THE REPUBLIC OF BULGARIA

EIGHTH NATIONAL REPORT

ON FULFILMENT OF THE OBLIGATIONS UNDER THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Sofia, 2024 г.

TABLE OF CONTENTS

SUMMARY

This report was prepared by the Republic of Bulgaria in accordance with Article 32 of the Joint Convention on the Safety of Spent Nuclear Fuel Management and on the Safety of Radioactive Waste Management, the first national report being from 2003. The report presents the status and development in the field of management of spent nuclear fuel (SNF) and radioactive waste (RAW) and the progress on the decommissioning of nuclear facilities within the scope of the eighth review under the Joint Convention. The information on the facilities and activities, the national policy and the regulatory framework for the safe management of SNF and RAW has been updated.

The present eighth national report conforms in structure and content to the International Atomic Energy Agency's 2023 Guidelines Regarding The Form And Structure Of National Reports - INFCIRC/604/Rev. 4.

Section B of the report presents the policies and practices in the Republic of Bulgaria related to the management of SNF and RAW, pursuant to the requirements of Art. 32, para. 1 of the Joint Convention. Section C presents the position of the Republic of Bulgaria on the full application of the Convention. Section D contains information on the SNF and RAW management facilities and the SNF and RAW accounting, pursuant to the requirements of Art. 32, para. 2. The application of the articles of the Convention from Art. 4 to Art. 28 are presented in Sections E to J. Section K presents safety enhancement activities that are currently being implemented as well as planned future measures. Section L contains appendices presenting more detailed information on some of the issues discussed in the report.

SECTION A. INTRODUCTION

The policy of the Republic of Bulgaria regarding the management of SNF and RAW is determined by the national legislation and is in accordance with international principles and all international agreements to which the Republic of Bulgaria is a party.
In the Republic of Bulgaria, a legislative and institutional framework has been created and maintained for the formation and implementation of the national policy in the field of the safe management of radioactive waste and spent nuclear fuel and for the implementation of state regulation and control, the responsibilities and functions of the executive authorities. being clearly defined and distributed.
The regulatory framework for the use of nuclear energy is in line with EU legislation, IAEA safety standards and international best practices. The Republic of Bulgaria fulfills its obligations as a party to the Convention on Nuclear Safety, the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiation Accident, the Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the Convention on the Physical Protection of Nuclear Material and the Additional Protocol to the Agreement on Nuclear Safeguards.
The Act on the Safe Use of Nuclear Energy regulates public relations related to the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of RAW and SNF, as well as the rights and obligations of the persons who carry out these activities to ensure the nuclear safety, radiation protection and physical protection.

The state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of RAW and SNF is carried out by the chairman of the Nuclear Regulatory Agency (BNRA), which is an independent specialized body of the executive power and has the competence defined by the *Act on the Safe Use of Nuclear Energy*.The Chairman of the BNRA develops and proposes for adoption by the Council of Ministers regulations on the implementation of the *Act on the Safe Use of Nuclear Energy* and proposes amendments and additions to them when this is necessary to improve the regulatory requirements, taking into account the operational experience, the conclusions drawn by safety analyzes and the development of science and technology
.
The RAW and SNF management activities are carried out by legal entities after obtaining a permit and/or license for the relevant activity in the cases specified in the *Act on the Safe Use of Nuclear Energy*. Responsibility for nuclear safety, radiation protection and physical protection rests entirely with the persons responsible for the facilities and activities under the *Act on the Safe Use of Nuclear Energy* and cannot be transferred to other persons.
The management of radioactive waste, outside of the facilities and activities in which it is generated, is carried out by the State Enterprise "Radioactive Waste" (SE "RAW"). RAW becomes state property at the moment of their transfer to SE "RAW". RAW whose owner is unknown are state property and the state is responsible for their safe management.
The legislation establishes mechanisms to ensure adequate resources (financial, technical and human) for the safe management of SNF and RAW. The financial mechanisms are based on the "polluter pays" principle. The management of RAW is financed by the Radioactive Waste Fund (RWF), and of the SNF is financed by the Kozloduy NPP-Plc. The decommissioning activities of nuclear facilities are financed by the "Decommissioning of Nuclear Facilities" Fund (the "DNF" Fund) and by the International Fund “Kozloduy”.

Nuclear facilities and activities

The Republic of Bulgaria has the following nuclear facilities:
• 2 power reactors in operation;
• 4 power reactors in the process of decommissioning;
• 2 SNF storage facilities in operation;
• Repository for RAW from nuclear applications in operation;

• RAW processing and storage facility at Kozloduy NPP in operation;
• Installation for plasma melting facility at the commissioning stage;
• National repository for the disposal of low- and intermediate-level short-lived RAW at the construction stage (NDF).

Units 1-4 of the Kozloduy NPP with reactors of type WWER-440 were decommissioned in 2002 and 2006. By Decision of the Council of Ministers, the units were declared radioactive waste management facilities and were made available for decommissioning to the SE "RAW", according to the licenses issued in 2014 and 2016.

Units 5 and 6 of the Kozloduy NPP with WWER-1000 reactors were commissioned in 1987 and 1991, respectively. There are two facilities for the storage of spent fuel at the site of the Kozloduy NPP - the Wet Spent Fuel Storage Facility - wet type and a Spent Fuel Storage Facility – dry type.

SNF is stored in:
• reactor pools of power units 5 and 6 of the Kozloduy NPP;
• Spent Fuel Storage Facility "wet type" ("wet" storage for SNF);
• Spent Fuel Storage Facility “dry type” (DSFSF).

The priority decommissioning activities are related to dismantling of the equipment in the controlled area. In parallel with these activities, a process of exemption from regulation of already dismantled equipment is underway.

The RAW management activities are mainly carried out at the site of the Kozloduy NPP and at the site of SD Centralised Storage Facility - Novi Khan.

The low- and medium-activity short-lived RAW are subject to disposal in the NDF. The activities of their processing, conditioning and packaging in a form that meets the criteria for acceptance into the NDF are carried out according to the annual program of the State Enterprise "RAW". Currently, packages of conditioned RAW are stored in a separate RAW management facility at the Kozloduy NPP site. The currently generated RAW from the two power reactors in operation at the Kozloduy NPP are also being conditioned.

The repository for RAW at the SD "Centralised Storage Facility - Novi Khan" accepts for storage RAW from nuclear applications in industry, medicine, agriculture and science. The facility stores untreated solid RAW, biological RAW and decommissioned sealed sources.

NDF is under construction, and construction activities will be completed in 2024.

The phase of commissioning the the plasma melting facility (PMF) at the site of the Kozloduy NPP, with the operator SERAW, continues.

Matrix for management of SNF and RAW in the Republic of Bulgaria

Type of responsibility	Long-term policy	Financing	Present practice/facilities	Planned facilities

SNF	Reprocessing out of the country	Financial resources are provided by the Kozloduy NPP-Plc	Storage in wet and dry SFSF at the site of the NPP / Storage and reprocessing out of the country	
RAW from the nuclear fuel cycle	Disposal	Financial resources are provided by the Kozloduy NPP-Plc	Reprocessing and storage at the Kozloduy NPP site	NDF – at the stage of construction;
		Following transfer to the SE RAW the financial resources are provided by the Fund RAW	Facility for reprocessing and storage at the Kozloduy NPP site	Interim storage for long-term storing of high-level active waste and long-lived RAW and medium active RAW.
RAW from nuclear applications	Disposal	Financial resources are provided by the generators of RAW	Storage at SD "Centralised Storage Facility-Novi Han"	NDF – at the stage of construction; Interim storage for long-term storing of high-level active waste and long-lived RAW and medium active RAW.
		Following transfer to the SE RAW the financial resources are provided by the Fund RAW		
Decommissioning	Strategy for uninterrupted dismantlement	Financial resources are provided by the Kozloduy NPP-Plc International Fund Kozloduy Fund "Decommissioning"	Decommissioning of units 1-4 of the Kozloduy NPP	NDF – at the stage of construction; Installation for plasma incineration- at the stage of commissioning
Disused sealed sources, including orphan sources	Disposal Return to the manufacturer	Financial resources are provided by the generators of RAW; The financial resources for disposal of orphan sources are provided by the Fund RAW	Storage at SD "Centralised Storage Facility-Novi Han"	NDF – at the stage of construction; Interim storage for long-term storing of high-level active waste and long-lived RAW and medium active RAW.

The challenges before the Republic of Bulgaria, delineated in the framework of the 7th review of the Joint Convention are presented in the table below:

CHALLENGE	REFERENCE IN THE PRESENT REPORT
Preparatory work (location, design) of deep geological disposal facility.	See section K
Final plan for financing of a deep geological disposal facility.	See section F

SECTION B. POLICIES AND PRACTICES

Article 32. Reporting, para 1

"Article 32. Reporting

1 In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

i. spent fuel management policy;

ii. spent fuel management practices;

iii. radioactive waste management policy;

iv. radioactive waste management practice;

v. criteria used to define and categorize radioactive waste."

National policy

The policy of the Republic of Bulgaria in the field of SNF and RAW management is defined in the national legislation (mainly in the *Act on the Safe Use of Nuclear Energy*, the *Act on Environmental Protection* and the *Act on Public Health*) and can be summarized as follows:

• The management of SNF and RAW is subject to state regulation and is carried out by legal entities only after obtaining a permit and/or license from the chairman of the BNRA;

• The facilities for the management of SNF and RAW have the status of nuclear facilities pursuant to the *Act on the Safe Use of Nuclear Energy*;

• SNF can be declared RAW by a decision of the Council of Ministers, if the following prerequisites are met: if there are conditions for safe storage and disposal in a relevant repository and if the operator has paid the corresponding contribution to the "RAW" Fund;

• RAW management activities outside the boundaries of the facilities, where they are generated, are carried out by the State Enterprise "RAW";

• RAW management activities can also be carried out by persons who have received a license to operate a RAW management facility, provided that these persons are holders of a license to operate another nuclear facility and the RAW management facility will be built or located on the same site;

• The persons, as a result of whose activities RAW are generated, bear the costs of their management, including disposal, in compliance with the "polluter pays" principle, by making contributions to legally established special funds - the Decommissioning of Nuclear facilities Fund and the "RAW" Fund ;

• The persons, as a result of whose activities RAW are generated, are responsible for their safe management until they are handed over according to the proper procedure to the SE RAW;

• Radioactive waste, duly handed over to SE RAW becomes state property;

• The management of RAW, whose owner is unknown, is the responsibility of the state;

• The state bears the ultimate responsibility for the safe and responsible disposal of RAW;

• The RAW generated in the Republic of Bulgaria is disposed of on Bulgarian territory, except in the cases of an effective agreement for the use of a facility for the disposal of RAW in another country;

• Prohibition on the import of radioactive waste into the country, except in the cases expressly defined in the *Act on the Safe Use of Nuclear Energy*, namely: in the case of reimport of spent sealed sources of ionizing radiation (SIR) produced in the Republic of Bulgaria or in cases where the radioactive waste are obtained from the processing of materials performed as a service for the benefit of the Republic of Bulgaria or a Bulgarian legal entity;

• Application of the principle of returning certain categories of radioactive sources to the manufacturer after their use has ceased.

The policy of the Republic of Bulgaria in the field of RAW and SNF management is based on the moral principle of avoiding the transfer of responsibilities to future generations. The principles of RAW and SNF management are declared in the national "Strategy for the Management of Spent Nuclear Fuel and Radioactive Waste".

The Strategy defines the specific goals in the management of

• SNF

- SNF containing useful components and that can be processed in the country of origin of the fuel or in third countries in an internationally acceptable and mutually beneficial manner from an economic, technological and ecological point of view;
- For long-term storage, SNF is stored using the "dry storage" technology;
- Participation of the country in projects of regional and international initiatives for deep geological disposal of SNF, as the search for international solutions should not hinder the planned measures, according to the strategy.

• RAW

- Application of the principle of the graded approach, based on an assessment of the radiation risk that the facility or activity may cause;
- Consideration of the interrelationships between all stages of RAW generation and management and safety requirements:
o prioritizing the minimization of generated RAW before measures to reduce the volume and activity of RAW in their subsequent management,
o consideration of the requirements for the minimization of RAW at the stage of design, construction, operation and decommissioning of the nuclear facility,
o bringing RAW into a safe passive form for storage and disposal in the shortest possible realistically achievable terms after their generation,
o ensuring safety in the long term, with elements of passive safety;
- Disposal in NDF of conditioned low- and medium-activity short-lived RAW, including waste from the decommissioning of nuclear facilities and waste from other sectors of the national economy;
- Geological disposal of highly active and long-lived RAW
- Application of approaches for reuse, recycling and exemption from regulation;
- Use of methods and means of safety proven in practice when managing RAW;
- Management of spent sealed sources as RAW;
A new update of the "Strategy for the Management of Spent Nuclear Fuel and Radioactive Waste" with a long time horizon has been prepared and is expected to be approved by the Council of Ministers in 2024.

Detailed information regarding the main characteristics of SFPs of Units 5 and 6, WSFSF and DSFSF is presented in Appendix L-1.

Practices in SNF management

Management of SNF from Kozloduy NPP

According to the Kozloduy NPP design, SNF is stored for a period of 5 years in reactor spent fuel pools until it is sent to Russia for reprocessing or transferred to a "wet" type spent fuel repository (WSFSF), commissioned in 1989 at the NPP site. According to the technical specifications for the operation of the Kozloduy NPP, sufficient free capacity must be provided in SFP 5 and 6 for emergency core unloading of the power reactors in operation.
In 1988, the last return of SNF from WWER-440 to Russia took place under the terms of the original contract (zero cost and no provision for return of HLW from its reprocessing).

Since 2008, the implementation of activities on the technological storage and reprocessing of spent nuclear fuel are carried out by the Federal Center for Nuclear and Radiation Safety under the relevant contracts, and nuclear fuel is transported for processing in Russia by river, rail and sea transport.
There are 2 facilities for SNF at the Kozloduy NPP from WWER-440 and WWER-1000 type. In the "wet" SFSF, transport baskets are used to store SNF under water. In the dry storage facility, CONSTOR 440/84 air-cooled containers are used to store WWER-440 SNF. It is planned to remove the entire amount of SNF from WWER-440 from the "wet" SFSF and load it into "CONSTOR 440/84" type containers, thus allowing the use of the "wet" SFSF only for SNF from the power reactors in operation . Options for dry storage of WWER-1000 SNF have been developed.

Detailed information regarding the main characteristics of SFPs of Units 5 and 6, WSFSF and DSFSF is presented in Appendix L-1.

RAW management practices

RAW management is justified as part of:
• the activity of using nuclear fuel for the production of electricity (SNF is not considered as RAW);
• the activities of using radioactive sources in medicine, industry, agriculture and research.

The licensees and permit holders process (to varying degrees) and store temporarily in their sites and facilities all generated RAW, until they are handed over to the SE RAW.
SE RAW, as the operator of nuclear facilities for the management of RAW, carries out RAW processing and storage activities, and after the construction of the NDF will carry out also activities on the disposal of the conditioned RAW. Until the NDF is commissioned, the conditioned RAW are stored in interim storage facilities at SE RAW.

Management of RAW from Kozloduy NPP Plc

At the Kozloduy NPP, category 2 RAW (low- and medium-level RAW) is generated, according to the classification of the *Regulation on Safety in the Management of Radioactive Waste*.
The solid RAW from the restricted area is collected and sorted according to radiation characteristics and by type of material - mainly into compactible and non-compactible.
Liquid RAW (radioactive concentrate and spent organic sorbents) are stored in separate tanks in the auxiliary buildings of the Kozloduy NPP.
Since 2001, a separate facility for processing and storing RAW has been operating at the site of the Kozloduy NPP. The operator of this facility is the State Enterprise RAW through SD RAW - Kozloduy.
The compactible solid RAW is pressed in 200-liter drums in 2 stages – preliminary compaction of RAW in the drums by a 50 tons load and subsequent super-compaction of the drums themselves by a 910 tons load.
Treatment of liquid RAW includes concentration by evaporation and conditioning by the cementation method.
A reinforced concrete container with a net volume of 5 m^3 is used for the packaging of RAW. The conditioning of reprocessed compactible solid RAW and non-compactible solid RAW is carried out differently depending on their radionuclide composition:

• combined conditioning with the liquid RAW by incorporation of the processed solid RAW in a cement-radioactive matrix;
• incorporation of the processed solid RAW in a cement non-radioactive matrix;
• packaging of the processed solid RAW without immobilizing them in a matrix. Conditioned RAW is stored in a warehouse with a capacity of 1,920 RAW packages.

Management of RAW from nuclear applications

Spent sealed sources, declared as RAW, are transferred without prior processing in the centralized repository of SD RAW - Novi han to SE RAW.

Information about the main purpose and essential characteristics of the RAW management sites is presented in Appendix L-4

Information regarding RAW generation and processing is presented in Art. 11, and regarding the radioactive releases from nuclear facilities - in Art. 24, of this report.

Criteria for determining and categorizing RAW

According to the *Regulation on Radioactive Waste Management Safety*, the classification of RAW is based on the division of solid RAW into categories and subcategories and is aimed at their safe long-term management and disposal.
In accordance with their activity and specific characteristics, solid RAW is classified as follows:

Category 1- Transitional waste, that contain small concentrations of safety significant radionuclides so that it does not require provisions for radiation protection or does not need a high level of containment and isolation; this category of waste is additionally sub-divided in:

1a - Exempt Waste,
1b - Very Short Lived Waste,
1c - Very Low Level Waste.

Category 2 - Low and Intermediate Level Waste (LILW). Because of its radionuclide content, LILW requires robust isolation and containment but no special measures for heat removal during its storage and disposal; this category of waste is additionally sub-divided in:

2a - LILW containing mainly short-lived radionuclides (with a half-life no longer then Cesium-137 half-life) as well as long-lived radionuclides at significantly lower levels of activity, limited for the long-lived alpha emitters under 4.10^6 Bq/kg for each individual package and a maximum average for all packages in the respective facility of 4.10^5 Bq/kg, for such RAW, reliable isolation and containment is required for a period of up to several hundred years,

2b - LILW containing long lived radionuclides at activity levels of long-lived alpha emitters, exceeding the limits for category 2a.

Category 3 - High Level Waste (HLW), with concentration of radionuclides so high, that heat removal must be considered in its storage and disposal; a higher level of isolation and containment compared to LILW is needed through disposal in deep, stable geological formations.

This classification also applies to liquid and gaseous RAW depending on the characteristics and form of the solid RAW expected to be obtained after conditioning of the liquid and gaseous RAW.
According to the methods and practices adopted for the treatment of RAW, the licensee may introduce additional sub-categories of low- and medium-level waste to support activities for the operation of the relevant facility. In the Kozloduy NPP and SD RAW - Kozloduy, an additional categorization has been introduced, oriented towards the specifics of the applied methods for handling and processing of RAW. The following additional categories apply, defined depending on the dose rate measured at 0.1 m from the surface for solid RAW:

- 2-I – from 1μSv/h to 0.3 mSv/h;
- 2-II – from 0.3 mSv/h to 10 mSv/h;

• 2-III – over 10 mSv/h.

For liquid RAW, the following additional categories have been introduced depending on the specific total activity:

• 2-H – less than 4.10^5 Bq/l;
• 2-C- from 4.10^5 to 8.10^7 Bq/l;
• 2-B - over 8.10^7 Bq/l.

SECTION C. AREA OF APPLICATION

Article 3 AREA OF APPLICATION

"Article 3. AREA OF APPLICATION

1. This Convention applies to the safety of the management of spent fuel generated as a result of the operation of civil nuclear reactors. This Convention does not apply to spent fuel that is in reprocessing plants as part of its reprocessing activities, unless the Contracting Party declares the reprocessing process as part of spent fuel management.

2. This Convention also applies to the safety of management of radioactive waste generated as a result of civil activities. It does not apply, however, to radioactive waste containing only natural radioactive substances and which were not generated in the nuclear fuel cycle, except in cases where it concerns disused sealed sources or when, for the purposes of this convention, they are declared as radioactive waste from the contracting party.

3. This Convention shall not apply to the safety of the management of spent fuel or radioactive waste, within the framework of military or defense programs, except when declared as spent fuel or radioactive waste by a Contracting Party for the purposes of this Convention. However, this Convention applies to the safety of spent fuel and radioactive waste management from military or defense programs if and when such materials are transferred definitively to civilian programs and managed exclusively within those programs.

4. This Convention also applies to discharges, as specified in Art. 4, 7, 11, 14, 24 and 26.

SNF generated as a result of the operation of the Kozloduy NPP and present on the territory of the country falls within the scope of the Joint Convention.
RAW generated as a result of civil activities and present on the territory of the country fall within the scope of the Joint Convention.
RAW containing only natural radioactive substances generated outside the nuclear fuel cycle, excluding sealed radioactive sources, are not declared as RAW for the purposes of the Joint Convention.
RAW that results from nuclear applications at Ministry of Defense facilities is managed in the same way as RAW from civilian nuclear application programs and is declared for the purposes of the Joint Convention.
Information and data regarding discharges generated as a result of decommissioning activities are presented in the next sections and appendices of this report.

SECTION D. INVENTORIES AND LISTS

Article 32. Reporting, para 2

"Article 32, para 2.

This report shall also include:

i. a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

ii. an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

iii. a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

iv. an inventory of radioactive waste that is subject to this Convention that:

a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

b) has been disposed; or

c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

v. a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities"

List of facilities and SSCs for management of SNF

Unit 5 at -reactor SF storage (Spent Fuel Pool - 5)
Location: in the reactor hall of unit 5, close to the reactor.
Purpose: storage of SF from unit 5.
Storage method: under water in one rack.
Storage capacity - 612 assemblies.

Unit 6 at -reactor SF storage (Spent Fuel Pool - 6)
Location: in the reactor hall of unit 6, close to the reactor.
Purpose: storage of SF from unit 6.
Storage method: under water in one rack.
Storage capacity - 612 assemblies.

Wet Spent Fuel Storage Facility (WSFSF)
Location: at the Site of Kozloduy NPP, nearby Units 3 and 4.
Purpose: Storage of the SF from all Units at the Site.
Storage method: under water, in a four sections pool.
Capacity - 168 baskets, (conditionally - 200 baskets).

Dry Spent Fuel Storage Facility(DSFSF)
Location: At the Kozloduy NPP Site, nearby the existing building of the WSFSF.
Purpose: long term storage of WWER-440 SF.
Storage method: dry, in reinforced concrete casks type CONSTOR 440/84.
Capacity – 72 containers.

The inventory of SNF in the SNF management facilities operated by the Kozloduy NPP Plc (as of 31.12.2023) is presented in the table below:

Reactor type	Number of assemblies	Heavy metal [kg]	Approximate activity [Bq]
WWER-440	2864	330910,0	$0,3.10^{19}$
WWER-1000	1617	665266,3	$2,6.10^{19}$
TOTAL	4481	996176,3	$2,9.10^{19}$

Detailed information on SF management facilities and spent fuel inventories are provided in Appendices L-1 and L-2 of the report.

List of facilities and SSCs for management of RAW

Auxiliary Building 3 (AB-3)

Location: a separate building on the Kozloduy NPP site, close to Units 5 and 6.
Purpose: processing of liquid RAW and storage of solid and liquid RAW from Units 5 and 6.
Processing methods: concentration via evaporation, filtration.
Storage capacity for solid RAW: 2700 m^3.
Storage capacity of the liquid RAW:

- liquid radioactive concentrate: 3600 m^3,
- spent ion exchange resins: 200 m^3.

Facilities and SSC for management of RAW operated by SERAW at the Kozloduy NPP site

Units 1 to 4 SSCs for RAW

Auxiliary Building-1 (AB-1)

Location: a separate building on the Kozloduy NPP site, close to Units 1 and 2.
Purpose: processing of liquid RAW and storage of solid and liquid RAW from Units 1 and 2.
Processing methods: concentration via evaporation, filtration.
Storage capacity for solid RAW - 1010 m^3.
Storage capacity for liquid RAW:

- liquid radioactive concentrate: 2350 m^3,
- spent ion exchange resins: 1076 m^3.

Auxiliary Building-2 (AB-2)

Location: a separate building on the Kozloduy NPP site, close to Units 3 and 4.
Purpose: processing of liquid RAW and storage of solid and liquid RAW from Units 3 and 4.
Processing methods: concentration via evaporation, filtration.
Storage capacity for solid RAW - 1010 m^3.
Storage capacity for liquid RAW:

- liquid radioactive concentrate: 2350 m^3,
- spent ion exchange resins: 1076 m^3.

At-reactor storage for RAW from Units 1 and 2

Location: in the Reactor hall of Units 1 and 2.
Purpose: storage of operational solid RAW category 2, additional category 2-III.
Storage method; in unprocessed form.
Storage capacity for solid RAW - 81.6 m^3.

At-reactor storage for RAW from Units 3 and 4

Location: in the Reactor hall of Units 3 and 4.
Purpose: storage of operational solid RAW category 2, additional category 2-III.
Storage method; in unprocessed form.
Storage capacity for solid RAW - 81.6 m^3.

RAW processing & storage facility and its SSCs

RAW processing plant (RAWPP)

Location: on the Kozloduy NPP site, close to AB-3.
Purpose: processing and conditioning of solid and liquid RAW category 2.
Processing methods: compaction of solid RAW, concentration via evaporation of liquid RAW, chemical and electrochemical decontamination of metal RAW.
Conditioning methods: immobilization in cement, packaging in reinforced concrete containers.
RAW processing capacity: liquid – 450 m^3/year and solid – 1500 m^3/year.

Storage for conditioned RAW (SFCRAW)

Location: Kozloduy NPP site, close to RAWPP.
Purpose: storage of conditioned in RAWPP RAW category 2.
Capacity - 1920 RAW packages.

Trench storage site

Location: Kozloduy NPP Site.
Purpose: storage of processed and unprocessed solid RAW category 2.
Capacity for storage of RAW - 3860 m^3.

Storage site for processed solid RAW

Location: Kozloduy NPP Site.
Purpose: storage of processed solid RAW category 2.
Capacity for storage of solid RAW - 1130 m^3.

Sites (No.1 and No.2) for storage of conditioned RAW packages

Location: Kozloduy NPP Site.
Purpose: buffer storage of processed solid RAW category 2-I and 2-II, packaged in reinforced concrete containers.
Capacity – 2100 RAW packages.

Site for storage of solid RAW in ISO containers

Location: Kozloduy NPP Site.
Purpose: storage of unprocessed and processed low level solid RAW category 2-I in standard ISO-containers.
Capacity for storage of RAW - 420 m^3.

