THE REPUBLIC OF BULGARIA

SEVENTH 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, 2020

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

AB – Auxiliary Building
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
FSAR – Final Safety Assessment Report
HLW – High Level radioactive Waste
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
LTO - Long-Term Operation
ME – Ministry of Energy
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
RAW – Radioactive Waste
RAWPP – Radioactive Waste Processing Plant
RCC – Reinforced Concrete Container
RH –Reactor Hall
SAR – Safety Assessment Report
SD RAW – Kozloduy – Specialized Department "RAW – Kozloduy"
SD Decommissioning-Kozloduy – Specialized Department "Decommissioning-Kozloduy units 1 to 4"
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
SSCs – Structures Systems and Components
StBK - reinforced concrete containers type
WSFSF – Wet Spent Fuel Storage Facility
WWER – Water Cooled Water Moderated Energy Reactor

SUMMARY

This report is prepared by the Republic of Bulgaria in compliance with Art. 32 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. It presents the developments and current status in Spent Fuel and Radioactive Waste management and in the decommissioning of nuclear facilities within the scope of the seventh review under the Joint Convention.

In the Republic of Bulgaria the radioactive waste and spent nuclear fuel has been generated since the middle of the twentieth century by the use of nuclear energy.

The radioactive waste originated from the nuclear applications such as medicine, agriculture, industry, research, are stored in a centralized storage facility since 1964.

Since 1974, when the first unite of Kozloduy NPP was put into operation, the radioactive waste generated at KNPP are stored and processed on its site. Currently, all the spent fuel was generated and is managed as part of the operation only of KNPP.

1. General Framework

The Republic of Bulgaria has established a comprehensive national framework (legislative, regulatory and organisational) for the safe management of spent fuel and radioactive waste. Commonly accepted safety requirements and safety standards in the field of SF and RAW management are introduced into the national framework.

The policy of the Republic of Bulgaria regarding the management of SF and RAW is defined by the national legislation. It is consistent with the relevant international principles and the international agreements to which Republic of Bulgaria is signatory.

The Act on the Safe Use of Nuclear Energy (**Nuclear Act**) establishes the state regulation over the use of nuclear energy and ionizing radiation and the management of radioactive waste and spent fuel, setting the responsibilities and obligations of the entities carrying out such activities for ensuring nuclear safety, security and radiation protection.

The state regulation of the use of nuclear energy and ionizing radiation and the management of radioactive waste and spent fuel is effectuated by the Chairman of the Bulgarian Nuclear Regulatory Agency that is the national nuclear regulatory authority.

The SF and RAW management are carried out only by entities that have received licence and/or permit by the BNRA Chairman. SF management is carried out only by entities that are licenced to operate a NPP. The licencee bears the prime responsibility for safety of the facility and/or activity and this responsibility cannot be transferred to another person.

RAW management outside the facilities where it has been generated is performed by SERAW. RAW becomes State ownership when transferred to the SERAW. The State is responsible for the management of RAW with unknown owner.

There are legislative provisions for assuring adequate resources (financial, technical and human) to sustain the implementation of the radioactive waste management strategy. The financial arrangements are based on the principle “polluter pays”.

SF and RAW management are conducted in an open and transparent manner, and the public have access to information where this does not infringe upon national laws and security issues.

2. Nuclear facilities

The following nuclear facilities exist in the Republic of Bulgaria:

- 2 power reactors in operation;

- 4 power reactors under decommissioning;
- 2 SF storage facilities in operation;
- National Disposal Facility for the disposal of low- and intermediate level short-lived RAW under construction;
- Centralized storage facility for RAW from nuclear applications - in operation;
- KNPP RAW processing&storage facility – in operation;
- Plasma Melting Facility – in commissioning stage.

SF from the two operated power reactors of Kozloduy NPP (KNPP) is stored in at-reactor pools and in the spent fuel storage facilities on-site of Kozloduy NPP.

All the SF is removed from KNPP units 1 to 4 which are under decommissioning.

3. Challenges listed for Republic of Bulgaria at the sixth review meeting

Challenges	Reference in present report
Construction and commissioning of the national disposal facility for short-lived LILW	See Section H.4.
Completing the technical specification of HLW waste forms from SF reprocessing	See Section B
Update of the decommissioning costs estimates for KNPP units in operation and of the final disposal facilities	See Section F.6.
Completing the remediation activities for Buchovo former uranium mining sites	See Section H.2.
Permanent maintaining the adequate staffing levels and competence of the Regulatory Body	See Section E.3.

4. Main developments in Bulgaria since the sixth Review Meeting

4.1. Regulatory frame

The national policy and the statutory and regulatory framework in the field of use of nuclear power comply with the EU legislation, the IAEA safety standards and the commonly accepted international practices. The Republic of Bulgaria also implements 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 Radiological Emergency, the Joint Convention on the 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 Nuclear Safeguards Agreement.

The consistency of the regulatory frame is maintained by BNRA. In connection with the Article 106 of Directive 2013/59/Euratom, a new *Regulation on Radiation Protection* was adopted, repealing the Regulation on the Basic Norms for Radiation Protection and the Regulation on Radiation Protection for Activities with Sources of Ionizing Radiation. The new *Regulation on Radiation Protection* covers all exposure situations – planned, existing and emergency. It ensures the consolidation, codification and complementarity of existing regulations in the field of radiation protection. The new Regulation systematizes the basic principles, norms and requirements for radiation protection. In 2019 the Nuclear Act was amended together with the three other regulations on its implementation.

4.2. Facilities and activities

The **Spent Fuel** is stored in WSFSF, DSFSF and in the at-reactor pools of Kozloduy NPP Units 5 and 6, which are operating according to the issued licences.

Four nuclear power reactors are in the process of **decommissioning**. The decommissioning in turbine hall was completed. Important activities for the next period are related with preparation for decommissioning in the restricted zone in reactor buildings of KNPP units 1 to 4. The process for release from regulatory control of material originating from dismantling or partial demolishing is performed.

The adopted by the Republic of Bulgaria Strategy for continuous dismantling of Kozloduy NPP Units 1 to 4 envisages their decommissioning to be completed by 2030.

RAW management activities are carried out predominantly at NPP Kozloduy site and at Novi Han site. The short-lived LILW are subject to disposal in the National Disposal Facility and the activities for their processing and conditioning into a form corresponding to the criteria for acceptance in NDF and are according to the annual program of SERAW. Currently the conditioned RAW packages are stored in a separate RAW management facility on Kozloduy NPP site. The operational RAW from the two nuclear power reactors in operation are conditioned in due time also. The Novi Han storage facility is receiving the RAW from the nuclear applications from different sectors of the industry, medicine, agriculture and science. In the facility are stored unprocessed solid RAW, biological RAW, disused sealed sources.

From 2017 the **National Disposal Facility** for short-lived LILW is under construction.

In 2018 the new Plasma melting facility was put in the commissioning stage at Kozloduy NPP site with operator - SERAW.

4.3. Financing

Under the control of the State, radioactive materials and waste management is financed by the nuclear licensees, in accordance with the polluter-pays principle.

The financing of the activities for SF management and operational RAW treatment and interim storage was provided by the KNPP operator. The operation of the RAW management facilities was provided by the RAW Fund.

The financing of the decommissioning was provided by the Nuclear Facilities Decommissioning Fund and the KIDS Fund.

4.4. Peer reviews

IAEA ARTEMIS mission was conducted in June 2018. It was peer review according to Article 14 of Directive 2011/70/Euratom with the purpose to review the national framework and program of SF and RAW management.

The mission concluded that the national safety framework ”*is well developed and provides a robust infrastructure for the safe management of RAW and SF, including mechanisms for development of a strategy for spent fuel and radioactive waste management*”. The national *Strategy for the management of spent fuel and radioactive waste by 2030*, contains the aspects for the management of radioactive waste and spent fuel set out in the Directive and recommendations for some improvements were presented, which will be addressed by the Ministry of Energy.

SECTION A. INTRODUCTION

The Republic of Bulgaria signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter referred to as the Joint Convention or the Convention) in Vienna on September 22, 1998. The Joint Convention was ratified by law in 2000 and has been in force in the Republic of Bulgaria since 18 June 2001.

In 2003 the Republic of Bulgaria prepared its First National Report that presented the level of compliance with the Convention requirements, the achieved safety level of spent fuel and radioactive waste management as well as the planned activities. The following National Reports of the Republic of Bulgaria presented the situation and efforts of the country in the implementation of the Convention requirements. These Reports highlighted the changes to the regulatory framework, the national infrastructure of spent fuel (SF) and radioactive waste (RAW) management, the status of the facilities, and the implementation of the regulatory safety requirements.

The ***Seventh National Report*** of the Republic of Bulgaria under the Joint Convention covers the information about facilities and activities and presents the policy, the national regulatory frame and its implementation, as well as the *National Strategy for Spent Fuel and radioactive Waste Management*. The National Strategy determines the specific goals, measures and the action plan for SF and RAW management by 2030. Meanwhile the updated document for longer strategic horizon is drafted.

The Republic of Bulgaria maintains the national frame (legislative, regulatory and organizational) for the use of the nuclear energy for peaceful purposes. The commonly accepted requirements and safety standards in spent fuel and radioactive wastes management are introduced in the national legislation already.

The State regulatory functions are assigned to an independent competent body – the Bulgarian Nuclear Regulatory Authority.

The responsibilities for the safety are allocated among all the actors in the field of spent fuel and radioactive waste management. The operation of the existing nuclear facilities and the activities with SF and RAW is performed by the licenced entities in compliance with the stipulated safety requirements. Requirements and availability of financial and human resources necessary for SF and RAW management are provided.

The prime responsibility for the safety in management of spent fuel and radioactive wastes lies with the licence holder and the ultimate responsibility rests with the State.

The international cooperation in the field of SF and RAW management is important for the Republic of Bulgaria. Close contacts with the regulatory authorities of other IAEA member states are maintained. The programs of IAEA and the European Commission in the field of SF and RAW are of particular significance and Bulgaria will continue to participate actively in them. In 2018 the Republic of Bulgaria has invited IAEA ARTEMIS mission, as an international peer review of the national infrastructure for SF and RAW management.

The present report has been prepared in compliance with the „Guidelines Regarding the Form and Structure of National Reports", INFCIRC/604/Rev.3, 18 December 2014. Since important steps for harmonization of the national frame with international standards and directives took part after complete presentation in the First National Report and as it was discussed during the sixth review meeting, in the current Seventh Report more comprehensive overview of the policies and practices under the Joint Convention articles is presented, instead to present only changes in comparison to previously reported information. Section B describes the policies and practices of the Republic of Bulgaria regarding management of SF and RAW, in accordance with the requirements of Art. 32, para 1 of the Convention. Section C presents the position of the Republic of Bulgaria on the full scope implementation of the Convention. Section D contains data on the facilities for SF and RAW management and an inventory of SF and RAW as required in Art. 32, para 2. The application of Convention Art. 4 through 28 is described in Sections E to J. Section K describes the safety

improvements and also lists measures planned in the future. Section L contains Appendices to the report that provide more detailed information on some of the presented topics.

SF and RAW management Overview Matrix of the Republic of Bulgaria

Type of Liability	Long-term management policy	Funding of Liabilities	Current Practice/ Facilities	Planned Facilities
SF	Reprocessing abroad	Funding of liabilities is always in the responsibility of the KNPP	Reprocessing abroad; Interim Storage in a Wet and Dry Spent Fuel Storage Facilities on KNPP site	
RAW from the nuclear-fuel cycle	Disposal	Funding of liabilities is always in the responsibility of the KNPP; After the transfer to SERAW – financing by RAW Fund	On-site storage and processing LILW Processing -and storage facility on KNPP site	Near-surface Disposal Facility for short-lived LILW - at construction stage; Interim long-term storage facility for HLW and long-lived LILW
RAW from nuclear applications	Disposal	Funding of liabilities is always in the responsibility of the generators. After the transfer to SERAW – financing by RAW Fund	Novi Han storage facility	Near-surface Disposal Facility for short-lived LILW - at construction stage; Interim long-term storage facility for HLW and long-lived LILW
Decommissioning	Strategy for continuous dismantling	Funding of liabilities is always in the responsibility of the KNPP; KIDS Fund	Decommissioning of KNPP Units 1-4	Near-surface Disposal Facility for short-lived LILW - at construction stage; Plasma Melting Facility – at commissioning stage
Disused sealed sources; orphan sources	Returning to the manufacturer; Disposal	The liability of the owners Orphan sources: RAW Fund	Novi Han storage facility	Near-surface Disposal Facility for low and intermediate level short-lived RAW - at construction stage; Facility for intermediate long-term storage of HLW and long-lived LILW

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 on SF and RAW management is laid down in the national legislation (mainly **Nuclear Act**, the Environmental Protection Act, the Health Protection Act, and the regulations for their application) and basically stipulates the following:

- SF and RAW management is subject to state regulation and shall be carried out only by entities that have obtained a licence and/or a permit issued by the Chairman of BNRA;
- SF management shall be carried out only by entities that have obtained an NPP operation licence;
- The responsibility of the licencees for the RAW safe management until it is transferred to the State, i.e. the SERAW, or until release from regulatory control of the waste;
- The State is ultimately responsible for the safe and responsible disposal of RAW, including other products resulting from processing operations, when RAW is exported for processing to third country;
- The state monopoly is established over RAW management activities - RAW management outside the entities where RAW is generated is assigned to SERAW;
- The RAW generating entities shall incur the costs for waste management, including its final disposal, following the "polluter pays" principle, by making respective payments to the established specialized funds;
- The State is responsible for the management of RAW whose owner is unknown;
- RAW import in the country is prohibited, except in the cases defined in Nuclear Act (re-entry of disused sealed sources manufactured in the Republic of Bulgaria, and when RAW is generated as a result of the material reprocessing carried out as a service abroad for a Bulgarian legal entity);
- Application of the principle for returning back to the manufacturer of certain categories of spent radioactive sources;
- SF may be declared as RAW if there are conditions for its safe storage and disposal in the respective facility, and if the operator has paid the respective contribution to the RAW Fund;
- RAW generated in the Republic of Bulgaria shall be disposed on Bulgarian territory, except in the case of an agreement for the use of a regional disposal facility in another country.

The policy of the Republic of Bulgaria in the field of SF and RAW management is based on the moral principle of avoiding undue burden on future generations. The RAW and SF management principles are first stated in the *Strategy* for *SF and RAW Management* from 2004 and are confirmed and further developed in the *Strategy for SF and RAW Management* approved by the Council of Ministers in 2011 and in the updated National Strategy in 2015.

There are defined specific goals for the management of:

Spent fuel and high level radioactive waste

- The spent fuel is a material containing useful components. This material should be reprocessed in the country of origin or in third country in an internationally acceptable and mutually beneficial economical, technological, and environmentally friendly manner;
- For long-term storage, the spent fuel shall be stored using the "dry storage" technology;
- Deep geological disposal is considered the only option for guarantee isolation and containment of high level and long-lived RAW;
- The country's participation in regional and international projects for deep geological disposal is expedient; however looking for international solutions should not jeopardize the current national program.

Radioactive waste

- Application of the graded approach;
- Taking into account the interdependences among all steps of management of radioactive waste and safety requirements:
    - to give priority to minimization of RAW generation in respect to the measures to reduce the volume and activity of RAW in their subsequent management,
    - to take into account the requirements for minimizing RAW at the design, construction, operation and decommissioning stage of a nuclear facility,
    - timely to processing RAW until their conditioning for safe storage and disposal,
    - assurance of long-term safety achieved by implementation of passive safety barriers.
- The conditioned short-lived low level and intermediate level RAW, including waste from the decommissioning of nuclear facilities and waste from other sectors of the national economy shall be disposed in one national near-surface storage facility. The construction of a facility for disposal of low level and intermediate level RAW has the priority;
- Application of approach for RAW reuse and recycling, and release from regulatory control or landfill disposal of VLLW;
- Use of approved RAW processing technologies;
- Management of disused sealed radioactive sources.

