations. The national self-assessment of the compliance with the pre-defined requirements was completed in 2023 and in October the same year a National self-assessment report containing the review results was published. The peer review covered both the regulatory framework and overall approach of licensees to fire safety - fire hazard analyses performed, application of fire protection concept and various aspect of fire protection defence in depth. Two international peer review meetings were held in September and October 2024 - a topical workshop for fire safety experts and a country review workshop to discuss the participating countries' reports. As a result of the peer review, the fire safety improvement measure identified in the course of the self-assessment related to the need to replace fire detectors as part of ageing management activities was verified. In 2025 National Action Plans are to be developed which will include both national improvement measures and measures from the ENSREG Action Plan common to all participants.

10. Interaction and Coordination with Other State Bodies for Specialised Control.

The BNRA Chairman interacts and coordinates the Agency's actions with the specialised control bodies pursuant to the ASUNE - the Minister of Health, the Minister of Environment and Water, the Minister of Interior, the Minister of Defence, the Minister of Transport, the Minister of Education and Science and the Chairman of the State Agency for National Security at:

- Preventive, ongoing and subsequent oversight on nuclear facilities and sites with SIR for their compliance with the regulatory requirements for ensuring radiation protection and physical protection and undertaking corrective actions in case that deviations are found;

- Control of high-activity sources (category 1, 2 and 3 sealed sources) and prevention of illicit trafficking of radioactive materials;

- Analyses and assessments of radiation and physical protection at the nuclear facilities and sites with SIR;

- Maintain emergency preparedness and response in the event of incidents and accidents;
- Inform the public on issues related to radiation protection in the country.

The interaction between the BNRA and the specialised control bodies include:

- Operational exchange of information and mutual notification in cases where intervention by different authorities is required;

- Joint inspections;

- cooperation in solving problems, agreement and coordination of actions and work organisation for completion of tasks related to radiation and physical protection, emergency planning and response, which are within the competence of different authorities.

Licences and permits for activities at sites with high-activity sources and radioactive substances are issued by the BNRA Chairman after coordination with the competent authorities from the Ministry of Interior regarding the physical protection. Inter-institutional procedures defining the response procedure of the specialised oversight bodies are applied for events related to orphan sources or illegal trafficking of radioactive materials.

The BNRA provides on a regular basis and on-demand information to the MoH, the MoI and SANS about the issued licences, permits and registration certificates for activities involving sources of ionising radiation and about the individuals performing these activities.

11. International Cooperation.

International Atomic Energy Agency (IAEA)

IRRS Mission

The IAEA Integrated Regulatory Review Service (IRRS) mission was conducted from 17 to 29 November 2024 to review Bulgaria's national regulatory framework for nuclear safety, radiation protection, and radioactive waste management.



The mission was conducted at the request of the Government of Bulgaria and in compliance with the Council Directive establishing a Community framework for the nuclear safety of nuclear installations, which encourages periodic reviews of the national frameworks and self-assessments of the competent supervisory bodies on improving nuclear safety every ten years.

The IRRS team consisted of 16 senior regulatory experts from 15 IAEA Member States from different review areas of nuclear safety and radiation protection. Representatives of the European Commission and the regulator of Thailand were included in the mission review team as observers.

The mission identified that Bulgaria has a comprehensive and mature regulatory infrastructure for nuclear and radiation safety in compliance with the IAEA safety standards.

The IRRS team observed that the BNRA has a culture of continuous improvement and is a mature and competent regulator, which fulfils its statutory obligations without undue influence. The team identified several areas of good performances, including:

> The BNRA, through its Communication Policy, proactively engages key stakeholders by using its website, social media and dedicated regular press conferences to provide updated information on nuclear and radiation safety in Bulgaria.

> Daily communications between site inspectors and BNRA headquarters staff ensure that the BNRA is consistently updated on the safety status of nuclear installations, enabling timely regulatory responses when necessary.

> The BNRA maintains a comprehensive registry and database for ionising radiation sources with direct inputs from licensees, enabling BNRA to systematically check the status of radiation sources in facilities and to track the import and export of those sources in real time.

The draft report also provided recommendations and suggestions to help Bulgaria enhance its regulatory framework, including for the Government to:

> Adopt the national policy and strategy for safety addressing all elements in line with IAEA safety fundamentals;

> Adequately increase the BNRA's budget to cater for regulatory activities associated with the planned expansion of Bulgaria's nuclear power programme;

> Ensure that there is a comprehensive long-term strategy for human resource development for the BNRA and Ministry of Health, with consideration of adequate remuneration of regulatory staff in comparison with other national nuclear organisations.