Storage for contaminated soil

Location: Kozloduy NPP Site.
Purpose: storage of soil, rubble and other residual material with very low level of contamination.
Capacity for storage of RAW - 8000 m^3.

Depot for process waste (BB-1)

Location: Kozloduy NPP Site.
Purpose: Landfill deposition of exempt waste.
Capacity for storage: 5350 m^3.

Installation for plasma incineration
Location: Kozloduy NPP Site.
Purpose: Reprocessing of RAW from operation and decommissioning of nuclear facilities
Capacity: 65kg/h solid RAW.

Facility for compaction and deactivation
Location: Kozloduy NPP Site.
Purpose: Reprocessing of materials from operation and decommissioning of nuclear facilities eligible for exemption of regulatory control.
Capacity: 1100 tons annually.

Centralized storage facility for institutional RAW at Novi Han site and its SSCs

Storage site for solid RAW
Purpose: storage of unconditioned solid low and intermediate level short-lived RAW, category 2a.
Capacity for storage of RAW - 237 m^3.

Storage site for biological RAW
Purpose: storage of conditioned LILW short-lived biological waste, treated with formaldehyde and stabilized in a gypsum matrix.
Capacity for storage of RAW - 80 m^3.

Storage site for disused sealed sources
Purpose: storage of unconditioned disused sealed sources.
Capacity - 1 m^3.

Engineered trench for solid RAW
Purpose: storage of unconditioned solid low and intermediate level short-lived wastes, category 2a.
Capacity for storage of RAW - 200 m^3.

Storage for liquid RAW
Purpose: storage of LILW.
Storage capacity for RAW - 48 m^3.

Sites No.1 and No.1A for storage of solid RAW
Purpose: storage of solid RAW, category 2a and 2b, in standard ISO-containers.
Capacity for storage of RAW - 442 m^3.

Site No. 2 for storage of solid RAW
Purpose: storage of low and intermediate level RAW category 2a and 2b in reinforced concrete containers type PEK, StBKUB, RCC, StBGOU.
Storage capacity: 7 slots for PEK containers, 171 slots type StBKUB, 60 slots for RCC and 18 slots for StBGOU.

Site No. 4 for storage of solid RAW
Purpose: temporary storage of solid RAW category 1, 2a and 2b, in 200-liter metal drums,
Capacity for storage of RAW - 80 m^3.

Complex for Processing of RAW
Location: on the site of SD RAW - Novi Han.
Purpose: characterization and processing of solid RAW, category 1, 2a and 2b and liquid contaminated solutions.
Treatment methods: fragmentation, compaction of solid RAW, concentration via evaporation of liquid RAW, abrasive decontamination of metal RAW.
Methods of conditioning: cementation, packing and overpacking.

Hot cell

Location: SD RSW – Novi Han site

Purpose: for handling (dismantling of technological devices) of DSS and storage of the DSS in shielded containers.

Capacity for storage of DSSs – 500 TBq.

Facilities for disposal of RAW

At the present moment there are no facilities for disposal of RAW in the Republic of Bulgaria. As of 2017 the construction of a facility for disposal of low and medium active RAW at the Kozloduy NPP site is in implementation.

More detailed information about the facilities and report of stored and conditioned RAW, such as volume or mass and specific radionuclides are provided in Appendix L-5 of the report.

Nuclear facilities in the process of decommissioning

Units 1 to 4 of the Kozloduy NPP are in the process of being decommissioned. The entire amount of nuclear fuel has been removed from the reactors and planned activities are carried out on the management of residual radioactive material, dismantling and decontamination.

The planned activities for the dismantling of the main technological equipment in the restricted area of these units are in progress. An approach to exemption from regulation of dismantled equipment and materials is applied, in accordance with the normatively established dose criteria and exemption levels.

Information about decommissioning is presented in this report in Art. 26 and Appendix L-3.

RAW inventory

The following RAW inventory is stored in the Republic of Bulgaria by 31.12.2023:

• from Kozloduy NPP-Plc - total activity 1.09^{14} Bq;

• from nuclear applications – total activity 2.44^{15} Bq.

SECTION E. LEGISLATIVE AND REGULATORY FRAMEWORK

Article 18. Implementing Measures

"Each Contracting Party stake, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention."

Article 19. Legislative and Regulatory Framework

"Article 19. Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

2. This legislative and regulatory framework shall provide for:

i. the establishment of applicable national safety requirements and regulations for radiation safety;

ii. a system for licensing spent fuel and radioactive waste management activities;

iii. a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

iv. a system of appropriate institutional control, regulatory inspection and documentation and reporting;

v. the enforcement of applicable regulations and of the terms of the licences;

vi. a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of

radioactive waste management.

3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention."

Implementation measures

The Republic of Bulgaria has created and maintains a legislative and regulatory framework to ensure the safe management of SNF and RAW while fulfilling its obligations under the Convention. The legislative and regulatory framework is in line with the applicable IAEA safety standards for SNF and RAW.

Legislative and regulatory framework

The national legislative and regulatory framework for safety of SNF and RAW management is two-fold:

- The *Act on the Safe Use of Nuclear Energy* (**Nuclear Act**), and the supplementing relevant acts (the *Environmental Protection Act*, the *Health Protection Act*).
- The regulations for their application. The regulations, mainly related to the SNF and RAW management are:
  - *Regulation for Radiation Protection*, adopted in 2018, last amended in 2020;
  - *Regulation for Ensuring the Safety in Spent Fuel*, adopted in 2004, last amended in 2018;
  - *Regulation for Safety of Radioactive Waste Management,* adopted in 2013, last amended in 2018;
  - *Regulation on the Procedure for Issuing Licences and Permits for the Safe Use of Nuclear Energy,* adopted in 2004, last amended in 2019;
  - *Regulation for the conditions and procedure for transfer of radioactive waste to the state enterprise "Radioactive Waste",* adopted in 2013, last amended in 2018;
  - *Regulation for Safety of the Decommissioning of Nuclear Facilities,* adopted in 2004*;*
  - *Regulation on the Terms and Procedure for Obtaining Vocational Qualification and on the Procedure for Issuing Licenses for Specialized Training and Individual Licenses for Work Activities involving Nuclear Power,* adopted in 2004, last amended in 2019*;*
  - *Regulation for Ensuring the Safety of Nuclear Power Plants,* adopted in 2004, last amended in 2018*;*
  - *Regulation for Emergency Planning and Emergency Preparedness in case of nuclear and radiological accident,* adopted in 2011, last amended in 2017;
  - *Regulation for the Provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Material,* adopted in 2015, last amended in 2022*;*
  - *Regulation on Radiation Protection During Work Activities with Materials with Increased Concentration of Natural Radionuclides,* adopted in 2012, last amended in 2018;
  - *Regulation on the Conditions and Procedure for Transport of Radioactive Material,* adopted in 2005, last amended in 2014.

More than 20 regulatory guides issued by the chairman of the BNRA, for the practical application of the regulatory requirements, and in the period 2020-2023 the following regulatory guides were developed and adopted:
• Applying a graded approach to activities with sources of ionizing radiation;
• Safe operation of a near surface facility for disposal of RAW;
• Manual for safe management of highly active sources during operation and decommissioning of sites with gamma irradiation devices;
• Determining the importance of operational events in terms of nuclear safety and radiation protection (INES scale level);
• Protection from internal fires in nuclear power plants;
• Deterministic analysis of the safety of nuclear power plants;
• Application of probabilistic safety analyzes in the safety management of nuclear power plants;
• Radiation protection during the decommissioning of a nuclear facility.

The list of the legislation relevant to radioactive waste management and spent fuel management are presented in Appendix L-6 and described under relevant JC articles.

National safety requirements and radiation protection regulations

The radiation protection requirements are established by the *Act on the Safe Use of Nuclear Energy*, *the Act on Public Health* and the regulations fortheir implementation.
The Regulation on Radiation Protection defines:
• The main principles of radiation protection: justification of practices, optimization of protection and limitation of doses;
• The main dose limits, derived limits and dose restraints. The individual dose limit for occupational exposure is 20 mSv/a, and for the population - 1 mSv/a. Population dose limits are set for each type of nuclear facility and for a site with multiple nuclear facilities as a whole;
• The reference levels for emergency exposure situations and existing exposure situations;
• The general criteria, dose criteria and specific levels of exemption from regulatory control;
• The requirements, responsibilities and measures relating to each of the three possible exposure situations, including the obligations of the competent state authorities and of licensees and permit holders;
• Specific rules and measures for radiation protection in the design and operation of nuclear facilities and in activities with sources of ionizing radiation.

The national legislation in the field of radiation protection is harmonized with the documents of the IAEA, respectively with the safety standard GSR part 3 "Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards".

Licensing system for the management activities of SNF and RAW

The *Act on the Safe Use of Nuclear Energy* establishes a system for regulating the activities and facilities for the safe management of spent nuclear fuel and radioactive waste, which includes the issuance of licenses and/or permits.
For each stage of the life cycle of SNF and RAW management facilities, the following shall be required as appropriate:

- permission to determine the location of a nuclear facility (site selection);
- design permit;
- construction permit;
- commissioning permit;
- permission to amend the following:

- - SCS related to nuclear safety and radiation protection;
- - conditions and limits for safe operation, on the basis of which the license for operation or decommissioning was issued;
- - the internal rules for carrying out the activities of the licensee, including instructions, programs, technical specifications and others, attached to the license for operation;
- license for operation;
- decommissioning license.

Separate permits are required for:
• transportation of SNF and RAW outside the site of a given nuclear facility, including transit transportation;
• transactions with nuclear materials;
• import and export of nuclear materials.
There are specific requirements for issuing a license to export spent fuel for reprocessing outside the EU. The contract with the country of destination is agreed with Euratom, and the processing facility in that country should comply with international safety standards, which is equivalent to the ratification of the Joint Convention by that third country.
All licenses and permits are issued by the chairman of the BNRA. The conditions and procedure for issuing licenses and permits are defined in the *Regulation on Issuing Licenses and Permits for the Safe Use of Nuclear Energy*. According to the regulation, the applicant submits documents demonstrating compliance with the requirements for nuclear safety, radiation protection and physical protection.
A license or permit, its change or the refusal of the BNRA chairman to issue the relevant document are subject to appeal before the relevant administrative court in accordance with the Code of Administrative Procedure.
According to the *Act on the Safe Use of Nuclear Energy*, the BNRA maintains a public register of licenses and permits issued by the chairman of the agency, as well as their amendment, renewal, termination and revocation.

Prohibition of operation without a license

Pursuant to Chapter III of the *Act on the Safe Use of Nuclear Energy*, the management of SNF and RAW is carried out by legal entities only after obtaining a license or permit. When carrying out an activity without the relevant license or permit, the administrative penal provisions are applied according to Chapter 11 of the *Act on the Safe Use of Nuclear Energy* and the Criminal Code.

Institutional control, regulatory inspection, documentation and reporting

Pursuant to the *Act on the Safe Use of Nuclear Energy*, the Chairman of the BNRA carries out control over the use of nuclear energy and ionizing radiation and the management of RAW and SNF.
This control is:
• preventive control when issuing licenses and permits for activities under the *Act on the Safe Use of Nuclear Energy*;
• ongoing control of compliance with the regulatory requirements for the activities under the *Act on the Safe Use of Nuclear Energy* and the requirements of the issued licenses and permits; ;
• subsequent control over the implementation of recommendations or prescriptions given by the control authorities.
In the course of implementing his control authority, the chairman of the BNRA:
• performs periodic and extraordinary inspections through authorized officials;
• notifies the other bodies of the specialized control with a view to taking measures within the scope of their competence;
• notifies the prosecutor's office in the presence of data on a committed crime;
• amends or revokes the issued permit or license;
• imposes coercive administrative measures and administrative penalties provided for by law.

Pursuant to the *Act on the Safe Use of Nuclear Energy*, the Chairman of the BNRA authorizes certain officials (inspectors) from the agency's administration to carry out control under the *Act on the Safe Use of Nuclear Energy* and the secondary legislation on its implementation. For the results of the performed inspections, protocols of findings are drawn up, to which the collected evidence, explanations and results of the performed observation, measurement and/or testing are attached.

The *Act on the Safe Use of Nuclear Energy* and the regulations for its implementation require the licensee or permit holder to maintain detailed records of the construction, operation, modifications that have taken place, decommissioning, or shutting down of SNF and RAW facilities.
The Kozloduy NPP-Plc and SE RAW periodically report to the BNRA on the condition and functioning of the operated facilities and notify immediately of all incidents that occur. Information related to safety in an agreed format is periodically provided to the BNRA, according to the specific conditions of the license. Procedures have been developed for notifying the BNRA in case of operational events.
The BNRA regularly informs the public about the state of nuclear facilities and operational events related to spent nuclear fuel and radioactive waste. The BNRA prepares an annual report on the state of nuclear and radiation safety in the Republic of Bulgaria and presents it to the Government and the Parliament.

Coercive administrative measures

In order to prevent and stop administrative violations, as well as to prevent and eliminate their consequences, the chairman of the BNRA imposes coercive administrative measures. The coercive administrative measures are also imposed in case of violations of the requirements for nuclear safety and radiation protection, physical protection and emergency preparedness, in which an accident occurs or there is an immediate danger of an accident occurring.
The coercive administrative measures that may be imposed in these cases are:
• suspension or constraaint of the activity for which a permit or license has been issued,
• temporary withdrawal of the certificate of competencies,
• order to carry out the following, namely:
o examinations, inspections, tests of installation, facility, products, their parts, systems or components;
o modification of established limits and operating conditions;
o changes to designs and structures that are relevant to nuclear safety, radiation protection, physical protection and emergency preparedness.
Coercive administrative measures are imposed by order of the chairman of the BNRA on the proposal of the agency's inspectors. The order imposing the coercive measures shall determine the appropriate period for their implementation. The order to impose coercive administrative measures can be appealed before the respective administrative court in accordance with the Administrative Procedure Code. An appeal does not suspend the execution of that order, unless the court has ruled otherwise.

Distribution of Responsibilities

Responsibilities between the relevant bodies involved in the management of SNF and RAW are distributed as follows:
• Council of Ministers - adopts aa Strategy for management of spent fuel and management of radioactive waste (programme); takes a decision to build a national repository for storing or disposal of radioactive waste and may declare spent nuclear fuel as radioactive waste;
• The Nuclear Regulatory Agency - the Chairman of the BNRA: carries out the state regulation of the safe management of RAW and SNF; maintains the legislative and regulatory framework in the field of safe management of RAW and SNF; issues licenses and permits, performs regulatory control and imposes enforcement measures to ensure compliance with regulatory requirements;

• Ministry of Energy (ME) - develops and proposes the national strategy for the management of spent nuclear fuel and radioactive waste; implements the SNF and RAW management policy and supervises the implementation of the planned activities with the Strategy;
• The Ministry of Health (MH) - carries out specialized health-radiation control through the National Center for Radiobiology and Radiation Protection and the Regional Health Inspectirates with Radiation Control divisions;
• The Ministry of the Environment and Water (MEW) - is responsible for the National System Environmental Radiological Monitoring and is the competent authority for environmental impact assessment for radioactive waste and spent fuel;
• Ministry of Internal Affairs (MIA) – responsible for physical protection, fire safety and the protection of the population;
• State Agency National Security - provides the licensee and the chairman of the BNRA with a threat assessment for each specific nuclear facility or for the cases of transportation of nuclear materials.

The responsible persons for managing SNF and RAW are its generators. They must bring it into a form suitable for transport, storage and ultimately disposal. These persons are obliged to cover all costs from its generation to its disposal through contributions to the relevant national funds.
The RAW, outside of the place of their generation, is managed by the State Enterprise RAW. The enterprise was established by the *Act on the Safe Use of Nuclear Energy*, which defined responsibilities, governing bodies, funding, etc. The management of orphan sources and spent sealed sources that cannot be returned to their producer is the responsibility of the State Enterprise RAW. RAW become state property at the moment of their transfer to the State Enterprise RAW.

Regulation of radioactive materials as radioactive waste

The *Act on the Safe Use of Nuclear Energy* and the *Regulation on Safety in Radioactive Waste Management* contain the following definition for RAW: "Radioactive waste is a radioactive substance in gaseous, liquid or solid form, the further use of which is not foreseen by the licensee or permit holder and which is controlled by the BNRA as radioactive waste". This definition corresponds to the internationally accepted definition.
SNF can be regulated as RAW if it is declared as RAW by a decision of the Council of Ministers.
In accordance with Art. 19 of the Joint Convention, the Republic of Bulgaria has established and implements a legislative and regulatory framework for the safe management of SNF and RAW.

A full list of the existing regulations applicable to radioactive waste and spent fuel management is presented in Appendix L-6.

Article 20. Regulatory Body

"Article 20. Regulatory Body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.

2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation."

Establishment and designation

The BNRA was established in 2002 by the *Act on the Safe Use of Nuclear Energy*. The Chairman of the BNRA implements the legislative and regulatory framework referred to in Article 19 of the Convention.
The BNRA is the legal successor of the Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP), which was established in 1957, when Bulgaria ratified the IAEA statute as a co-founder. In 1985, the first nuclear law was adopted - the Law on the Use of Atomic Energy for Peaceful Purposes. The CUAEPP was assigned supervisory functions for nuclear safety control and tasks for promoting nuclear applications and research.
In 2002, after the first IRRS mission of the IAEA in Bulgaria, a completely new *Act on the Safe Use of Nuclear Energy* was adopted, which established the BNRA as the sole nuclear regulatory agency of Bulgaria. The act distinguishes the regulatory functions in nuclear energy from those for the promotion of nuclear energy. The *Act on the Safe Use of Nuclear Energy* is in line with the current IAEA safety standards and the legislative practice of EU countries in this area.
According to the *Act on the Safe Use of Nuclear Energy*, the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of RAW and SNF is carried out by the chairman of the BNRA, which is an independent specialized body of the executive power. The status of the Chairman of the BNRA is defined in Chapter II of the *Act on the Safe Use of Nuclear Energy*, with a clear and unequivocal allocation of responsibilities, assignment of regulatory functions and provision of financial and human resources. The chairman of the BNRA has the following authorities and responsibilities:

- • manages and represents the BNRA,
- • issues, amends, supplements, renews, temporarily suspends and revokes licenses and permits,
- • controls compliance of activities and facilities with safety requirements and standards applicable to nuclear energy and nuclear applications, incl. the management of RAW and SNFand in accordance with the conditions of the issued licenses as well as issuing, terminating and revoking certificates of competencies to work under the *Act on the Safe Use of Nuclear Energy*,
- • imposes mandatory administrative measures and administrative sanctions,
- • assigns the performance of expertise, studies and research related to nuclear safety and radiation protection when using nuclear energy and related to nuclear safety and radiation protection to the management of nuclear power plants and RAW,
- • carries out the international cooperation of the Republic of Bulgaria in the field of nuclear safety and radiation protection, as well as in the field of SNF and RAW management,
- • provides citizens, legal entities and state bodies with objective information about the state of nuclear safety and radiation protection,
- • reports to the Council of Ministers by presenting annual reports on the state of nuclear safety and radiation protection in the management of SNF and RAW, as well as on the activities of the BNRA,
- • organizes and coordinates the implementation by the Republic of Bulgaria of the obligations under the Agreement with the IAEA on nuclear safeguards related to the NPT and the Additional Protocol,
- • performs the functions of a central authority and contact point for emergency notification and assistance in accordance with the Convention on early notification of a nuclear accident and the Convention on assistance in case of a nuclear accident or radiological emergency,

- • performs the functions of a central authority, contact point and coordinator for the fulfillment of obligations under the Convention on the Physical Protection of Nuclear Material,
- • develops and proposes for adoption by the Council of Ministers regulations on the implementation of the *Act on the Safe Use of Nuclear Energy*.

The chairman of the BNRA issues licenses and permits for the facilities and activities for the management of SNF and RAW, bearing full responsibility for conducting the process of making informed decisions.
With the Law on the Ratification of the Joint Convention, the chairman of the BNRA is designated as a regulatory authority within the meaning of Art. 20 of the convention and for the coordinator of the preparation of the national reports on the fulfillment of the obligations of the Republic of Bulgaria arising from this convention.
The BNRA shall perform the review and assessment necessary to determine compliance with the safety requirements for the facilities and management activities of SNF and RAW as prepared by the operator for issuance either of a license/permit or periodically during subsequent operation.
The BNRA implements an integrated management system based on the requirements of the IAEA, GSR part 1. The management system brings together all interrelated elements of the organization - structure, resources, processes (work practices) and culture of the organization to ensure overall control and consistency in taking decisions.
The chairman of the BNRA and the two deputy-chairmen are appointed by the Council of Ministers and are required to have at least 10 years of experience in the field of nuclear energy, radiation protection or the management of nuclear power and radioactive waste.
The *Act on Safe Use of Nuclear Energy* creates two advisory councils to the Chairman of the BNRA - on nuclear safety and on radiation protection. The members of these councils are appointed by the chairman of the BNRA, selecting scientists and experts with extensive academic, research or operational experience in various aspects of nuclear safety and radiation protection at the national and international level.
The structure, activity and organization of the BNRA are determined by the Rules of Procedure of the BNRA, adopted by the Council of Ministers. According to the Rules of Procedure, the BNRA has 114 statutory positions, and currently about 100 staff members are employed, divided into five departments: General Department "Nuclear Safety", Department "Radiation Protection", Department "Safety Analyzes and Assessments", Department "International cooperation" and the Department "General Administration". The implementation of the legislative and regulatory framework for spent fuel is mainly carried out by the General Department "Nuclear Safety", and the management of radioactive waste by the Department "Radiation Protection".
The requirements for the qualifications and experience of BNRA personnel are defined in the job descriptions for each specific position. Almost all BNRA employees hold a university degree (master's degree, some with a doctorate) and have many years of professional experience in the design, construction, operation and decommissioning of nuclear facilities and in nuclear applications, as well as in their regulation. The professional experience of the employees is on average more than 20 years.
The professional selection of the personnel in the BNRA is carried out in accordance with the requirements of the *Civil Servant Act*, the *Act on Administration*, the *Labor Code* and the internal rules of the BNRA. The requirements for candidates are focused on professional competence, personal attitudes, ability to work in a team, desire for development, communication skills, leadership skills for management positions, etc. BNRA consistently implements a policy of transferring experience to younger employees to ensure continuity in the organization and preserve established professional practices.
BNRA implements a system of training and qualification of personnel, in accordance with national and international standards. Specialized training is conducted to maintain and improve the qualifications of employees, including the acquisition of additional professional knowledge and skills. It is based on the systematic approach to training and is carried out on an annual basis. Participation in international projects, technical meetings, training courses and seminars is useful for BNRA employees as a form of feedback from international regulatory practices.
In cases of need for competence in specific technical areas, BNRA provides external expert opinions by concluding contracts with independent experts and/or organizations.

BNRA is a legal entity financed from the state budget. The annual budget of the BNRA is developed directly with the Ministry of Finance. With the *Act on the State Budget* of the Republic of Bulgaria for 2023, expenses of about BGN 8.4 million have been determined for the BNRA. The budget covers the expenses for the maintenance costs of the Agency, for staff remuneration, for social and health insurance, for membership fees in international organizations, for the acquisition of long-term tangible assets and others.
All costs of the BNRA are covered by state fees from the licensees. For the current year, the revenue from the BNRA budget is about 10.6 million. In recent years, stability has been achieved in the financing of the regulatory body.

Independence of regulatory functions from other functions

Pursuant to Art. 4 of the *Act on Safe Use of Nuclear Energy* and Art. 19, para. 4 of the *Act on Administration*, the chairman of the BNRA is an independent regulatory body of the executive power, which is separate from other state bodies, government agencies and commercial entities carrying out the planning, construction, operation and decommissioning of SNF and RAW management facilities or which carry out special activities with SNF and RAW.
The Chairman of the BNRA is approved by the Council of Ministers and appointed by the Prime Minister for a 5-year term and may be appointed for another term. The mandate can be terminated only in the cases specified in the *Act on the Safe Use of Nuclear Energy*.
The chairman and deputy-chairmen of the BNRA fill out a declaration of conflict of interest in the areas of competence of the regulatory body.
The Chairman of the BNRA reports annually to the Council of Ministers on the state of nuclear safety and radiation protection of nuclear facilities and activities in the Republic of Bulgaria independently of other state bodies and ministries that are related to the use of ionizing radiation for various purposes.
The *Act on the Safe Use of Nuclear Energy* established the financial independence of the regulatory body. The Chairman of the BNRA is the primary budget authority and manages the budget of the BNRA in accordance with the Law on Public Finances.
SE RAW, established under the *Act on the Safe Use of Nuclear Energy*, is in the portfolio of the Minister of Energy, who oversees the implementation of the National Strategy for the Management of Spent Fuel and RAW in the Republic of Bulgaria.
Responsibilities and functions in the management of SNF and RAW are distributed among state bodies according to competence. The regulatory body has complete independence of judgment and decision-making. The results of BNRA's licensing and control activities are published in annual reports.
In conclusion, an independent regulatory body has been established in the Republic of Bulgaria, charged with the implementation of the legislative and regulatory framework related to the management of SNF and RAW, with the necessary powers, competence, financial and human resources.

Openness and transparency

The BNRA's policy is aimed at timely informing the public about the state of nuclear safety and radiation protection. The website of the BNRA maintains up-to-date public information about operational events in nuclear facilities.
The open dialogue with all interested parties, the transparency of actions and decisions of the BNRA, including the provision of public access to information, are key issues for the effectiveness of regulatory activity. The BNRA website contains comprehensive information on nuclear safety and radiation protection, as well as the agency's activities. The annual reports of the BNRA from 2003 until now, the national reports of the Republic of Bulgaria on the fulfillment of the country's obligations under the Convention on Nuclear Safety and under The Joint Convention on Safety in the Management of Spent Nuclear Fuel and Radioactive Waste arew also published there. The reports on the country's fulfillment of its obligations under the IAEA Codes and on the fulfillment of European directives in the field of nuclear safety and radiation protection have also been published.

Public registers of issued licenses and permits for nuclear facilities and activities with sources of ionizing radiation, licenses for carrying out specialized training and certificates of competencies for carrying out activities with sources of ionizing radiation and for work in nuclear facilities are available.

SECTION F. OTHER GENERAL SAFETY PROVISIONS

Article 21. Responsibility of the Licence Holder

"Article 21. Responsibility of the Licence Holder

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste."