The listed strategic policies, goals and basic guidelines are reflected in the *Regulation on Ensuring the Safety in Spent Fuel Management* and in the *Regulation on Safe Management of Radioactive Waste.*

SF management practices

SF Management at Kozloduy NPP

According to the Kozloduy NPP design, SF is stored for a period of 5 years in at-reactor spent fuel pools till its shipment to Russia for reprocessing or its transfer to Wet Spent Fuel Storage Facility (WSFSF). A separate WSFSF on the site of Kozloduy NPP was commissioned in 1989.

In 1988, the last return of SF from WWER-440 to Russia was carried out under the initial contract conditions without provisions for returning back the HLW from reprocessing.

Regarding SF technological storage and reprocessing in Russia with subsequent reimport of HLW obtained upon its reprocessing, long-term agreements were signed with the Russian company Techsnabexport JSC in 1998 for SF from WWER-440 and in 2000 for SF from WWER-1000. Since 2008, the performance of the activities took part under the contracts for reprocessing, which were transferred from Techsnabexport JSC to Federal Centre for Nuclear and Radiation Safety FSUE. The possibility for reprocessing of SF delivered as fresh nuclear fuel (FNF) after 2002 was provided in the FNF supply contract with the Russian company TVEL JSC.

The spent fuel is transported to Russia for reprocessing by the Nautilus barge. The barge is equipped to transport 8 casks loaded with SF from WWER-440 (240 assemblies) or WWER-1000 (96 assemblies).

At Kozloduy NPP there are two SF storage facilities for fuel from WWER-440 and WWER-1000 reactors. In the WSFSF the spent fuel is stored in transport baskets under water in 4 pools.

Additionally a Dry Spent Fuel Storage Facility (DSFSF) for the WWER-440 SF was constructed. The storage is a container type system with natural convection air-cooled casks CONSTOR 440/84 with a capacity of 72 casks for 84 fuel assemblies each.

Till 30.06.2020, 15 CONSTOR-440/84 casks were loaded in the DSFSF.

Long-term SF management

According to the Technical Specifications for Operation of Kozloduy NPP a sufficient free capacity in SFP 5 and 6 for emergency core unloading shall be ensured. For this purpose SF assemblies shall be regularly removed from SFP-5 and/or SFP-6.

The removal of all SF from WWER 440 from WSFSF is envisaged and it shall be performed by loading it into dry storage casks "CONSTOR 440/84 and/or its transportation for reprocessing in Russia. This will allow using the full WSFSF capacity only for SF from the operating units. Dry storage options for WWER-1000 SF are elaborated also.

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 considered:

a. part of the practice of using nuclear fuel for generation of electricity.

b. part of the practice of using radioactive sources in medicine, industry, agriculture and research. This practice includes the operation of a centralized facility for the storage and processing of institutional RAW.

The operators of nuclear facilities and the licencees of the nuclear applications perform treatment (to a different extent) and/or interim storage on their sites of all generated RAW until their transfer to SERAW.

SERAW as operator of RAW management facilities carries out processing and storage, and after the construction of the National Disposal Facility, will also operate the disposal facility. Till the commissioning of the National Disposal Facility, the conditioned RAW are stored in SERAW interim storage facilities.

RAW management at Kozloduy NPP

RAW generated at Kozloduy NPP are RAW category 2 – LILW according to the classification in the *Regulation on Safety of Radioactive Waste Management*.

Solid RAW in the restricted area are collected and sorted according to dose rate characteristics and the type of material – mainly as compactible and non-compactible.

Liquid RAW (radioactive concentrate and spent sorbents) are stored in separate tanks in the auxiliary buildings of the Kozloduy NPP.

Since 2001, a separate RAW processing & storage facility is operated on Kozloduy NPP site. The operator of the facility is SERAW through SD RAW-Kozloduy. The compactable solid RAW are compacted in 200-litter drums in 2 stages: preliminary RAW compaction in the drums by a 50-ton load and subsequent super-compaction of the drums themselves by a 910-ton load. The treatment of liquid RAW is performed via concentration by evaporation and conditioning by using the cementation method.

A reinforced concrete container of net volume 5 m^3 is used for RAW packaging. The conditioning of the compactable and non-compactable solid RAW is performed according to their radionuclide composition:

- combined conditioning with the liquid RAW by incorporation of the solid RAW in a cement-radioactive matrix,
- incorporation of the solid RAW in a non-radioactive cement matrix,
- packaging of the solid RAW.

Management of RAW from nuclear applications

About 2000 different sites of national industrial, medical, agricultural and scientific research use sources of ionizing radiation (SIR).

The disused SIR declared as RAW are transferred without preliminary treatment to the centralized storage facility operated by SERAW through SD RAW - Novi Han where installations for cementing, abrasive decontamination, compaction of solid RAW are available also.

Information about the main purpose and essential characteristics of the RAW management sites is presented in Appendix L-3

The main characteristics of the stored RAW are presented in Annex 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.

RAW classification

The Classification of RAW, introduced by the *Regulation on Safe Management of Radioactive Waste*, is based on considerations of long term safety, in particular disposal options. Solid radioactive waste 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.

The classification applies also to liquid and gaseous RAW according to the characteristics of the expected solid RAW by its conditioning.

According to the methods and practice accepted for treatment of RAW, the operator of a nuclear facility may introduce more detailed additional subcategories of LILW facilitating the day-by day operations in the facility.

SECTION C. AREA OF APPLICATION

All spent fuel on the territory of the country in the scope of the Convention.

Radioactive waste containing only natural radioactive substances, generated outside the nuclear fuel cycle, except sealed radioactive sources, are not to be declared as RAW for the purposes of the Joint Convention.

RAW generated from nuclear applications on sites of the Ministry of Defense shall be managed as RAW from the civil programs for nuclear applications and are declared for the purposes of the Convention.

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"

SF management facilities and inventory

In the Republic of Bulgaria SF is stored in two spent fuel pools in the reactor hall of the two operational nuclear power reactor units 5 and 6 of Kozloduy NPP, as well as in two SF storage facilities at Kozloduy NPP site - Wet Spent Fuel Storage Facility for WWER-440 and WWER-1000 SF assemblies and Dry Spent Fuel Storage Facility for WWER-440 assemblies.

The inventories of spent fuel in the SF management facilities operated by Kozloduy NPP with reference to the respective characteristics and quantities of stored SF, as at 31.12.2019:

Reactor type	Number of assemblies	Heavy metal [t]	Approximate activity [Bq]
WWER-440	2864	330,9	$0{,}3.10^{19}$
WWER-1000	1545	624,8	$2{,}5.10^{19}$
TOTAL	**4409**	**955,7**	**$2{,}8.10^{19}$**

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

RAW management facilities and inventory

In Republic of Bulgaria the RAW management facilities and the associated SSCs are located at Kozloduy NPP site and at Novi Han site.

Kozloduy NPP has SSCs for treatment and storage of RAW, built according to the entire NPP design. The operation of these RAW SSCs is performed under the KNPP operation licence. The principal treatment techniques used for low- and intermediate-level operational waste are concentration via evaporation and filtration.

SERAW is operating RAW Processing and Storage facility for treatment, conditioning and subsequent storage of the conditioned waste with origin KNPP. The facility accepts low and intermediate radioactive RAW solid and liquid radioactive concentrate (with different boric acid content) and assures safe storage of RAW conditioned for subsequent disposal in NDF. To the facility belong designated SSCs for RAW storage at Kozloduy NPP site.

SERAW is operating under separate licences the nuclear units under decommissioning, including its SSCs for liquid RAW treatment and storage.

SERAW is operating the centralized storage facility for RAW from the nuclear applications. The facility consists of designated storage and treatment SSCs at Novi Han site. The processing methods used are fragmentation, compaction of solid RAW, concentration via evaporation of liquid RAW, abrasive decontamination of metal RAW.

The RAW inventories stored at the nuclear facilities, as at 31.12.2019:

- from Kozloduy Nuclear Power Plant – 1.10^{14} Bq total activity,
- from nuclear applications – 2.10^{15} Bq total activity.

List of SF and RAW facilities and SSCs

SF management facilities and SSCs

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.

RAW management facilities and SSCs
Operated by Kozloduy NPP

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.

Operated by SERAW

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 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.

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 SSC 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-litter 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.

More detailed information about the facilities and report of stored and disposed RAW, such as volume or mass and specific radionuclides are provided in Appendices L-3 and L-4 of the report.

Disposal of Radioactive Waste

There are no radioactive waste disposal facilities in Bulgaria. However, construction of the National Disposal Facility for LILRAW has started in 2017.

Radioactive Waste from Past Practices

INRNE - BAS

Activities on the spent nuclear fuel management in the country began with the commissioning of the research reactor IRT-2000 in 1961 at the Institute of Physics of the Bulgarian Academy of Sciences (BAS) Sofia. The reactor was intended for scientific research and for production of radioactive isotopes. Irradiated fuel was stored in the at-reactor shaft storage pool-type facility, constructed within the boundaries of the biological shield of the reactor. The research reactor was permanently shut down in 1989.

In 2008 the complete removal of the SF from site and shipped abroad, as presented in the Third National Report, and the research reactor is removed from the list of the SF management facilities.

The operational RAW were transferred to SERAW for subsequent storage and processing. The RAW generated during the partial dismantling of IRT-2000 equipment have been conditioned in reinforced concrete containers RCC type and transferred to SERAW and is reported in the inventory of SERAW.

The management or RAW arising from the forthcoming restoration activities on this site with radioactive substances shall be carried out within the established regulatory regime under the Nuclear Act.

Nuclear facilities under decommissioning

All the SF is removed from reactors of KNPP unites 1 to 4 and the planned activities for reducing the radiological inventory, for processing the operational liquid radioactive concentrates, for dismantling of the equipment in the restricted area and for decontamination are carried out.

The equipment in the Turbine Hall has been dismantled. The process of clearance of material arising from dismantling activities is conducted.

Information about decommissioning is presented in this report in Art. 26.

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."

Implementing Measures

The Republic of Bulgaria has established and is maintaining a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management in implementation of its obligations under the Convention.

The legislative and regulatory framework is consistent with the relevant IAEA safety standards on SF and RAW.

Legislative and regulatory framework

The national legislative and regulatory framework for safety of SF 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 (ordinances) for their application. The regulations, mainly related to the SF and RW management are:
  - *Regulation for Radiation Protection*, adopted in 2018;
  - *Regulation for Ensuring the Safety in Spent Fuel Management*, 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 2018;
  - *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 2016*;*
- *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*;*
- *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.

There are also more than 20 regulatory guidelines issued by the BNRA Chairman for the practical implementation of the legislative requirements. The regulatory guides are not mandatory; the aim is to facilitate the licencee in implementing the particular legislative requirements.

The basic requirements on nuclear safety, radiation protection and physical protection of nuclear facilities are set out in the Nuclear Act, adopted by National Assembly of the Republic of Bulgaria. The regulations on its application are adopted by the Council of Ministers, and they specify in details the requirements of the law.

The Nuclear Act regulates the safe use of nuclear energy, including the management of radioactive waste and spent nuclear fuel. The new Nuclear Act was adopted in 2002, and was last amended in 2020.

In 2010, the Nuclear Act was supplemented, taking into account the experience gained in the enforcement measures, the adoption of new EU directives on nuclear safety and the changes in the Convention on the Physical Protection of Nuclear Material. The EU Directive2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste and the EU Council Directive 2013/59/ Euratom laying down basic safety standards for the protection against the dangers arising from exposure to ionising radiation, were transposed in the national legislation 2013 and 2018 respectively.

With the Nuclear Act and the Regulations are established the requirements for provision of nuclear safety and radiation protection for the SF and RAW activities and facilities, including for each stage of the lifecycle - site selection, design, construction, commissioning, operation, decommissioning and/or closure of the RAW management facility.

The fissile material from the SF is state (EU) property. The ultimate responsibility of the State lies with the disposal of the RAW, incl. HLW arising from SF reprocessing.

Determined are the dose constraints and requirements for safety assessments related to the SF and RAW facilities. The safety of the facility shall be based on application of the defense-in-depth concept, exercised by implementation of a system of physical barriers and implementation of technical and organizational measures for control and protection of the barriers.

Specific requirements for design and operation of SF management facilities, both "wet" and "dry" storage technologies, are determined.

The RAW classification is in accordance to the IAEA GSG-1.

There are provisions to govern: the interdependencies between the different steps in the RAW management in the safety context; the priority of RAW minimization at the source of its generation and the volume-and/or activity reduction in the subsequent processing; RAW minimization at each stage of the nuclear facility life cycle; conditioning of RAW as soon as achievable after its generation; the long-term safety with elements of passive safety; the disposal type for each of the RAW classes.

Defined are the responsibilities of the entities generating RAW for its safe management from the generation until its transfer to the State (resp. to the SERAW as operating organization) or its release from regulatory control.

The licensee of a nuclear facility is obliged to implement a program for management of RAW, which describes and justifies the current and planned activities on management of all generated RAW until their disposal, or release from regulatory control, including:

- the sources, streams and characteristics of the generated RAW,
- description of the selected management option for each RAW stream,
- justification of the selected option for processing and storage,
- demonstration of compliance with the national policy and strategy for management of RAW and with the legislative safety requirements,
- description of its administrative organization established to implement the program,
- assessment of costs and sources of funding for the program and risk assessment.

The program itself is a practical approach for optimization of the RAW management by the nuclear operator. Since 2005 KNPP maintains such program as a licence condition. Its implementation is agreed with the SERAW and is supervised by BNRA.

All RAW arising from nuclear applications shall be transferred to the SERAW for subsequent storage, processing and disposal.

The list of the legislation relevant to radioactive waste management and spent fuel management are presented in Annex L-5 and described under relevant JC articles.

National safety requirements and regulations for radiation safety

National requirements for radiation safety are established in the Nuclear Act, Health Act and the specific regulations of their fulfilment. The legislation aims at protecting human health against ionising radiation, implementing the internationally agreed principles of justification of a practices, dose limitation and optimization of the radiation protection.

The new *Regulation for Radiation Protection* adopted in 2018 in transposition of the Euratom Directive59/2013 defines:

- The radiation protection principles for justification of practices, dose limitation and optimization of the protection;
- The dose limits, derived limits, dose constraints. The individual dose limit for occupational exposure is 20 mSv/a and for the public is 1 mSv/a. The dose constraints for the population are set for each individual type of nuclear facility and for a nuclear multi-facility site as whole;
- Reference levels for radiation control and for protection planning purposes (for emergency – and existing exposure situations);

- The general criteria, the dose criteria and the nuclide specific clearance levels for release from regulatory control (exemption and clearance);
- The requirements, responsibilities and measures concerning each of the three exposure situations, including the obligations of the competent state bodies and of the entities;
- Specific rules and measures for radiation protection in design and operations of nuclear facilities and activities.

The national legislation in radiation protection is consistent with the IAEA GSR Part 3 safety standard.

System of licensing of spent fuel and radioactive waste management activities

In the scope of the Nuclear Act are defined the nuclear facilities and activities with nuclear material and RAW which are subject of authorization. It establishes authorization system, based on the concept for graded approach and consisting of four regimes - notification, registration, permission, licencing.

The spent fuel and radioactive waste management activities generally are performed in dedicated nuclear facilities. The SF is nuclear material and it may be declared as radioactive waste by the Council of Ministries. The licencing and permission regimes are applicable to each of the SF and RAW facilities and activities. A licence for operation of a spent fuel management facility can be granted only to a nuclear power plant operator.

For the nuclear applications, depending on the radiation risk magnitude, beside the licencing and permission, the notification and registration regimes are applicable also.

The Nuclear Act requires the entity to possess for the respective stage of the entire facility life cycle:

- siting permission,
- design permission,
- construction permission,
- commissioning permission,
- permit for modifications of:
    - safety related SSCs,
    - operational limits and conditions on the basis of which the licence for operation or decommissioning has been issued,
    - licensee's documents - rules, procedures, programs, technical specifications and other documents envisaged by the operation/decommissioning licence,
- operation licence,
- decommissioning licence.

Separate permissions are required for transport of nuclear material and RAW outside the nuclear facility; deals with nuclear facility and nuclear material; import and export of nuclear material; transit of nuclear material. There are specific prerequisites for granting a permit for export of spent fuel for reprocessing outside the EU. The contract with the country of destination shall be agreed with the EC Supply Agency and the reprocessing facility in that country shall comply with the international safety standards, which equivalent is the ratification of the Joint Convention by that third country.