> Finalize the revision of the Strategy for Spent Fuel and Radioactive Waste Management, etc.



IAEA General Conference

The 68th Regular Session of the IAEA General Conference was held from 16 to 20 September 2024 in Vienna, Austria. The Bulgarian delegation was headed by Mr. Tsanko Batchiyski, BNRA Chairman.

In his speech in the plenary hall, Mr. Batchiyski, the BNRA Chairman, highlighted that Bulgaria considers nuclear safety and security of the nuclear facilities a major factor for developing nuclear energy. Bulgaria supports and strictly applies the internationally recognised standards on safety and security in the nuclear energy sector during the operation of Kozloduy NPP Units 5 and 6 and in other nuclear applications. He stressed the need to develop capacity and attract younger generations to the nuclear field.

Fulfilment of the Obligations of the Republic of Bulgaria under the IAEA Conventions and EU Directives

The BNRA submitted within the established deadlines:

> 8th National Report on the implementation of the obligations of the Republic of Bulgaria under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention);

> 4th National Report of the Republic of Bulgaria on the implementation of the obligations of the Republic of Bulgaria under Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.

Participation of IAEA Bodies and Activities

In 2024, BNRA representatives participated in the Ministerial Conference on Nuclear Science, Technology and Applications and the Technical Cooperation Programme, in the International Conference on Nuclear Knowledge Management and Human Resources Development, in the International Conference on Nuclear Security (ICONS) and in the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs), hosted by the IAEA.

The IAEA organised the first International Conference on Small Modular Reactors and their applications from 21 to 25 October 2024. More than 1200 representatives from about 100 countries participated in the Conference. Tsanko Batchiysky, BNRA Chairman and Elizabeth Tsvetanova, Safety Analyses and Assessments Director took part in the International Conference on behalf of the Republic of Bulgaria.

In 2024, BNRA employees took part in over 50 events organised by the IAEA (symposia, technical meetings, seminars, etc.). A representative of the BNRA was a member of the IAEA IPPAS mission in Kuwait.

BNRA representatives were regularly involved in the work of the IAEA Safety Standards Committees and other working bodies and groups, performing their duties and obligations as national coordinators under the IAEA Conventions, Safeguards System and various IAEA information systems.

Technical Cooperation

During the 68th Regular Session of the IAEA General Conference, Mr Tsanko Bachiyski, Chairman of the Bulgarian Nuclear Regulatory Agency, and Mr Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation, signed Bulgaria's Country Programme Framework (CPF) for the period of 2024-2029. The programme is important for achieving the national objectives in the field of safe use of nuclear energy and nuclear applications.

In 2024, the implementation of the two national projects for the 2024-2025 cycle under the IAEA Technical Cooperation Programme, for which the Nuclear Regulatory Agency is the coordinator for Bulgaria, started.

> BUL6015 Enhancing the Capacity of Cyclotron and Small Scale Radiopharmaceutical Production. The beneficiary of the project is Alexandrovska University Hospital with a total budget of EUR 674,580;

> BUL5020 Increasing the Yield and Quality of Main Vegetable Crops through Nuclear Technology

to Withstand the Impacts of Climate Change with a beneficiary - the Institute of Vegetable Crops – Maritsa, the town of Plovdiv with a total budget of EUR 410,020.



Throughout the year, scientific visits at the BNRA within the framework of the IAEA Technical Cooperation Programme were conducted by experts from the National Atomic Energy Agency of Poland (PAA) and the Radioactive Waste Management Plant (ZUOP) of Poland and the Agency for Nuclear and Radiation Safety in Georgia (ANRS).

The BNRA hosted the closing technical meeting of the International Project on Completion of Decommissioning (COMDEC) with the participation of more than 20 representatives of 15 countries.

Under the IAEA Technical Cooperation Programme, a regional workshop on 'Building capacities in education and training in the field of nuclear energy focusing on the activities for its promotion in secondary schools' was held in Sofia.

Cooperation with the European Union Structures

European Nuclear Safety Regulators Group (ENSREG)

Last year, representatives of the BNRA took part in the seventh European Nuclear Safety Conference under the auspices of the European Nuclear Safety Regulators Group (ENSREG) and in cooperation with the European Commission, as well as in the plenary sessions of the Group.

Western European Nuclear Regulators Association (WENRA)

The BNRA Chairman participated in WENRA' spring and autumn plenary meetings, where decisions on the harmonisation of the reference levels of nuclear safety, decommissioning and spent fuel and radioactive waste management were discussed and adopted in fulfilment of the new strategy being effective as of January 2024.