Holder of a license or permit

All SNF and RAW management activities, including conditioning, storage and disposal, take place or will take place at nuclear facilities. Pursuant to the *Act on the Safe Use of Nuclear Energy*, the management of RAW and SNF is carried out by legal entities only after obtaining a license and/or permit for the safe implementation of the relevant activity. In order to ensure that the holder of a license or permit fulfills its responsibilities, the Republic of Bulgaria has established a regulatory body entrusted with the implementation of legislative and regulatory requirements as described above.

Pursuant to Art. 3, para. 2 of the *Act on the Safe Use of Nuclear Energy*, the responsibility for ensuring nuclear safety and radiation protection is borne in full by the persons responsible for the facilities and activities under the act, and cannot be transferred to other persons. Regulations implementing the *Act on the Safe Use of Nuclear Energy* include the specific responsibilities and obligations of the holder of a license and/or permit in the specific areas:

- the facilities and activities for the management of SNF and RAW;
- radiation protection;
- emergency planning and preparedness;
- physical protection;
- notification of the BNRA in case of nuclear events;
- transferring of RAW to the State Enterprise RAW;
- staff training, terms and conditions for licensing and others.

The Kozloduy NPP Plc is the main generator of SNF and RAW. Spent fuel is stored at the site of the Kozloduy NPP in the wet SFSF and in the dry SFSF. Intermediate storage and processing of RAW from operation and from decommissioning is carried out by Kozloduy NPP - Plc and by SE RAW in facilities designated for the purpose. According to the regulations, the above-mentioned facilities are nuclear facilities and are operated according to the relevant licenses. The BNRA exercises regulatory oversight to ensure that holders of licenses or permits under the *Act on the Safe Use of Nuclear Energy* fulfill their responsibilities and obligations under the Act.

In Chapter IV of the *Act on the Safe Use of Nuclear Energy*, it is determined that the responsibility for the acceptance, processing, conditioning, storage or disposal of radioactive waste, outside the places where it was generated, is carried out by the SE RAW. SE RAW is the operator of the nuclear facilities for the management of RAW in Bulgaria. Each licensee, as a result of whose activities RAW is generated, bears the responsibility for their safe management until they are handed over to the SE RAW or exempted from regulatory control.

The specific responsibilities of the license holder are developed in detail in the *Regulation* on ensuring the safety of spent fuel management and in the *Regulation on the safety of radioactive waste management*, including the requirements for the implementation and maintenance of the management system for the effective distribution of responsibilities within the operating organization.

Pursuant to Art. 22, para. 3 of the *Act on the Safe Use of Nuclear Energy*, upon termination of a license, the previous holder of a license or permit is obliged to ensure nuclear safety, radiation protection and physical protection until:

- • issuing a new license;
- • issuing a new license to a new holder;
- • until the safe decommissioning of the relevant facilities.

Unlicensed facilities, activities and materials

Pursuant to Art. 21, item 2 of the Joint Convention, the Republic of Bulgaria has taken legislative measures, so that the responsibility for the management of SNF and RAW is borne by the State in cases where their owner is not known, cannot be found or has fallen into bankruptcy.
Purssuant to Art. 73 of the *Act on the Safe Use of Nuclear Energy*, SNF and RAW, whose owner is unknown, are state property, and the chairman of the BNRA designates the person to whom they shall be transferred and the conditions for this. The state is responsible for their safe management.

Article 22. Human and Financial Resources

"Article 22. Human and Financial Resources

Each Contracting Party shall take the appropriate steps to ensure that:

i. qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

ii. adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

iii. financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility."

Qualified personnel

The *Act on the Safe Use of Nuclear Energy* stipulates that a license to operate a nuclear facility is issued if the applicant has qualified personnel. The requirements for qualification and training of personnel for all activities related to the operation of facilities for the management of SNG and RAW are provided for in the *Regulation* on the conditions and procedure for acquiring professional qualifications and on the procedure for issuing licenses for specialized training and certificates for competencies to use nuclear energy. The *Regulation* defines:

- • the conditions and procedure for acquiring a professional qualification for carrying out activities in nuclear facilities and with sources of ionizing radiation (SIR);
- • the positions, respectively the activities, for the performance of which competencies is required;
- • the procedure for issuing, amending, renewing, terminating and revoking licenses for specialized training for activities in nuclear facilities and with SIR (specialized training);
- • the procedure for issuing, terminating and withdrawing certificates of competencies;
- • the conditions and procedure for conducting examinations for acquiring the competencies to perform activities in nuclear facilities and with SIR;
- • the procedure for carrying out control over the fulfillment of the conditions of the issued licenses for specialized training and certificates of competencies.

According to the *Act on the Safe Use of Nuclear Energy*, the Chairman of the BNRA issues licenses to persons who conduct specialized training for activities in nuclear facilities and with sources of ionizing radiation.

The construction, maintenance and implementation of a system for personnel selection and qualification is the duty of the holders of licenses and/or permits to carry out activities. This system takes into account professional and qualification requirements.

Professional qualification is an officially proven level of knowledge, skills and habits necessary to perform functions defined in a job description for a specific position in a nuclear facility. The training and qualification system, including the internal certification system, applies a systematic approach to specialized training for activities related to nuclear safety and radiation protection in nuclear facilities and nuclear applications.

A training center has been established at Kozloduy NPP. The Kozloduy NPP Plc holds a license to conduct specialized training and issue certificates of competencies, in accordance with the *Act on the Safe Use of Nuclear Energy*.

According to the curriculum for training and qualification, an individual program (curriculum for initial specialized training or general program) is drawn up for each person of the staff performing functions either affecting or ensuring nuclear safety and radiation protection. The professional qualification of management and operational personnel is certified by the BNRA qualification examination committee.

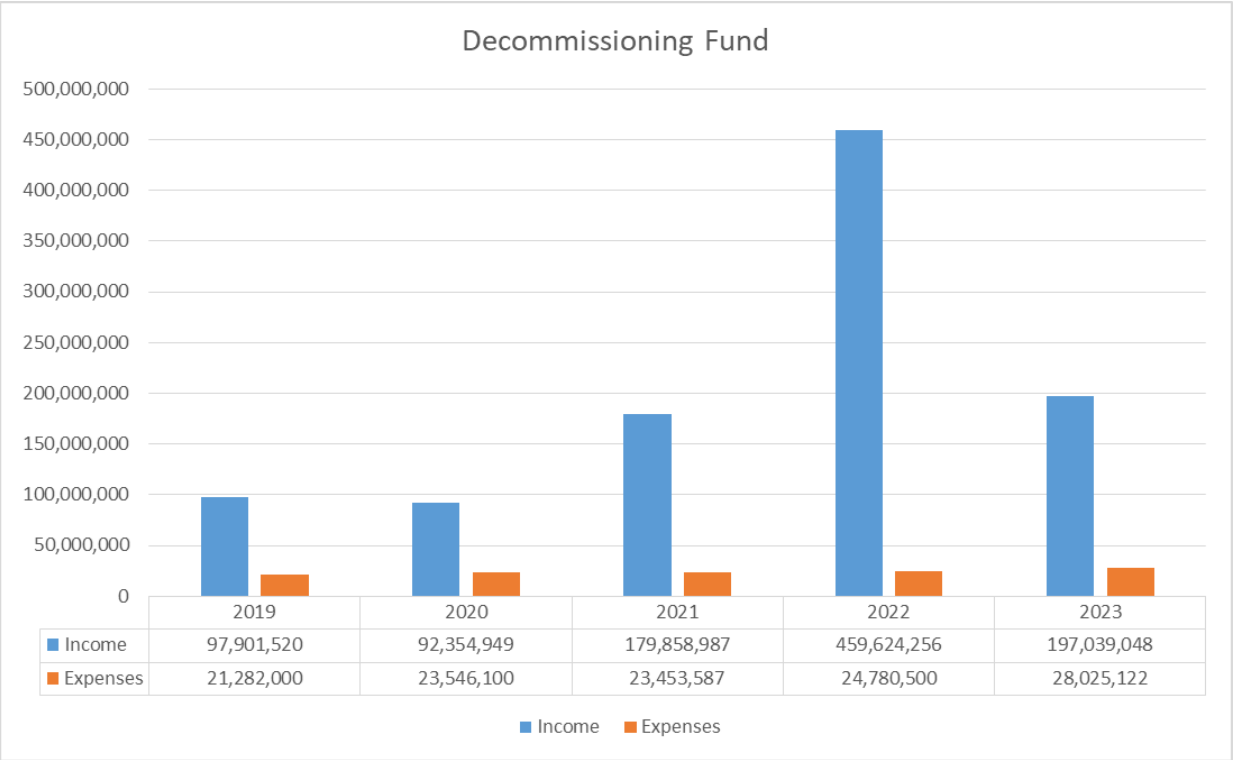
Adequate financial resources and provision for institutional control

The *Act on the Safe Use of Nuclear Energy* establishes and requires the maintenance of an appropriate mechanism to ensure and maintain adequate financial resources to fulfill the responsibilities of the relevant licensees and permit holders, as well as for control and monitoring in the period after the closure of the disposal facility. A license to operate a nuclear facility is issued to a person possessing financial, technical, material resources and an organizational structure to maintain a high level of safety for the entire period of operation of the nuclear facility and in the management of radioactive waste and spent fuel, as well as for its decommissioning.
The *Act on the Safe Use of Nuclear Energy* established the Radioactive Waste Fund and the Decommissioning of Nuclear Facilities Fund. Each of the RAW generators makes contributions to the Radioactive Waste Fund. The Kozloduy NPP Plc makes contributions to the "Decommissioning of Nuclear Facilities" Fund.
With the *Regulation on the Procedure for Establishing, Collecting, Spending and Controlling Funds* and on the Amount of Due Contributions to the "Radioactive Waste" Fund and the *Regulation on the Procedure for Establishing, Collecting, Spending and Controlling Funds* and on the *Amount of Due Contributions* to the Decommissioning Fund is determined the procedure for collecting, spending and control of necessary resources. The availability of financial resources to ensure the safety of SNF and RAW management facilities during their operational life, for decommissioning and for institutional control and monitoring mechanisms after the closure of a disposal facility is ensured through these specialized funds and as part of the state budget.
The financing of the management of SNF and RAW during the operation of the nuclear power units is provided by Kozloduy NPP - Plc.
The financing of the decommissioning and management of RAW after their transfer to SE RAW is provided by the "Decommissioning of Nuclear Facilities" Fund and the "Radioactive Waste" Fund.
The funds are targeted and managed in accordance with the current legal provisions in order to guarantee:

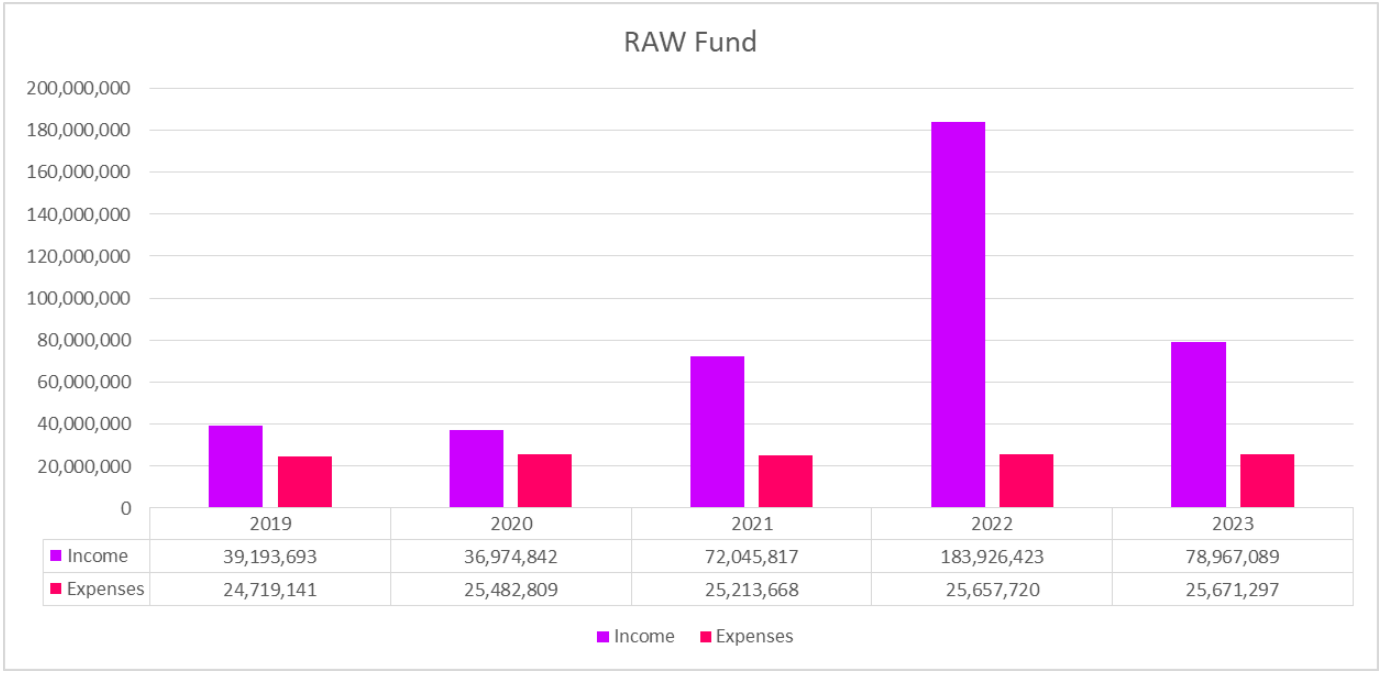
• sufficient funds that will always be available so as not to transfer an overwhelming burden to future generations;
• transparency in the financial management of funds, which guarantees that these funds will not be illegally diverted for other purposes.

According to the current regulations, the volume of expenditures of the Radioactive Waste fund depends on the terms of the planned events in the current "Strategy for the Safe Management of Spent Nuclear Fuel and Radioactive Waste" and the current annual programs for the activities of the State Enterprise RAW. The financial resources accumulated in the funds are spent for an unlimited period of time.
The accumulated financial resources in the two funds as of 31.12.2023 are as follows:
• RAW Fund - to the amount of BGN 411,899,361.
• Decommissioning Fund - to the amount of BGN 2,462,261,531.

The annual income and expenses in the Decommissioning Fund for the period 2019-2023 are presented in the following chart:



The annual revenues and expenses in the RAW Fund for the period 2019-2023 are presented in the following chart:



The costs for RAW management activities, which are carried out in the specialized divisions of the SE RAW are financed by the RAW Fund. The annual financing of the activities is carried out according to annual programs approved by the management board of the fund. In the three-year budget forecast for the activities of SE RAW, expenses are foreseen based on the production program for annual amounts of RAW, which are accepted in the divisions of SE RAW, including operational waste from the Kozloduy NPP and waste from nuclear applications, as well as by activities in the management of facilities for the management of RAW. The

costs for the decommissioning activities are planned to be financed by the Decommissioning Fund, as well as by the Kozloduy International Fund (KIDS), administered by the EBRD and created for the purpose of managing the grant provided by the European Commission in connection with the early decommissioning of units 1 to 4 of the Kozloduy NPP.

Final Plan for Financing of a Deep Geological Repository

A new update of the "Strategy for the Management of Spent Nuclear Fuel and Radioactive Waste" with a long time horizon has been prepared and is expected to be approved by the Council of Ministers in 2024. It is planned from the beginning of 2025 to start the collection of financial resources in the RAW Fund for the financing of a project for the design and construction of a repository for geological disposal (RGD) of high-level waste, through targeted contributions from the operator of nuclear facilities. The financial management of the funds will be carried out under the current conditions of operation of the RAW Fund, with separate target planning and accounting of the collected and spent resources for the RGD.

In connection with the update of the Strategy, a preliminary assessment of the costs for the implementation of the RGD project (BGN 5 billion) was made. The necessary funds will be raised by Kozloduy NPP Plc during the long-term operation of units 5 and 6, and according to initial forecasts, the Kozloduy NPP Plc should contribute about 6% of the revenues from the sale of electricity. Periodically, every 5 years, an estimate of the construction costs of the RGD will be updated to ensure sufficient financial resources at the end of the operational lifetime of the units.

Other sources of funding

With Council Regulation (Euratom) 2021/100 of 25 January 2021 establishing a special financial program for the decommissioning of nuclear facilities and radioactive waste management and repealing Council Regulation (Euratom) No. 1368/2013, for period 2021-2027, the Kozloduy program has been allocated additional funds to the amount of 63 million euro, which are aimed solely at the implementation of projects for the decommissioning of units 1-4 of the Kozloduy NPP.

Article 23. Quality Assurance

"Article 23. Quality Assurance

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programs concerning the safety of spent fuel and radioactive waste management are established and implemented."

According to the *Act on the Safe Use of Nuclear Energy*, persons who perform activities in the management of RAW and SNF are obliged to maintain a high level of quality of the activities they perform.
The requirements for the development of the quality management systems of nuclear power plants are described in detail in the *Regulation* for ensuring the safety of nuclear power plants, which is aligned with the IAEA safety standard GSR Part 2 "Leadership and Management for Safety".
The specific requirements for the management systems during the operation of facilities for the management of SNF and RAW are specified in the *Regulation* on ensuring safety in the management of spent nuclear fuel (chapter VII) and in the *Regulation* on safety in the management of radioactive waste (chapter X).

Development in the quality management systems of the operating organizations
Quality assurance at Kozloduy NPP Plc

The policy of the Kozloduy NPP Plc for the purposes of safety in the management of RAW and SNF is aimed at ensuring the following:
• effective protection of personnel, the population and the environment from the harmful effects of ionizing radiation;
• safe management of fresh and spent nuclear fuel;
• safe management of RAW.

For the implementation of the Kozloduy NPP Safety Management Policy, in accordance with the *Regulation on ensuring the safety of nuclear power plants* and the conditions of the issued licenses for the operation of the power reactors at the Kozloduy NPP, an integrated management system is implemented, which ensures coordinated application of requirements for nuclear safety and radiation protection, health and safety at work, environmental protection, security, quality and economy, taking into account the interaction between technical, human and organizational factors.
The management system of the Kozloduy NPP - Plc was developed in accordance with the requirements of the IAEA safety standard GSR Part 2 "Leadership and Management for Safety" and taking into account:
• the applicable normative and regulatory requirements;
• the principles and requirements defined in applicable IAEA and WANO safety standards and manuals;
• the requirements of BDS EN ISO 9001:2015 "Quality management systems. Requirements", BDS EN ISO 14001:2015 "Environmental management systems", BDS EN ISO 45001:2018 "Health and safety management systems at work" and other standards applicable in the Company.
The management system of the Kozloduy NPP - Plc is based on a process approach and covers all activities related to the Company's field of activity, which are structured in 29 processes, divided into three groups: management, basic and auxiliary.
The activities of collection, sorting, chemical treatment, deactivation, storage and exemption from regulation of radioactive materials are described in auxiliary process AP.19. "RAW Management" from the Management System.
The activities of storage of SNF in WSFSF and DSFSF and removal of SNF for processing are described in the basic process "Management of the nuclear fuel cycle" of the Management System.

Quality assurance in SE RAW
An integrated management system, developed in accordance with the requirements of the standards, is implemented in the SE RAW:

• ISO 9001:2015 "Quality management systems. Requirements";
• ISO 14001:2015 "Environmental management systems. Requirements and guidelines for implementation";
• ISO 45001:2018 Occupational health and safety management systems;
• IAEA safety standard GSR Part 2 "Leadership and Management for Safety".

The entire system is in continuous improvement and refinement. Quality assurance is based on principles by applying a process approach. In the period 2020 - 2023, by order of the Executive Director, new editions of the processes of the integrated management system and the related management procedures were put into effect.

The protection of the environment is among the main, priority goals in the policy of the State Enterprise RAW, which determines compliance with the regulatory requirements in this area.

Article 24. Operational Radiation Protection

"1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

i. the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

ii. no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

iii. measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2 Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and;

(ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects."

The requirements towards the licensees and permit holders and the basic principles, norms and rules for ensuring radiation protection, which must be observed when carrying out activities in nuclear facilities, are defined by the *Act on the Safe Use of Nuclear Energy* and the *Regulation on Radiation Protection*.

The "ALARA" principle was introduced for facilities and activities for the management of SNF and RAW. It is the duty of the operator of a nuclear facility to implement practical approaches and measures to maintain the exposure of personnel and members of the public to the lowest reasonably achievable level.

Operators of nuclear facilities implement in practice the introduction of dose limits, control and administrative levels in relation to the individual effective dose for personnel, which are always lower than the basic dose limits for occupational exposure. Administrative levels together with the estimated collective dose for a given nuclear facility are important tools in the process of optimizing occupational exposure. The established "ALARA" councils and the participation of managers at all levels demonstrate the commitment of the management. The result is a clearly delineated trend of lowering the dose load of personnel to sustainable low levels.

In order to apply the principle of optimization, the *Regulation on Radiation Protection* requires the determination and application of dose limits in relation to the population in situations of planned exposure.

Dose limits for personnel and members of the public are defined in the *Regulation on Radiation Protection* and are:

for staff:

- •annual effective dose of 20 mSv;
- • an annual equivalent dose to the eye lens of 20 mSv or 100 mSv total dose for any five consecutive years, provided that the maximum dose does not exceed 50 mSv in any individual year;
- • annual equivalent skin dose of 500 mSv, averaged for every 1 cm^2 of the skin surface, regardless of the area of the exposed surface;
- • annual equivalent limb dose 500 mSv.

per person of the population:

- • annual dose 1 mSv;
- • annual equivalent dose for eye lens 15 mSv;
- • annual equivalent skin dose of 50 mSv, averaged for every 1 cm^2 of the skin surface, regardless of the area of the exposed surface.
- Special dose limits have been introduced for women exposed to occupational exposure during pregnancy and breastfeeding, for students aged 16 to 18 years, as well as for cases of permitted increased exposure.

Measures to prevent unplanned and uncontrolled release of radioactive materials

The *Regulation on Radiation Protection* regulates the measures that license and/or permit holders must take to prevent unplanned and uncontrolled release of radioactive substances into the environment.
A requirement was introduced for zoning in nuclear facilities (restricted and supervised areas) depending on the radiation factors (dose rate, surface radioactive contamination, concentration of radioactive aerosols in the air). The requirements for the organization of air flows, the speed, the under pressure maintenance and the purification of the air, the order of access and the control for the non-spread of radioactive contamination beyond the boundaries of the restricted areas are specified in detail.
The levels of exemption from regulatory control of materials (according to the specific activity of individual radionuclides) – unconditional and conditional exemption, including exemption of metals for recycling, are established in the *Regulation on Radiation Protection*. Intentional mixing and dilution of radioactive material with the aim of subsequent release from control is prohibited.

Measures to limit discharges

The permitted levels of activity (or specific activity) of gaseous and liquid radioactive discharges into the environment are approved by the chairman of the BNRA with the relevant licenses or permits. Levels of permitted releases to the environment are determined based on population dose constraints.
According to the *Regulation on ensuring the safety of nuclear power plants in all operational states of a given nuclear power plant*, the annual individual effective dose to members of the population caused by the impact of all nuclear facilities on the NPP site must not exceed 150 μSv.
The technical specifications of the nuclear facilities, which are on the site of the Kozloduy NPP, contain the limits and conditions for operation, including the permissible levels of gaseous and liquid radioactive discharges into the environment during normal operation. The regulated activity levels of gaseous and liquid radioactive discharges from the Kozloduy NPP site ensure that the annual individual effective dose for members of the population will not exceed 50 μSv.

According to the *Regulation on Safety in the Management of Radioactive Waste*, the annual individual effective dose for the relevant critical group of persons from the population as a result of a facility for the surface disposal of radioactive waste after its closure must not exceed 100 μSv. The annual individual effective dose for the relevant critical population group as a result of a facility for the geological disposal of RAW after its closure should not exceed 300 μSv.
A comprehensive monitoring system for gaseous and liquid radioactive discharges has been established. Information about the system is presented in the previous reports under the Convention and in the Report of the Republic of Bulgaria under Art. 35 of the Euratom Treaty. Both licensees' environmental radiation monitoring networks and information on radiation monitoring conducted by state institutions are presented.

Corrective measures in case of unplanned and uncontrolled release of radioactive materials
The system for radiation monitoring of gaseous and liquid radioactive discharges is designed to function both during normal operation of the nuclear facilities for the management of SNF and RAW, as well as in cases of deviations from normal operation and accidents. In such cases, the operator is obliged to apply the relevant emergency plans to limit and eliminate their consequences, as presented in this report under Art. 25 of the Joint Convention.

Operational experience following submission of the seventh national report
Within the framework of the established licensing regime for each nuclear facility, the state of radiation protection is assessed by analyzing the doses of external and internal exposure of the personnel and the population, the number of persons who received doses above the established limits, the radioactive contamination of the environment and compliance with the norms and radiation protection rules. The detailed information on the exposure dose of the population and of the personnel of the Kozloduy NPP and SE RAW during the operation of the RAW management facilities, presented in the previous reports, has been updated with the data for the period 2020-2023.

Kozloduy NPP - Plc
Occupational exposure
The control of the occupational exposure of the personnel from external and internal exposure is carried out by the Control Center "Personal Dosimetry", accredited by the Executive Agency "Bulgarian Accreditation Service" as a Type C Inspection body.
The main method of measuring external exposure doses is thermo-luminescent method, with a detection limit of 0.10 mSv. For the purposes of operational dosimetric control, direct reading dosimeters with a sensitivity of 0.01 mSv are used.
The personnel from the Kozloduy NPP, who are responsible for the management of nuclear power plants, control the neutron exposure in addition to the gamma radiation exposure. Neutron dose monitoring is performed with individual track neutron dosimeters with a sensitivity threshold of 0.02 mSv. The registration level required by legislation is 0.20 mSv.
The internal exposure of personnel is measured "in vivo" with a gamma-spectrometric system. Intake assessment and dose estimation are performed with specialized software that implements the ICRP biokinetic models.
For the period from 2020 to 2023, there are no registered cases of internal exposure of personnel engaged in activities with RAW or SNF.
The exposure dose of personnel performing activities with SNF and RAW in the restricted area of units 5 and 6 of the Kozloduy NPP is indicated in the following table:

Year	2020	2021	2022	2023
Collective effective dose [man.mSv]	5.2	6.43	4.20	0.27

Maximum individual dose [mSv]	3.92	1.66	1.56	0.27

Discharges from the Kozloduy NPP site

Summary data on gaseous and liquid discharges to the environment

Gaseous discharges

The regulated limits for the activity of radioactive substances in gaseous discharges are defined so that if the limit values are reached during the year for each component, the exposure dose for a person of the population will not exceed 50 μSv/y.