All the licences and permits are granted by the BNRA Chairman.

The permissions are time-limited and the maximum term of the licence validity is 10 years. Licence renewal is based on the results of the periodic safety review, performed by the operator once per 10 years.

The conditions and procedure for issuance of licences and permits are defined in the *Regulation on the Order for Issuance of Licences and Permits for the Safe Use of Nuclear Energy*. The applicant has to submit documents confirming the compliance with the legislative requirements of nuclear safety and radiation protection. It is accepted that the requirements for licence or permit issuance are met if: all

the document with the required quality are submitted; the licencee has fulfilled all requirements and conditions of preceding licenses, permits and other acts, issued by BNRA and related to the requested licence or permit; the results of the BNRA regulatory review and evaluation of the documents confirm compliance with the legislative safety requirements. The Regulation defines also the scope and the content of the issued licences and permits.

Each licence or permit, the change thereof, or the refusal for issuance of the requested document is subject of appeal to the respective administrative court in accordance with the Administrative Procedure Code.

A public register of the issued licences and permits is maintained by BNRA.

Prohibition of Operation without a Licence

Chapter III of the Nuclear Act covers the established authorization system, according to which the RAW management and sf management shall be performed by a legal entity only after obtaining a licence or a permit for conduction of the relevant activity in the cases specified in same Act. Penalties for violations are imposed according to the Nuclear Act and the Penal Code.

Institutional Control, Regulatory Inspection, Documentation and Reporting

The Nuclear Act assigns to the BNRA Chairman the responsibility to carry out regulatory control over the nuclear safety and radiation protection in the RAW and SF management.

The regulatory control includes:

- regulatory review and assessments for issuing of licences and permits for activities and facilities,
- supervision of the implementation of the licence conditions,
- control on the implementation of recommendations and prescriptions given by the BNRA inspectors.

The Regulatory Authority is entitled to:

- perform planned and unscheduled inspections through its authorized officials. The planned inspections take into account the operational status of nuclear facility and/or activity, as well as the results from previous inspections, implementing the graded approach,
- inform other competent authorities to take action within their competences if necessary,
- amend or revoke licences and permits,
- impose enforcement measures and penalties.

According to the Nuclear Act comprehensive system for supervision of the nuclear activities and facilities is established. The state inspectors responsible for the supervision are designated by the BNRA Chairman. The inspectors have the right to:

- access to the licencees' facility site and staff,
- require from the licencee all the necessary information and explanations, related to the safety,
- findings of violations of the Nuclear Act,
- issue mandatory prescriptions related to the safety of the respective facility and activity.

The inspection results are recorded in an inspection report of findings. The Nuclear Act and the supplemented regulations require comprehensive documentation on the design, construction, operation, modifications, decommissioning/closure of the nuclear facility and that documentation shall be kept by the operator.

The nuclear operators Kozloduy NPP and SERAW periodically report to BNRA about the current material conditions at the facilities. Safety relevant information in agreed format is periodically

submitted to BNRA according to the particular licence conditions. There are procedures for notification of BNRA in case of operational events.

BNRA regularly informs the public on the condition of the nuclear facilities and operational events, related to SF and RAW also. BNRA prepares annually report on the status of the nuclear and radiation safety in Bulgaria and submits it to the Government and the Parliament.

Enforcement

Mandatory administrative measures that may be imposed are:

- suspension or constraint of activity for which the permit or licence has been originally issued or of the activity for which a notification is submitted or a registration is made,
- suspension of individual employment licence,
- prescription for elaboration and implementation of technical and organizational safety relevant measures. Such measures are related with design modifications of SSCs, operational limits and conditions, physical protection, emergency planning, training programmes etc.

Mandatory administrative measures are imposed through an order of the BNRA Chairman, based on a protocol of findings of BNRA inspectors. The order for imposing mandatory measures shall determine appropriate time for their implementation. The order for imposing mandatory administrative measures may be appealed before the respective Administrative Court under provisions of the Administrative Procedural Code. An appeal does not suspend execution of that order, unless the court has ruled otherwise.

Allocation of Responsibilities

The Nuclear Act allocates the responsibilities of the bodies involved in the SF and RAW management as follows:

- The Council of Ministers - adopts the National strategy (program) for spent fuel management and for radioactive waste management; decides on construction of a RAW disposal facility and may declare the spent fuel as radioactive waste;
- Bulgarian Nuclear Regulatory Authority (BNRA) - performs state regulation over the radioactive waste and spent nuclear fuel activities and facilities. The BNRA maintains the legislative and regulatory framework for safety in the subject area. BNRA issues licences and permits, exercises regulatory control and imposes enforcement measures to ensure compliance with the legislative requirements;
- Ministry of Energy (ME) - develops and submits to the Council of Ministers for adoption the National Strategy for management of spent nuclear fuel and radioactive waste; implements the policy for SF and RAW management and oversights the inplementation of the activities as plannen with the Strategy;
- Ministry of Health (MH) carries out the public heath radiological control through its bodies - the National Center for Radiobiology and Radiation Protection and the Regional Health Inspectorates;
- Ministry of Environment and Water (MEW) is in charge of the National System for Environmental Radiological Monitoring and is the competent authority for the environmental impact assessment for radioactive waste and spent fuel management facilities;
- Ministry of Interior (MoI) has responsibilities related to the physical protection, fire safety and civil protection.

The responsible entities for management of spent fuel and of radioactive waste are its generators. They have to bring it into a form appropriate for safe transport, storage and eventually for disposal. These

entities are obliged to meet all expenses for SF and RAW management from the generation to the disposal, through contributions to the Radioactive Waste Fund.

Radioactive waste outside the place of its generation is managed by the State Enterprise Radioactive Waste. It is establishes by the Nuclear Act, where are specified its responsibilities, management bodies, financing, etc. The management of the orphan sources and DRS, which cannot be returned to their manufacturer, is obligation of the SERAW. RAW becomes state property with its transfer to the SERAW.

Regulating Radioactive Materials as Radioactive Waste

The Nuclear Act and the *Regulation on Safe Management of RAW* give the following definition of radioactive waste:" *Radioactive waste shall be a radioactive substance in a gaseous, liquid or solid form for which no further use is foreseen by the licensee or permit holder and which is controlled as radioactive waste by the Agency*." This is consistent with the internationally agreed definition. Spent fuel is not considered as waste but rather as recyclable material that is exploited by reprocessing, unless it is declared by its owner to be radioactive waste that has to be disposed of.

In conclusion, the Republic of Bulgaria implements the legislative and regulatory system in accordance to Art.19 of Joint Convention and has further planned activities in this field.

A full list of the existing regulations applicable to radioactive waste and spent fuel management is presented in Appendix L-5.

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 Bulgarian Nuclear Regulatory Agency is established in 2002 with the Safe Use of Nuclear Energy Act. The BNRA is entrusted with the implementation of the legislative and regulatory framework referred to in Article 19 of the Convention.

BNRA is successor of the Committee on the use of atomic energy for peaceful purposes (CUAEPP) which was established back in 1957 when Bulgaria ratified as co-founder the Statute of the IAEA. In 1985 was adopted the first nuclear act - the Act on the Use of Nuclear Energy for Peaceful Purposes. At that time CUAEPP had nuclear safety supervisory functions together with some tasks in the promotion of nuclear research.

In 2002 following the first IAEA IRRS mission in Bulgaria, completely new Act on the use of atomic energy (Nuclear Act) was adopted which established the Bulgarian Nuclear Regulatory Agency as the only nuclear regulatory authority of Bulgaria and separated the nuclear regulatory functions from the nuclear energy promotion. The Nuclear Act is consistent with the current IAEA safety standards, and the legislative practice of EU in this area.

According to the Nuclear Act, the state regulation of the safe use of nuclear energy and ionizing radiation, and the safe management of radioactive waste and spent nuclear fuel is effected by the Chairman of the Nuclear Regulatory Agency who is an independent specialized body of the executive power.

The status of the BNRA Chairman is established by the Nuclear Act, Chapter II, with clear and unequivocal allocation of the responsibilities, assignment of the regulatory functions and securing of financial and human resources. So the BNRA Chairman has the following authorities and responsibilities:

- manage and represent the BNRA,
- issue, amend, supplement, renew, suspend and revoke licences and permits,
- supervise compliance of the activities and facilities with the safety requirements and standards applicable to nuclear energy and nuclear applications, incl. radioactive waste and spent nuclear fuel management, and with the licence conditions,
- issue, terminate and withdraw registration certificates and individual licences for carrying out activities under the Nuclear Act,
- impose compulsory administrative measures and administrative penalties,
- contract expert reviews, studies and research, related to nuclear safety and radiation protection of SF and RAW management,
- carry out the international cooperation of the Republic of Bulgaria in the field of nuclear safety and radiation protection, and of the SF and RAW management,

- provide the public, entities and state bodies with information on the status of nuclear safety and radiation protection,
- reports to the Council of Ministers by submission of annual reports on the status of nuclear safety and radiation protection of the nuclear activities and facilities, as well on the activities of BNRA,
- organize and coordinate the implementation by the Republic of Bulgarian of the obligations under the Agreement with the IAEA for the nuclear safeguards, related to the NPT and the Additional Protocol,
- perform the functions of a central authority and contact point for notification and assistance under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency,
- act as the competent authority, point of contact, and coordinator under the Convention on the Physical Protection of Nuclear Material,
- develop and propose for adoption to the Council of Ministers the regulations on the implementation of the Nuclear Act.

BNRA is the licensing authority for the spent fuel and radioactive waste management facilities and activities. It is fully responsible for conducting the regulatory decision-making process and for issuance the respective authorization according to the Nuclear Act.

According to the Act on the ratification of the Joint Convention, the BNRA Chairman is designated as the regulatory authority pursuant to art.20 of the Convention, and he coordinates the preparation of the national reports on the fulfilment of the obligations of the Republic of Bulgaria under the Convention.

BNRA performs the review and assessment needed to judge the compliance to the safety requirements for SF and RAW management facilities and activities, as prepared by the operator both for granting authorization and periodically during the subsequent operations.

The BNRA implements an Integrated Management System based on the requirements of the IAEA GSR Part 1. The management system brings together all the interconnected elements of the organization - structure, resources, processes (working practices) and culture of the organization for ensuring comprehensive control and consistency for the regulatory decision-making.

The chairman of BNRA and the two deputy chairmen are appointed by the Council of Ministers and they shall have as a minimum a master degree in natural and technical sciences and at least 10 years of experience in nuclear energy, radiation protection and SF and RAW management

The Nuclear Act establishes two advisory bodies to the BNRA Chairman - Advisory Council on Nuclear Safety and Advisory Council on Radiation Protection. The members are appointed by the BNRA Chair and are prominent Bulgarian scientists and experts having extensive academic, research, or operational experience in various aspects of nuclear safety and radiation protection, nationally and internationally.

The BNRA structure, operation and organization are determined in the BNRA Rules of Procedure, adopted by the Council of Ministers upon proposal of the BNRA Chairman. There are 114 statutory positions and currently about 100 employees divided into five departments: Nuclear Safety; Radiation Protection; Safety analyses and assessments; International co-operation; General Administration. The implementation of the legislative and regulatory framework concerning spent fuel lies mostly with the Department Nuclear Safety, and concerning radioactive waste management - mainly with the Division the Decommissioning and RAW of the Radiation Protection Department.

The requirements on BNRA staff qualifications and experience are defined in a job description for each particular position. Almost all employees of the Agency hold a higher education degree (Masters' Degree, some of them PhD) and have long-term professional experience in the field of design,

construction, operation and decommissioning of nuclear facilities and in the nuclear applications as well of their regulation. The professional experience of the specialized administration officers in average exceeds 20 years.

The professional selection of the staff in BNRA is carried out in compliance with the requirements of the Civil Servant Act, the Labour Code and the BNRA internal rules. The requirements for candidates are aimed at the professional competence, personal attitudes, ability to work in a team, desire for development, communication skills, leadership and management competence for the management positions, etc. BNRA has consistently implemented a policy of transferring the experience to the younger employees for ensuring continuity in the organization and preservation of well-established professional practices.

BNRA has a staff training and qualification system in accordance with national and international standards. Specialized training is held to maintain and improve the qualifications of the employees, including the acquisition of additional professional knowledge and skills. It is based on the systematic approach to training and is performed on an annual base planning. Participation in international projects, technical meetings, training courses and seminars is very useful for BNRA employees as feedback of the international regulatory practices.

In cases of specific technical areas, BNRA provides external expertise also by contracting independent experts/TSOs. In particular external technical support to BNRA is assured for the decommissioning of KNPP units 1 to 4, covering the related RAW management and the LILW disposal facility also.

BNRA is a legal person, financed by the State Budget. The BNRA annual budget is developed directly with the Ministry of Finance of the Republic of Bulgaria. The Law on the State Budget of the Republic of Bulgaria for 2020 allocates expenses to the amount of BGN about 7.2 million to BNRA. So there are covered the maintenance costs of the agency, staff remuneration, social and health contributions, membership fee in international organizations, acquisition of long-term tangible assets etc. All expenses of BNRA are covered by state taxes from the licencees. For the current year incomes of the BNRA budget are set to about 8.6 million BGN. Recent years, there has been reached stability in the financing of the regulatory authority.

Effective independence of the regulatory functions from other functions

In terms of Article 4 of the Nuclear Act and Article 19, Para. 4 of the Law on Administration, the Chairman of the BNRA is an independent regulatory body of the executive power. It is separate from each other state body and from the governmental organizations and commercial entities performing the planning, construction, operation and decommissioning/closure of SF and RAW management facilities or involved in particular activities with SF and RAW.

The BNRA Chairman is approved by the Council of Ministers and appointed by the Prime Minister for a 5-year mandate and may be appointed for one more term of office. The mandate may be terminated only in very limited cases, especially mentioned by the Nuclear Act.

The Chairman and his deputies draw up a declaration for conflict of interests in the areas within the competence of the regulatory authority.

BNRA Chairman reports to the Council of Ministers annually for the status of nuclear safety and radiation protection for the nuclear facilities and activities in Bulgaria and thus ensuring a legal independence with respect to other governmental bodies and Ministries that promote the use of ionizing radiation for various purposes.

The Act on the Safe Use of Nuclear Energy creates preconditions for the financial independence of the regulatory authority. The BNRA Chairman is a budget authorizer by delegation and draws up its own budget in accordance with the Act on Public Finances.

The allocation of the responsibilities by the Nuclear Act ensures the effective independence of the regulatory functions from the management functions of the SF and the RAW. The owners of spent fuel

and radioactive waste in Bulgaria are primarily the NPP operators. The disused radioactive sources from the nuclear applications (medicine, industry and research) are owned by the licensees. All the RAW (including HLW from SF reprocessing, SF if declared as RAW, RAW arising from the nuclear facilities and applications) become state property after their transfer to the SERAW for the subsequent storage, processing and disposal.

As State owned company, established by the Nuclear Act, SERAW is in the patrimony of the Minister of energy. The Minister of energy has to conduct the National program (the National Strategy) on the SF and the RAW management in Bulgaria also, as part of the general promotion of nuclear energy and technologies.

So the responsibilities for the management of radioactive waste and for the regulatory function are allocated to different governmental bodies, and the regulatory body is granted complete independence in its judgement. The results of the licencing and supervision activities of BNRA are published within the BNRA annual report.

In summary, Bulgaria has established a regulatory body entrusted with the implementation of the legislative and regulatory framework related to spent fuel and radioactive waste management, provided with the necessary authority, competence and and financial and human resources to fulfil its responsibilities and has ensured the effective independence of the regulatory functions from all the other functions of organizations related to SF and RAW management.

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."

Licence Holder

All activities for management of spent fuel and radioactive waste, including conditioning, storage and disposal, are or will be carried out in nuclear facilities. The Nuclear Act provides that the radioactive waste and spent fuel management shall be performed by legal entity solely after obtaining a permit and/or a licence for the safe implementation of the relevant activity. In order to ensure that the licence holder meets his responsibilities, the Republic of Bulgaria has established a regulatory body entrusted with the implementation of the legislative and regulatory framework, as described above.