A representative of the Agency was actively involved in the work of the Reactor Harmonization

Working Group at WENRA.

Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD)

BNRA's representatives continued to be actively involved in the NEA committees and working groups activities within its competence.

The BNRA also participated in the activities of the permanent Interdepartmental Coordination Mechanism for Bulgaria's Accession to the Organisation for Economic Co-operation and Development (OECD).

Bilateral Cooperation

An agreement between the BNRA and the Radiation Inspection and Control Service (RICS) at the Department of Labour Inspection (Radiation Protection Section) of the Ministry of Labour and Social Insurance of Cyprus for early notification of a nuclear accident and cooperation in the field of nuclear safety and radiation protection regulation was signed in 2024.

The Agreement envisages exchange of information in the event of an accident, bilateral cooperation and exchange of information on regulatory issues in the field of safe use of nuclear energy, sources of ionising radiation and nuclear applications.



A delegation of the National Atomic Energy Agency of Poland (PAA) headed by its President, Andrzej Głowacki, visited Bulgaria in July. The delegation met with the BNRA representatives and visited Kozloduy NPP, the State Enterprise RAW and the National Disposal Facility for Radioactive Waste at the Radiana Site.

The strategic partnership between the BNRA and the U.S. Nuclear Regulatory Commission (U.S.NRC) continued. The development of administrative capacities at the BNRA was made a priority in connection with the preparation for licensing the AP-1000 technology within the plans for construction of new nuclear facilities with the said technology at the Kozloduy NPP site. BNRA experts participated in training courses on the AP-1000 technology at the Technical Training Centre of the U.S. Nuclear Regulatory Commission in Chattanooga, Tennessee and in joint course in Warsaw, organised in cooperation with the National Atomic Energy Agency of Poland (PAA).

U.S. Delegation headed by David Wright, Commissioner of the U.S. Nuclear Regulatory Commission visited the BNRA in Sofia in August. The future plans for cooperation between the two regulators were discussed during the visit.



INIS National Centre

Bulgaria has been a member of the IAEA International Nuclear Information System (INIS) since its establishment in 1970. The National INIS Centre is responsible for uploading inputs to the system from Bulgaria. Access to documents in the INIS repository is free and unrestricted via the Internet at: https://inis.iaea.org.

In 2024, over 650 documents were reviewed and categorised, 254 of which were referred to INIS. Of these documents, 210 were articles published in specialised Bulgarian magazines, and 44 documents are reports from the 2023 and 2024 Bulgarian Atomic Forum. Thus, the total number of documents uploaded to the INIS Repository by Bulgaria since the systems creation has reached 15,128, including 3,518 full-text documents.

Detailed information on the INIS system and the services provided by the National Centre is also available on the BNRA website.



APPENDIX 1

List of operational events, which occurred in the nuclear facilities in 2024, reported to the BNRA

№	Date	Site	Description	
1.	11 March	Unit 5	Leak of fire extinguishing valve	0
2.	20 May	Unit 5	RPS control rod deformation	0
3.	19 Septem ber	Unit 6	A diesel generator from a safery system third train was off stand-by mode	0
4.	19 Novem ber	Unit 6	Unplanned actuation of the safety system first train	0
5.	03 Decem ber	Unit 5	Planned unload of the safety system third train and disconnection of the switchgears	0

APPENDIX 2

Nuclear Facilities Inspections

Nº	Site	Period	Inspection Topic
1.	Kozloduy NPP	21 - 22 February 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors, Units 5 and 6
2.	Kozloduy NPP	05 - 07 March 2024	Operation, maintenance and repair of Units 5 and 6 ventilation systems
3.	Kozloduy NPP	12 - 14 March 2024	Ageing management of electrical and technical equipment and primary I&C equipment
4.	Kozloduy NPP	20 April 2024	Surveillance of fresh nuclear fuel transportation (RWFA Westinghouse)
5.	Kozloduy NPP	07 - 08 May 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors, Unit 5
6.	Kozloduy NPP	14 - 16 May 2024	Preparedness of Kozloduy for Wet SFSF licence renewal
7.	Kozloduy NPP	02 - 03 June 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors, Unit 5
8.	Kozloduy NPP	03 - 06 June 2024	Preparedness of Unit 5 for start-up and operation following 2024 outage
9.	Kozloduy NPP	18 - 20 June 2024	Ageing management of primary mechanical equipment
10.	Kozloduy NPP	19 June 2024	Inspection in connection with 'Primary coolant leakage at Unit 6 from open collectors of the third steam generator'
11.	Kozloduy NPP	30 June - 02 July 2024	Inspection pursuant to Order No. P-123/28.06.2024 of the Prime Minister of the Republic of Bulgaria
12.	Kozloduy NPP	09 - 11 July 2024	Ensuring the physical protection of Kozloduy NPP
13.	Kozloduy NPP	20 - 22 August 2024	Emergency planning and preparedness
14.	Kozloduy NPP	25 - 26 September 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors, Dry SFSF
15.	Kozloduy NPP	20 - 21 October 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors, Unit 6
16.	INRNE-BAS	12 November 2024	Preparedness of the INRNE to renew licence Series "CO", Reg. No. 5561 for carrying out specialised training and issuance of certificates of competency for activities with sources of ionising radiation
17.	Kozloduy NPP	17 - 20 November 2024	Preparedness of Unit 6 for start-up and operation following 2024 outage