The gaseous discharges from the Kozloduy NPP site for the period 2020 - 2023 are as follows:

Gaseous discharges	2020	2021	2022	2023
Radioactive noble gases, Bq	6.57E+11	3.78E+12	8.27E+11	1.32E+12
Iodine-131, Bq	7.43E+05	5.07E+07	4.95E+06	2.78E+07
*Radioactive aerosols, Bq	1.09E+06	8.97E+06	4.52E+06	3.22E+06
Tritium, Bq	4.82E+11	6.07E+11	5.64E+11	6.59E+11
Carbon-14, Bq	4.92E+11	7.24E+11	6.20E+11	6.73E+11

*The value given in the row "Radioactive aerosols" is obtained as the sum of gamma emitters, alpha emitters and radiostrontium. The amounts of alpha emitters and radiostrontium are negligible.

Radioactive noble gases, aerosols and iodine-131(131I) registered in the gaseous emissions from the plant are below 0.1% of the specified limits.

Liquid discharges

The regulatory limits for the activity of radioactive substances in liquid discharges are defined so that if the specified limit values are reached during the year, the exposure dose per person of the population will not exceed 50 μSv/y.

The liquid radioactive discharges for the period 2020-2023 in the Danube River are given in the following table:

Year	2020	2021	2022	2023
**Total activity, Bq (without tritium)	1.73E+07	5.55E+07	8.44E+07	5.36E+07
^{3}H, Bq	2.33E+13	2.46E+13	2.25E+13	2.26E+13

**The value shown on the line “Total activity without H-3” is obtained as the sum of gamma emitters, alpha emitters, radiostrontium, Ni-63 and Fe-55.

Over the past 10 years, the amount of tritium in liquid discharges has varied between 10% and 13% of the specified limit value. For the same period, the total activity of liquid discharges (without tritium) is below 0.1% of the specified limit value.
SD RAW-Kozloduy generates waste water and air during its activities, which are discharged into the environment through the facilities of units 5 and 6 and are accounted for in the presented data.

Assessment of the radiation exposure of the population from liquid and gaseous discharges
To assess the exposure dose of the population from radioactive discharges into the environment, verified and validated model programs are used, based on the CREAM methodology adopted by the European Union (EU) and adapted to the relevant geographical and hydrological features of the Kozloduy NPP area. The radiation risk from the liquid and gaseous discharges from the Kozloduy NPP site is negligible. For the last 10 years, the individual effective dose for members of the population has been found to be below 10 μSv per year.
The values of the maximum individual dose of gaseous discharges from the Kozloduy NPP site, taking into account the contribution of ^{3}H and ^{14}C, are as follows:

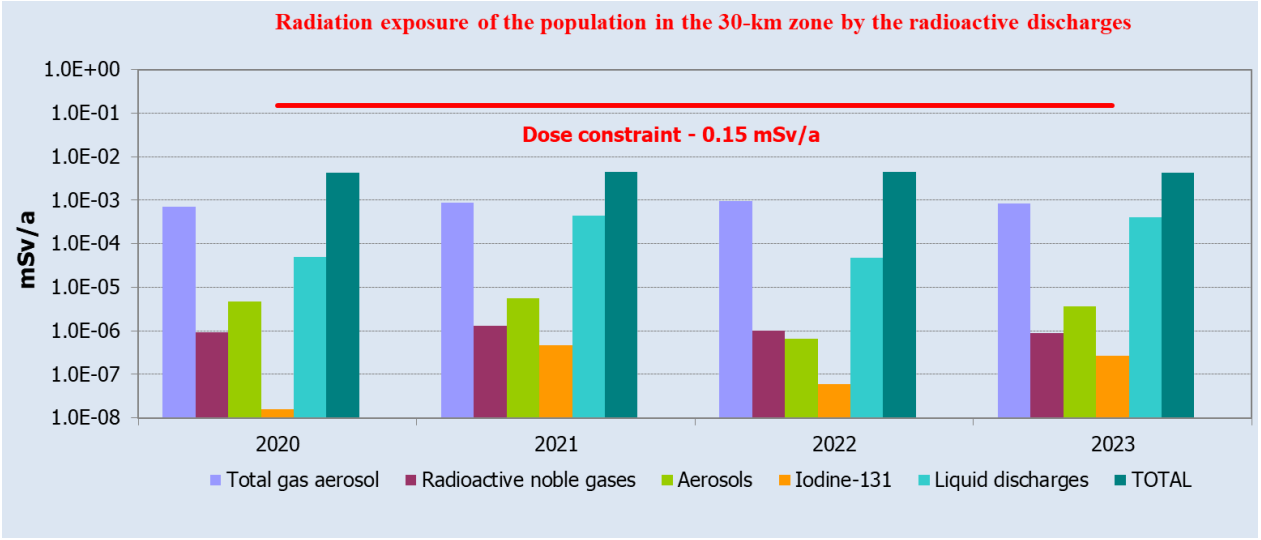
Gaseous discharges	
Year	Individial effective dose, 30 km zone [Sv]
2020	7.15E-07
2021	8.80E-07
2022	9.71E-07
2023	8.53E-07

The results for exposure per person of the population from liquid discharges by year are as follows:

Liquid discharges		
Year	Individual effective dose	
	max 30 km zone [Sv]	Person with extreme habits [Sv]
2020	4.14E-07	3.47E-06
2021	4.38E-07	3.66E-06
2022	4.05E-07	3.41E-06
2023	4.03E-07	3.38E-06

The maximum individual effective dose, total from gas-aerosol and liquid discharges, for representative persons of the population in a 30-km zone is estimated conservatively in the interval 1.13 ÷ 1.38 μSv/a, and for a person with extreme habits in the coastal pump area station on the Danube river varies from 4.19 to 4.54 μSv/a.

The results of the assessment of the exposure of a person of the population from radioactive emissions from the Kozloduy NPP in a 30-km monitored area for the period from 2020 to 2023 are as follows:



Exposure of individuals from the population in the surveillance area around the Kozloduy NPP is 0.2% lower than the exposure due to the natural radiation background. The data are fully comparable with other NPPs operating PWR (WWER) reactors.

SE "RAW"

Exposure dose of the personnel

In the period 2020-2023, there has been no exceeding of regulatory and administrative limits for occupationally exposed persons. For these persons, no intakes of radionuclides have been registered as a result of RAW management activities in SD RAW-Kozloduy. In accordance with the ALARA principle, during the reporting period the exposure dose of the personnel was maintained at a level significantly below the dose limits for occupationally exposed persons.

The maximum annual individual effective dose in recent years is 3.97 mSv, which is below 20% of the annual limit for occupationally exposed persons, according to the *Regulation on Radiation Protection*.

Exposure dose of the staff of the SD Decommissioning units 1-4

Year	2020	2021	2022	2023
Collective effective dose [man.mSv]	31,91	49,83	115,28	86,24
Average individual effective dose [mSv]	0,06	0,07	0,15	0,13
Maximum individual dose [mSv]	1,58	2,36	3,97	2,62

Exposure dose of the staff of SD RAW-Kozloduy

Year	2020	2021	2022	2023
Collective effective dose [man.mSv]	0,45	1,48	2,74	4,54
Average individual effective dose [mSv]	0,11	0,13	0,16	0,23
Maximum individual dose [mSv]	0,12	0,23	0,31	0,76

Exposure dose of the staff of the SD Centralised Storage Facility-Novi Khan"

Year	2020	2021	2022	2023
Collective effective dose [man.mSv]	10,29	8,24	5,8	3,63
Average individual effective dose [mSv]	0,17	0,13	0,09	0,06
Maximum individual dose [mSv]	1,86	0,44	3,2	0,93

Radioactive discharges into the environment from the facilities of SE "RAW"

There are no direct gaseous and liquid discharges from SD RAW - Kozloduy into the environment. The release is carried out through the relevant facilities of the Kozloduy NPP and is included in the reports of discharges from the plant.

Technologically, radioactive noble gases, aerosols and iodine-131 are not discharged from the Central facility RAW. The share of the RAW management facility in the gaseous discharges from the site is less than 0.1% at full load of the facilities in SD RAW - Kozloduy. The doses to the population as a result of the operation of the facilities of SD RAW - Kozloduy are included in the assessment of the general radiation impact on the population from all facilities at the Kozloduy NPP site.
The analysis of the results of the monitoring of the sites of SD RAW-Kozloduy shows that the radiation influence on the site of the nuclear facility and on the site of the Kozloduy NPP as a result of the management of RAW is negligible. No unacceptable impacts on the environment were found.
The SD Centralised Storage Facility-Novi Khan" conducts its own monthly radiation monitoring with the measurement of water samples from the control boreholes, soils and vegetation from the surrounding environment, in accordance with the radiation monitoring program.
The operation of the nuclear facilities is in accordance with the regulatory requirements. There is no deviation from the dose restraints and dose limits for personnel and members of the population, which is an indicator of the degree of optimization of radiation protection in the implementation of activities for the management of SNF and RAW.

Article 25. Emergency Preparedness

"1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory."

Emergency plans

Emergency preparedness and response to a nuclear or radiation emergency is part of the national disaster protection system. The main regulatory requirements for the structure of the disaster protection system are regulated by the *Disaster Protection Act* (DPA), the *Act on the Safe Use of Nuclear Energy*, the *Regulation on Emergency Planning and Emergency Preparedness* in the event of a nuclear and radiation accident, and the *Regulation on Radiation Protection*. The DPA is harmonized with the *Act on the Safe Use of Nuclear Energy* in terms of the requirements for the development of emergency plans, their content, the necessary human resources, material and technical support and others.

According to the *Act on the Safe Use of Nuclear Energy*, state authorities and persons who carry out activities in the operation of nuclear facilities are obliged to take measures to prevent incidents and accidents and to limit their consequences. Emergency planning measures are established with the emergency plans as follows:

• for the protection of the population (off site emergency plan), which regulates the areas for emergency planning and determines the actions of the competent authorities for the protection of the population, property and the environment in the event of an accident;

• for the protection of the personnel of the nuclear facility (on site emergency plan), which determines the actions of the licensee within the boundaries of the site where the nuclear facility is located to limit the accident and mitigate its consequences in accordance with the off site emergency plan.

The national disaster protection plan contains an analysis of the dangers that may occur on the territory of the country. For each danger, specific measures have been developed to protect the population, eliminate the consequences and restore the affected area. To respond to a nuclear or radiation accident at Kozloduy NPP Plc, an Off site Emergency Plan has been developed, which is part of the National Disaster Management Plan (NDMP). The bodies of the executive power develop plans for the fulfillment of their obligations provided for in the NDMP.

The *Regulation on Radiation Protection* defines:

• basic elements of emergency exposure management;

• reference levels in situations of emergency exposure for members of the population;

• reference levels in situations of emergency exposure for the persons participating in the mitigation and liquidation of the accident;

• requirements for the content of the off-site emergency plan, requirements for the scope and content of information provided to the public in the event of an emergency.

The *Regulation on Emergency Planning* and Emergency Preparedness in the event of a nuclear and radiation accident determines:

- • the conditions and procedure for developing emergency plans;
- • the persons who apply the emergency plans and their duties;
- • actions and measures to limit (localize) and liquidate the consequences of a nuclear or radiation accident;
- • ways to inform the population;
- • the procedure for maintaining and checking emergency preparedness;
- • risk categories of sites, facilities and activities, as well as classes of accidents;
- • intervention levels such as predicted dose and preventable dose values for a given time, dose rate and specific activity, at the reaching of which begins the application of protective measures.

  Persons carrying out activities in the management of SNF and RAW are required to prepare and maintain on site emergency plans commensurate with the risks associated with the facilities and activities.

  On site emergency plans are maintained for all nuclear facilities for the management of SNF and RAW:
- • Emergency plan of Kozloduy NPP - Plc - includes the operating nuclear facilities, facilities for managing SNF at the site (SFP, WSFSF and DSFSF) and the facilities of the SE RAW, located on the site of the Kozloduy NPP - Plc;
- • Emergency plan of SD RAW- Kozloduy;
- • Emergency plan of the SD Decommissioning units 1-4;
- • Emergency plan of SD Centralised Storage Facility - Novi Khan".

A separate emergency plan is maintained by the Kozloduy NPP - Plc for the transportation of nuclear fuel.
The emergency plans of SE RAW (SD RAW - Kozloduy and SD Decommissioning) are tied to that of the Kozloduy NPP - Plc.
The off site emergency plan for actions outside the Kozloduy NPP site is an integral part of the National Disaster Protection Plan (Part III).
In 2023, an outsourced Emergency Management Center (EMC), located outside the site of the Kozloduy NPP, was put into operation, duplicating the functions of the emergency center on the site itself.

Emergency exercises and drills

A systematic approach is applied to emergency preparedness and response training.
The emergency teams are trained at the Training Center at the Ministry of the Interior. It conducts initial and periodic training for actions in the event of a nuclear or radiation emergency, in accordance with the planned activities.
The training of the personnel of the Kozloduy NPP - Plc and SE RAW takes place in the Training Center and the Emergency Center of the Kozloduy NPP - Plc.
National exercises are organized and conducted:
• every 5 years – a full-scale exercise on the application of the National Disaster Protection Plan;
• every year – training in mastering the elements of the plan.
In the full-scale emergency exercises, the executive authorities, operators and organizations involved in the implementation of Part III of the National Disaster Protection Plan, as well as local authorities, participate. The plan for the conduct of each full-scale exercise is approved by the Minister of the Interior.
The evaluation of the full-scale emergency exercises is carried out by an expert committee, whose composition may include representatives of the BNRA, the Ministry of the Interior, the Ministry of the Interior, the Ministry of Energy, Bulgarian Energy Holding, etc. After each exercise, an analysis is prepared and measures are determined to eliminate the weaknesses and deficiencies found during the exercises.
In the period 2020 – 2023, the BNRA participated in all exercises of the ConvEx series (organized by the IAEA) for the international exchange of information in the event of a nuclear or radiation accident and in the international exercises ECURIE and INEX organized by the EU. Participation in international IAEA and EU

exercises improves coordination, both between participants and international organizations, and between regulatory authorities of neighboring or nearby countries in terms of operational exchange of information on emergency events, as well as when requesting/providing assistance.

The chairman of the BNRA performs the functions of a central authority and contact person for notification in case of accidents and providing assistance under the Convention on operational notification in the event of a nuclear accident and the Convention on assistance in the event of a nuclear accident or radiation emergency.

In 2022, a Memorandum was signed between the BNRA and the Nuclear Regulatory Authority of the Republic of Turkey for cooperation and information exchange in the field of nuclear safety and information exchange in the event of an accident.

In 2023, an Agreement was signed between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Hellenic Commission for Atomic Energy of the Republic of Greece for operational notification of a nuclear accident and cooperation in the field of nuclear safety regulation and radiation protection.

Also in 2023, the BNRA renewed its cooperative agreement with the US Nuclear Regulatory Commission.

Article 26. Decommissioning

"Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

i. qualified staff and adequate financial resources are available;

ii. the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

iii. the provisions of Article 25 with respect to emergency preparedness are applied; and

iv. records of information important to decommissioning are kept."

The national regulatory framework requires decommissioning of nuclear facilities to take place after obtaining a license under the *Act on the Safe Use of Nuclear Energy*.

A license to decommission nuclear facilities is issued to a legal entity that possesses financial, technical and material resources, as well as the organizational structure and qualified and trained personnel to maintain safety. A necessary condition for issuing the license is a positive decision of the Minister of Environment and Water on the environmental impact assessment report. The licensee submits to the chairman of the BNRA a plan for the decommissioning of a nuclear facility at least 2 years after the final shutdown of the facility.

The licensing procedure established in the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy* ensures that operational radiation protection and emergency preparedness measures are justified, including the prevention of unplanned and uncontrolled radioactive discharges. Specific requirements have been introduced for a management system, including the requirements for maintaining qualified personnel, as well as for the availability of adequate financial resources and emergency planning.

According to the *Regulation on Safety in Decommissioning of Nuclear Facilities*, planning for the decommissioning of a nuclear facility is carried out at each stage of the facility's life cycle. The final decommissioning plan shall be substantiated with the safety assessment report. The basic safety requirements for the decommissioning of the safety-related systems and equipment, for the deactivation and dismantling of the equipment, for radiation protection and for the management of radioactive waste are defined.

Exemption of materials from regulation resulting from nuclear facility decommissioning activities is regulated by the *Act on the Safe Use of Nuclear Energy* and the *Regulation on Radiation Protection*.

Personnel and financial resources

In order to issue a decommissioning license for a nuclear facility, a final decommissioning plan is required, supported by evidence that the necessary financial resources have been secured for its implementation. The decommissioning activities of nuclear facilities are financed by the Decommissioning Fund.

The estimate of costs for decommissioning of a nuclear facility is prepared and maintained by the licensee in accordance with the recommendations of the IAEA and the OECD document "Costs for decommissioning of nuclear power plants" (NEA No. 7201, 2016). The cost estimate for decommissioning shall include the maintenance of personnel, including training and exercises.

The main income in the Decommissioning Fund is formed from contributions made by the persons who operate a nuclear facility. The amount of contributions is determined so that at the end of the operational lifetime, the necessary funds are collected to cover the costs of decommissioning. The mechanism for determining the amount of the contributions, for accumulating the necessary funds and for financing the activities is determined by the *Regulation* on the procedure for establishing, collecting, spending and controlling the funds and on the amount of the due contributions to the Decommissioning of Nuclear Facilities fund

Kozloduy NPP Plc, as the licensee for the nuclear units in operation, developed estimated costs for decommissioning, which were determined in accordance with the recommendations of the IAEA and the OECD document "Costs for decommissioning nuclear power plants" (NEA No. 7201 , 2016). The assessment was developed for the needs of updating the National Strategy and for assessing the amount of the contributions to the Decommissioning Fund.

The decommissioning activities that have an impact on safety may only be performed by qualified personnel. The conditions and procedure for acquiring a professional qualification, the positions for which competencies is required and for conducting examinations are defined in a separate *Regulation* on the conditions and procedure for acquiring a professional qualification and for the procedure for issuing licenses for specialized training and certificates of competencies to use nuclear energy.

Radiation protection

The provisions of the *Act on the Safe Use of Nuclear Energy* and the *Regulation on Radiation Protection* are applied to ensure radiation protection in the decommissioning of nuclear facilities, covering all aspects of Article 26, item ii (see Section F.4). As a mandatory part of the decommissioning plan, the licensee shall develop radiation protection programs. Dose limits, control and administrative levels, permissible gaseous and liquid radioactive discharges, reference levels and specific requirements and measures to ensure radiation protection are determined.

The removal of physical barriers in the process of dismantling the nuclear facility, which limit the spread of radioactive substances in the environment, is carried out only under the condition that liquid and gaseous discharges will not exceed the regulated values for permitted discharges during the period of decommissioning works. The requirements of the provisions under Art. 24 of the Convention apply to nuclear facilities in the process of decommissioning.

Emergency planning

The requirements of the *Act on the Safe Use of Nuclear Energy* and the *Regulation on Emergency Planning and Emergency Preparedness* in the event of a nuclear and radiation accident also apply to any nuclear facility in the phase of decommissioning. The safety assessment report for the decommissioning phase contains accident analyses, which are the basis for emergency planning during decommissioning. For the issuance of a license for the decommissioning of nuclear facilities, the applicant is required to submit an on site emergency plan to the BNRA.

Storage of information important for decommissioning

In accordance with the requirements of the *Regulation* on safety during the decommissioning of nuclear facilities, the licensee develops and maintains a management system that also contains requirements for storing the information necessary for the purposes of decommissioning. The licensee ensures the proper storage of this information, in accordance with the requirements set out in the terms of the license and the current regulatory requirements.

Additional information related to the sites in a process of decommissioning can be found in Appendix L-3 of the report.

SECTION G: SAFETY OF SPENT FUEL MANAGEMENT

Article 4. General Safety Requirements

"Article 4. General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

i. ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

ii. ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

iii. take into account interdependencies among the different steps in spent fuel management;

iv. provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

v. take into account the biological, chemical and other hazards that may be associated with spent fuel management;

vi. strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

vii. aim to avoid imposing undue burdens on future generations."

Basic safety requirements

The *Act on the Safe Use of Nuclear Energy* sets out the regulatory safety requirements at each stage of the life cycle of nuclear power management facilities that ensure the protection of human life, health and living conditions of present and future generations, the environment and material assets from harmful impact of ionizing radiation.

The general requirements are to ensure effective protection of personnel, the population and the environment, to avoid actions that lead to foreseeable consequences for future generations exceeding those permissible for the current generation and to avoid transferring an excessive burden to future generations.

The national regulatory framework provides a clear division of responsibilities and ensures effective regulatory control of facilities and activities related to the management of SNF.

In addition, the following requirements are specified in the *Regulation* on ensuring safety in the management of SNF:

• ensuring subcriticality and removal of residual heat removal;

• passive safety;

• application of a graded approach;

• minimizing the generation of RAW;

• keeping the impact of ionizing radiation on individuals, the population and the environment as low as reasonably achievable.

Holders of licenses and permits bear full responsibility for ensuring the safety of facilities and activities.

Criticality and residual heat removal

The criticality and heat removal are accounted for in the design and at each stage of the licensing process of a spent fuel management facility. The licensee plans and carries out periodic and systematic assessment of the safety of the facilities, assessment of the radiation impact on the environment during reasonable periods of time during the design life of the facilities and ensures safe operation with a level of safety in accordance with the current regulatory requirements. The assessment period cannot exceed 10 years. The safety assessment

report reflects the actual condition of the facilities throughout their operational lifetime and during the decommissioning period and examines the safety aspects related to the site, design, construction, operation and decommissioning.

According to the *Regulation on ensuring the safety in the management of SNF*, the licensee should ensure: the appropriate containment of the radioactive products within the limits of the physical barriers, ensuring criticality, removal of the residual heat and ensuring the possibility of removing the SNF from the storage area. These functions are provided through appropriate site selection, design, construction and commissioning of SNF management facilities, as well as proper management and safe operation. To ensure sub criticality in normal operation and in design basis accidents, the effective neutron multiplication factor must be lower than 0.95. The spent fuel burn up depth can be used as a parameter to justify nuclear safety, only if control of the burn up of spent fuel entering the facilities is carried out by technical means.

The design of the SSC and the operational procedures that are applied in the relevant SNF facilities of the Kozloduy NPP Plc (SFP of units 5 & 6 and WSFSF and DSFSF) to ensure sub-criticality and residual heat removal have been evaluated in the relevant safety analysis.

In the design and in the operation of the facilities for the management of SNF, technical means and organizational measures are foreseen, excluding the possibility of increasing the temperature of the spent fuel elements cladding above the design limits in conditions of normal operation and in case of design basis accidents.

Minimization of RAW during SNF management
The regulatory requirements determine the application of technological processes for the storage of SNF and preliminary treatment of RAW, which are designed in such a way so that the amount of RAW is minimal. The design must ensure that the volume and activity of liquid RAW generated is limited to a reasonably achievable low level, through effective systems for purification and reuse of radioactive fluids, preventing leaks from systems containing radioactive fluids, and reducing the frequency of events requiring significant measures for decontamination.
The RAW management systems are designed taking into account the requirements for the safe management of SNF and the minimization of RAW during the entire lifetime of the facility.

Information about the generated RAW during SF management in WSFSF as well as about the respective trends is presented in Section H of this report in the texts pursuant to Art. 11 of the Convention.

In the same section, summarized information is also presented on the generated RAW and the relevant trends from units 5 - 6 of the Kozloduy NPP Plc (it is not possible to specify what part of the RAW was generated as a result of the storage of nuclear fuel and what - as a result of the operation of the units) .

Consideration of the interdependence of the various steps in the management of SNF

The *Regulation on ensuring safety in the management of SNF* covers all stages of the life cycle of nuclear facilities for SNF management - site selection, design, construction, operation and decommissioning, as well as in all SNF management activities - storage, on site transport and handling of SNF.

The *Regulation* includes specific requirements to address the interdependencies between the various steps in the use of fresh nuclear fuel, SNF management and accountability. According to Article 82, when managing SNF, the licensee takes into account the requirements to SNF for its future management outside the facility, including compatibility with the requirements for handling, storage, transport and processing, as well as the possibilities for its further management until its disposal.

Protection of personnel, the population, the environment and future generations

According to the *Act on the Safe Use of Nuclear Energy* and its implementing regulations, in the management of SNF, the exposure of personnel and the public must be kept to the lowest reasonably

achievable level. Effective protection of personnel, the population and the environment is ensured by applying the principle of defense in depth and creating a system of physical barriers along the path of propagation of ionizing radiation in the environment and a system of technical and organizational measures for barrier protection and storage of their effectiveness.

The regulatory requirements regarding the limits of the annual individual effective dose and dose limits in relation to the population, caused by the impact of liquid and gaseous discharges into the environment from the facilities for the management of SNF, as well as from the discharges as a result of design basis and beyond design basis accidents are defined in the *Regulation on ensuring safety in the management of nuclear power plants*.

Detailed information on the implementation in the national legislation of the generally accepted principles for limiting exposure doses and substantiating practices for the protection of personnel and the population is presented in Section F, Art. 24, of this report.

Biological, chemical and other risks

The assessment of biological, chemical and other risks that may be associated with the management of SNF is the subject of an EIA report, which is required in accordance with the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy* for the main stages of the lifecycle of the nuclear facility. The requirements of the *Environmental Protection Act* regarding an EIA report are fully applicable to the approval of the construction of a SNF management facility.

Avoiding the imposition of undue burden to future generations

The Bulgarian legislation introduces the principle of not allowing the imposition of undue burden on future generations. In the Strategy for the Management of Spent Fuel and Radioactive Waste, adopted by the Council of Ministers, the various options for the management of SNF are indicated. The strategy defines the option for the transport of SNF for reprocessing and return of HLW for storage and final disposal as the most acceptable with a view to avoiding an undue burden on future generations.

Providing the necessary financial means to manage SNF is not left to future generations. The provision of sufficient financial resources is an obligation of the NPP operator, according to Article 16 of the *Act on the Safe Use of Nuclear Energy*, and is ensured through contributions to the specialized funds during the operation of the NPP.

Sending SNF for reprocessing is also an aspect of national policy to avoid imposing the burden on to future generations.

Technical information about the assurance of sub-criticality and residual heat removal in the different SF management facilities is presented in Appendix L-1

Article 5. Existing Facilities

"Article 5. Existing Facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility."

Section D provides an overview of the existing SNF management facilities. These facilities are licensed as required under the *Act on the Safe Use of Nuclear Energy*.