According to Art.3 Para.2 of the Nuclear Act, the prime responsibility for ensuring nuclear safety and radiation protection lies completely with the licensee of the particular facility/activity and may not be transferred to another person. The regulations on the implementation of the Nuclear Act detail the specific responsibilities and obligations of the licence holder in the particular areas: SF and RAW management facilities and activities operations, radiation protection, emergency planning and preparedness, physical protection, BNRA notification in case of nuclear events, transfer of RAW to the SERAW, training of the staff, licencing terms and procedures, etc.

The generator of spent fuel and radioactive waste is primarily the Kozloduy NPP operator. Spent fuel is stored at the WSFSF and DSFSF on-site of KNPP. According to the Nuclear Act, a SF management facility may be operated only by the licenced operator of a NPP, so the licence holder for WSFSF and DSFSF is KNPP. Interim storage and processing of operational and of decommissioning RAW is carried out by KNPP and by SERAW at designated facilities. All these facilities are nuclear facilities which are operated according to the respective licences. The supervision, exercised by BNRA, ensures that the licence holders shall meet their responsibilities and obligations according to the law.

The Nuclear Act establishes in chapter IV that the responsibility for the collection, processing, storage and disposal of radioactive waste outside the entity where generated, shall be carried out by the SERAW. SERAW is the licenced operator of the nuclear facilities for RAW management in Bulgaria. Each licencee as a result of which activities RAW is generated bears the responsibility for its safe management from its generation till its transfer to SERAW or its release from regulatory control.

The specific responsibilities of the licence holder are developed in details in the *Regulation on Ensuring the Safety in Spent Fuel Management* and in the *Regulation on Safety Management of Radioactive Waste*, including the requirements for implementation and maintaining the management system for effective allocation of the responsibilities within the operating organization.

According to Art. 22 para. 3 of the Nuclear Act, the former licence holder bears the responsibility for provision of nuclear safety, radiation protection and physical protection in case of license termination until: issuance of new license; safe decommissioning of the facility; transfer of the facility to another licenced operator.

Unlicensed Facilities, Activities and Materials

In compliance with Article 21, item 2 of the Joint Convention, the Republic of Bulgaria has taken the legislative measures that the responsibility rests with the State in cases when a responsible entity for the spent fuel and radioactive waste management is unknown, cannot be found or is bankrupted.

According to Art. 73 of the Nuclear Act, any radioactive waste and spent fuel under such circumstances, shall be state property. The State bears the responsibility for its safe management. The BNRA Chairman designates in a separate administrative act (Order) a licenced operator of SF or RAW management facility who shall receive the radioactive material and sets also the relevant conditions for performing those operations.

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 Staff

The Nuclear Act specifies that licence for operation of nuclear facility is issued if the applicant has qualified personnel. The qualification and training requirements to the personnel for all activities related to the operation of facilities for SF and RAW management are provided in the *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*.

The *Regulation* determines the requirements for the professional qualifications for staff responsible for carrying safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility, including:

- the procedure for qualification acquisition,
- the procedure for issuance of training center's licence,
- the requirements for the system of personnel selection and qualification,
- the requirements for qualification and mandatory specialized training of the NF personnel, including the minimal requirements for training programs content and for the training duration for specific positions in the various types of nuclear facilities.

The organizations providing training and qualification of the NF personnel are subject to licencing by the BNRA Chairman as established in the Nuclear Act and the Regulation. The control for implementation of the licences conditions for specialized training and certificates of competence is provided by the BNRA.

In the Kozloduy NPP and SERAW a system for selection of personnel is applied. This system takes into account the professional and qualification requirements. The training and qualification system, including the internal attestation system, implements the systematic approach for specialized training for safety related activities in nuclear facilities and nuclear applications. The Training Centre is an separate unit in the organizational structure of Kozloduy NPP. Kozloduy NPP is licenced to conduct specialized training and issuance of certificates of competence, in accordance with the requirements of the Nuclear Act.

According to the curriculum for training and qualification of the personnel (curriculum for initial specialized training or general curriculum) an individual programme shall be prepared for each position performing functions influencing or ensuring nuclear safety and radiation protection (personnel groups A and B). The professional capacity of group A is required un individual employment licence issued by an examination board of the BNRA.

Adequate Financial Resources and Provision for Institutional Controls

The Nuclear Act establishes and requires maintenance of appropriate mechanism to ensure adequate financial resources to discharge the relevant licencees' responsibilities, as well as for control and monitoring for the post closure period of a disposal facility. A licence for operation of NF may be

issued to the applicant who has demonstrated suffusion financial resources for maintaining the safety for the entire lifetime of the nuclear facility.

Two funds: "Radioactive waste" and "Decommissioning of nuclear facilities", are established by the Nuclear Act. Each of the radioactive waste generators shall make contributions to the "Radioactive waste" fund. The NPP operator shall make contributions to the "Decommissioning of nuclear facilities" fund also.

The *Regulation on the procedure for establishing, collecting, spending and control of and the amount of contributions due to the RAW Fund* and the *Regulation on the procedure for establishing, collecting, spending and control of, and the amount of contributions due to the Decommissioning of Nuclear Facilities Fund*, determine the terms and conditions for gathering and use of financial resources. The availability of financial resources to support the safety of facilities for SF and RAW management during their operating lifetime, for decommissioning and for institutional controls and monitoring arrangements following the closure of a disposal facility, is ensured through these specialised Funds and as a part of the yearly State budget allocations.

The adoption of these regulations guarantees the collection of sufficient funds for the NF decommissioning and for the long term RAW management (including disposal), with the funding being provided by the payments of NF operators and/or RAW generators, from the state budget, bank interests and donations.

The financing of SF and RAW management in the frame of Kozloduy NPP operation is provided by the operator.

The financing of the decommissioning and of the management of RAW after its transfer to SERAW is provided by the Decommissioning fund and the RAW fund. The funds are special purpose funds and are managed in accordance with the applicable legislation to ensure the following:

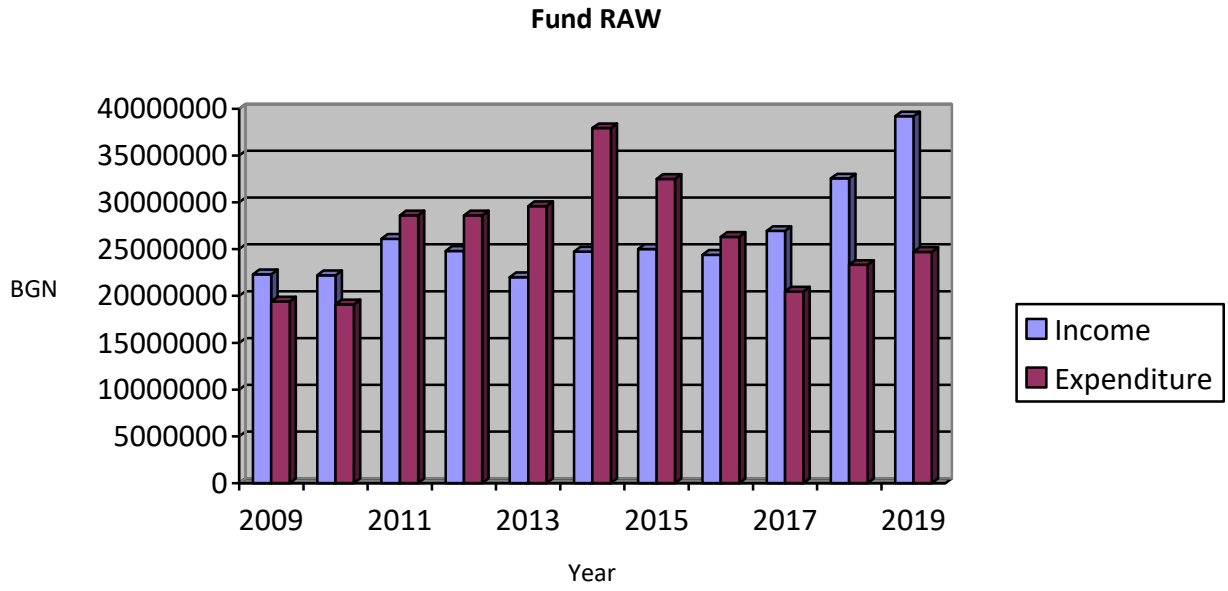
- sufficient financial resources which will be available in order to avoid the imposing of undue burden on the future generations,
- transparency in the management of the financial resources, ensuring that these resources will not be diverted improperly for other purposes.

Under the current legislation, the expenditures from the RAW fund and Decommissioning fund are approved according to the envisaged terms for the planned activities in the *Strategy for spent fuel and radioactive waste management* and the planned activities in the current annual program of SERAW. The financial resources accumulated in the funds may be spent in an indefinite period of time.

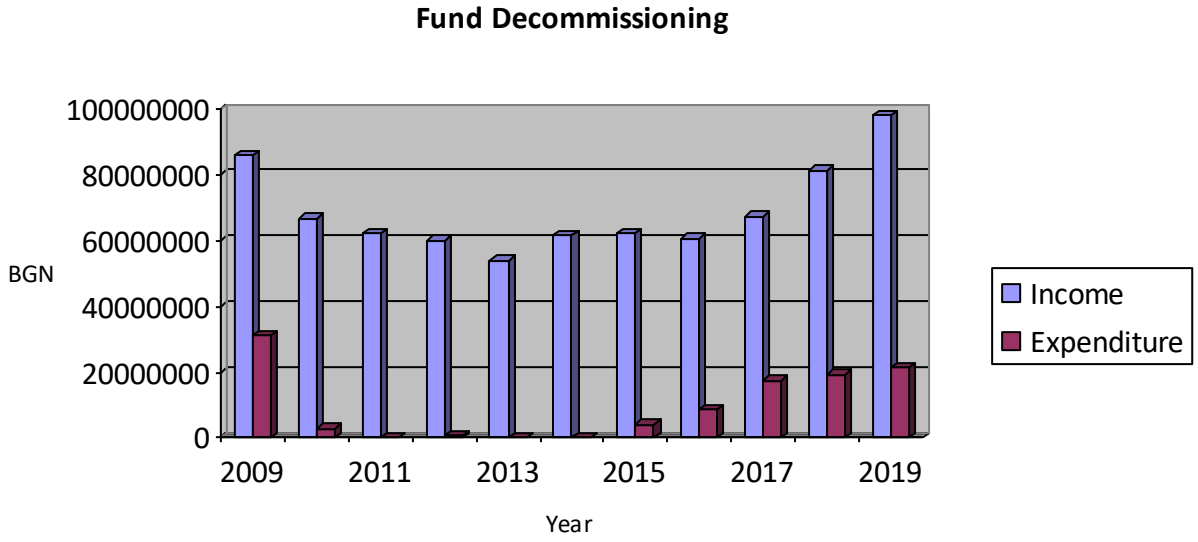
Currently the main financial resources accumulated in the RAW fund and in the Decommissioning fund come from contributions from KNPP.

By 30.06.2020 the accumulated financial resource of the RAW fund is BGN 148,6 million.

Assuming that the production volume, the amount of the contribution and the price of electricity will remain the same it is expected that about 120 million BGN, undiscounted and without calculated interest will be accumulated in the RAW Fund in the next five years.



By 30.06.2020, BGN 1 668 million were accumulated in the Decommissioning Fund.



Assuming that the production volume, the amount of the contribution and the price of electricity will remain the same, it is expected that about 298 million undiscounted BGN will be accumulated in the Decommissioning Fund in the next five years.

Information about the financing of the decommissioning of nuclear facilities and the dynamics of the resources in the fund for decommissioning of nuclear facilities is presented in the texts under Art. 26 in this section of the report and Appendix L-6

Information on the practical application of the requirements of this Article by the operators of SF and RAW management facilities is presented in Appendix L-6.

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 Nuclear Act, the entities, performing radioactive waste and spent fuel management activities, are obliged to maintain high quality of the performed activities.

The requirements for development of the NPP quality management systems are specified in detail with the *Regulation on ensuring the safety of nuclear power plants* in accordance with safety standard of IAEA GS-R-3 „The management system for facilities and activities".

The specific requirements to the management system of the operators of the SF and RAW management facilities are developed in the *Regulation on Ensuring the Safety in Spent Fuel Management* (Chapter VII) and in the *Regulation on Safe Management of RAW* (Chapter X).

Development of the quality management systems of the operating organizations

Quality assurance at Kozloduy NPP

The management system integrates all aspects of management and ensures consistency in the implementation of the requirements for safety, health and safety at work, environment, security, quality and business activity of the company, so as to ensure the highest priority to the safety. It was developed in accordance with the IAEA Safety Standard GS-R-3 "The Management System for Facilities and Activities" and is in force from 2012.

In 2018, the management system was also evaluated in the framework of the periodic safety review of KNPP Unit 6 (PPP-2018), Safety Factor 11 "Organization, Management System and Safety Culture". Measures are planned and implemented to transition to the IAEA standard, GSR Part 2 "Leadership and Management for Safety", 2016.

Quality assurance at SERAW

In the State Enterprise Radioactive Waste, integrated management system is in place for ensuring the priority of safety. The system was developed in accordance with the IAEA Safety Standard GS-R-3:2006 "The Management System for Facilities and Activities".

In its Declaration of Policy, the management of SERAW stated that it is committed to maintain the integrated management system. The company policies are directed to the safety, environmental and quality management, health and safety, and security aspects.

In the framework of the management review in 2018, a decision was taken to review and update the management system processes in relation to the published IAEA standard GSR Part 2, 2016 "Leadership and Management for Safety", ISO 9001:2015 "Quality Management System, Requirements" and 14001:2015 "Environmental Management System. Requirements and instructions for implementation".

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 general requirements for the licencee and permit holders and the fundamental principles, standards and rules for ensuring radiation protection which have to be observed when carrying out activities in nuclear facilities are set out in Nuclear Act. The detail radiation protection requirements for carrying out the activities under Nuclear Act are established by the *Regulation* [1]*on Radiation Protection*, Specific requirements of the Nuclear Act are also developed in the *Regulation on Ensuring the Safety of Nuclear Power Plants.*

The *Regulation on Radiation Protection* introduces the obligations for implementation of the principle ALARA for facilities and activities for SF and RAW management. It is an obligation of the nuclear facility operator to implement practical approaches to maintain the radiation exposure of the personnel and the population ALARA. Through the control on the implementation of the licence conditions a practical mechanism has been created for control over the fulfilment of these legislative requirements.

A practice applied by nuclear facility operators is the introduction of administrative control levels of the individual dose for the personnel which are below the legislative limits. These administrative levels together with the estimated collective dose for the nuclear facility are important tools in the process for optimization of occupational exposure.

The established ALARA councils and the involvement of managers at all levels demonstrate the commitment of the management to the process. As a result the personnel exposure is maintained at sustainable low levels.

In order to implement the principle of optimization of the radiation protection, the *Regulation on Radiation Protection* requires the elaboration and justification of the dose constraints for exposure of the population to different sources.

[1] All quoted BNRA regulations are published, including in English on the website of the BNRA - http://www.bnra.bg/

Exposure limitations

In the *Regulation on Radiation Protection* the exposure dose limits are specified **for personnel:**

- effective dose of 20 mSv per year,
- annual equivalent doses of 20 mSv for the eye lens or100 mSv in any five consecutive years subject to a maximum dose of 50 mSv in a single year,
- annual equivalent doses of 500 mSv for the skin (this limit applies to the average dose received by any area of 1 cm^2, regardless of the area of the exposed surface),
- annual equivalent doses of 500 mSv for the hands to the elbows, feet and ankles,
- specific requirements have been introduced for occupational exposed women during pregnancy and lactation, for students aged 16 to 18 years, as well as in the cases of permitted increased exposure;

and for the population:

- annual effective dose of 1 mSv,
- annual equivalent dose of 15 mSv for the eye lens and of 50 mSv for the skin (this limit applies to the average dose received by any area of 1 cm^2, regardless of the area of the exposed surface).

Measures for prevention unplanned and uncontrolled release of radioactive materials

The *Regulation on Radiation Protection* regulate the measures that the licencee is required to undertake in order to prevent unplanned and uncontrolled release of radioactive materials into the environment.