Nº	Site	Period	Inspection Topic
18.	Kozloduy NPP	18 - 22 November 2024	Application of the Safeguards under the Treaty on the Non-Proliferation of Nuclear Weapons – jointly with the IAEA and EC inspectors. Annual inventory check at Units 5 and 6, Wet SFSF and Dry SFSF
19.	Kozloduy NPP	10 - 11 December 2024	Activities related to new type of nuclear fuel delivery and storage
20.	SD Decommissioning Units 1-4	04 - 06 December 2024	Emergency planning and preparedness
21.	SD RAW - Kozloduy	19 - 20 June 2024	Acceptance criteria for RAW processing. Unification of RAW packages for solid RAW disposal, including decommissioning.
22.	SD RAW - Kozloduy	21 June 2024	Options of accepting sludge and sediments from Kozloduy NPP to SE RAW - Kozloduy
23.	SD Decommissioning Units 1-4	23 - 25 October 2024	Preparedness for licence renewal of SD Decommissioning - Kozloduy, Units 1 and 2
24.	SD NDF	03 - 04 December 2024	Activities related to construction and commissioning of the National Disposal Facility.
25	SD RAW - Kozloduy	05 - 06 December 2024	RAW processing methods. Practical aspects of the application of the principle of taking into account the interrelationships between the different stages of the RAW management. Implementation of a comprehensive RAW management programme.

ABBREVIATIONS

NPP	Nuclear Power Plant
RS	Reactor Scram
UNAP	Updated National Action Plan
NEA	Nuclear Energy Agency
BNRA	Bulgarian Nuclear Regulatory Agency
BAS	Bulgarian Academy of Sciences
SFP	Spent Fuel Pools
PSA	Probabilistic Safety Analysis
WWER	Water-Water Energy Reactor
NA	Naval Academy
MMA	Military Medical Academy
WChR	Water Chemistry Regime
NFSCP DG	National Fire Safety and Civil Protection Directorate General
SANS	State Agency for National Security
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
SE RAW	State Enterprise Radioactive Waste
EC	European Commission
EU	European Union
URS	Unified Rescue System
ASUNE	Act on Safe Use of Nuclear Energy
CSA	Civil Servants Act
EEA	Executive Environment Agency
SIR	Sources of Ionising Radiation
INES	International Nuclear and Radiological Event Scale
IRT-2000	Research Reactor at INRNE- BAS
IPA	Institute of Public Administration
INRNE	Institute for Nuclear Researches and Nuclear Energy
SSCs	Structures, systems, and components
CCI	Complex Chemical Indicator
CNS	Convention on Nuclear Safety
IAEA	International Atomic Energy Agency
MHAT	Multidisciplinary Hospital for Active Treatment
MI	Ministry of Interior
MH	Ministry of Health
MEW	Ministry of Environment and Water

СМ	Council of Ministers
NEK	Natsionalna Elektricheska Kompania EAD
NRSIR	National Register of SIR
RTCEPESA	Regulation on the Terms and Conditions for Evaluation of the Performance of
	Employees in the State Administration
NRWR	National Radioactive Waste Repository
NCRBRP	National Centre of Radiobiology and Radiation Protection
NH	National Headquarters
OECD	Organisation for Economic Co-operation and Development
JINR	Joint Institute for Nuclear Research - Dubna
SNF	Spent Nuclear Fuel
PRRAW	Permanent Repository for RAW
RAW	Radioactive Waste
SSs	Safety Systems
PMF	Plasma Melting Facility
TPR	Topical Peer Review
UMHAT	University Multidisciplinary Hospital for Active Treatment
RAWTF	Radioactive Waste Treatment Facility