Existing facilities

SNF from the operation of the Kozloduy NPP, after its stay in the SFP, is stored in a spent fuel storage facility. At the Kozloduy NPP, there are two repositories for the storage of spent nuclear fuel from the WWER-440 and WWER-1000 reactors. In the spent fuel storage facility (SFSF), with underwater storage technology, spent fuel is stored in 4 pools in transport baskets. A facility for dry storage of spent fuel (DSFSF) from WWER-440 was also built. The storage is a container system using air-cooled containers by natural convection type CONSTOR 440/84, with a capacity of 72 containers with 84 assemblies. The SFSF accepts spent fuel that has been stored for at least 3 years in the spent fuel pools (SFP).

The operating organization maintains a high level of safety culture and demonstrates safety through analyses and assessments of safety.

The BNRA carries out a regulatory review of the safety documentation provided. When non-compliance with the safety requirements is found in the submitted documentation, corrective measures are required to eliminate them.

The spent fuel pools are evaluated in the periodic safety inspections of the Kozloduy NPP units.

After the accident at the Japanese nuclear power plant in Fukushima, stress tests were conducted, as a result of which measures were taken to improve the safety of the SFP of units 5 and 6.

The project for LTO of the Kozloduy NPP Plc also provides for appropriate measures to increase the safety of the SFP.

Pursuant to the provisions of the *Regulation* on ensuring safety in the management of nuclear power plants regarding the implementation of changes leading to the modification of structures, systems and components important for safety, the changes proposed by the operator in the design of the nuclear power plant are reviewed and verified by the BNRA.

According to the *Regulation* on ensuring safety in the management of nuclear power plants, the licensee must develop and implement a system for storing, processing and analyzing information related to the operation of the facilities, the state and failures of the systems and components, and the errors committed by the personnel. The results of the analyzes should be systematically reported and applied to improve operational practice, personnel qualification and maintenance optimization. More information on the requirements for the effectiveness of the management system to ensure safety improvement in the management of SNF can be found, for example, in Art. 2 and Art. 122 of the *Regulation on ensuring safety in the management of SNF*.

Article 6. Siting of Proposed Facilities

"Article 6. Siting of Proposed Facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

i. to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;

ii. to evaluate the likely safety impact of such a facility on individuals, society and the environment;

iii. to make information on the safety of such a facility available to members of the public;

iv. to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

The national legislative framework covers all stages of the life cycle of nuclear facilities, including existing and planned facilities for the management of SNF in Bulgaria.

The Chairman of the BNRA issues permits for:

- determining the location of a nuclear facility (site selection);
- for designing a nuclear facility;
- for construction of a nuclear facility;
- for the commissioning of a nuclear facility.

For the issuance of a site selection permit, a set of documents is required to be submitted with the application, including a conceptual description of the nuclear facility, general characteristics and site acceptability criteria, and a preliminary safety analysis report of the nuclear facility. The permit is issued if there is compliance with the requirements, norms and rules for nuclear safety and radiation protection. The site selection process is the initial stage of the life cycle of the facility as defined in the *Regulation* on Ensuring Safety in the Management of SNF, and the scope and conditions for this process are described in detail in Section II, Chapter III of the same *Regulation*. It is necessary to prepare a preliminary safety assessment report, which is submitted to the BNRA before the approval of the selected site.

The application of environmental impact assessment procedures is a legislative requirement. The decision on the EIA report that has entered into force is a mandatory condition for the approval/authorization of the investment proposal in accordance with a special law. The approving/permitting authority takes into account the nature of the decision, takes into account the conditions, measures and restrictions set in it, and the decision is an annex, an integral part of the administrative act of approval/permitting, necessary for the implementation of the investment proposal.

The *Environmental Protection Act* sets out the statutory requirements for providing information to the public and consulting potentially affected neighboring countries.

Site Evaluation of a Proposed SNF Management Facility

According to the requirements of the *Regulation on ensuring safety in the management of SNF* and the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy*, within the site selection procedure for SF management facilities, the characteristics of the site must be examined and evaluated. which may have an impact on the safety of the facilities. The data that must be contained in the preliminary safety analysis report, which should be submitted with the request for the issuance of an order for approval of the selected site, are specified.

The selection of a site for a SNF storage facility is made based on an assessment of:

• the influence of natural and anthropogenic factors on the safety of the facility;

• the impact of the facility on the environment;

• the radiation impact of the facility on the population;

• the specific characteristics of the site significant for the migration and accumulation of radioactive substances;

• the possibilities of implementing protective measures for the population in case of an accident in the facility.

When the nuclear facility is planned to be located on the site of another nuclear facility already built and commissioned, the preliminary safety analysis report shall consider the possible impact on the safety of the proposed new nuclear facility and of other existing nuclear facilities located on the same site .

Access to safety information and consultation of contracting parties

According to the requirements of the *Environmental Protection Act*, when selecting a site, a public consultation of the results of the EIA is organized jointly by the municipal authorities and the competent authority that issues the EIA decision. The procedure for carrying out EIA is regulated in the *Regulation on environmental impact assessment* for investment proposals for construction, activities and technologies. The competent authority for making a decision on EIA is the Minister of Environment and Water. The EIA decision is taken on the basis of the prepared EIA, the results of the consultations and the public discussion and in accordance with the current legislation.

The Republic of Bulgaria is a party to the Convention on Environmental Impact Assessment in a Transboundary Context. Consultations with other contracting parties likely to be affected by the facility are carried out under the *Environmental Protection Act*, the *Regulation on Environmental Impact Assessment* and in accordance with the Convention.

Article 7. Design and Construction of Facilities

"Article 7. Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

ii. at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

iii. the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis."

The permission regime for determining the location of a nuclear facility (site selection) is established by the *Act on the Safe Use of Nuclear Energy*. In its essence, the permission regime represents a two-level regulatory action - issuing a permit to carry out activities at a selected site and approval by the chairman of the BNRA of the selected site by issuing the relevant administrative act - an order approving the selected site. The design criteria are described in detail in Chapter III of the *Regulation on ensuring safety in the management of SNF*. Among other requirements, the safety of the SNF management facility is ensured by:

• a conservative approach in establishing barriers and levels of protection;

• high quality of design, construction and used equipment;

• implementation of technologies proven in practice.

The procedure for issuing a permit for the construction of a nuclear facility, including a SNF management facility, requires the applicant to submit an interim safety assessment report and a technical design. The national regulatory framework regarding the design stage of a nuclear facility requires the application of procedures for the issuing of a permit pursuant to the *Territory Planning Act* and the *Act on the Safe Use of Nuclear Energy*. The construction of a SNF management facility is based on the approved Technical Design.

The control over the implementation of the regulatory requirements is carried out by the BNRA. The permit holder bears full responsibility for strictly following the approved design, controlling the construction and installation works, the quality of the materials and components used, by applying an appropriate management system.

The design stage as part of the licensing process of the SNF life cycle is presented in Article 19 of this report pursuant to the Convention.

Limitation of possible radiological impacts during the development of the project and the construction of a SNF facility

The main dose limits and dose restraints in the course of designing and construction of a facility for SNF are stipulated in the *Regulation on Radiation Protection* and in the *Regulation on Ensuring Safety* in the Management of SNF.

Evidence of compliance with applicable safety requirements is required during design and construction. The design approval procedure requires an interim safety assessment report to be submitted for regulatory review by the BNRA.

The interim safety assessment report should contain all necessary information to confirm that the radiological effects are in accordance with the dose limits. The results of the safety analyzes as well as the interim safety assessment report are verified by an organization independent of the designer.

The specific requirements for the radiation protection of a facility for the management of nuclear fuel are specified in Chapter V of the *Regulation on ensuring safety in the management of spent nuclear fuel*.

Decommissioning and closure measures in the development of the nuclear facility design

At all stages, including design, of the life cycle of a facility for processing and storage of RAW, as well as for storage of SNF, the licensee plans and implements measures facilitating decommissioning. According to the requirements of the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy*, the safety analysis report of a nuclear facility should include a section "Decommissioning", justifying the concept of decommissioning, the suitability for carrying out the decontamination and the dismantling works and the possibilities of exemption from regulation.

Article 8. Assessment of Safety of the Facilities

"Article 8. Assessment of Safety of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

ii. before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph "i".

Safety assessment

The *Act on the Safe Use of Nuclear Energy* and the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy* require a safety assessment to be carried out during site selection, design, commissioning and operation of a nuclear facility, as well as in case of design changes, decommissioning or closure.

Approval of the technical design requires the submission of an interim safety assessment report covering all aspects of safety for the design life of the facility. The construction permit is based on an approved Technical Design and the interim safety assessment report..

Prior to operation of the facility for SNF management it is required to submit a final safety analysis report for the nuclear facility, which updates the interim safety assessment report, based on the results obtained during the commissioning phase.

Chapter VI of the *Regulation on ensuring safety in the management of SNF* determines the stages for preparing safety assessments. Safety assessments include systematic analysis of internal and external events to demonstrate the facility's ability to ensure safety during normal operation as well as anticipated operational events and design accidents. Safety assessments must demonstrate the ability to perform safety functions, safety criteria, and the achievement of safety objectives. According to the said regulation, the interim safety assessment report and the final safety analysis report of the nuclear facility must reflect the actual condition of the facility throughout its life cycle, including decommissioning.

Safety assessment reports are subject to detailed regulatory review and evaluation. The positive conclusion of the carried out regulatory review is the basis for issuing the relevant permits for construction and commissioning and for a license for operation.

In addition, the *Regulation on ensuring the safety of nuclear power plants* requires periodic safety reviews during the life cycle of the nuclear facility, including the facilities for managing SNF. The procedure and requirements of the periodic safety reviews are specified in the regulation.

Article 9. Operation of Facilities

"Article 9. Operation of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

ii. operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

iii. operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

iv. engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

v. incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

vi. programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

vii. decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body."

License for the operation of SNG management facilities

According to the *Act on the Safe Use of Nuclear Energy*, the operation of nuclear facilities is carried out only by legal entities holding the operation license. Detailed requirements for issuing a license for the operation of facilities for the management of SNF are defined in the Ordinance on ensuring safety in the management of nuclear power plants, the *Regulation on ensuring the safety of nuclear power plants* and the *Regulation on safety in the decommissioning of nuclear facilities*. The license to operate the SNF management facility is granted, inter alia, based on a final safety assessment report.

The BNRA supervises the construction of the facility for compliance with the approved design and construction permit.

After the completion of the construction works, a Program for commissioning of the nuclear facility is presented, according to the regulatory requirements.

A license for the operation of a nuclear facility is issued after fulfilling the conditions of the permit for commissioning of the nuclear facility, established by a commission of inspectors from the BNRA, designated by order of the chairman of the BNRA. The commission verifies the documents submitted by the applicant and conducts an on-site inspection. The documents that must be submitted to the BNRA together with the application for issuing a license to operate a nuclear facility are specified in the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy*.

The operating license is issued after the commissioning program has demonstrated that the SSC fulfill their design functions and safety requirements. The operating license is issued for a maximum period of 10 years. An updated safety assessment report of the nuclear facility is required to renew the operating license. A possibility was discussed that licenses for the operation of nuclear facilities in which nuclear material is used, manipulated or stored would not be time-limited, but the requirement to submit a periodically updated assessment of the safety of the nuclear facility would remain.

Limits and conditions of operation

The operator has the statutory obligations to develop and apply indicators and methodology for assessing the safety level during operation, including a safety self-assessment program, which contains an assessment of the achieved safety level, a comparison with the planned safety level and specific tasks to improve safety.

The operator is obliged to develop and implement a system for storing, processing and analyzing the information related to the operation of the facilities, the status and failures of the systems and components,

and mistakes made by the personnel. The results of the analyzes are systematically reported and applied in the improvement of the operational practice, the qualification of the personnel and the optimization of the maintenance.
According to the regulatory framework, the operation of the facility must be carried out in accordance with the established limits and conditions of operation. The operating limits and conditions are defined and justified based on the design, safety analyzes and commissioning tests. Limits and conditions are subject to periodic review, taking into account operational experience, changes made to structures, systems and components important for safety, new safety analyses, changes in regulations and developments in science and technology. The licensee may establish administrative control levels that are below the operational limits and which can be used as targets for operational improvement.

The Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy requires, together with the application for the issuance of a permit to commission a nuclear facility, that operational limits and conditions be submitted to the BNRA, including:

• safety limits;

• values of the parameters for actuation of the safety systems;

• the operational limits and conditions;

• tests, inspections, supervision and operational control of systems important to safety;

• personnel actions in case of deviations from normal operation.

The requirements of the Regulation on ensuring safety in the management of SNF and the *Regulation on ensuring the safety of nuclear power plants* cover all aspects of the operation of facilities for the management of SNF. The license application is accompanied by detailed and well-documented operational procedures, as required by Chapter IV of the *Regulation on ensuring safety in the management of SNF*.

The technical specification for operation, which contains the operational limits and conditions, was developed on the basis of the design of the facilities and the interim safety assessment report. The technical specification is updated based on the results in the process of commissioning of the nuclear facility and on the basis of the final safety analysis report. At the operational stage, changes to the design of the nuclear facility are made after the issuance of a permit pursuant to the *Act on the Safe Use of Nuclear Energy*. The changes are reflected in the technical specifications.

Compliance with established operating procedures
The requirements for the existence of procedures for operation, maintenance, monitoring and others are defined in the regulations on the implementation of the *Act on the Safe Use of Nuclear Energy*. An appendix to a license to operate a nuclear facility must include a list of the internal rules for carrying out the activity of the licensee, such as instructions, programs, technological regulations and others, the significant change of which affects nuclear safety, radiation protection, physical protection or emergency preparedness of the facility. The Kozloduy NPP Plc has introduced the system of procedures for carrying out assessments and analyses, as well as a procedure for making decisions on corrective measures and evaluating their effectiveness in relation to feedback from operational experience. The BNRA carries out regulatory control for compliance with all requirements. Also, the BNRA carries out regular reviews, including of reported events and the implementation of corrective measures, and inspections according to an approved annual inspection plan.

Engineering and technical support

The *Act on the Safe Use of Nuclear Energy* requires that technical support be provided in all safety-related areas throughout the life cycle of a nuclear facility.

According to the *Regulation on ensuring safety in the management of SNF*, during the operation of the SNF facility, the licensee provides engineering and technical support, with the aim of analyzing the behavior of structures, systems and components important for safety, justifying the proposed changes in the design and in the operational documentation, analysis of operational experience and operational events.

Event reporting and operational experience analysis

The licensee must develop and implement a system for storing, processing and analyzing the information related to the operation of the facilities, the status and failures of the systems and components and the errors made by the personnel. The results of the analyzes should be systematically reported and applied to improve operational practice, personnel qualification and maintenance optimization. The requirements for providing information to the BNRA by a licensee or permit holder, including requirements for mandatory notification to the BNRA in case of an event, incident or accident, are set out in the *Regulation on the Terms and Procedures for Notifying the Nuclear Regulatory Agency of Events at Nuclear Facilities* , in sites and during activities with sources of ionizing radiation and when transporting radioactive substances. The *Regulation* determines the procedure, conditions and deadlines for notifying the regulatory body, as well as the methods for evaluating and analyzing the events and the structure and content of the reports on the events that have occurred.
In the period after the publication of the seventh national report, no operational event related to the management of SNF has been reported.

Analysis of operating experience

The *Act on the Safe Use of Nuclear Energy* requires the operator of a nuclear facility, including SNF management facilities, to conduct systematic safety assessments and to monitor and analyze operational experience gained at comparable facilities.
The *Regulation on Ensuring Safety in the Management of SNF* requires the operator to include operational experience gained during safety assessments and to determine the relevance to its facility of operational experience gained at comparable facilities.
The responsibilities of the operator for the development and implementation of indicators and methodology for assessing the level of safety during operation, including a self-assessment program that contains an assessment of the level of safety achieved, a comparison with the planned level of safety and specific tasks for improving safety, are provided for in the *Regulation on ensuring safety in the management of SNF*.

As a result of the feedback from the operational experience in activities with SNF at Kozloduy NPP Plc, the following measures were implemented in the period 2020÷2023:
• a new level and temperature control system was installed in the sections of the spent fuel pool;
• a partial modernization of the control system of th MPHOG-440/1000 refuelling machine was carried out;
• modernization of the system for limiting the overloading of the lift 160 t of an electric bridge crane 160/32/8 t in the WSFSF.

Plan for Decommissioning / Closure of a Facility

In accordance with the *Regulation on safety during the decommissioning of nuclear facilities* and the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy*, a periodic update of the decommissioning plan is required for issuing and renewing an operating license. At the same time, the decommissioning cost estimate is updated.

The development of the decommissioning plans for the SF management facilities is discussed in Section F of this report and in the texts under Article 26 of the Convention.

Article 10. Disposal of Spent Fuel

"Article 10. Disposal of Spent Fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste."

According to the Bulgarian legislation, the Council of Ministers can declare SNF as RAW under the conditions specified in the *Act on the Safe Use of Nuclear Energy*.

The *Regulation on ensuring the safety of SNF management* stipulates that the state is responsible for the safe disposal of SNF, including secondary products, when SNF is processed in a third country.

The national strategy for the management of SNF and RAW defines reprocessing as a specific policy for SNF management, and direct disposal of SNF is not foreseen for now.

The deep geological repository is accepted as the most appropriate option for long-term safety assurance in the isolation of highly active and long-lived RAW, as provided for in Art. 18, item 5 of the *Regulation on Safety in the Management of RAW*.

SECTION H: SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Article 11. General Safety Requirements

"Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

i. ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

ii. ensure that the generation of radioactive waste is kept to the minimum practicable;

iii. take into account interdependencies among the different steps in radioactive waste management;

iv. provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

v. take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

vi. strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

vii. aim to avoid imposing undue burdens on future generations."

General safety requirements

The requirements introduced by the Act on the Safe Use of Nuclear Energy, the Health Act and the *Environmental Protection Act* and their implementing regulations ensure the protection of individuals, society and the environment from harmful effects, including radiation effects, at every stage from the RAW management.

Control and confirmation of compliance with the regulatory requirements in the field of nuclear safety and radiation protection is carried out by the chairman of the BNRA and the ministers of health and the environment, within the framework of the licensing process.

RAW should be managed in such a way as not to allow an undue burden to be transferred to future generations. Accordingly, RAW generators should seek and implement safe, practical and environmentally friendly solutions in their long-term management.

The management of RAW is carried out by legal entities after obtaining a permit and/or license for the relevant activity. Responsibility for ensuring nuclear safety and radiation protection in nuclear facilities is borne in full by the persons responsible for the facilities and activities, as specified in the relevant license or permit.

The *Regulation on Safety in RAW Management* details the safety requirements at each stage of the RAW management life cycle, including the basic obligations of the licensee.

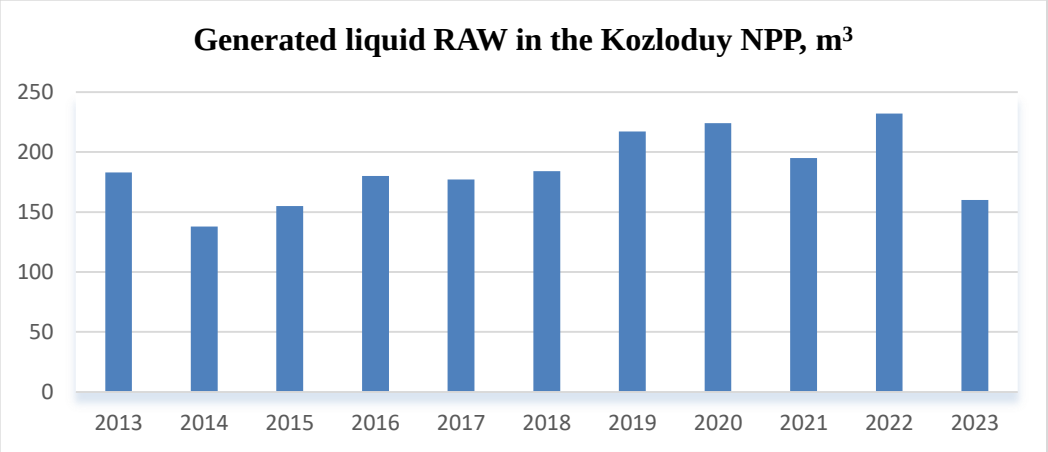
Ensuring subcriticality and removal of residual heat

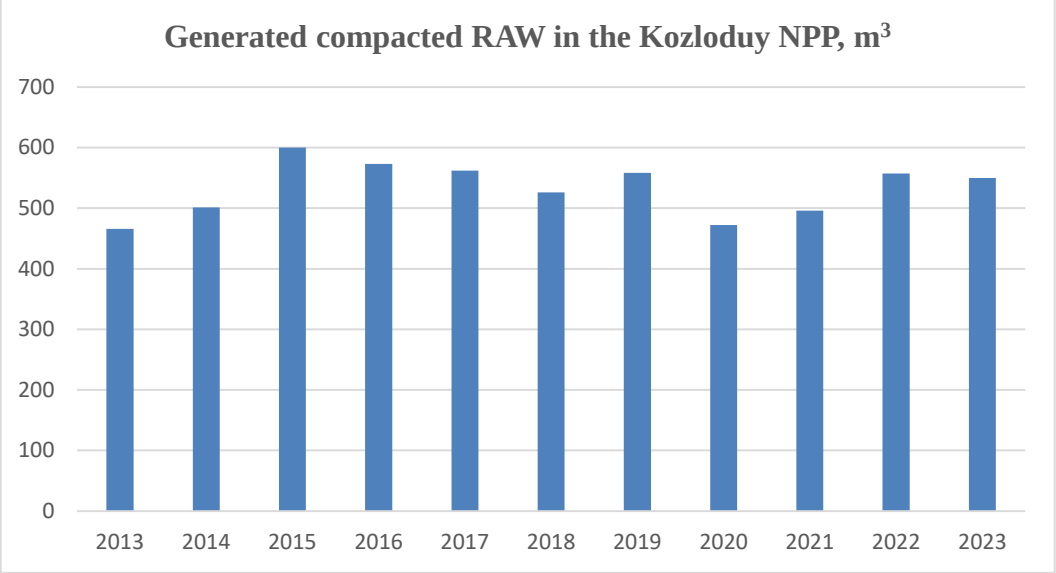
In accordance with the *Regulation on Safety in the Management of RAW*, the licensee should ensure that the issues of subcriticality and removal of residual heat during RAW management are adequately addressed. In case it is necessary, the design of a facility for storing or disposing of RAW should contain technical solutions for maintaining subcriticality and ensuring removal of the residual heat. The existing in the Republic of Bulgaria facilities and activities for processing RAW do not require special measures to ensure subcriticality and removal of the residual heat. This is substantiated in the relevant safety reports and assessed during the licensing process, including being controlled through the permit regime under Art. 15, para. 4, i. 5 of the *Act on the Safe Use of Nuclear Energy*. In cases where RAW contains fissile material, the national legislation on SNF applies.

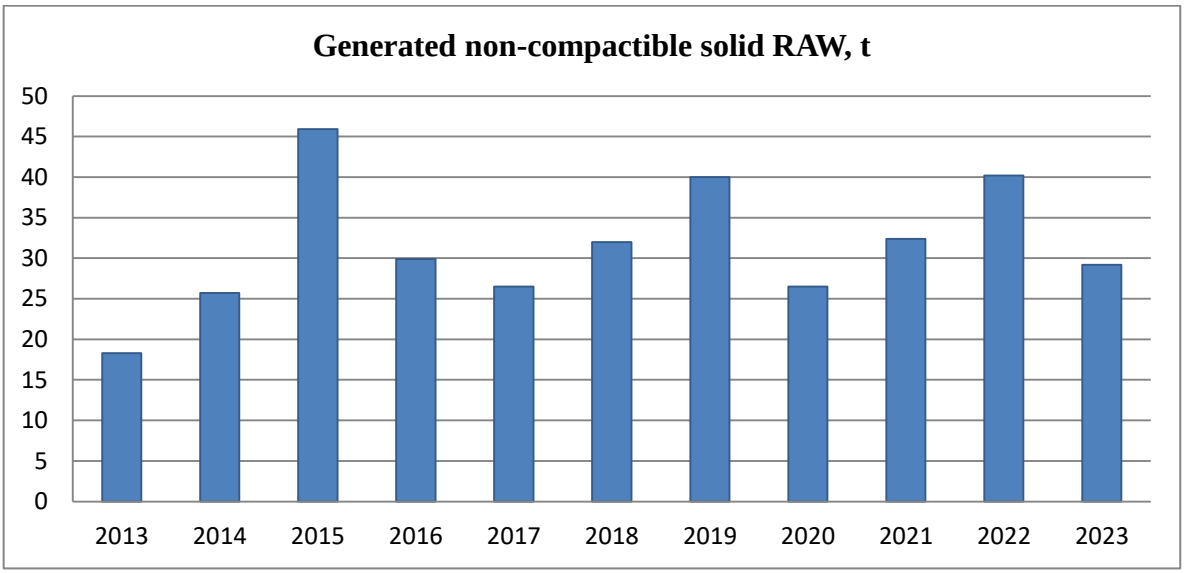
RAW minimization

The requirement to minimize the generated RAW is detailed in the *Regulation on Safety in the Management of RAW*. Limiting the generation of RAW at the source of their formation takes priority over measures to reduce the volume and activity of RAW in their subsequent management. These requirements must be taken into account at the stage of design, construction, operation and decommissioning of the nuclear facility.

To achieve the minimization of RAW generation, the necessary organizational and technological measures are applied during daily work at the Kozloduy NPP. As a result, the data for the period 2013 - 2023, presented in the table below, show the practical effect of the implementation of the requirements for the minimization of RAW. The data show the achievement of a sustainable acceptable level of the amount of RAW generated during the operation of the Kozloduy NPP.







As a result of the implemented measures to minimize the currently generated RAW from the Kozloduy NPP, the capacity of the existing RAW processing facilities is sufficient for timely processing, including historical RAW.

Along with limiting the generation of RAW, the necessary attention is also paid to the requirements for minimizing the amounts of RAW for disposal, by means of the application of appropriate treatment and conditioning methods. In SE RAW-Kozloduy practices are implemented to minimize the volume of RAW subject to disposal by reducing the volume of RAW to be compacted. The concept of exemption from regulatory control is applied, and procedures for exemption from regulation of materials (unconditional or conditional exemption) related to decommissioning activities of nuclear facilities and decommissioned metallic RAW have been implemented. The commissioning of the plasma incineration plant provides a significant reduction in the volumes of RAW for disposal.