A requirement has been introduced to nuclear facilities for zoning (restricted and supervised areas) of the sites and premises depending on the value of the dose rate, the surface contamination or air contamination. The requirements for organization of the air flows, velocity, under-pressure maintenance and air purification, the procedure for access and the control for non-spreading of radioactive contamination beyond the boundaries of the zones are specified in detail.

The clearance levels (according to the specific activity for individual radionuclides) for release from regulatory control of material – unconditional clearance and release of metals for recycling are established by the *Regulation on Radiation Protection*, where deliberated dilution of a radioactive material with the purpose of subsequent release from control is prohibited.

Measures for limiting releases

The admissible levels of activity for liquid and gaseous releases are not set by the law, but are approved by the BNRA individually for each nuclear facility and site. The levels of the permitted releases into the environment are determined on the basis of the dose constraints for the population.

The dose constraint as result of liquid and gaseous releases at normal NPP operation according to the *Regulation on ensuring the safety of nuclear power plants* from all nuclear facilities from the entire KNPP site is 150 μSv/y.

The Technical Specifications for Operation of KNPP nuclear facilities containing the operational limits and conditions include also levels of radioactive releases into the environment in normal operation. The introduced activity levels of liquid and gaseous releases guarantee public exposure dose below 50 μSv/y.

The *Regulation on Safe Management of Radioactive Waste* introduces the requirement that the individual effective dose for the respective critical group of persons of the population due to a near-

surface RAW disposal facility after its closure shall not exceed 0,1 mSv per year and for geological disposal facility after its closure 0,3 mSv per year.

A comprehensive system for monitoring of the liquid and gaseous radioactive releases is established. The results of the monitoring of the radioactive discharges are reported on annual bases pursuant to Art. 35 of the Euratom Treaty.

Corrective measures in the case of unplanned and uncontrolled release of radioactive materials

The system for radiation monitoring of liquid and gaseous radioactive releases was designed to function both in normal operation of the nuclear facilities for spent fuel and radioactive waste management and in the case of deviations from normal operation and accidents. In such cases, the operator is required to execute the respective emergency procedures and/or emergency plans for mitigation of their consequences, as presented in the report pursuant to Art. 25 of the Convention.

Operational experience following the presentation of the Sixth National Report

Within the established licensing regime for nuclear facilities, radiation protection is assessed through analysis of the doses from external and internal exposure of the personnel and the population, received during the operation of nuclear facilities; the radioactive contamination of the environment; compliance with the radiation protection rules and regulations.

The detailed information about the exposure dose of the population and the personnel of the Kozloduy NPP and SERAW in the course of operation of the facilities for management of RAW presented in the previous reports, has been updated with the data for the period 2017-2019.

Kozloduy NPP

Occupational exposure dose

The control on the occupational external and internal exposure is carried out by the "Personal Dosimetry" Control Centre accredited by the "Bulgarian Accreditation Agency as an Inspection body of type C.

The main measurement method for external exposure doses is the thermo-luminescent method with a detection limit of 0,10 mSv. Dosimeters with direct reading with a sensitivity of 0,01 mSv are used also.

In the process of control of internal exposure, the "in vivo" method is used, including a gamma-spectrometry measurement of the incorporated activity and a subsequent assessment of the intake and dose with the aid of specialized software applying the biokinetic models of ICRP. The level of minimum detectable activity for the whole body is 200-300 Bq for the different nuclides. Recorded are doses above 1 mSv/y estimated by individual measurements.

In 2017-2019, for the staff engaged in SF and RAW activities, internal doses over 1 mSv/y are not recorded.

Annually, an assessment of the individual dose by neutrons of the staff from Kozloduy NPP, which is responsible for the management of SF, is carried out and there is no registered dose higher than 1mSv/y.

For the period 2017÷2019 the exposure dose of the personnel (own and external contractors), involved in SF management and RAW handling in the restricted areas of Kozloduy NPP is the following:

Year	2017	2018	2019
Collective effective dose [man.mSv]	1,71	1,04	5,66
Maximum individual dose [mSv]	0,33	0,24	0,29

Discharges from Kozloduy NPP site

Summarized data for the gaseous and liquid discharges

The monitoring of the gaseous and liquid discharges from Kozloduy NPP and the reporting is performed in accordance with the requirements of the Recommendation of the European Commission 2004/2 /EURATOM.

The discharges into the atmosphere for the period 2017-2019 is the following:

Emissions	**2017**	**2018**	**2019**
Radioactive noble gases, Bq	$1{,}2.10^{12}$	$6{,}2.10^{11}$	$4{,}6.10^{11}$
Iodine-131, Bq	$2{,}9.10^{7}$	$7{,}0.10^{6}$	$3{,}3.10^{5}$
* Radioactive aerosols, Bq	$3{,}4.10^{6}$	$8{,}5.10^{7}$	$6{,}6.10^{6}$
Tritium, Bq	$5{,}2.10^{11}$	$4{,}3.10^{11}$	$4{,}0.10^{11}$
Carbon-14, Bq	$5{,}7.10^{11}$	$5{,}4.10^{11}$	$5{,}1.10^{11}$

Liquid discharges into the Danube River in the period 2017-2019:

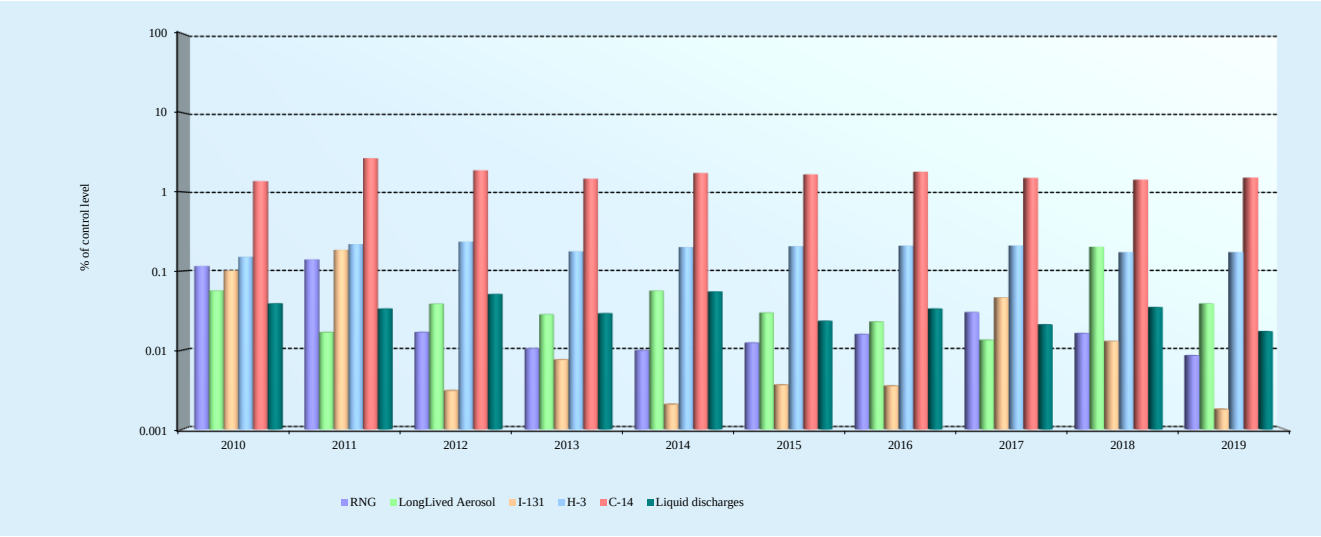
Year	**2017**	**2018**	**2019**
**Total activity, Bq (without tritium)	$1{,}1.10^{8}$	$1{,}5.10^{8}$	$3{,}9.10^{7}$
^{3}H, Bq	$2{,}2.10^{13}$	$2{,}3.10^{13}$	$2{,}6.10^{13}$

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

The gaseous and liquid discharges from Kozloduy NPP is comparable to similar levels in other countries operating WWER/PWR nuclear reactors.

Due to the fact that the SD RAW -Kozloduy is located at the Kozloduy NPP site, its discharges are released into the environment through the SSCs of the KNPP and are reported within the total discharges from the Kozloduy NPP site.

The trends in the activity of gaseous and liquid discharges from Kozloduy NPP (as % from control levels) for the period from 2010 - 2019 are presented below.



Assessment of the radiation exposure of the population from liquid and gaseous discharges

In order to calculate the additional exposure dose of the population caused by the radioactive emissions into the environment, verified and validated model assessment codes are used based on the CREAM methodology adopted by the European Union and adapted to the respective geographical and hydrological characteristics of the Kozloduy NPP area.

In 2019, the models on transfer and radiological impact of tritium have been updated, taking into account the IAEA platform – MODARIA.

The low levels of the radioactive releases from Kozloduy NPP create negligible radiation risk for the population in the area of the power plant. In the last 10 years the maximum individual effective dose of the population due to gaseous and liquid releases varies in the interval 4 to 7 μSv/a.

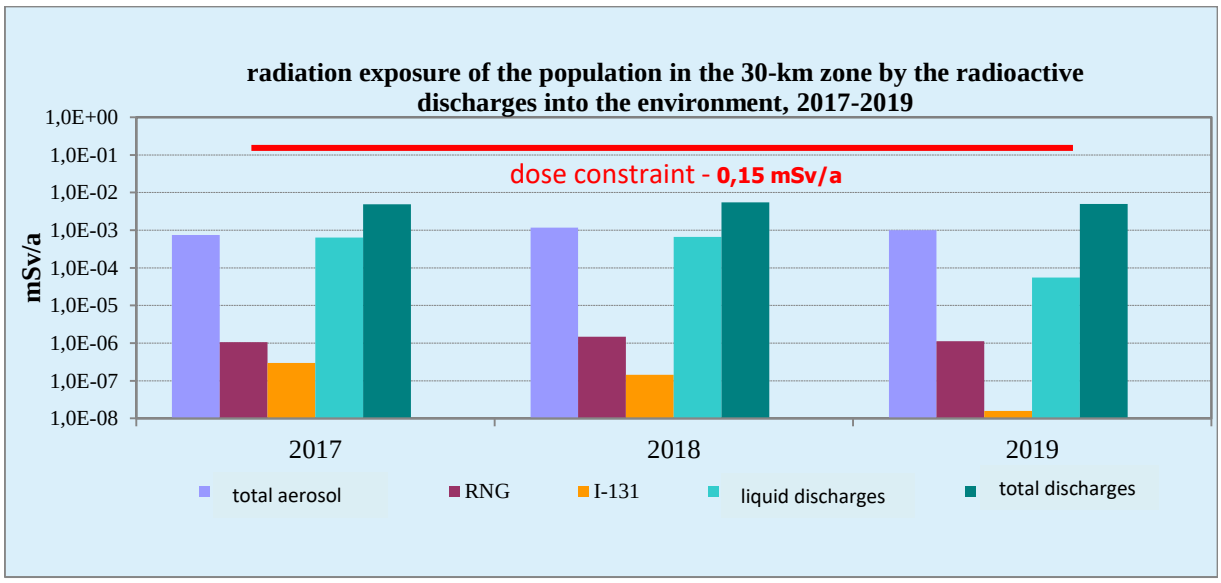
The maximum individual dose of the gaseous discharges from Kozloduy NPP site including the contribution of ^{3}H and ^{14}C is the following:

Gaseous discharges	
Year	Individual effective dose [Sv]
2017	$7{,}4.10^{-7}$
2018	$1{,}2.10^{-6}$
2019	$1{,}0.10^{-6}$

Public exposure by liquid discharges is the following:

Liquid discharges		
Year	Individual effective dose	
	max 30 km zone [Sv]	Critical group [Sv]
2017	$3{,}5.10^{-7}$	$3{,}3.10^{-6}$
2018	$3{,}6.10^{-7}$	$3{,}4.10^{-6}$
2019	$4{,}3.10^{-7}$	$4{,}0.10^{-6}$

The maximum individual effective dose in the 30 km zone is 1.4 μSv/y, and the values of a representative of a crucial group of the population along the Danube River vary from 4.01 to 4.92 μSv/y.



The results show that the additional population exposure in the 30 km zone is about 500 times lower than the obtained from the natural radiation background (2400 μSv/y).

SERAW

Occupational exposure

In the period 2017–2019 no legislative and administrative occupational exposure limits were exceeded. Radionuclide intake by personnel as a result of the waste management activities was not registered in SD RAW - Kozloduy. In accordance with the ALARA principle, during the report period the occupational exposure was maintained at levels considerably below the dose limits for occupational exposure.

The recorded maximum annual individual effective dose is 20% of the dose limit according to the *Regulation on Radiation Protection*.

Occupational exposure at SD Decommissioning – Kozloduy

Year	2017	2018	2019
Collective effective dose [man.mSv]	40,11	22,72	17,69
Average individual effective dose [mSv]	0,42	0,44	0,33
Maximum individual dose [mSv]	3,64	2,13	1,36

Occupational exposure at SD RAW - Kozloduy

Year	2017	2018	2019
Collective effective dose [man.mSv]	1,58	1,6	2,67
Average individual effective dose [mSv]	0,01	0,01	0,02
Maximum individual dose [mSv]	0,52	0,24	0,33

Occupational exposure at SD RAW – Novi Han

Year	2017	2018	2019
Collective effective dose [man.mSv]	2,19	2,42	6,01
Average individual effective dose [mSv]	0,03	0,04	0,1
Maximum individual dose [mSv]	0,27	0,29	0,61

Radioactive releases into the environment by SERAW facilities

There are no direct gaseous and liquid releases from SD RAW - Kozloduy into the environment. Their separation is performed through the respective SSC of Kozloduy NPP and is included in the reports on releases from the power plant.

Technologically no radioactive noble gases, short-lived aerosols and ^{131}I are released from SD RAW Processing Plant. The share of the waste management facility in the gaseous releases from the site is less than 0,1%. The population exposure doses resulting from the operation of the facilities of SD RAW - Kozloduy are included in the assessment of the overall radiological impact of all facilities on the site.

The analysis of the results from the monitoring of the installations of SD RAW - Kozloduy shows that the radiation impact from the site of Kozloduy NPP due to radioactive waste management is negligible.

Own radiation monitoring is held monthly at SD RAW - Novi Han with measurement of: water samples from the control wells; soil and plant samples; gaseous aerosol measurements at the site in accordance with the radiological monitoring program.

The Nuclear facilities operation complies with the regulatory requirements. There is no violation of the dose limits, which is an indicator of the degree of optimization of the radiation protection of the activities of SF and RAW management.

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

The emergency preparedness and response in case of nuclear accident or radiological emergency is a part of the general national arrangements for protection in case of disaster. The main legislative and regulatory requirements for the structure and organisation of the emergency preparedness are specified in the Disaster Protection Act (DPA), the Nuclear Act, the *Regulation on Radiation Protection* and the *Regulation on emergency planning and emergency preparedness in case of nuclear and radiological emergencies.*

According to Nuclear Act, the State bodies and entities engaged in the operation of nuclear facilities are obliged to take measures to prevent incidents and accidents and to limit their consequences. Emergency response measures are established with the emergency plans as follows:

- for protection of the population (off-site emergency plan), which defines actions by the competent authorities to protect people, property and the environment in case of nuclear emergency at a facility in Bulgaria as well in the vicinity of its territory. The plan is based on the emergency planning zones and distances,
- for protection of the personnel of the nuclear facility (on-site emergency plan) and which defines the on-site actions of the licencee for accident management to mitigate the off-site consequences,and is consistent with the off-site emergency plan .

The Regulation on emergency planning and emergency preparedness in case of a nuclear or a radiological emergency complies with IAEA recommendations in emergency preparedness and response area, included in GS-G-2.1 Arrangements for Preparedness for a Nuclear or Radiological Emergency 2007; EPR-Method (2003) Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency, 2003, etc. and it defines:

- basic elements of management in emergency exposure situations,
- reference levels for the public for emergency workers in emergency exposure situations,
- requirements to the off-site emergency plan scope and content,
- scope of the information provided to the public in case of an emergency.

The National Plan for Disaster Protection (Off-site Emergency Plan) is based on analyses of the hazards which could affect the territory of the country and elaborates the respective response measures. Part III of the National plan is the KNPP off-site emergency plan.