Consideration of the interdependence of the various steps in the management of RAW

According to the *Regulation on Safety in RAW Management*, operators of nuclear facilities should take into account the interrelationships between the various stages of RAW management. It is required that the RAW management activities are carried out in such a way as to facilitate the future steps of the management of the respective RAW. These requirements are reflected in the program of Kozloduy NPP Plc for RAW management.

The applied methods for RAW processing must guarantee compliance with the acceptance criteria regarding the subsequent steps in RAW management - processing, storage and/or disposal, carried out by the SE RAW.

The requirements towards the process of the physical transfer of RAW between operators of various nuclear facilities are settled by the *Regulation* on the terms and conditions for the transfer of radioactive waste to the State Enterprise "Radioactive Waste", and are part of the established mechanism for accounting for the interrelationships between the individual stages in the management of RAW.

In the Republic of Bulgaria, a facility for disposal of RAW is currently being built. The technical specifications of the existing packaging, which are approved by the BNRA, were taken into account when developing the design foundations of the facility for RAW disposal.

Protection of individuals, society, the environment and future generations

The protection of human life, health and living conditions of present and future generations is a fundamental principle introduced by Article 3 of the *Act on the Safe Use of Nuclear Energy*.

Detailed information on the implementation in the national legislation of the generally accepted principles for dose limitations, substantiating practices and optimizing the protection of personnel and members of the

population is presented in Section F of this report (Article 24 of the Convention).

The dose restraints adopted in the Bulgarian legislation regarding facilities for the disposal of RAW, which facilities would have an impact on future generations, are not more liberal than the currently effective dose restraints for the population. The specific values, as well as the applied approaches for dose restraints, are discussed in section F, art. 24 of this report.

Biological, chemical and other risks

The possible risks of the harmful effects of various biological, chemical or other factors are subject to national legislation in the field of health care and environmental protection. Article 15 of the *Regulation on the Safety in the Management of RAW* provides specific requirements for RAW management, which take into account the biological, chemical and other risks arising from the management of RAW.

The assessment of biological, chemical and other risks is the subject of an EIA and is required under the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy* for the various stages of the life cycle of each nuclear facility.

Avoiding the transfer of undue burden to future generations

The Bulgarian legislation is based on the principle of not allowing the transfer of an undue burden on future generations. In the *Regulation on Safety in the Management of RAW*, this principle is developed in the direction of timely processing of RAW until they are brought to a safe form in the long term, as well as for the timely disposal of the processed waste. The regulation defines the requirements for post-closure control of the RAW management facilities and for monitoring, in accordance with the results of the assessments made. The construction of a National Repository for the disposal of RAW and the choice of a concept for disposal of highly active and long-lived RAW confirm the principle of protection and non-burdening of future generations introduced by the Strategy for the Management of SNF and RAW.

More detailed information about the activities for the construction of a National Disposal Facility for low and intermediate level RAW is contained in the report under Art. 13 and in Section K of the Convention and for the other planned measures - in the report under Section K.

Concepts about the process of decommissioning of nuclear facilities have also undergone development in recent years. The updated strategy for the decommissioning of units 1-4 of the Kozloduy NPP adopts the concept of immediate dismantling and the provision of the necessary financial resources for RAW management, including decommissioning, without burdening future generations.

Article 12. Existing Facilities and Past Practices

"Each Contracting Party shall in due course take the appropriate steps to review:

i. the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

ii. the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention."

Section D presents an overview of the existing facilities for RAW management managed by the Kozloduy NPP Plc and SE RAW. These facilities are licensed under the *Act on the Safe Use of Nuclear Energy*.

The national regulatory framework clearly defines responsibilities for the development of safety assessments and for the review of RAW facilities, both for new and existing facilities.

The established regulatory system ensures continuity of responsibility for safety at the various stages in the management of RAW, including during the transfer and acceptance of RAW for subsequent safe management by the State Enterprise RAW.

Existing facilities

Pursuant to the *Act on the Safe Use of Nuclear Energy*, the regulatory review of nuclear facility safety assessment reports is carried out by the BNRA.

The national legislation stipulates a requirement for the renewal of the license for the operation of nuclear facilities, the duration of which cannot be longer than 10 years.

The Kozloduy NPP Plc has structures, systems and components for RAW processing and storage. The operation of these structures, systems and components is carried out within the framework of the license for the operation of the nuclear power plant. The review of the safety of structures, systems and components for the processing and storage of RAW is carried out within the framework of the periodic safety reviews of the NPP.

In 2021 and 2023, periodic safety reviews were completed for Unit 5 and Unit 6 of the Kozloduy NPP, as a result of which an integrated program was prepared for the implementation of measures from the periodic safety reviews. This program and the updated safety analysis report, in accordance with the results of the LTO project, are submitted to the BNRA as part of the package of documents required for each unit's license renewal.

The regularly required periodic safety reviews were carried out for the RAW management facilities operated by the State Enterprise RAO through the SD RAW - Kozloduy and the SD Centralised Storage Facility - Novi Khan". Safety assessment reports are developed, updated and submitted for review by the BNRA as part of the procedure for renewing the relevant licenses.

As a result of the carried out regulatory control of the submitted documents, transitional conditions were formulated in the licenses, which oblige the licensee to implement specific technical and organizational measures within certain deadlines. Thus, the process of continuous improvements in the safety of nuclear facilities is guaranteed.

The results of the assessments prove that adequate protection of the personnel and the population is ensured under normal and emergency conditions of operation of the nuclear facilities. The radiation impact on the population and the environment is negligible.

Past practices

In accordance with the requirements of the *Regulation* on the terms and conditions for the transfer of radioactive waste to the State Enterprise "Radioactive Waste", measures are implemented for the acceptance and management of RAW from past practices, including spent sealed sources whose owners are unknown or originate from enterprises, declared bankrupt.

The information on RAW management from past practices (uranium mining and uranium processing industry in the past, research reactor IRT-2000) is presented in the seventh national report under the Joint Convention. Following the complete removal of SNF from the research reactor in 2008, the IRT-2000 has been removed from the list of nuclear spent fuel management facilities. The RAW from operation and the conditioned RAW from the partial dismantling of the reactor have been transferred to SE RAW for subsequent management and are reported in the inventory report of SE RAW. The decommissioning of IRT-2000 as a facility with radioactive substances is pending in accordance with the requirements of the *Act on the Safe Use of Nuclear Energy*.

Article 13. Siting of Proposed Facilities

"Article 13. Siting of Proposed Facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

i. to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

ii. to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

iii. to make information on the safety of such a facility available to members of the public;

iv. to consult Contracting Parties in the vicinity of such a facility, insofar as they are

likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11."

The existing and planned RAW facilities in the Republic of Bulgaria are part of the RAW management infrastructure and the established national legislative framework covering all stages of the life cycle of a nuclear facility.

According to the *Act on the Safe Use of Nuclear Energy*, a permit is issued by the Chairman of the BNRA for the selection of a site for the deployment of a nuclear facility.

The site selection process is an initial stage in the life cycle of a nuclear facility for RAW as defined in the *Regulation on the Safety of RAW Management*. The scope and conditions for site selection and approval are detailed in Section II, Chapter IX of this *Regulation*. A necessary condition for issuing the relevant site selection permit is the preparation of a preliminary report on the safety analysis of the nuclear facility. The site selection process is carried out in four phases, with the necessary documents to be submitted to the BNRA. The four phases include:

- development of a concept for disposal and planning the activities related to site selection
- data collection and analysis of the regions, which includes:

- analysis of the regions - an analysis and assessment of the territory of the entire country is carried out, excluding large areas with unfavorable conditions for the placement of a facility for RAW disposal and determining the areas for analysis that represent large areas with favorable geological-tectonic, geomorphological (topographical), hydrogeological, engineering-geological, hydrological, climatic and other characteristics;

- selection of prospective sites - in the areas for analysis under letter "a", the potential sites that meet the criteria for locating a disposal facility are located, and the prospective sites for further research are designated;

- characterization of the sites - the designated sites are thoroughly investigated and one site is selected;

- site confirmation.

Applying environmental impact assessment procedures is a legal requirement. The presence of a positive decision on the EIA report from the Minister of Environment and Water is a necessary condition for obtaining a design visa under the *Territorial Planning Act*.

The Environmental Protection Act contains the regulatory requirements for providing information to the public and consulting potentially affected neighboring countries.

Assessment of the Site for a Proposed RAW Management Facility

The permissive regime for site selection for a RAW management facility is the same as for any other nuclear facility. Site approval requires the submission of a preliminary safety analysis report, taking into account all factors related to site safety that may affect the safety of such a facility during its lifetime, as well as the long-

term safety of a facility for disposal after its closure.

The selection of a site for a facility for the processing and storage of RAW is carried out on the basis of an assessment of:

• the influence of natural and anthropogenic factors on the safety of the facility;

• the impact of the facility on the environment;

• the radiation impact of the facility on the population; • the specific characteristics of the site relevant to the migration and accumulation of radioactive substances;

• the possibilities of implementing protective measures for the population in case of an accident in the facility.

In the selection of a RAW disposal facility site, the safety assessment of the facility is aimed at assessing the impact of the natural characteristics of the site upon the engineering barriers provided for in the technical design. This ensures the integrity of the protective barriers for the longest possible period of time and proves the capability of the site, in combination with the chosen disposal concept, to ensure the protection of the population while complying with dose limits and restrictions for the population.

Access to safety information and consulting neighboring countries about RAW management facilities
Access to information on the safety of proposed facilities for the management of RAW is mainly guaranteed by the application of the provisions of the *Environmental Protection Act* and the implementation of the mandatory EIA procedure of such investment intention.
In the case of the investment proposal for the construction of the National Repository for RAW disposal, an Environmental Impact Assessment Report was developed based on terms of reference approved by the Ministry of Environment and Water to determine the scope and content of the EIA. Public hearings on the Report were held in the settlements of the region.

According to the requirements of the *Environmental Protection Act*, when choosing a site, a public hearing of the results of the EIA is organized jointly by the municipal authorities and the competent authority that issues the EIA decision. The procedure for carrying out EIA is delineated in the *Regulation on environmental impact* assessment for investment proposals for construction, activities and technologies. The competent authority for making a decision on EIA is the Minister of Environment and Water. The EIA decision is taken on the basis of the prepared EIA report, the results of the consultations and the public hearings and in accordance with the current legislation.
The Republic of Bulgaria is a party to the Convention on Environmental Impact Assessment in a Transboundary Context. Consultations with other contracting parties likely to be affected by the facility are carried out under the *Environmental Protection Act*, the *Regulation on Environmental Impact Assessment* and in accordance with the Convention. In connection with the construction of the NDF, the Republic of Romania has been notified with the information under Art. 3 of the Convention and a public hearing was held.

Additional information related to the selection of site for NDF is presented in the report under Section K.

Article 14. Design and Construction of Facilities

"Article 14. Design and Construction of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

ii. at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

iii. at the design stage, technical provisions for the closure of a disposal facility are prepared;

i. iv. the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis."

The *Act on the Safe Use of Nuclear Energy* establishes a permitting regime for the stages of design and subsequent construction of a nuclear facility.

Design requirements and criteria are detailed in Section III, Chapter IX of the *Regulation on the Safety in the Management of RAW*, and for the construction of a nuclear facility for RAW in Section IV, Chapter IX of the same *Regulation*.

The design basis define the necessary qualities of structures, systems and components, with a view to ensuring safety functions and contain design limits, operating conditions, safety classification of these structures, systems and components, important design assumptions and, in some cases, special analysis methods. The application of approved methods and technologies for the processing of RAW in the design process is also a regulatory requirement.

For regulatory review and assessment of the design, an interim safety assessment report is required, in which compliance with the regulatory requirements for providing radiation protection to personnel and members of the public must be substantiated. The design stage ends with the issuance of an order by the chairman of the BNRA to approve the Technical design.

The construction of a RAW management facility is based on the approved Technical Design.

The operating organization bears full responsibility for the strict adherence to the approved design, controlling the construction and installation works, the quality of the materials and components used, by applying an appropriate management system. Regulatory control over the implementation of normative requirements is carried out by the BNRA.

The design is also subject to approval under the *Territorial Planning Act*.

Limitation of possible radiological impacts during development of the design and construction of a radioactive waste management facility.

The main dose limits and constraints, including the specific requirements for the design of a nuclear facility for RAW management, which must be observed in the desgn, are stipulated in the *Regulation on Radiation Protection* and the *Regulation on Safety in RAW Management*.

For designed nuclear facilities and those under construction, it is necessary to provide evidence of compliance of the design with all applicable safety requirements. The procedure for issuing a design permit and approving the technical design requires the licensee to submit an interim safety assessment report, which is subject to review by the BNRA and must contain all the necessary information to confirm that possible radiation impacts are limited to regulated acceptable levels. The results of the safety analyzes in the interim safety assessment report must be verified by an organization independent of the designer of the specific facility.

Mesures for decommissioning and closure in the development of the nuclear facility design

The design of a RAW management facility should contain technical solutions facilitating decommissioning.

The regulatory framework requires the interim safety assessment report to also include a "Decommissioning" section, justifying the concept of decommissioning, the suitability for carrying out the decontamination and dismantling works and the possibilities for exemption from regulation.

In the case of a RAW disposal facility, the interim safety assessment report must include a "Post-closure safety analysis" section, in which the long-term stability of the facility and of the exposure of the population during normal operation and in case of damaged protective barriers will be assessed, including human intrusion at the site.

The National Repository for the disposal of low- and medium-level radioactive waste is under construction and is scheduled to be completed in 2024.

Article 15. Assessment of the Safety of Facilities

"Article 15. Assessment of the Safety of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

ii. in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

iii. before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i)"

Safety assessment

The *Act on the Safe Use of Nuclear Energy* and the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy* require a safety assessment to be carried out during the site selection, design, commissioning and operation of nuclear facilities, as well as in case of changes to the decommissioning project or closure.

Approval of the technical design requires the submission of an interim safety assessment report covering all aspects of safety for the design life of the facility. The construction permit issued by the BNRA chairman is based on the approved technical design and the interim safety assessment report.

Approval of the technical design requires the submission of an interim safety assessment report, which must take into account the hazards that the facility may pose throughout its design life. A subsequent construction permit can be issued based on the approved Technical Design. Obtaining a license to operate a nuclear facility for the management of RAW requires the submission of a final safety assessment report, which updates and details the interim safety assessment report based on the results obtained during the commissioning phase.

Safety assessments include a systematic analysis of internal and external hazards to demonstrate the facility's ability to ensure safety under normal operation and expected operational events and design basis accidents.

When applying the graded approach, the available inventory of RAW and possible radioactive discharges into the environment are taken into account in all operating conditions and emergency conditions, including for events with a very low probability of occurrence, but with significant radiation consequences.

In addition, the *Regulation on the Safety in RAW Management* requires the operator to perform periodic safety reviews, which also include safety assessments during the operation of a RAW management facility. The procedure and requirements for carrying out a periodic safety review are detailed in the *Regulation* on ensuring the safety of nuclear power plants.

The safety assessment of a nuclear facility for waste disposal must cover a period of time sufficient to reach the maximum estimated exposure dose to the population. Exposure estimation models used must be verified and evaluated to gain confidence in their applicability for the time period being evaluated. The safety assessment substantiates the measures to limit the release of radionuclides into the environment in the event of human activity after the closure of the RAW disposal facility and considers the low-probability natural events and human activity that may affect the functioning of the facility's physical barriers.

Safety assessment reports are subject to regulatory review and assessment, on the basis of which the relevant building permits and operating licenses are issued.

In the case of an investment proposal for a RAW disposal facility, the EIA report is prepared on the basis of Terms of reference approved by the Minister of Environment and Water. Public hearings on the EIA report are held in the settlements in the respective region.

These requirements also apply to facilities for processing and storing RAW

Article 16. Operation of facilities

"Article 16. Operation of Facilities

Each Contracting Party shall take the appropriate steps to ensure that:

i. the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning program demonstrating that the facility, as constructed, is consistent with design and safety requirements;

ii. operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

iii. operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

iv. engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

v. procedures for characterization and segregation of radioactive waste are applied;

vi. incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

vii. programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

viii. decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

ix. plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body."

Licenses for the operation of RAW management facilities

According to the *Act on the Safe Use of Nuclear Energy*, the operation of nuclear facilities is carried out only by legal entities holding an operation license.

Detailed requirements for issuing a license for the operation of RAW management facilities are defined in the Regulation on Safety in the Management of RAW, the *Regulation on Ensuring the Safety of Nuclear Power Plants* and the *Regulation on Safety in Decommissioning of Nuclear Facilities*.

A license for the operation of a nuclear facility for the management of RAW is issued for a period of up to 10 years. For the renewal of the operating license, the reports from the periodic safety review of the nuclear facility, which take into account the current regulatory requirements, the actual condition of the nuclear facility and the intended operational period, are also attached to the application.

Limits and conditions of operation

According to the *Regulation on Safety in RAW Management*, the operation of the RAW management facility must be carried out in accordance with the limits and conditions for operation. The limits and conditions for operation are defined and justified based on the design, safety analyzes and commissioning tests. Limits and conditions are subject to periodic review, taking into account operational experience, changes made to structures, systems and components important for safety, new safety analyses, changes in regulations and developments in science and technology. The licensee may establish administrative control levels that are below the operational limits and which can be used as targets for operational improvement.
The Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy requires, with the application for the issuance of a permit for commissioning of a nuclear facility, to submit to the BNRA the limits and conditions of operation, including:

• safety limits,

• values of safety system actuation parameters,

• operational limits and conditions,

• tests, inspections, supervision and operational control of systems important to safety,

• personnel actions in case of deviations from normal operation.

The limits and conditions for the operation of the RAW management facilities are an integral part of the main operating document - the technical specification for the operation of the nuclear facility, which also contains the rules for safe operation and the general order for the implementation of technological operations related to safety.

Any amendment to the technical specifications, respectively to the limits and conditions of operation, is subject to a permitting regime.

Compliance with established operating procedures

The requirements for the existence of procedures for operation, technical support, monitoring and others are defined in the normative documents.

According to the *Regulation on Safety in the Management of RAW*, during the operation of a RAW management facility, it is necessary to ensure that diagnostics, maintenance, repair, testing and supervision of SSC, important for safety, are carried out in accordance with schedules, repair and supervision procedures and instructions for ensuring the design indicators of reliability and operability, as well as the implementation of corrective measures to eliminate the inconsistencies of the treated RAW or the stored packaging with the technical requirements.

The compliance with the regulatory requirements and the adequacy of the procedures is checked within the licensing process, both during the issuance of licenses and permits, and during the ongoing control of the fulfillment of the conditions of the issued licenses and permits.

The application of the procedures is also subject to topical inspections according to the annual inspection plan of the BNRA, as well as subsequent control over the implementation of the given recommendations and prescriptions.

During the operation of the RAW management facility, the licensee is required to analyze, according to written procedures, the operation of the structures, systems and components important to the safety, operational experience, as well as the processes of the management system.

Technical Support

The *Act on the Safe Use of Nuclear Energy* requires adequate technical support in all safety-related areas throughout the lifetime of the facility.

According to the *Regulation on Safety in Radioactive Waste Management*, during the operation of the RAW management facility, the licensee must provide support for the activities in order to analyze the behavior of structures, systems and components important for safety, justify the proposed changes in the design and operational documentation, analysis of operational experience and operational events, as well as the effectiveness of the RAW management system.

Characterization and sorting of waste

According to the *Regulation on Safety in RAW Management*, the criteria for accepting RAW for processing, storage and disposal in a specific nuclear facility are determined by the operator and are subject to approval by the BNRA. The licensee must develop and implement procedures for the characterization and sorting of waste, taking into account the peculiarities of the technological process and the relationships between the various steps in the management of RAW.

The procedures for the characterization of the RAW of Kozloduy NPP Plc are aimed at determining the characteristics of the RAW with a view to the possibilities for the subsequent sorting, processing and conditioning, and ensuring the radiation protection of the personnel during their handling. Wide-ranging

studies were conducted to characterize the liquid RAW from the Kozloduy NPP in terms of determination of difficult-to-measure radionuclides, maintenance of scaling factors and nuclide vectors.

Information related to the projects for RAW characterization and radiological investigation of the installations of Units 1-4 is presented in Section K of this Report.

Event reporting, operational experience analysis

The obligation of licensees to report operational events (deviations from normal operation, incidents or accidents) is established in Article 19 of the *Act on the Safe Use of Nuclear Energy*. The specific requirements are defined in the *Regulation on the conditions and procedure for notifying the BNRA of events in nuclear facilities* and sites with sources of ionizing radiation and in the transport of radioactive materials. The *Regulation* also defines the sequence and deadlines for notifying the regulatory authority, the methodology to be applied for the classification of events according to the IAEA INES scale, as well as the structure and content of the analysis report.

According to the *Regulation on Safety in RAW Management*, during the operation of a RAW management facility, an analysis of operational events significant for safety is performed and corrective measures are applied to prevent the recurrence of operational events. An operational experience feedback program is required to document, classify, analyze and archive technological and radiation parameters, failures of structures, systems and components important for safety, operational events and safety indicators.

A means of review and analysis of the own operating experience is the system of safety indicators developed by the operator of each nuclear facility as a condition under the issued licenses for the operation of a nuclear facility. The results of the condition review and trends are presented periodically in the BNRA.

Facility Decommissioning / Closure Plan

In accordance with the *Regulation on safety during the decommissioning of nuclear facilities* and the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy*, a periodic update of the decommissioning plan is required for the issuance and renewal of an operating license. At the same time, the decommissioning cost estimate is also updated. In the case of a RAW disposal facility, submission of a closure plan is required.

When updating the decommissioning/closure plan, the current regulatory requirements and the current state of the nuclear facility are taken into account. The updated plans are subject to review by the BNRA as part of the process of issuing/renewing the operating license.

The requirements for the closure plan (structure and content) are detailed in Art. 43 of the *Regulation* on Safety in RAW Management.

The closure plan contains the operational history of the facility, including a description of significant operational circumstances and events related to the closure.

In 2023, the development of a final plan for the decommissioning of Centralised Storage Facility - Novi Khan began.

Detailed information for these facilities can be found in Appendix L-3.

Article 17. Measures for departmental control after closure

"Article 17. Measures for departmental control after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

i. records of the location, design and inventory of that facility required by the regulatory body are preserved;

ii. active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

iii. if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary."

The requirements for institutional control after the closure of RAW disposal facilities have been introduced into the legal framework after the First Review of the fulfillment of the obligations of the Republic of Bulgaria under the Joint Convention.

Section VI, Chapter IX of the *Regulation on the Safety of RAW Management Safety* sets out the requirements for ensuring institutional control and monitoring mechanisms to ensure the safety of RAW storage and disposal facilities, both during operation and after closure.of the facility.

Record keeping

Pursuant to Art. 44 of the *Regulation on the safe management of RAW*, the closure activities of RAW disposal facilities include updating and archiving of all operational information for the previous stages of the life cycle of the disposal facility, including the initial design documentation and the structural changes made during operation and closure of structures, systems and components important to the safety of the relevant facility. The operator of a RAW disposal facility is required to develop and implement within its management system operational procedures to maintain the documentation control process and record keeping in order to ensure the traceability of the entire inventory of that facility, in particular the characteristics (radiological, chemical, physical and mechanical) for each individual RAW package and the emplacement/location.

Institutional control

According to the *Regulation on the Safety of RAW Management*, the closure of a RAW disposal facility is based on a technical design for the implementation of the activities and an assessment of the safety of the facility after its closure. Two types of institutional control are regulated - active and passive. The closure plan should specify organizational measures necessary for institutional control, including storage of information related to the disposal of RAW. For a surface disposal facility, the duration of the active control phase shall not be less than 50 years and the total duration of institutional control may not exceed 300 years. Active control includes monitoring, access control, minimal technical maintenance of the site's infrastructure. In the period of passive control, it is necessary to apply an administrative measure to control land use. The plan for closing the repository also defines the specific measures for institutional control - for radiation monitoring, site investigation and the applicable restrictions on the use of the site. Institutional control after closure of the RAW disposal facility is carried out by state bodies authorized to implement the planned measures. According to Art. 45 of the *Regulation on Safety in RAW Management*, the responsibilities for institutional control are assigned by a decision of the Council of Ministers. The Council of Ministers also designates the entities responsible for identifying, addressing and implementing active remediation work and corrective actions on site.

Intervention measures

Pursuant to Art. 60 of the *Regulation on Safety in the Management of RAW*, the intervention in the event of an unplanned leakage of radioactive materials into the environment after the closure of the disposal facility is based on the levels of intervention established in the *Regulation on Emergency Planning and Emergency Preparedness* in the event of a nuclear and radiation accident. Active remediation works and on-site corrective measures during the phase of active institutional control may be carried out if the results of the conducted monitoring do not comply with the safety requirements, and if the effectiveness of the intervention measures is justified.

SECTION I. CROSS-BORDER TRANSPORT

Член 27. Cross-border transport

"Article 27. Transboundary Movement

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instrument.

In so doing:

i. a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

ii. transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

iii. a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

iv. a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

v. a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

i. the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

ii. rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

iii. the right of a Contracting Party to export its spent fuel for reprocessing;

iv. rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin. "

Transboundary transport of spent nuclear fuel and RAW is a regulated activity under the *Act on the Safe Use of Nuclear Energy*. Transboundary transport can only be carried out after prior notification to the country of destination and corresponding confirmation. Before shipment to a third country, the Republic of Bulgaria takes measures to ensure that the safety level of the SNF and RAW management infrastructure (administrative and technical capacity and regulatory structure) in the country of destination is equivalent to the safety standards established by legislation of the EU or that the country of destination is a party to the Joint Convention.

International transport on the territory of the Republic of Bulgaria is carried out after the issuance of a license or permit, and after the applicant has submitted the required administrative acts and documents, including for approval of the structures of the relevant packages.

The Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy requires that the following documents must be attached to the application for the issuance of a transport permit:

• transport permits or their corresponding administrative acts, issued by the competent authorities of the country receiving the cargo and of the countries through which transit transport will take place - in the case of export of nuclear material;

• documents regulating the relationship between the consignor and the consignee and between the applicant and the subcontractors related to the transport carried out on the territory of the country;

• administrative acts issued by the relevant competent authorities for the approval of transport packaging in accordance with the requirements of the *Regulation on the terms and conditions for carrying out the transport of radioactive substances*;

• documents certifying that if the shipment cannot be carried out or the conditions cannot be fulfilled, the applicant will return the cargo to the point of departure and the consignor will accept the cargo.