The operators of RAW and SF facilities are required to establish and maintain emergency on-site plans commensurate with the hazards associated with the respective facility and activity. Emergency on-site plans are subject to approval of BNRA as part of the licencing procedures at the respective stages of the facility lifecycle: for granting permission for commissioning; licence for operation; licence for decommissioning. On-site emergency plans shall be maintained during operation of the nuclear facility, taking into account the actual legislative requirements, the operational feedback and the international practices.

Emergency on-site plans of all nuclear facilities for SF and RAW management are maintained:

- KNPP Emergency Plan, Revision 2018. It includes the nuclear facilities in operation, the on-site SF management facilities (SFP, WSFSF and DSFSF) and also takes into account SERAW facilities located on the site of Kozloduy NPP;
- SD RAW- Kozloduy Emergency Plan, Revision 2014;
- On-site emergency plan of the SD Decommissioning –- Kozloduy, Revision 2014;
- SD RAW - Novi Han Emergency Plan, Revision 2018;
- Emergency plan in case of incidents and accidents during transport of spent nuclear fuel, Revision 2019.

The on-site emergency plans of SERAW (SD RAW- Kozloduy and SD Decommissioning - Kozloduy are coordinated with the plans of Kozloduy NPP.

In the scope of the regulatory control BNRA performs regular inspections in nuclear facilities in the area of emergency planning and preparedness.

Emergency exercises and drills

Systematic approach is applied in the training for emergency preparedness and response.

Emergency personnel are trained in the Training Centre of the Ministry of Interior. Initial and recurrent training for actions in a nuclear or radiological emergency are conducted according to the planned activities.

Training of Kozloduy NPP and SERAW staff is held at the NPP Training Centre and in the ERC.

National emergency drills and exercises are organised and performed:

- every 5 years – a full-scale emergency exercise on the National Off-site Plan,
- annually – drills in mastering the elements of the on-site plans.

Trainings and exercises are performed by a programme, prepared and approved in advance.

Full-scale emergency exercises involve the executive authorities, the nuclear operators and entities included in implementation of Part 3 of the National Plan for Disaster Protection (Off-site Emergency Plan), as well as local authorities and the population in the emergency planning zones. The program for the conduct of such exercise is approved at national level by the Minister of Interior.

The evaluation of emergency exercises results is performed by a designated expert committee, which includes representatives of the involved authorities and entities. After each exercise an analysis is prepared and are planned measures for addressing the weaknesses and shortcomings noted during the exercises.

Last time a full-scale national exercise “Protection 2019” was held in November 2019. The scenario included as initiating event failure during SF handling and subsequent events of loss of power, LOCA and discharge of radioactive material into the environment.

The BNRA Chairman performs the functions of a central authority and point of contact for notification of an accident and providing assistance, under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency.

In 2018, the Republic of Bulgaria became a member of the network for assistance in case of nuclear or radiological accident RANET established by the IAEA. Through this network, States which have ratified the Convention on Assistance in the event of a nuclear accident or radiological emergency shall be able to promptly and effectively request or assist in the event of a nuclear or radiological emergency. This facilitates the mechanism of the Convention and significantly shortens the time to receive or deliver assistance.

The Republic of Bulgaria has concluded bilateral agreements for cooperation in the field of nuclear safety and exchange of information in case of a nuclear accident with Greece, Romania, Turkey and

Ukraine. In 2018 was signed an agreement with the Republic of Serbia. Agreements for notification and exchange of information in the event of a nuclear or radiological accident have been concluded between BNRA and the nuclear regulators of Greece, Macedonia, Romania, Russia, Hungary and Ukraine.

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 frame requires that the decommissioning of a Nuclear Facility is carried out only after obtaining of licence under the Nuclear Act.

The licence for decommissioning shall be issued provided that there is a positive decision on the Environmental Impact Assessment report.

A licence for decommissioning of nuclear facility is issued to a legal entity that possesses financial, technical and material resources and the organisational structure and qualified and trained personnel to maintain the safety. The licencee submits to BNRA Chairman decommissioning plan of the nuclear facility at least 2 years after the facility final shutdown.

The licencing procedure, set up in the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* guarantees that all respective aspects of operational radiation protection, discharges and unplanned and uncontrolled releases, as well as of emergency preparedness, are justified and controlled. There are specific requirements for management system, including the elements for maintaining of qualified staff, for availability of adequate financial resources and for emergency planning.

According to the *Regulation on Safety during Decommissioning of Nuclear Facilities* the decommissioning planning shall be performed at each stage of the facility lifecycle, starting from the design stage though the operation. The final decommissioning plan shall be justified by a separate Safety Assessment Report.

The Regulation defines the basic safety requirements for the maintenance of the safety related SSCs, for the decontamination and dismantling of the equipment, for the radiation protection and for the radioactive waste management during decommissioning. It defines the overall process for at each stage, the decision making process and the process for the involvement of interested parties.

Clearance of materials arising from decommissioning activities may be allowed as provided by the Nuclear Act and the *Regulation for Radiation Protection*.

Personnel and financial resources

The final decommissioning plan is required for issuance by BNRA of decommissioning licence, supplemented by evidence that the provided financial resources are sufficient for the implementation of the decommissioning plan. For financing the activities for decommissioning of nuclear facilities, a special Decommissioning Fund is set up.

The decommissioning cost estimation is prepared and maintained by the licencee, based on the Work Breakdown Structure. The decommissioning cost estimation includes the operational costs for personnel, including training and drills, besides the others costs.

The main revenues come from contributions of the operator of the NPP. The amount of the contributions is set so that at the end of the operating period, the necessary financial resources to cover the decommissioning costs are accumulated.

The mechanism for assessment of the amount of the contributions is defined in the legislation with the *Regulation on the Procedure for Assessment, Collection, Spending and Control of the Funds and the Amount of Contributions due to the Decommissioning of Nuclear Facilities Fund*. KNPP, as the licencee of the nuclear units in operation, has estimated decommissioning costs following the IAEA

recommendations and OECDs' „Costs of Decommissioning Nuclear Power Plants" NEA No.7201, 2016. The cost estimate is used in the update National Strategy and for assessment of the level of contributions to the Fund.

The decommissioning activities which have an impact on safety can only be carried out by qualified personnel. For the positions related to the safety management a certificate of competence is required. The terms and conditions for professional qualification, the job positions for which a certificate is required and the testing procedure are set out in a separate *Regulation on the Terms and Conditions for Acquiring a Professional Qualification and the Procedure for the Issuance of Licences for Specialized Training and Certificates of Competence in Nuclear Energy Use*.

Information about the available qualified personnel is presented in the report under Art. 22

Radiation Protection

The Nuclear Act and the *Regulation on Radiation Protection* covers all aspects of Article 26 Clause ii of the JC as fully applicable to the decommissioning of nuclear facilities also. As obligatory part of the decommissioning plan, the licencee shall develop programs for radiation protection. The plan shall contain the dose limits, constraints, authorized radioactive releases, reference levels and the administrative restrictions for the personnel and the population.

The removal of physical barriers restricting the spreading of radioactive substances in the environment during the dismantling of the nuclear facility shall be performed only if the radiological criteria according to the decommissioning plan have been achieved.

In this respect the provisions of Art. 24 of the Convention are applied also for the facilities in a stage of decommissioning.

Emergency Planning

The requirements of Nuclear Act and the *Regulation on Emergency Planning and Emergency Preparedness in Case of a Nuclear and Radiological Emergencies* apply to decommissioning and cover all aspects of the provisions of Art. 25 of the Convention.

The decommissioning Safety Assessment Report contains analyses of anticipated events, which are bases of the emergency planning during the decommissioning. For the issuance of a licence for decommissioning of a nuclear facility, the applicant is required to submit to the BNRA an on-site emergency plan.

Records keeping for the decommissioning

Pursuant to the requirements of the *Regulation on Safety during Decommissioning of Nuclear Facilities*, the licencee shall develop and maintain a management system for the decommissioning stage, which includes records keeping requirements. The licencee shall ensure proper records keeping, according to the requirements laid down in the conditions of the authorisation and in accordance with the regulations in force.

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."

General Safety Requirements

The Nuclear Act determines the regulatory requirements for safety at each stage of lifecycle of the SF facilities that ensure the protection of human life, health and the living conditions of the present and succeeding generations, the environment and property against the harmful impact of ionizing radiation.

The legislation provides for efficient protection of the individuals, the society and the environment, as well as for avoidance of actions that lead to predictable consequences for future generations, exceeding the ones admissible for the present generation and avoide to impose of undue burden on future generations.

The national regulatory framework provides clear allocation of responsibilities and ensures the effective regulatory control of the facilities and activities concerning the spent fuel management.

Further the *Regulation on Ensuring the Safety in Spent Fuel Management* specifies the following requirements: assurance of sub-criticality and residual heat removal; passive safety; application of a graded approach; minimization of RAW generation; maintenance of the radiological impact on the individuals, the society and the environment as low as reasonably achievable.

Licence and permit holder shall bear the overall responsibility for ensuring the safety of the facilities and activities as specified in the licence or the permit. Compliance with the legal requirements regarding nuclear safety and radiation protection is verified and enforced by BNRA.

Criticality and Heat Removal

Criticality and heat removal are addressed by the design and during the licensing process at each stage of a nuclear facility lifecycle. The safety assessments shall be periodically reviewed against the regulatory requirements and shall be revised during the operation in the periodic safety review performed every 10 years.

According to the *Regulation on Ensuring the Safety in Spent Fuel Management*, the licencee shall ensure appropriate, criticality safety and heat removal. These functions are ensured by the proper siting, design, construction and commissioning of the storage facility, its proper operation management.

To maintain sub-criticality in normal operation and in case of design-basis accidents, the effective neutron multiplication factor should be below 0,95. The SF burn-up depth may be used as a parameter for nuclear safety justification only if the burn-up of spent fuel entering the SF facilities is controlled through technical means.

The design of the SSCs and operational procedures which are applied in the relevant SF facilities of Kozloduy NPP (SFP of Units 5&6, WSFSF and DSFSF) ensure sub-criticality and residual heat removal and are evaluated in the relevant safety assessment documentation.

The design and the organizational measures in the operation of the SF management facilities shall prevent the possibility for temperature rise in the spent fuel elements cladding above the design limits for normal operation and in case of design-basis accidents.

Generation of Radioactive Waste

The regulatory requirements stipulate that and treatment of the radioactive contaminated media arising in SF management facility operation should generated minimal RAW quantities. The design shall ensure restriction of the volume and activity of the liquid RAW to a reasonably achievable level through efficient purification systems and multiple use of the radioactive fluids, prevention of leakages from systems containing radioactive fluids, and reduction of the frequency of events that require significant decontamination measures. The facility systems shall be designed considering the requirements for safe SF management and the RAW minimization principle throughout the 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.

This section also presents summarized information about the generated RAW and the respective trends for KNPP Units 5&6 (it is practically not possible to specify what part of RAW was generated as a result from SF storage and what part is due to the operation of the Units).

Consideration of the interdependency between the different SF management steps

The *Regulation on Ensuring the Safety in Spent Fuel Management* covers all stages of the lifecycle of nuclear facilities for SF management – site selection, design, construction, operation and commissioning, as well as and all activities for management of SF – storage, on-site transport and handling of SF.

The Regulation includes specific requirements for consideration of the interdependency between the different steps of nuclear fuel management and according to Art.82, in the SF management the licencee shall consider the requirements for handling, storage, transport and reprocessing, as well as the options for its further management until disposal.

Protection of Individuals, Society and the Environment and future generations

According to Nuclear Act and the regulations on its implementation, the exposure of the personnel and the public in SF management has to be kept as low as reasonably achievable. The defense-in-depth principle for the SF management facilities shall be applied.

The requirements for the dose limits and dose constraints for the public, caused by the authorized liquid and gaseous releases during normal operation and also in case of design-basis and beyond design-basis accidents are provided in *Regulation on Ensuring the Safety in Spent Fuel Management*, art.4, and are consistent with the commonly accepted practices.

The currently adopted in the Bulgarian legislation SF disposal dose constraints are considered regarding the future generations also and are the same as for the present one. The specific values as well as the used methods to limit exposure are discussed in Section F, Art.24, of this Report.

Biological, Chemical and other Hazards

The assessment of the biological, chemical and other hazards in SF management is subject to EIA, which is required in accordance with the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* for the main stages of the lifecycle of the nuclear facility. The requirements of the Environmental Protection Act regarding the EIA are fully applicable for authorization and implementation of SF management facility

Avoidance of the imposition of undue burden on future generations

The Bulgarian legislation is based on the principle *to avoid imposing undue burdens* on the future generations. The *Strategy for Spent Fuel and radioactive Waste Management* adopted by the Council of Ministers specifies the option for SF transport for reprocessing and HLW return for storage and final disposal as most acceptable with a view to non-imposing undue burden on future generations.

The provision of the necessary funds for management of SF is not left for future generations. The provision of sufficient financial resources is NPP operator duty according to article 16 of the Nuclear Act and is ensured by fees to the specialized funds during the operation of NPP.

The reprocessing is also aspect of the national policy for avoiding of imposing of burden on 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."

An overview of the existing spent fuel management facilities is given in Section D. These facilities have been licenced as required by the Nuclear Act.

Existing facilities

The spent nuclear fuel from the operation of the Kozloduy NPP units is stored in underwater storage technology facility - WSFSF. The WSFSF accepts spent fuel, which has been stored for at least 3 years in the spent fuel ponds (SFP).

The operating organization shall maintain a high level of safety culture and demonstrate safety by safety analyses and assessments.

The BNRA carries out regulatory review of the provided safety documentation. When a non-compliance with the safety requirements is identified in the submitted documentation, corrective measures for removal of deficiencies is required to be applied.

The spent fuel pools are evaluated in the periodic safety reviews of the respective unit of Kozloduy NPP.

After the accidents in the Japanese Fukushima NPP the stress tests were held and the prescribed measures were undertaken as to improve the safety of the SF management facilities at KNPP site. The measures which were planned after the held stress tests in connection with the Fukushima NPP accident have been completed at SFP-5 and SFP-6.

The project for LTO also envisaged relevant measures to improve the safety of the SFP.

In accordance with the provisions of the *Regulation on Ensuring the Safety in Spent Fuel Management* regarding the implementation of changes leading to the modification of structures, systems and components important for safety, the proposed by the operator changes in the design were reviewed and verified by BNRA and in result the WSFSF operation licence was renewed.

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 existing SF facilities in Bulgaria are part of the NPP infrastructure and the established national legislative framework covers all the stages of the lifetime cycle of such nuclear facilities.

The site selection and approval may be proceeded after having granted permission according to the Nuclear Act and according to the requirements of regulations for its application.

The site selection process is the initial stage of the entire lifetime of the SF facility, as defined in the *Regulation on Ensuring the Safety in Spent Fuel Management*, and the scope and conditions for this process are described in detail in Section II, Chapter III of that Regulation.

The site selection process is carried out in four phases, with the necessary documents required by the regulator. A preliminary Safety assessment report needs to be submitted to BNRA for approval of the already selected site.

The implementation of environmental impact assessment procedures is a legislative requirement. The positive resolution by the Ministry of Environment and Water on the EIA Report is required for obtaining a design visa under the *Territory Planning Act*. The Environment Protection Act contains the requirements for providing information to the public and consulting potentially affected neighboring countries.

Assessment of the site for the proposed SF management facility

In accordance with the requirements of the *Regulation on Ensuring the Safety in Spent Fuel Management* 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, which may affect the safety of the facilities. The particulars to be contained in the preliminary Safety assessment report to be submitted for approval of the selected site and shall include:

- the impact of human and natural 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 site characteristics significant for the migration and accumulation of radioactive substances,
- the possibility for implementation of public protection measures in case of accident in the facility.

It is stated that in the case where the nuclear facility is intended to be located on multyfacility site, the preliminary Safety assessment report shall take into account the possible safety impact of the proposed facility on existing facilities and vice versa.

Access to safety information and consulting neighbouring countries about such facility

According to the requirements of the EPA, a public consultation of the results of the EIA shall be organised jointly by the municipal authorities and the competent authority on the EIA. The procedure for carrying out the EIA is according to the *Regulation on Environmental Impact Assessment for investment proposals for construction, activities and technologies*. The competent authority for the EIA is the Minister of Environment and Water. The EIA approval is based on the prepared EIA, the results of the held public consultations and the legislation in force.