The requirements for safety during transport are defined in the *Regulation on the conditions and procedure for carrying out the transport of radioactive substances*, which was developed in accordance with the requirements of the IAEA safety standards for the transport of radioactive materials, as well as with the requirements of the relevant international rules for transport of dangerous goods:

• European Agreement on the International Carriage of Dangerous Goods by Road (ADR);

• Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) of the Central Office for International Carriage by Rail (OCTI) – these regulations constitute an appendix to the Convention on International Transport by Rail (COTIF);

• European Agreement for the International Carriage of Dangerous Goods by Inland Waterways (ADN)

• Technical instructions for safe transportation of dangerous goods by air (ICAO – Technical Instructions);

• International Maritime Dangerous Goods Code (IMDG Code by IMO).

In the case of international transport within the European Union, the chairman of the BNRA issues a document confirming the international transport, subject to the consent of the other countries involved in the relevant international transport, or a document containing written consent to carry out the transport through the territory of the Republic Bulgaria.
The Republic of Bulgaria complies with its obligation not to license the transport of SNF or RAW to a destination south of 60 degrees south latitude for storage or disposal.
In the period after the submission of the seventh national report, two shipments of SNF for processing in the Russian Federation were carried out, respectively in 2020 and 2021. When issuing the relevant permits, it was taken into account that the Russian Federation meets the guiding and additional criteria described in the Recommendation of the Europen Commission of December 4, 2008 regarding the criteria for export of RAW and SNF to third countries.

SECTION J: DECOMMISSIONED CLOSED SOURCES

Article 28. Decommissioned closed sources

"Article 28. Disused Sealed Sources

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources."

The activities with radioactive sources are subject to a permitting regime regulated by the *Act on the Safe Use of Nuclear Energy* and the *Regulation on the Procedure for Issuing Licenses and Permits for the Safe Use of Nuclear Energy*. The specific requirements of the *Regulation on Radiation Protection* are observed. The BNRA maintains a National Register of sources of ionizing radiation in the Republic of Bulgaria with data on all sealed radioactive sources from category 1 to 5 and on the relevant licensees.

When a source is no longer used or recycled, it is considered radioactive waste and, according to the *Act on the Safe Use of Nuclear Energy*, it must be transferred by its owner to SE RAW. The BNRA is notified of each transfer.

In cases where the owner is unknown or the licensee is declared bankrupt, the sealed source becomes state property and, on the basis of an order issued by the chairman of the BNRA, is transferred to SE RAW.

The *Act on the Safe Use of Nuclear Energy* states that in order to import a sealed source, the owner deposits a lump sum in the RAW Fund to financially secure the management of the RAW in the event of bankruptcy.

The transfer of radioactive sources declared as RAW is carried out in accordance with the *Regulation on the terms and conditions for the transfer of radioactive waste* to the State Enterprise Radioactive Waste. In the period 2020-2023, a total of 2,720 SIR with a total activity of $1.37x10^{14}$ Bq were accepted for storage in the Centralized Storage Facility - Novi Khan.

The capacity of SE RAW is sufficient to receive, process and store diused sealed sources from industry, science and medicine. It is planned to accept in the National Repository for Disposal of RAW for disposal the disused sealed sources from nuclear applications, including those declared as RAW, which are now stored in the Centralized Storage Facility - Novi Khan.

The reuse of disused sealed sources of categories 1, 2 and 3 in the Republic of Bulgaria is carried out under the conditions of a license issued by the BNRA for the use of such sources for a specific purpose other than the original purpose for which they were produced and delivered.

Reimport of disused sealed sources

The Bulgarian legislation does not prohibit the reimport of disused sealed sources on the territory of the Republic of Bulgaria, if they were produced in the country. Applications for the issuance of a permit for such imports have not been submitted to the BNRA, as there are no producers of sealed sources in the country.

SECTION K: PLANNED SAFETY ENHANCEMENT ACTIVITIES

The National *Strategy for Spent Fuel and radioactive Waste Management is* developed in line with the stated priority for updating the existing SF and RAW management strategy as part of the government program for stable development of the Republic of Bulgaria. The Strategy is in line with the requirements of Directive 2011/70/Euroatom of the Council of the European Union establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. The *Strategy for Spent Fuel and radioactive Waste Management* is currently updated and is under procedure of approval.

This report includes measures that are currently being implemented and/or are planned for implementation in the next five-year period.

Measures taken on proposals and challenges referred to in the Seventh National Report of the Republic of Bulgaria

A preliminary zoning of the territory of the Republic of Bulgaria was carried out based on a developed system

of exclusion criteria, tailored to the specific conditions of the country for the construction of a deep geological repository. A summary map has been drawn up, on which three areas of interest have been identified. With the help of selection criteria, five potential areas were located in the areas of interest, the characteristics of which maximally correspond to certain preferred natural conditions, characteristics and requirements. An analysis of the geological-tectonic, geomorphological, neotectonic, seismic, hydrogeological and engineering-geological conditions, hydrological-climatic and socio-economic features was carried out on each of the prospective areas for deep geological storage. On this basis, six potential geological blocks have been located. SE RAW plans activities to conduct subsequent research and studies of these geological blocks in connection with the selection of suitable sites for a deep geological repository.

Results achieved and areas for improvement

Construction of a National Disposal Facility for low- and intermediate-level radioactive waste

In the period 2020-2023, large-scale construction of the National Disposal Facility for RAW was carried out, and in practice the main construction activities were completed, according to the approved technical design. The construction of the facility will be completed in 2024.

During commissioning, the operator and the regulator should adequately consider and address the specificity of this type of surface storage facility for RAW disposal.

Construction of a facility for the manufacture of containers for RAW

The reinforced steel concrete container is licensed as an element of the packaging for RAW. Conditioned RAW is temporarily stored at the Kozloduy NPP site and is subject to disposal without further processing.

In 2024, the construction of a facility for the production of reinforced steel concrete containers at the site of the Kozloduy NPP will be completed, which will solve the issue of packaging the increased amounts of generated RAW that are expected as a result of the planned decommissioning of the nuclear facilities.

Minimizing the amounts of RAW for disposal

Plasma Incineration Installation (PLI)

The constructed plasma incineration plant will contribute significantly to reducing the final volumes of RAW subject to disposal. During the commissioning of the installation, numerous tests are carried out, during which the operating modes for processing the various RAW streams are optimized. The introduction into regular operation should be in 2025.

Size reduction and decontamination shop (SRD)

Technological equipment for size reduction and for mechanical, chemical and electrochemical deactivation of dismantled equipment from the restricted area of units 1-4 of the Kozloduy NPP has been installed in the constructed SRD.
The aim is to bring as much as possible of the processed material into compliance with the criteria for exemption from regulation.

Extraction and conditioning of the solid phase from the liquid concentrate from the tanks for temporary storageof liquid RAW

An installation for the processing of "wet" solid waste (evaporation concentrate, spent ion exchange resins, residues, sludges) has been installed and complex tests of the installation with real RAW are being conducted.

According to the conditions of the issued permit, the qualities of the final product should be proven during tests in industrial conditions. Achieving the design productivity is of key importance for the timely processing and conditioning of the currently stored operational RAW from units 1-4 of the Kozloduy NPP.

Modernization of CFRAW

The Centralized Facility for RAW has been in operation for 25 years and solves the issues with the management of RAW generated during the operation of the Kozloduy NPP.
The main goal of the modernization is both the rehabilitation of equipment with an expiring operational resource and the provision of sufficient capacity for the processing of RAW generated during the decommissioning of Units 1-4 at the Kozloduy NPP.

Decommissioning of Centralized Storage Facility Novi Han

In 2023, the development of a final plan for the decommissioning of the Centralized Storage Facility Novi Han began.

The decommissioning plan should account for the operational history of the facility, including a description of significant operational circumstances and events. Within the framework of the current license for operation, SE RAO should implement the measures provided for in the program for the management of RAW from nuclear applications.

In 2022, the Republic of Bulgaria has requested a full-scale peer review from the IAEA - an IRRS mission. It will be held in November 2024.

SNF from Kozloduy NPP

The difficulties that have arisen after 2021 for the removal of SNF for processing in the Russian Federation represent a challenge, due to the geopolitical changes that have occurred and the resulting transport and logistics problems.

In case of impossibility of removal of SNF from WWER-1000 in the long term, the useful capacity of the WSFSF is expected to be filled in 2032. This requires that the extension of the DSFSF (stage 1a) to be put into operation not later than 2030 for storage of 722 WWER-1000 SNF assemblies, thus providing a buffer capacity for the operation of units 5 and 6, but only for a period until 2040.

In order to ensure the safe management of SNF until the end of the operational lifetime of units 5 and 6, taking into account the construction of new nuclear units, it is appropriate to take the respective actions to implement possible options such as:

• conducting negotiations and signing an agreement for the processing of SNF from the previous and future operation of WWER-1000 in an EU member state;

• continuing the transport of SNF from WWER-440 for processing in the Russian Federation;

• reaching an agreement with the European Commission to continue the current practice of transport for reprocessing of SNF from WWER-1000 type reactors.

All peer review reports are publicly available and can be accessed at the following web address:

- https://www.iaea.org/services/review-missions/calendar?type=All&year%5Bvalue%5D%5Byear%5D=&location=3513&status=4275

All national reports on the fulfillment of the obligations of the Republic of Bulgaria under the Joint Convention are publicly available and can be accessed at the following web address:

https://bnra.bg/en/dokumenti/dokladi/

Section L: Appendices

Appendix L-1

LIST OF FACILITIES FOR SPENT FUEL MANAGEMENT, THEIR LOCATION, MAIN PURPOSE AND ESSENTIAL CHARACTERISTICS

I.Kozloduy NPP

I.1 Wet Spent Fuel Storage Facility

The Wet Spent Fuel Storage Facility (WSFSF) is a separate building located on the Kozloduy NPP site, with equipment and systems for ensuring sub-criticality, SF residual heat removal and biological protection.

The Wet Spent Fuel Storage Facility is intended for storage of spent fuel (SF) from WWER-440 and WWER-1000 reactors after having stored initially for at least three years in the at reactor pools. The storage facility is of "wet" type, i.e. SF is stored in pools under water. The storage facility has four SF storage pools. The SF assemblies are stored in transport baskets. The WSFSF design capacity is 168 baskets.

The sub-criticality is ensured by the baskets design (the grid step of placing the SF assemblies and the basket inventory) and the grid step of placing the baskets in the pool. This allows that the SF storage pool is filled with demineralized water without reagents (boric acid, etc.), which considerably facilitates the WSFSF operation.

The residual heat removal is ensured by heat exchangers cooled with service water.

The biological protection is ensured by the building structure and the water layer above SF in the fuel storage pools.

The WSFSF is integrated with the following KNPP systems:

- physical protection system,
- emergency planning,
- radiation control,
- fire protection,
- system for signaling in case of an accident
- processing and storage of radioactive and non-radioactive waste.

The safety during spent fuel storage is practically based on the application of the "defence-in-depth" principle.

The current licence for WSFSF operation also includes the operations for loading of CONSTOR 440/84 type casks with SF.

I.2 SFP-5 and 6

SFP -5 and 6 are situated in the containment and are designed for spent fuel storage after it is extracted from the reactor and serve for storage and cooling of spent fuel (until decrease of residual heat to permissible level), allowing it to be transported to the WFSF or for reprocessing.

Spent fuel is stored at racks. The total capacity of SFP is 612 assemblies.

Sub-criticality is provided by the assemblies' location pitch in the racks, and pipes from borated steel, even if SFP would be filled with demineralized water.

The spent fuel decay heat removal is provided by cooling through heat exchangers with service water. The cooling system consists of three channels and includes three pumps for pool cooling, three heat exchangers on the suction side of each of the pumps, pipelines and valves. The canals are connected between each other with connections of the suction and pressure pipes that allow realization of switching over from one canal to

another in case of failure of any of the canals. On the pressure and suction pipes, three on each, localizing fast-acting valves are installed, of which one is located in the containment.

The performance of each of the three system canals is such that each canal can independently ensure residual heat removal from the pool in all operation modes of the system.

I.3 Dry Spent Fuel Storage Facility (DSFSF)

DSFSF is licenced for long-term storage of spent fuel from WWER-440 of Kozloduy NPP.

DSFSF is provided with equipment and systems ensuring the spent fuel receiving, storage and removal.

DSFSF is a standalone structure consisting of a one-story hall divided into two main operation areas: the receiving area and the hall for storage of casks. The two areas are separated with a protective door.

The receiving area and the hall for storage of casks are serviced by an overhead crane with a lifting capacity of 145 tons.

SF is stored in CONSTOR 440/84 type casks.

DSFSF has a capacity of 78 casks.

The cask consists of a body with a basket, a cask closure system with primary lid, a seal plate and trunnions. The body of the CONSTOR® 440/84 cask serves as a chamber for housing the basket and the fuel assemblies. The cask body represents “sandwich” type structure with facing and lining made of fine-grained steel with an intermediate layer. The protective shielding from gamma radiation is ensured by the lining, and for the neutron radiation- by the intermediate layer.

The qualified volume welds and the welding procedure of the sealing plate and the first cover ensure the same quality of the welds as that of the factory welds of the container body.

The cask cavity in which the spent fuel is located is dried by using a qualified process of vacuum drying of the cask and is filled with helium. The inert atmosphere of the cask cavity excludes the corrosion of the fuel rods for the period of long-term storage.

The passive system of DSFSF for natural cooling by means of the air convection and the casks design for optimum heat exchange (from the fuel rod cladding to the cask outer surface) guarantee non-exceeding of the temperature limits for the fuel rod cladding and prevention of ageing of structures of the fuel assemblies and the cask.

Appendix L-2

SPENT FUEL REPORT

The accumulated spent nuclear fuel on the Kozloduy NPP site, stored in SFP, WSFSF and in DSFSF, amounted to 996.2 tons of heavy metal as of 31.12.2023. This quantity is distributed in 2864 spent fuel assemblies from WWER-440 and 1617 spent fuel assemblies from WWER-1000, or a total of 4481 assemblies.

Inventory of SFP in the WSFSF

Reactor type	TOTAL	
	Number of assemblies	Heavy metal weight [kg]
WWER-440	1268	146667,9
WWER-1000	924	373019,9
TOTAL	2192	519687,8

Inventory of SFP in the DSFSF

Reactor type	TOTAL	
	Number of assemblies	Heavy metal weight [kg]
WWER-440	1596	184242,1

Inventory of SFP 5 and 6

Reactor type	SFP-5		SFP-6		TOTAL	
WWER-1000	Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weight [kg]
TOTAL	344	141949,9	349	150296,5	693	292246,4

Appendix L-3

LIST OF NUCLEAR FACILITIES IN THE PROCESS OF DECOMMISSIONING

UNIT ONE

Reactor type: WWER-440, model B-230

Commissioning: October 1974

Final shutdown: By decision of the CM, shutdown on 31.12.2002.

License for decommissioning: Series "IE", No. 4650/14.11.2014, valid until 14.11.2024.

Scope - Structures, systems and components of the nuclear facility and the nuclear facility site

Permitted main activities – decontamination and dismantling of structures, systems and components, management of materials and RAW from the decommissioning of the facility

UNIT TWO

Reactor type: WWER-440, model B-230

Commissioning: November 1975

Final shutdown: By decision of the CM, shutdown on 31.12.2002.

License for decommissioning: Series "IE", No. 4651/14.11.2014, valid until 14.11.2024.

Scope - Structures, systems and components of the nuclear facility and the nuclear facility site

Permitted main activities – decontamination and dismantling of structures, systems and components, management of materials and RAW from the decommissioning of the facility

UNIT THREE

Reactor type: WWER-440, advanced model B-230

Commissioning: December 1980

Final shutdown: By decision of the CM, shutdown on 31.12.2006.

License for decommissioning: Series "XE", No. 5099/28.07.2016, valid until 28.07.2026.

Scope - Structures, systems and components of the nuclear facility and the nuclear facility site

Permitted main activities – decontamination and dismantling of structures, systems and components, management of materials and RAW from the decommissioning of the facility

UNIT FOUR

Reactor type: WWER-440, advanced model B-230

Commissioning: July 1982

Final shutdown: By decision of the CM, shutdown on 31.12.2006.

License for decommissioning: Series "XE", No. 5100/28.07.2016, valid until 28.07.2026.

Scope - Structures, systems and components of the nuclear facility and the nuclear facility site

Permitted main activities – decontamination and dismantling of structures, systems and components, management of materials and RAW from the decommissioning of the facility

Appendix L-4

LIST OF THE FACILITIES FOR RAW MANAGEMENT, THEIR LOCATION, MAIN PURPOSE AND ESSENTIAL CHARACTERISTICS

1. SSC FOR THE MANAGEMENT OF RAW IN THE KOZLODUY NPP

1.1 Auxiliary Building-3

A building with a reinforced concrete structure, located on the site of the Kozloduy NPP, with the main purpose of pre-treatment, temporary storage of RAW 2a category - solid RAW, liquid radioactive concentrates and spent sorbents from the operation of units 5 and 6.

The solid RAW 2a category is stored in bunker-type rooms with an upper hatch with a total volume of 2700 m^3. The reinforced concrete structure provides biological protection. Operating conditions – ambient temperature, atmospheric pressure. They are equipped with automatic fire alarm and fire extinguishing systems.

Liquid radioactive concentrates are stored in 7 stainless steel tanks, with a total useful volume of 3584 m^3. Each tank is located in a separate room lined with metal cladding. Operating conditions - temperature up to 100^oC, atmospheric pressure. They are equipped with a level control system. The radioactive medium is transported with a "monjus". The suction ventilation system from the tank premises also provides gas cleaning.

The spent sorbents are stored in 2 stainless steel tanks, with a useful volume of 95 m^3 each. Each tank is located in a separate room lined with metal cladding. Working conditions - temperature up to 40^oC, atmospheric pressure. They are equipped with systems for level and temperature control, for hydrotransportation of the radioactive medium and for fire extinguishing. The suction ventilation system from the tank premises also provides gas cleaning.

2. SE RAW Facilities and its SSC for RAW Management

2.1 Units 1 to 4

2.1.1 Auxiliary Building-1

A building with a reinforced concrete structure, located next to units 1 and 2 of the Kozloduy NPP, intended for the temporary storage of RAW, category 2 - solid RAW, liquid radioactive concentrates and spent sorbents.

Solid RAW is stored in 7 bunker-type rooms with an upper hatch, with a total working volume of 1010 m^3. The reinforced concrete structure provides biological protection. Operating conditions - room temperature, atmospheric pressure. They are equipped with automatic fire alarm and fire extinguishing systems.

The liquid radioactive concentrates are stored in 5 stainless steel tanks, each of which is located in a separate room lined with metal cladding. Each of the tanks has a diameter of 10 m, a height of 7 m and a working volume of 470 m^3. Operating conditions - temperature up to 100^oC, atmospheric pressure. They are equipped with a level control system, and the radioactive medium is transported with the so-called "monjus". The suction ventilation system from the tank premises also provides gas cleaning.

The spent "high activity" sorbents are stored in 4 stainless steel tanks: two tanks with a volume of 350 m^3 for "higher activity levels" and two tanks with a volume of 188 m^3 for "low activity". The tanks are located in separate rooms and lined with metal cladding. Operating conditions - temperature up to 100^oC (resp. 40^oC), atmospheric pressure. They are equipped with a level control system. The transportation of the radioactive sorbents is carried out by hydro unloading. The suction ventilation system from the tank premises also provides gas cleaning.

2.1.2 Auxiliary Building-2

AB-2 located next to units 3 and 4 of the Kozloduy NPP, and its technical characteristics are practically the same as those of AB-1.

2.1.3 **At-reactor storage for RAW from units 1 and 2**

It is located in the reactor hall of units 1 and 2, intended for the temporary storage of solid RAW, category 2, from the operation of the nuclear reactors. The facility is a tubular type. It is a monolithic reinforced concrete structure, providing the necessary biological protection. The concreted steel pipes with an upper hatch are four hundred in number, with a diameter of 0.18 m and a height of 8 m and a total useful volume of 81.6 m^3. Operating conditions - room temperature, atmospheric pressure.

2.1.4 **At-reactor storage for RAW from units 3 and 4**

It is located in the reactor hall of units 3 and 4.

Its characteristics are the same as those of the At-Reactor Storage for RAW of Unit 3 and Unit 4.

2.2 A facility for the processing and storage of RAW and its SSC

It is located on the site of the Kozloduy NPP and includes:

2.2.1 RAW processing plant

A separate site, located next to AB-3, intended for carrying out the activities of processing RAW, category 2, from the operation of the Kozloduy NPP.

Three technological lines are distinguished in the facility:

- "Solid RAW" line - intended for sorting and compaction of the solid RAW in order to reduce their volume and prepare for subsequent conditioning. The processing includes compaction of solid RAW in 210 l barrels by a 50 t compactor and super-compaction by a 910 t super-compactor;
- "Liquid RAW" line - it is intended for the treatment and conditioning of liquid radioactive concentrates, including packaging in containers.
- Decontamination line - Designed for decontamination of metallic RAW by mechanical (abrasive), chemical and electrochemical methods.

For the conditioning of solid and liquid waste, a method of immobilization in a cement matrix is applied. The reinforced concrete container is an element of the packaging form approved by the BNRA. The container itself has external dimensions of 1.95x1.95x1.95 m and a useful volume of 5 m^3.

According to the characteristics of RAW, the packaging is:

- solid RAW and liquid radioactive concentrates immobilized together in a cement matrix,

- super-compacted solid RAW immobilized with a non-radioactive cement matrix,
- super-compacted solid RAW, and/or non-compacted metal RAW not immobilized in a matrix.

Thus, the conditioned packages of the waste are stored at the site for subsequent disposal without further processing.

2.2.2 Storage facility for conditioned RAW

A separate site, located next to AB-3, intended for interim storage (until disposal) of the conditioned RAW from the Kozloduy NPP. A surface reinforced concrete facility provides the necessary engineering barriers between the stored RAW environment and personnel. Its capacity is 1,920 reinforced concrete containers with conditioned RAW (in 4 rows on top of each other). Transport operations in the storage facility are carried out with two overhead cranes with a load capacity of 25 t each.

2.2.3 Trench storage

It is intended for the storage of unprocessed and processed solid RAW of categories 2-I and 2-II and serves all nuclear facilities at the Kozloduy NPP site. The storage facility is near-surface, reinforced concrete structure, bunker type. It is divided into forty cells with an upper hatch, each with dimensions of 2.7x5.9x6.0 m and a volume of 96.5 m^3. Operating conditions – ambient temperature, atmospheric pressure, automatic fire alarm and fire extinguishing systems.

2.2.4 Storage for treated solid RAW

It is intended for the storage of processed solid RAW category 2-I and 2-II from all nuclear facilities at the Kozloduy NPP site.

The storage facility is a building-type, reinforced concrete panel construction with a receiving transport aisle. The processed solid RAW is stored in metal pallets arranged in three rows in height. The net volume of the storage is 1130 m^3. Operating conditions – ambient temperature, atmospheric pressure.

2.2.5 Sites (#1 and #2) for storing conditioned solid RAW packages

Open sites intended for buffer storage of processed and unprocessed solid RAW of category 2-I and 2-II, in StBK-1 and StBK-2, with the packaging form being in accordance with Technical Decision RAO.TR.-02/11.07.01 – solid RAW immobilized in a non-radioactive cement matrix. The sites serve all the nuclear facilities of the Kozloduy NPP. The sites have the capacity to accommodate about 2100 packages.

2.2.6 Site for storage of solid RAW in ISO-containers

Open site intended for buffer storage of unprocessed and processed solid low-active RAW of 2-I category. It serves all the nuclear facilities of the Kozloduy NPP. The site has the capacity to accommodate 14 ISO-containers (large-tonnage containers).

The high-tonnage standard ISO-container has a side door and external dimensions of 5.8x2.2x2.4 m and a net volume of 30 m^3.

2.2.7 Storage for contaminated soil masses

It is intended for storing soil, construction and other bulk technological waste with a very low level of radioactive contamination. The storage capacity is about 8,000 m^3.

2.2.8 Depot for process waste (BB-1)

It is intended for the deposition of soil, construction and other bulk technological waste that meets the levels for exemption from regulation. The storage capacity is about 5350 m^3.

2.2.9 Size reduction and decontamination shop (SDR)

A separate building located on the territory of units 1 to 4, is a complex of specialized working premises, equipped with specialized equipment for size reduction and for mechanical, chemical and electrochemical deactivation of dismantled equipment from the restricted area of units 1-4 of the Kozloduy NPP. The maximum capacity of the site is 1100 tons/year.

2.2.10 Plasma Incineration Installation (PII)

The installation is located in AB-2 of units 3 and 4. It is intended for the processing of RAW, category 2a, from operation and decommissioning of nuclear facilities. The maximum capacity of the facility is 250 tons/year.

2.3 Centralised storage facility for institutional RAW at the Novi han site and its SSC

It is located 35 km southeast of Sofia and 6.5 km from the village of Novi han in the Lozen Mountains. It is designed to store conditioned and unconditioned RAW from nuclear applications from various branches of industry, medicine, agriculture and science and includes*:*

Repository for solid RAW

For storage of non-conditioned solid low- and intermediate-level short-lived RAW (category 2a). The storage facility is a reinforced concrete facility with a volume of 237 m^3. It consists of three identical cells measuring 5 x 4.5 x 3.5 m, 4 upper hatches with outer diameter 1200 mm/inner diameter 800 mm and 3 upper hatches with outer diameter 1400 mm/inner diameter 1000 mm.

Storage of biological RAW

For the storage of conditioned by stabilization in a gypsum matrix of pre-treated with formaldehyde low- and medium-activity short-lived biological waste. The capacity of the storage is 80 m^3, a reinforced concrete structure, with geometric dimensions - length 8.35 m, width 4.00 m, depth 2.5 m and height of the above-ground part (roof structure) 0.5 m and 8 upper hatches with dimensions 0.8 x 0.80 m.

Storage for disused sealed sources

For storing non-conditioned sealed sources, with a capacity of 1 m. A reinforced concrete facility lined with stainless steel located at a depth of 5.5 m below the surface. The sources enter through the stainless steel coil ∅108 mm and thickness 5 mm. Protection from ionizing radiation is provided by the heavy concrete and lead plates with a total thickness of 50 mm located between the storage and the surface. The facility has a heavy removable roof structure.

Engineering trench for solid RAW

For non-conditioned low- and medium-active short-lived solid RAW category 2a, with a volume of 200 m^3 and dimensions: length 29 m and width 4.1 m. It consists of 8 cells built with precast reinforced concrete elements 300 mm thick, bituminous waterproofing, protected by a brick wall.