The Republic of Bulgaria is a party to the Convention on Environmental Impact Assessment in a transboundary context.

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 Nuclear Act establishes permission regime for design and the subsequent construction stages.

The design criteria are detailed in Chapter III of the *Regulation on Ensuring the Safety in Spent Fuel Management*. Among other requirements the safety of the spent fuel management facility is provided through:

- Defence-in depth approach, establishing necessary barriers and the protection levels;
- High quality of design, construction and equipment;
- Implementation of proven technologies.

For the construction permission is required submission of Interim Safety assessment report and technical design documentation by the applicant. The national regulatory frame requires application of procedures for issue of design permissions under the *Territory Planning Act* and under the Nuclear Act also.

The construction of SF management facilities is based on the approved Technical design.

The control over the application of the legislative requirements is provided by BNRA. The operating organization bears the overall responsibility to implement strictly the approved design, by controlling of the civil construction and assembling works, the quality of used materials and components by applying the appropriate management system.

The design stage as part of the SF lifecycle licencing process is presented in the report under Art. 19 of the Convention.

Limitation of the possible radiological impacts during development of the design and construction of SF management facility

The dose limits and constrains which the design has to observe are established in the *Regulation on Radiation Protection* and the *Regulation on Ensuring the Safety in Spent Fuel Management*.

For the design and the construction is required to be presented evidences for compliance to the applicable safety requirements. The procedure for design approval requires that the licencee shall submit the Intermediate Safety assessment report to BNRA for review. The ISAR has to contain all the necessary information for confirmation that the radiological impacts are in compliance with the legislative dose constraints. The results of the safety analyses, as of the ISAR, are required to be verified by TSO independent from the design organization. The specific requirements for the radiation protection of the SF management facility are specified in Chapter V of the *Regulation on Ensuring the Safety in Spent Fuel Management*.

Measures related to decommissioning and closure of NF at design stage

At all stages, including design, from the life cycle of an SF management facility, the licencee shall plan and implement measures facilitating decommissioning.

The Nuclear Act and the *Regulation on the procedure for issuing licenses and permits for the safe use of nuclear energy* require for approval of the technical design the submitted to BNRA ISAR to include the section "Decommissioning" justifying the concept of decommissioning, the suitability for carrying out the decontamination and dismantling activities and the possibilities for release of material, building and site from regulatory control.

Information about the issued permit for the DSFSF commissioning is provided in the text under Article 9 of the Convention.

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 Nuclear Act and the *Regulation on the Procedure for Issuing Licences and Permits for the Safe Use of Nuclear Energy* stipulate the obligations for the applicant to carry out safety assessments at different stages from nuclear facility lifecycle - site selection, design and operation, design modifications and for decommissioning of SF management facility.

For approval of the Technical design is required submission of ISAR that covers all aspects of safety for the design lifetime of the facility. The BNRA permission for construction is based on the approved Technical design and ISAR.

Before operation of SF management facility is required submission of FSAR that updates the ISAR based on the results gained during the commissioning stage.

The Chapter VI of the *Regulation on Ensuring the Safety in Spent Fuel Management* specifies that the safety assessments shall include a systematic analysis of internal and external events to demonstrate the facility's ability to ensure safety in the normal operation of the facility, as well as in the event of expected operational events and design accidents. The safety assessments shall demonstrate the ability of the fulfillment of the safety functions and safety criteria, and achievement of the safety objectives. According to the Regulation both the ISAR and FSAR have to reflect the entire lifecycle, including decommissioning.

The Safety assessment reports are subject of detail regulatory review and evaluation on the bases of which the respective construction permit and operation licence are issued.

Furthermore, *the Regulation for Ensuring the Safety of Nuclear Power Plants* requires periodic safety reviews which include also safety assessments during operation of the NF, including their spent fuel management facilities. The procedure and the requirements of the periodic safety reviews are outlined 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."

The licence to operate a spent fuel management facility

According to the Nuclear Act the nuclear facility operation is carried out solely by entity, possessing licence for operation. The detail requirements for issuance of an operation licence are provided in the *Regulation on Ensuring the Safety in Spent Fuel Management*, the *Regulation on Ensuring the Safety of Nuclear Power Plants* and the *Regulation on Safety during Decommissioning of Nuclear Facilities*. The licence for operation of SF management facility is granted based, inter alia, on a Final Safety assessment report.

BNRA supervises the construction of the facility to be assured that the facility is built in accordance with the approved design and the construction permit.

After construction stage for issuance of a commissioning permit a Programme for commissioning of a nuclear facility is required by the regulations.

The operational licence is issued only if the conditions of the nuclear facility commissioning permit have been fulfilled, which has to be confirmed by the BNRA inspectors.

A regulatory review on the document submissions and on-site inspections shall be performed. There is a list of the documents required to be submitted within the application for issuance of an operational licence for a nuclear facility andthe licence for operation may be issued if the commissioning programme has demonstrated that the SSCs fulfils their design functions and safety requirements.

The operation licence is issued for a maximum term of 10 years. It may be renewed only based on the results of the periodic safety review report.

The operational limits and conditions

The national regulatory framework provides that the operation of the facility shall be carried out in observance of the established operational limits and conditions. The operational limits and conditions are determined and justified on the basis of the design, of safety analyses and of the commissioning tests, and if necessary, shall be periodically reviewed in order to reflect the operational feedback, the modifications made to safety-related SSCs, the new safety analysis and the technological developments. The licencee may also establish administrative control levels below the operational limits which are used as target values for improvement of operations.

The *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*, Chapter V, requires the application for issuance of a permit for commissioning of the nuclear facility submitted to BNRA to include:

- the safety limits,
- the values of the parameters for actuation of the safety systems,
- the operational limits and conditions,
- the necessary tests, inspections, supervision and operational control of safety-related systems,
- procedures in case of anticipated operational events.

The requirements of the *Regulation on Ensuring the Safety in Spent Fuel Management* and the *Regulation on Ensuring the Safety of Nuclear Power Plants* cover all the relevant aspects of the operation of SF management Facilities.

The Technical Specification for Operation that contains the operating limits and conditions shall be based on the facility's design and the ISAR, and later on updated based on the results obtained in the commissioning stage, on the design changes during commissioning and on the FSAR.

The operator has to evaluate the operational feedback in order to revise and update the operational limits and conditions if applicable. Such modifications of the Technical Specification for Operation may be implemented only if permitted by BNRA.

Procedures for operation of the facility

The requirements for availability of procedures for operations, maintenance, monitoring, etc. are specified in the regulations under the Nuclear Act.

The list of procedures for the particular facility is set in the operation licence. The KNPP system of procedures for analyses and assessments, as well as the procedure for taking corrective measures operational feedback and for assessment of their efficiency, are in place.

BNRA provides regulatory reviews of the procedures for operation of the facility, including of the reported operational events and the implemented corrective measures.

Engineering and Technical Support

The Nuclear Act requires that respective technical support is available in all areas related to safety throughout the operational lifetime of the facility.

According the *Regulation on Ensuring the Safety in Spent Fuel Management*, during the operation of the SF facility, the licencee shall ensure engineering support of the activities with the aim of analyzing the behavior of the safety-related SSCs, justification of the proposed design changes and operational documentation, analysis of operating experience as well as the efficiency of the RAW management.

Reporting of operational events

The operator has to maintain a system to register, to process and to analyze the operational data and information related to the failures of the SSCs and to deficiencies in the operating procedures as well as the human. Based on the results from the analyses shall be planned and implemented corrective and preventive measures for improvements in equipment, operational documents and staff performance.

The obligations of the licencee for reporting the operational events (deviations from the normal operation, incidents or accidents) to the BNRA, and the relevant requirements are set by the *Regulation on the Conditions and Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionising Radiation* and by the *Regulation on the Conditions and Procedure during Transport of Radioactive Material*. The regulation also defines the sequence and time-limits for notifying the regulatory body, the methodology to be implemented for events classification and evaluation, and the analyses report's structure and content.

In the period after the publication of the Sixth National Report no operating event related to spent fuel management was reported.

Collection and Analysis of Operating Experience

The Nuclear Act requires the operator of a nuclear facility, including spent fuel management facilities, to collect and analyze its operating experience and to conduct systematic safety assessments.

The *Regulation on Ensuring the Safety in Spent Fuel Management* further requires the operator to include its own operating experience in the safety assessments and to determine the relevance for his facility of the operating experience gained in comparable facilities.

The operator is obliged also for the development and implementation of performance indicators and methodology for assessment of the operational safety including also a program for safety self-assessment.

Decommissioning plans

According to the *Regulation on Safety during Decommissioning of Nuclear Facilities* and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*, the decommissioning plan shall be periodically updated and that a pre-condition for the issuance and reissuance of the operation licence. In parallel, the decommissioning costs estimation shall be updated.

The development of the decommissioning plans for the SF management facilities is discussed in Section E 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 spent fuel as radioactive waste under the conditions specified in ASUNE.

The *Regulation on Ensuring the Safety in Spent Fuel Management* provides that the State is responsible for the safe and responsible disposal of SF, including the RAW when the SF is reprocessed abroad. Based on the above the National Strategy defines the reprocessing as a specific policy for management of SF.

Pursuant to the *Strategy for SF and RAW management till 2030*, updated on 2015, direct SF disposal is not envisaged.

The deep geological repository is presumed to be a most suitable option for the long term safety of HLW, as provided in Art.18, p.5 of the *Regulation on Safe Management of Radioactive Waste*.

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, laid down in the legislation – *Nuclear Act, HPA* and *EPA* and the subordinate regulations for their implementation, ensure the protection of individuals, society and the environment against radiological and other risks at all stages of radioactive waste management.

The verification for compliance with the regulatory requirements in the field of nuclear safety and radiation protection is carried out by the competent state bodies – BNRA, Ministry of Health and the Ministry of Environment and Water in the framework of the licencing process.

The radioactive waste shall be managed in such way as to avoid imposing undue burden on future generations, so the RAW generators are obliged to implement safe, practicable and environmentally friendly solutions for RAW long term management.

RAW management shall be performed by legal entities solely after obtaining a permit and/or a licence for the relevant activity/facility. Licencees and permit holders shall bear the overall responsibility for ensuring the safety of the facilities and activities as specified in the licence.

The *Regulation on Safe Management of Radioactive Waste* specifies the safety requirements for the management of RAW for each lifecycle stage of the nuclear facility.

Criticality and residual heat removal

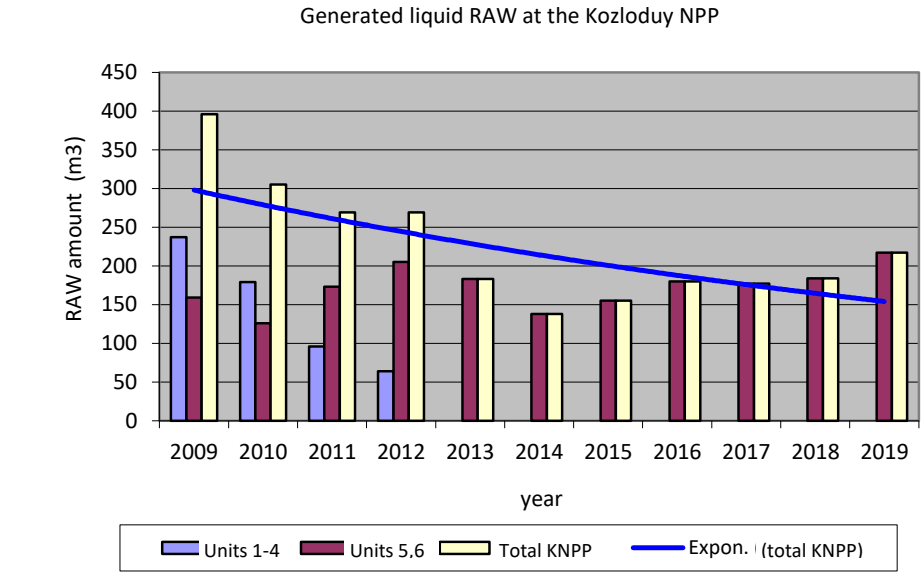
According to the *Regulation on Safe Management of Radioactive Waste* the licencee shall ensure that the criticality and removal of residual heat generated during radioactive waste management are adequately addressed. In the case that this issue is relevant, the design of the facility for RAW storage or disposal shall elaborate technical solutions to maintain sub-criticality and ensure residual heat removal.

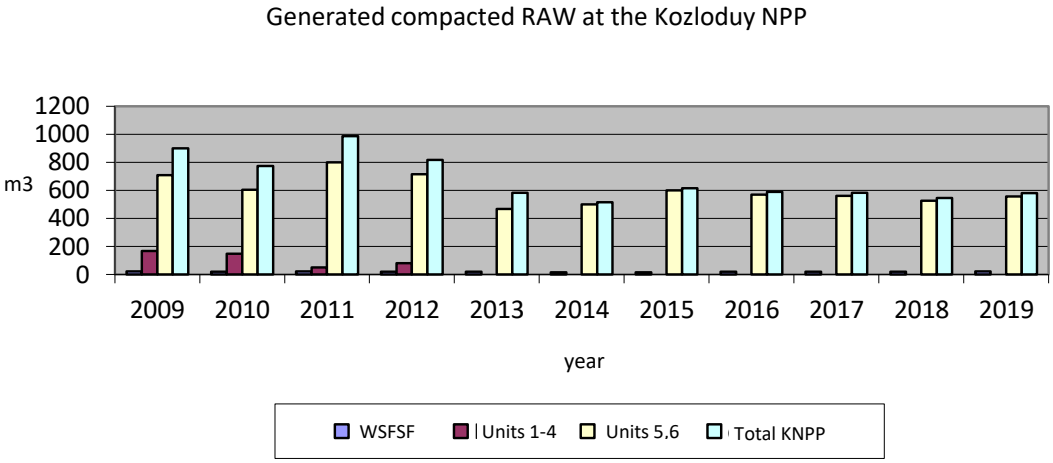
The existing now facilities for RAW management in the Republic of Bulgaria do not require special measures for sub-criticality and residual heat removal. This is justified in the respective safety reports and is assessed during the licencing process, and is controlled via the authorization system for the implementation of safety-related facility design modifications. If RAW may content fissile material, the legislation concerning spent fuel management is also applicable.

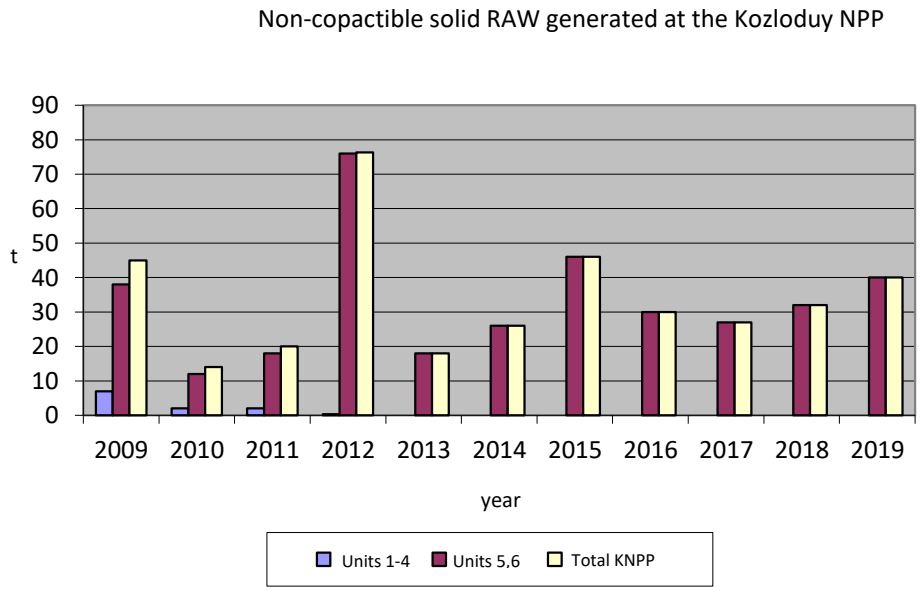
RAW minimization

The requirement for the minimization of RAW generation is detailed in the *Regulation on Safe Management of Radioactive Waste*. Limiting the generation of RAW at the source of formation has priority to the measures for the reduction of the volume and/or activity of RAW during their subsequent processing. These requirements shall be taken into account at the stages of design, construction, operation, and decommissioning of the nuclear facility also.