Storage for liquid RAW

For storing liquid RAW categories 1 and 2a. It consists of four tanks, 12 m^3 each, made of 4 mm thick X18H9T stainless steel, mounted on concrete supports 0.5 m above the floor of a reinforced concrete cell measuring 5.7 x 7.4 x 4.3 m. The cell is completely buried in the ground.

Site No. 1 and 1A for storing solid RAW

For the storage of other RAW category 2a and 2b in standard ISO-containers, with dimensions of 6.00 x 2.35 x 2.4 m. They are equipped with fire alarm detectors in transport packages, solid radioactive waste and disused sealed sources with low specific activity (β, γ), which do not require the construction of additional protection, neutron sources and α-sources in transport packages. Site No. 1 measures 22 m x 9.5 m, and Site No. 1 A measures 21.5 m x 7.5 m.

The capacity of the site is 14 railway containers with a total volume of 461 m^3.

Site No. 2 for storing solid RAW

For storing low- and medium-level RAW category 2a and 2b in reinforced concrete containers type StBKUB, StBK, StBGOU. The site has a total volume of 248 m^3 and measures 41.3 m x 17 m. The capacity of the site is 171 units of StBKKUB with a total volume of 248 m^3, 60 units of StBK with a total volume of 300 m^3 and 18 units of StBGOU with a total volume of 59 m^3.

Site No. 3 for storing solid RAW

It is used to store empty packaging - metal Europallets and containers for RAW. Site No. 3 measures 41 m x 17.5 m.

Site No. 4 for storing solid RAW

In 210 l barrels in Euro pallets for storing solid RAW category 1, 2a and 2b. The capacity of the site is 400 barrels, respectively 100 Euro pallets.

RAW-receiving preparation and laboratory complex

A complex of separate specialized work premises, compartments, laboratories and technological premises, equipped with the relevant equipment and workplaces, intended for carrying out activities in the management of RAW - receiving, incoming control and characterization, sorting, marking and processing of solid RAW category 1, 2a and 2b and of liquid RAW; dismantling of SIRs from fire alarm detectors and dismantling of disused sources from technological devices, packaging and repackaging of RAW in barrels. Includes liquid RAW processing systems; for compacting RAW in 200 l barrels; for abrasive decontamination; auxiliary systems and laboratories, a centre for the decontamination of vehicles and large packages with RAW was also built.

Unit Hot Cell

A separate building, representing a complex of specialized work premises, specially equipped for the safe handling of high-activity sources during the implementation of incoming and operational control activities. The maximum permissible activity when performing technological operations in the hot cell is 500 TBq.

Appendix L-5

RADIOACTIVE WASTE INVENTORY

Description of the facilities/SSCs, volume/mass, materials and specific radionuclides

This Appendix provides information on the RAW management facilities and the associated SSCs which are located at Kozloduy NPP site and at Novi Han site.

SSCs operated by KNPP				
Facility/SSC	**Stored RAW, m^3**	**Processing step**	**Morphological features, % vol.**	**Radionuclide content, Bq/kg**
Auxiliary building-3	solid RAW 21,7 m^3	-	-	-
Auxiliary building-3	liquid radioactive concentrates 1279	Concentrated via evaporation	total salt content 160 ÷ 220 g/l, boron acid concentration – 20 ÷ 55 g/l, pH 10 ÷11. Available solidified phase	$^{137}Cs – 2.10^7$ $^{134}Cs – 4.10^6$ $^{60}Co – 2.10^5$ $^{125}Sb - 1.10^5$
Auxiliary building-3	spent resins 120	stored under water	~70% sorbent and ~30% water	$^{60}Co – 7.10^6$ $^{137}Cs – 3.10^5$ $^{54}Mn– 3.10^5$ $^{134}Cs – 4.10^4$
Facilities and SSCs operated by SERAW				
Facility/SSC	**Stored RAW, m^3**	**Processing step**	**Physical content, % vol.**	**Radionuclide content, Bq/kg**
I. Units 1 to 4 under decommissioning				
Auxiliary building-1	solid RAW 98	compacted in 210-l drums	metals (22%), wood (2%), polymers (20%), mixed (56%)	$^{137}Cs – 6.10^4$ $^{60}Co – 2.10^5$ $^{134}Cs – 2.10^4$ $^{58}Co – 2.10^4$
Auxiliary building-1	liquid radioactive concentrates 2170	concentrated via evaporation	total salt content of the concentrate 28 - 35 %, boron acid up to 4%, pH7-9. Available solidified phase	$^{137}Cs - 1.10^6 - 4.10^7$ $^{134}Cs - 5.10^4 - 2.10^6$ $^{60}Co -3.10^4 - 1.10^6$
Auxiliary building-1	spent resins 209	stored under water	~70% sorbent and ~30% water	$^{137}Cs - 6.10^6 \div 2.10^8$ $^{134}Cs - 1.10^5 \div 2.10^7$ $^{60}Co - 1.10^5 \div 2.10^7$
At-reactor storage RB-1	solid RAW 46	non treated	metal (100%)	
Auxiliary building-2,	solid RAW 220	compacted in 210-l drums	textile (4%), wood (4%), polymers (42%), mixed (47%)	$^{134}Cs – 2.10^4$ $^{58}Co – 2.10^4$ $^{137}Cs – 6.10^4$ $^{60}Co – 2.10^5$
Auxiliary building-2	liquid radioactive concentrates 2040	concentrated via evaporation	total salt content 8÷35 %, boron acid 20÷75 g/l, pH7÷9. Available solidified phase	$^{134}Cs - 1.10^4 \div 2.10^6$ $^{137}Cs - 6.10^6 \div 4.10^7$ $^{60}Co - 6.10^4 \div 1.10^6$
Auxiliary building-2,	spent resins 266	stored under water	~70% sorbent and ~30% water	$^{134}Cs - 4.10^5 \div 2.10^6$ $^{137}Cs - 6.10^6 \div 3.10^8$ $^{60}Co - 2.10^6 \div 3.10^6$
At-reactor storage RB-2	solid RAW 28	non treated	metal (100%)	historical RAW
II. *RAW storage SSCs at Kozloduy site*				
Storage for	solid RAW	conditioned via	conditioned RAW packages	$^{137}Cs - 1.10^4 \div 4.10^6$

conditioned RAW	1494 RAW packages	immobilization in cement matrix	type StBK-2 and StBK-3 (radioactive cement matrix)	^{134}Cs - $2.10^{1} \div 1.10^{4}$ ^{60}Co - $6.10^{3} \div 9.10^{4}$ ^{54}Mn - $1.10^{2} \div 3.10^{4}$ ^{110m}Ag-$1.10^{0} \div 6.10^{1}$ ^{57}Co - $1.10^{1} \div 3.10^{1}$
Trench storage	solid RAW 2040	super-compacted drums, free space in-between filled with zeolite	mixer (48%), textile (28%), construction bulk (7%), metal (7%), thermal insulation (5%), wood (2	^{137}Cs – $2{,}6.10^{4}$ ^{60}Co – $1.08.10^{4}$ ^{54}Mn – $7{,}57.10^{1}$ ^{134}Cs – $2{,}16.10^{1}$ ^{110m}Ag-$5{,}18.10^{-2}$
Storage for treated solid RAW	solid RAW 22,06	super-compacted drums	metal (28,2%), polymers (18,13%), wood (27,2%), sludges and sediments (26,65%).	category 2a
Sites (No. 1 and No. 2) for storage of conditioned RAW package	solid RAW 1134 RAW packages	super-compacted drums, immobilization in cement	Conditioned RAW packages type StBK-2 (non-radioactive cement matrix)	^{137}Cs-$2.10^{2} \div 3.10^{4}$ ^{60}Co-$1.10^{4} \div 3.10^{4}$ ^{134}Cs-$2.10^{2} \div 6.10^{2}$ ^{54}Mn-$1.10^{0} \div 2.10^{2}$ ^{110m}Ag-$1.10^{1} \div 3.10^{3}$
Site for storage of solid RAW in ISO containers	85,58	mixed, compacted in 210-l drums and non-treated	filters (42%), construction bulk (20,8%), mixed (9,08%), metal (13%), boric acid (16,69%), wood(4%)	^{59}Fe – $6.63.10^{0}$ ^{58}Co – $1.20.10^{0}$ ^{60}Co – $2.44.10^{3}$ ^{110m}Ag – $3.77.10^{2}$ ^{134}Cs –$1.30.10^{2}$ ^{137}Cs – $4.53.10^{3}$ ^{95}Nb – $2{,}75.10^{-1}$ ^{241}Am – $5.57.10^{1}$ ^{226}Ra – $1.24.10^{2}$
Storage for contaminated soil	318,27	non processed	bulk waste	Total activity: $7{,}33.10^{9}$ Bq
Depot for process waste (BB-1)	Exempt process waste 2000	landfill deposition	Non processed	Total activity: $5{,}72.10^{9}$ Bq
III. Centralized storage facility for institutional RAW at the Novi Han site				
Storage for solid RAW	44,604 m^3	Non treated	mixed (100%)	^{137}Cs – 1,949E+12 Bq. ^{60}Co – 5,696E+10 Bq. ^{90}Sr – 4,783 Bq. ^{14}C – 3,989E+11 Bq. ^{3}H – 5,88E+11 Bq.
Storage for biological RAW	56,28 m^3	Stabilization in gypsum matrix	biological waste from scientific research (100%)	^{137}Cs – 7,133E+10 Bq. ^{90}Sr – 8,853E+09 Bq. ^{14}C – 9988E+09 Bq. ^{3}H – 2,94E+09 Bq. ^{60}Co – 1,03E+09 Bq.
Storage for disused sealed sources	0,65 m^3	Non processed	DSS	^{137}Cs – 3,562E+13 Bq. ^{60}Co – 5,181E+11 Bq. ^{226}Ra – 5,605E+11 Bq. ^{239}Pu – 1,989E+11 Bq. ^{90}Sr – 4,431E+10Bq.
Engineered trench for solid RAW	160 m^3	Non treated	mixed (100%)	^{137}Cs – 4,46E+11 Bq. ^{90}Sr – 8,853E+10 Bq. ^{60}Co – 2,076E+10 Bq. ^{239}Pu – 6,87E+05 Bq.
Storage for liquid	1 m^3	Filtration		^{137}Cs – 8,642E+05

RAW				Bq. ^{3}H – 2,533E+05 Bq. ^{90}Sr – 3,593E+05 Bq. ^{60}Co – 5,45E+02 Bq. Alpha emitters – 6E+02 Bq.
Site No. 1 and 1A solid RAW	68 m^3	Non treated	mixed (100%)	Pu-Be – 6,881E+12 Bq. Am-Be – 1,477E+12 Bq.

Приложение L-6

LIST OF INTERNATIONAL TREATIES, ACTS AND SECONDARY LEGISLATION APPLICABLE TO THE FACILITIES FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT

1. International treaties and agreements

1.1. JOINT CONVENTION on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
1.2. VIENNA CONVENTION on Civil Liability for Nuclear Damage;
1.3. CONVENTION on the Physical Protection of Nuclear Material;
1.4. CONVENTION on Early Notification of a Nuclear Accident;
1.5. CONVENTION on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
1.6. CONVENTION on Nuclear Safety;
1.7. CONVENTION on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters;
1.8. CONVENTION on Environmental Impact Assessment in a Transboundary Context;
1.9. TREATY on the Non-Proliferation of Nuclear Weapons;
1.10. AGREEMENT between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Republic of Finland, the Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community (EURATOM) and the International Atomic Energy Agency (IAEA) in IMPLEMENTATION of Article III, (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons (78/164/EURATOM, respectively IAEA INFCIRC 193);
1.11. ADDITIONAL PROTOCOL (1999/188/EURATOM, respectively IAEA INFCIRC 193 add. 8) to the Agreement between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Republic of Finland, the Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community (EURATOM) and the International Atomic Energy Agency (IAEA) in implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons;
1.12. AGREEMENT between the Government Republic of Bulgaria and the Government of the United States of America for the use on nuclear energy for peaceful purposes;
1.13. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation for co-operation in the field of peaceful use of atomic energy;
1.14. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation on cooperation in the field of nuclear energy.
1.15. AGREEMENT between the Government of the Republic of Bulgaria, the Government of the Russian Federation and the Cabinet of Ministers of Ukraine in the field of transportation of nuclear materials between the Russian Federation and the Republic of Bulgaria and through the territory of Ukraine.
1.16. AGREEMENT between the Government of the Republic of Bulgaria, the Government of the Republic of Moldova, the Government of the Russian Federation and the Cabinet of Ministers of Ukraine on cooperation in the field of transportation of nuclear materials between the Republic of Bulgaria and the Russian Federation through the territory of Ukraine and the territory of the Republic of Moldova.
1.17. AGREEMENT between the Government of the Republic of Bulgaria and the Cabinet of Ministers of Ukraine on operational notification of nuclear accidents and on cooperation in the field of nuclear and radiation safety.

1.18. AGREEMENT between the Government of the Republic of Bulgaria and the Government of Romania on operational notification in the event of a nuclear accident and exchange of information on nuclear facilities.
1.19. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Greece on operational notification in the event of a nuclear accident and exchange of information on nuclear facilities.
1.20. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Turkey on operational notification in the event of a nuclear accident and on the exchange of information on nuclear facilities.
1.21. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Serbia on the early exchange of information in the event of a radiation accident.
1.22. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Nuclear Regulatory Commission of the United States of America on the exchange of technical information and cooperation on nuclear safety issues.
1.23. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Federal Service for Environmental, Technological and Atomic Supervision of the Russian Federation on cooperation in the field of regulation of nuclear and radiation safety in the use of atomic energy for peaceful purposes.
1.24. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Hellenic Commission for Atomic Energy of the Republic of Greece on operational notification of a nuclear accident and cooperation in the field of nuclear safety regulation and radiation protection.
1.25. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the National Commission for the Control of Nuclear Activities of Romania for the exchange of technical information and cooperation in the regulation and control of nuclear safety and radiation protection.
1.26. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Directorate for Radiation Protection of the Republic of Macedonia on cooperation in the field of radiation protection.
1.27. AGREEMENT between the Committee for the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Economy of the Slovak Republic on cooperation in the field of state regulation of safety in the use of atomic energy for peaceful purposes.
1.28. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the State Committee for Nuclear Regulation of Ukraine on cooperation in the field of state regulation and safety control in the use of atomic energy.
1.29. AGREEMENT between the Committee for the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Environmental Protection of Ukraine on cooperation in the field of state regulation and safety control in the use of atomic energy for peaceful purposes.
1.30. MEMORANDUM of understanding for cooperation and exchange of information on nuclear regulatory issues between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Hungarian State Atomic Energy Authority.
1.31. MEMORANDUM of understanding between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Nuclear Regulatory Authority of the Republic of Turkey for cooperation and exchange of information in the field of nuclear safety and security.

2. Acts

2.1. *Act on the Safe Use of Nuclear Energy*;
2.2. *Act on Environmental Protection*;
2.3. *Health Act*;
2.4. *Territory Planning Act*.
2.5. The State Agency for National Security Act
2.6. Ministry of Interior Act
2.7. Disaster Protection Act

3. Secondary Legislation

3.1. REGULATION on Radiation Protection;
3.2. REGULATION on Safety of Spent Fuel Management;
3.3. REGULATION for Safe Management of Radioactive Waste;
3.4. REGULATION on Safety during Decommissioning of Nuclear Facilities;
3.5. REGULATION on the Terms and Procedure for the Transfer of Radioactive Waste to the State Enterprise "Radioactive Waste";
3.6. REGULATION on the Procedure for Determination, Collection, Spending and Control of the Funds and the Amount of Due Contributions to the Nuclear Facilities Decommissioning Fund;
3.7. REGULATION on the Procedure for Determination, Collection, Spending and Control of the Funds and the Amount of Due Contributions to the Radioactive Waste Fund;
3.8. REGULATION on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy;
3.9. REGULATION on NPP Safety Assurance;
3.10. REGULATION on the Terms and Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation and in the Transit of Radioactive Materials;
3.11. REGULATION on the Terms and Procedure for Exclusion of Small Quantities of Nuclear Material from the Application of the Vienna Convention on Civil Liability for Nuclear Damage;
3.12. REGULATION on the Terms and Procedure for Obtaining Vocational Qualification and on the Procedure for Issuing Licences for Specialised Training and Individual Licences for Work Activities involving Nuclear Power;
3.13. REGULATION on Emergency Planning and Emergency Preparedness in the Case of Nuclear or Radiological Emergencies;
3.14. REGULATION on the Provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Material;
3.15. REGULATION on the Terms and Procedure for the Collection and Provision of Information and for the Maintenance of Registers on the Activities Subject to the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons;
3.16. REGULATION on ensuring the safety of research nuclear installations;
3.17. REGULATION on the Terms and Procedure for Transport of Radioactive Materials;
3.18. REGULATION No. 1 on Standards for Radiation Protection and Safety in the Elimination of the Consequences from Uranium Mining in the Republic of Bulgaria;
3.19. REGULATION on the Terms and Procedure for Implementation of Environmental Impact Assessment;
3.20. RULES OF PROCEDURE of the Nuclear Regulatory Agency;
3.21. REGULATION on the Procedure for Payment of the Fees pursuant to the *Act on the Safe Use of Nuclear Energy*;
3.22. TARIFF for the Fees Collected by the Nuclear Regulatory Agency pursuant to the *Act on the Safe Use of Nuclear Energy*;
3.23. REGULATION No. 9 on the Terms and Procedure for Establishing and Maintaining a Public Register of the Sites of Public Use Controlled by the Regional Health Inspectorates;
3.24. REGULATION for radiation protection in activities with radiation flaw detectors.

ADDITIONAL INFORMATION

National strategy for the management of spent nuclear fuel

The strategy for the management of spent nuclear fuel (SNF) and radioactive waste (RAW) represents the national program of the Republic of Bulgaria for the responsible and safe management of SNF and RAW in the sense of Directive 2011/70/Euratom of the Council of EU on the establishment of a Community Fraamework for responsible and safe management of SNF and RAW. It was developed pursuant to Art. 74 of the *Act on the Safe Use of Nuclear Energy* and the secondary legislations (regulations).

The strategy for the management of SNF and RAW is the main document presenting the national policy, principles, goals and tasks related to the safe and responsible management of all stages of the management of SNF and all types of RAW - from generation, through their storage, to their possible processing and finally to their disposal. The strategy outlines the implemented and planned practical solutions, their stages and deadlines for implementation, as well as the method of their financing.

In 2018, the Republic of Bulgaria received an Official Letter of Infringement Procedure No. 2018/2017 for non-fulfillment of obligations arising from Council Directive 2011/70/Euratom on the Responsible and Safe Management of Spent Fuel and Radioactive Waste.

In order to correctly fulfill the obligations arising from Directive 2011/70/Euratom and with a view to maximally adequate reflection of the recommendations of the European Commission regarding the infringement procedure launched against the Republic of Bulgaria, as well as the recommendations of the ARTEMIS mission of the IAEA conducted in 2018, which is an international peer review within the meaning of Article 14 of Directive 2011/70/Euratom, a new draft of an updated strategy for the management of SNF and RAW in Bulgaria has been developed - a national program in accordance with Directive 2011/70/Euratom. The strategy accounts for and takes into consideration the adverse geopolitical changes that occurred in early 2022 after the start of the war of the Russian Federation against Ukraine and the newly emerging risks related to the management of SNF and high-level active waste. The prepared draft strategy should go through the relevant procedures according to national, European and international environmental legislation, after which it will be submitted for adoption by the Council of Ministers.

At the moment, a Report on the Environmental Impact Assessment with its annexes has been prepared, and the draft of the updated Strategy is in the final phase of a transboundary environmental assessment procedure, which includes holding public hearings with the responsible institutions and the public. A statement of the Minister of Environment and Water is pending, after which the Strategy will be submitted for consideration by the Council of Ministers. The aim is for the same to be adopted by the Council of Ministers in 2024 and notified to the EC.

Management of SNF from nuclear facilities

In 2019, in implementation of the European Strategy for Energy Security, (May 2014), activities were started at the Kozloduy NPP to analyze the possibilities for diversifying the supply of fresh nuclear fuel. It should be taken into account that any improvement of the fuel cycle (for example, introduction of a 5-year operating cycle of nuclear fuel), as well as the implementation of a project to diversify the supply of fresh nuclear fuel, will reflect on the generation of SNF, respectively, also on the management with the aim of increasing safety and reducing the volumes and activity of RAW subject to disposal.

The management of SNF from units 5 and 6 includes the initial storage of SNF in the spent fuel pools for a minimum period of 5 years. The next stage is intermediate storage of SNF in an underwater storage facility (wet type SFSF) at the site of the Kozloduy NPP. Fuel from both WWER-440 and WWER-1000 is stored in the WSFSF (WWER-440 fuel is also stored in the DSFSF). Intermediate storage makes it possible to

make an optimal choice for the next stages of management, given that it is not an alternative to the final stage of SNF management.

It is considered that the long-term storage of SNF in a dry manner, in the absence of possibilities for its transportation and/or processing in the future, may require its direct disposal, which is associated with solving a number of complex technical problems. For these reasons, storage of SNF from WWER-440 and WWER-1000 in a dry manner is considered as a backup option (buffer) in case of impossibility to transport away the SNF.

In this regard, the following activities should be carried out:

- step-by-step filling of the CONSTOR 440/84 containers with SNF from WWER-440 and their storage in the DSFSF (if it is impossible to transport away the SNF);
- conducting negotiations with the parties possessing technological capabilities and clarifying the possibilities of sending for long-term storage and processing of SNF that has been stored for some time in a dry manner.

From the very beginning of its nuclear program, the Republic of Bulgaria has chosen a practice for reprocessing SNF.

According to the contracts for the construction of units 1 and 2 of the "Kozloduy" NPP, it is not required to return to Bulgaria the HLW and other RAW obtained from the processing of SNF from them. The transport, long-term storage and processing of SNF can be done by agreement with other countries, and return to us of the HLW and other RAW obtained from the processing.

Transport of nuclear fuel from WWER-440 for technological storage and reprocessing at the FGUP PO "MAYAK" enterprise in the the former USSR, now the Russian Federation, began in 1979. In the period 1979-2017, a total of 7,296 assemblies with spent nuclear fuel from WWER-440 reactors were transported.

In accordance with the existing practices, in order to prevent overfilling of the volume of the WSFSF, in 2001, removal of SNF from WWER-1000 for long-term storage and processing in the Russian Federation was started. In the period up to 2008, 959 assemblies from WWER-1000 reactors were transported to the FGUP "GHK" enterprise. The transport of SNF from WWER-1000 was resumed in 2020, and in 2020-2021, 288 assemblies were transported to the FGUP "PO "MAYAK" enterprise.

In the period 2015 – 2019, 26.5 t of TM were transported in the SNF.

In the period 2020 - 2021, 114.7 t of TM were transported in SNF. It should be taken into account that, as a rule, removal of nuclear fuel from WWER-1000 can be done after reducing the residual heat release below a certain limit (10-11 years after its removal from the reactor core).

In order to sustainably reduce the amount of SNF stored at the site of the Kozloduy NPP, it would be necessary to carry out an average annual transport of 77 t TM in SNF.

The military actions of the Russian Federation against Ukraine, which began in February 2022, led to the impossibility of carrying out the transport of SNF to the Russian Federation. The current practice of processing SNF in the Russian Federation may prove impossible or be seriously endangered due to transport and logistics problems.

In 2022, a framework supplement was concluded for the transportation of 1,268 WWER-440 assemblies (approximately 146.5 t TM) in the period 2023 - 2028 for long-term storage and reprocessing. These are assemblies that are in the stage of intermediate storage by wet method in the WSFSF.

Management of high-level active waste from the processing of spent nuclear fuel in the medium and long term, including its disposal

The mid-term and long-term plan for the management of SNF is specified in the draft of the updated Strategy for SNF and RAW Management in Bulgaria - National Program in accordance with Directive 2011/70/Euratom. The options for SNF management laid down in the draft of the updated Strategy are SNF transport for processing outside the territory of the Republic of Bulgaria and SNF storage at the

Kozloduy NPP Plc site (underwater storage in the WSFSF and dry SNF storage). In the long term (up to 2050), the Republic of Bulgaria is considering the possibility of building and putting into operation a deep geological repository for burying HLW, RAW category 2b and SNF.

List of the used abbreviations in the Sixth National Report under the Joint Convention

AB – Auxiliary Building
ASUNE - Act on the Safe Use of Nuclear Energy or Nuclear Act
BNRA – The Bulgarian Nuclear Regulatory Authority (Nuclear Regulatory Agency)
BAS – Bulgarian Academy of Science
BEH – Bulgarian Energy Holding
CM – Council of Ministers
DSFSF - Dry Spent Fuel Storage Facility
EBRD – European Bank for Reconstruction and Development
EIA – Environmental Impact Assessment
EPA – Environmental Protection Act
EU – European Union
NF –Nuclear Fuel
FSAR – Final Safety Assessment Report
HLW – High Level radioactive Waste
HLST – High Activity Level Spent Sorbents Tank
HPA – Health Protection Act
IAEA – International Atomic Energy Agency
INRNE – Institute of Nuclear Research and Nuclear Energy
ISAR – Intermediate Safety Assessment Report
KIDSF – Kozloduy International Decommissioning Support Fund
LILW – Low – and Intermediate Level radioactive Waste
LLST – Low Activity Level Spent Sorbents Tank
LTO - Long-Term Operation
ME – Ministry of Energy
MI – Ministry of Economy
MH – Ministry of Health
MEW – Ministry of Environment and Waters
MS – Management System
NDF – National Disposal Facility
NF – Nuclear Facility
NPP – Nuclear Power Plant
PSAR – Preliminary Safety Assessment Report
PD – Personal Dosimetry
RAW – Radioactive Waste
RAWPP – Radioactive Waste Processing Plant
RCC – Reinforced Concrete Container
RH –Reactor Hall
RR – Research Reactor
RP –Radiation Protection
SAR – Safety Assessment Report
SD RAW – Kozloduy – Specialized Department “RAW – Kozloduy”
SD Decommissioning-Kozloduy – Specialized Department “RAW Decommissioning-Kozloduy”
SD RAW – Novi Han - Specialized Department “RAW - Novi Han”
SERAW – State Enterprise “Radioactive Waste”
SF– Spent Fuel
SFP – Spent Fuel Pool

SIR – Sources of Ionizing Radiation
StBK - reinforced concrete containers type
WSFSF – Wet Spent Fuel Storage Facility
WWER – Water Cooled Water Moderated Energy Reactor