For achieving minimization of the generation of RAW KNPP has applied the necessary organizational and technological measures during the day-to-day operation. In results the data for the period 2009-2019, presented in a table below, show the practical effect of the application of the requirements for RAW minimization. The data demonstrate achievement of acceptable level of the amount of RAW generated during Kozloduy NPP operation.







After the final shutdown of KNPP Units 1-4, the amount of the generated liquid RAW has decreased. In the operation of Units 5 and 6, a consistent policy for decreasing liquid RAW generation has been implemented. Generally, the trend of decreasing the liquid RAW generated at the Kozloduy NPP was preserved.

As a result of the implemented measures for minimization of the currently generated RAW, the capacity of the existing RAW processing facilities is sufficient for its timely processing together with the "historical" RAW. In the period 2017-2019 the amount of processed RAW continuously exceeded the amount of RAW generated by Kozloduy NPP. As a result the amount of untreated RAW stored on KNPP site was reduced.

In parallel with RAW generation limitation, due attention was paid by the NPP operator to the requirements for minimization of the volume of RAW intended for disposal, through the application of appropriate treatment and conditioning methods and through application of the concept for release from regulatory control. Practices for minimization of the volume of RAW subject to disposal have been applied at SD RAW-Kozloduy by reducing the volume of the compactible RAW. Procedures for clearance (unconditionally or conditionally for recycling) of material from decommissioning of nuclear facilities and of decontaminated metal RAW were implemented.

Interdependency between the different RAW management steps

Consideration of the interdependency between the RAW management steps is required by the operators of RAW facilities as provided in the *Regulation on Safe Management of Radioactive Waste*. RAW management activities shall be performed in a way facilitating the subsequent steps of RAW management. These requirements are reflected in the RAW management programme of Kozloduy NPP.

In this respect the applied RAW treatment methods shall guarantee compliance with the acceptance criteria for the subsequent management steps of processing, storage and disposal performed by the SERAW.

The requirements regarding the process of RAW transfer between operators of different nuclear facilities are laid down in the *Regulation on the Conditions and Procedure for the Transfer of Radioactive Waste to SERAW* and are part of the developed mechanism for consideration of the interdependencies between the different RAW management steps.

A RAW disposal facility is currently being constructed in Bulgaria. In the design bases for development of the RAW disposal facility the characteristics of the waste packages already specified and approved by BNRA have been considered.

Protection of individuals, society, environment, and future generations

The protection of live, health and living conditions of the present and future generations is a basic principle, introduced with Article 3 of the Nuclear Act.

Detailed information about the implementation in the national legislation of the commonly accepted principles for dose limitations, justification of practices and the optimization of the protection is presented in Section F of this report (Art. 24 of the Convention).

The adopted in the Bulgarian legislation dose constraints applied to a disposal facility which would affect the future generations are the same as for the present generation. The specific values as well as the used methods to limit exposure are discussed in Section F, Art.24, of this Report.

Biological, chemical and other risks

The biological, chemical and other risks are governed by the national legislation in the field of health and environmental protection. With Article 15 of the *Regulation on Safe Management of Radioactive Waste* are provided specific requirements for RAW management for taking into account the biological, chemical and other hazards that may be associated with radioactive waste management.

The assessment of those risks is subject to EIA, which is required in accordance with the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* for the main stages of the nuclear facility lifecycle.

Avoidance of the imposition of undue burden on future generations

The Bulgarian legislation is based on the principle *to avoid imposing undue burdens* on the future generations. In the *Regulation on Safe Management of Radioactive Waste*, this principle has been developed in the direction of timely RAW processing until it is brought in a long-term safe form, as well as for of timely disposal of the processed waste. The Regulation also contains requirements for control after closure of the facilities and monitoring according to the results from the assessments made. The construction of a National Disposal Facility for LILW and a concept for disposal of high level and long-lived RAW are practical examples for implementation of the introduced with the *Strategy for SF and RAW Management* principle for protection and avoidance of the imposition of burden on the future generations.

More detailed information about the planned activities for the selection of a site for 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.

The practical approach for implementation of the nuclear facilities decommissioning process has also evolved in the recent years. In the updated strategy for decommissioning of KNPP Units 1-4 the concept of immediate dismantling has been adopted. The provision of the necessary funds for management of RAW, including those from decommissioning, is not left for 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."

An overview of the existing radioactive waste management facilities, operated by Kozloduy NPP and SERAW is given in Section D. These facilities have been licenced as required by the Nuclear Act.

The national regulations are setting clearly defined responsibilities for safety assessments and regulatory review of the radioactive waste facilities both for new and existing. It is required that for renewal the licence or permission the applicant shall submit the periodical safety review report.

It is ensured continuity of responsibility for safety through regulatory control (e.g. by means of a licencing system) over the different steps in waste management, including the RAW transfer to the SERAW for its subsequent management.

Existing facilities

The evaluation of safety assessment reports is responsibility of the nuclear regulator.

The safety assessments of the nuclear facilities, operated by Kozloduy NPP, as well as the SERAW facilities at KNPP site and at Novi Han site, demonstrate their ability to ensure safety in RAW management as it is required by the legislation..

More detailed information is provided hereafter.

Facilities operated by Kozloduy NPP

Kozloduy NPP has the SSCs for treatment and storage of RAW built according to the entire power plant design. The operations of these SSCs are performed under the KNPP operation licence. Safety assessments concerning those RAW SSCs are performed under the scope of the periodic safety reviews of KNPP.

In 2016 and 2018 a periodic safety review of Units 5 and of Unit 6 was carried out and it was developed an Integrated programme to address the identified safety issues. The program and the Safety Assessment Report for a long-term operation of these facilities were submitted to BNRA as part of the document package required for renewal of the units' licences.

Facilities operated by SERAW

The legislative required periodic safety reviews were carried out for the RAW management facilities operated by SERAW. The Safety assessment reports were developed or updated and were submitted for regulatory review to BNRA for issuance or for renewal of the respective licences.

The safety assessments demonstrated that the safety of the personnel is assured and that the radiological impact to the public is negligible.

As a result from the completed regulatory review of the safety documentation, some transitional licence conditions were formulated that imposed to the licencee mandatory organizational and technical measures with respective deadlines. Thus an ongoing process of continuous improvement of the safety of the nuclear facilities was ensured.

Past Facilities and Practices

The information about the management of RAW from past practices – waste from closed uranium mining and processing industry and the stored disused sealed sources from other nuclear applications, is updated in this Report.

In accordance with the *Regulation on the Conditions and Procedures for the Transfer of Radioactive Waste to SERAW,* measures have been implemented regarding the acceptance of RAW from past practices, including mainly disused sealed orphan sources or RAW from bankrupt industrial entities.

Additional information is presented in Section J of this Report.

Closed uranium mining

The mitigation of the consequence from uranium mining and processing in the Republic of Bulgaria has been performed in accordance with the Decree of the Council of Ministers No.74 of 27.03.1998, supplemented and amended in 2007. In accordance with the program developed by the Ministry of Environment and Water, the institutional measures include liquidation and remediation activities as well as monitoring. The measures based on the Decree of the Council of Ministers No. 74/98 for mitigation of the consequence from uranium mining and processing have been fulfilled as whole.

Activities have been carried out for remediation and conservation of "Buchovo" tailing pond and uranium contaminated terrains known as „Yana flood". "Buchovo-1" tailing pond, with capacity for storage of waste materials of 1.3 million m^3, is fulfilled, comparatively well compacted and partially recultivated. For "Buchovo-2" tailing pond, with capacity for storage of 10 million m^3 residual material, are prepared remediation plan and design documentation.

In "Eleshnitsa" tailings pond are stored in total 9 millions tons of tailings and material from the liquidation of the Zvezda hydrometallurgical plant. The site is recultivated.

Purification of uranium contaminated mining waters is carried out on the "Chora", "Byalata voda" and "Iskra". The line for regenerative purification of ion-exchange resins is located in the territory of the former Zvezda uranium-processing plant in Eleshnitsa. The capacity of the line is 0.5 m^3/h regenerated resins.

Those activities do not include management of RAW within the meaning of the Nuclear Act and the *Regulation on Safe Management of Radioactive Waste*.

Research reactor IRT-2000 of the Bulgarian Academy of Science

Because of the complete removal of the SF from site in 2008 as it has been presented in the Third National Report, the research reactor is removed from the list of the SF management facilities.

The slightly contaminated liquid solutions that were stored at the site of the research reactor IRT-2000 (from radiochemistry laboratories, special sewage and spent fuel pool) have been transported to Kozloduy NPP for treatment.

The operational solid RAW, including DRSs used in different laboratories at the INRNE that were stored on a site near the reactor have been transported to the SERAW for treatment and/or storage.

RAW generated during the dismantling of the equipment of IRT-2000 were treated and packaged in reinforced concrete containers type StBK and have been transported to Kozloduy NPP for storage.

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 Bulgaria are part of the RAW management infrastructure and the established national legislative framework covers all the stages of the lifecycle of a nuclear facility.

The site selection and approval can be preceded after having granted permission according to the Nuclear Act and according to the requirements of regulations for its application.

The process of siting is the initial stage of the facility, as defined in the *Regulation on Safe Management of Radioactive Waste*, and the scope and conditions for this process are detailed in Section II, Chapter IX of the same Regulation. The development of the preliminary safety assessment report (PSAR) for the approval of a site is required. The site selection process is established into four phases and the necessary documentation required by the regulator are determined.

The application of the Environment Impact Assessment procedures is legislative requirement. The existence of a positive conclusion from the EIA by the competent authorities is a necessary condition for obtaining a visa for designing according to the *Territory Planning Act*.

The legal requirements for informing the public and consulting the potentially affected neighboring countries are established by the EPA.

Assessment of the site for the proposed RAW management facility

The licencing regime for siting a RAW management facility is the same as for any other nuclear facility. For the site approval by BNRA, the submission of a Preliminary Safety assessment report is required, that takes into account factors, related to the safety of the site, which can have an impact on the safety during facility operation, as well as long-term safety for a disposal facility after closure.

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

- the impact of human and natural 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 site characteristics significant for the migration and accumulation of radioactive substances,
- the possibility for implementation of public protection measures in case of accident in the facility.

In the selection of a disposal facility site, an assessment of the safety of the facility is made by evaluating the natural site characteristics in interaction with the engineering barriers envisaged by disposal concept which shall guarantee the integrity of the protection barriers for a maximum period of time and demonstration of the site capability, to ensure protection of the population in observation of the dose constraints.

In the sixth JC Report the siting procedure for the case of the National Disposal Facility was described in details. The NDF siting process was completed in 2012. It was carried out in accordance with the requirements of the regulatory documents and the conditions set in the permits for site selection, issued by the BNRA Chairman.

Access to safety information and consulting neighboring countries about such facility

The access to information about the safety of proposed RAW management facilities is mainly ensured through the implementation of EPA provisions regarding the execution of a mandatory EIA procedure for such investment intention and the public consultation.

In the particular case for NDF construction the Environment Impact Assessment report was developed, on the basis of the Terms of Reference, approved by MEW. Public hearings on the EIA report have been conducted in the settlements of the region. In addition and in compliance with the requirements of the Convention for EIA in transboundary context, the Republic of Romania was notified with the information pursuant to Art. 3 of the same Convention and public consultations were conducted.

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;

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

The Nuclear Act establishes permission regime for each of the stages design and the subsequent construction of RAW management facility.

The design criteria shall be in accordance with required scope and conditions as detailed in Section III, Chapter IX of the *Regulation on Safe Management of Radioactive Waste* and the construction of the RAW facility shall follows Section IV, Chapter IX of the same Regulation.

The design basis define the respective characteristics of the NF SSCs for assuring the safety functions and shall includes design limits, facility operational states, safety classification of SSCs, important assumptions within the design process, and in individual cases, special methods of analysis. Implementation of approved RAW processing methods and technologies in the design is regulatory requirement also.

The information, required to demonstrate whether the possible radiological impacts are within the regulatory limits and whether they have been optimized to acceptable levels, is specified in detail in the legislation. The design stage is completed with the Technical design approval by BNRA.

The construction of RAW management facilities is based on the approved Technical design.

The control over the implementation of the legislative requirements is provided by BNRA. The licencee bears the overall responsibility to implement strictly the approved design, by controlling of the civil construction and assembling works, the quality of used materials and components by applying the appropriate management system.

The design is subject to approval according to the civil regulations under *Territory Planning Act* also.

Limitation of the possible radiological impacts during development of the design and construction of RAW management facility

The dose limits and constrains which the design has to observe are established in the *Regulation for Radiation Protection,* the *Regulation Ensuring the Safety of Nuclear Power Plants* and the *Regulation on Safe Management of Radioactive Waste*.

For the design and the construction is required to be presented the evidences for compliance with the applicable safety requirements. The procedure for design approval requires that the licencee shall submit the Intermediate Safety assessment report to BNRA for review and evaluation. The ISAR has to contain all the required information and evidences necessary for confirmation that the radiological impacts are in compliance with the dose constraints. The ISAR shall contain also safety analyses for the radiological impact from discharges during normal operation as well for postulated event of uncontrolled releases. The results of the safety analyses, as of the ISAR, are required to be verified by TSO independent from the designer of the particular facility.

Measures related to decommissioning and/or closure of a nuclear facility

The design of the RAW facility shall contain measures to facilitate its decommissioning.

The legislative requirement provide that the ISAR shall include a separate part on Decommissioning, where to justify the decommissioning concept, the implementation of decontamination and dismantling works, RAW management and the release from regulatory control.

For a disposal facility, the ISAR should include a section "Safety analyses after closure" for assessment of the long-term stability of the facility and the population exposure in normal evolution and in case of damaged protective barriers, including human intrusion.

Facilities under design and construction

In the beginning of 2014, the NDF Technical Design and the ISAR were submitted to BNRA. The regulatory review of the documents by BNRA supported by an external consultant - RISKAUDIT IRSN\GRS International concluded the compliance with the safety requirements and as a result the NDF Technical Design was approved and the subsequent construction permit was issued in 2017. After that started the practical civil works for construction of the new nuclear facility.

Currently about 40% of the construction of the first phase is completed.

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 Nuclear Act and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* stipulate the obligations for the applicant to carry out safety assessments at different stages of nuclear facility lifecycle - site selection, design, operationand design modifications, decommissioning or closure.

For BNRA approval of the Technical design it is required submission of ISAR appropriate to the hazard presented by the facility and that covers the design lifetime of the facility. The subsequent permission for construction is based on the approved Technical design and ISAR.

Before operation of RAW management facility the licencee is required to prepare FSAR that updates and details the ISAR and is based on the results gained during the commissioning stage.

The specific principles, criteria and requirements for a RAW management facility, including for the disposal facility after its closure, are established in the *Regulation on Safe Management of Radioactive Waste,* requiring the application of deterministic and probabilistic approaches in the safety assessments. The safety assessments shall include a systematic analysis of internal and external hazards in order to prove the capability of the facility to ensure safety in normal operation and anticipated operating occurrences and design basis accidents. In the application of the graded approach, the respective RAW inventory and the possible radioactive releases to the environment in all operational states and accident conditions shall be taken into account, including events with very low occurrence but with considerable radiation consequences, the complexity of the facility and of the activities carried out, as well as to what extent the used technologies and facilities are proven in practice.

The safety assessment of a RAW disposal facility shall cover a period, sufficient for reaching the maximum predicted public exposure dose. The used safety assessment models shall be verified in order to confirm their applicability for the assessed time period. The safety assessment shall justify the measures for limiting the spreading of radionuclides in the environment due to human intrusion after closure and shall consider natural events of low probability, which may compromise the effectiveness of the physical barriers.

Furthermore, *Regulation on Safe Management of Radioactive Waste* requires the operator to carry out periodic safety reviews which include also safety assessments during operation of a RAW management facility. The procedure and the requirements of the periodic safety review are outlined in the *Regulation for Ensuring the Safety of Nuclear Power Plants*.

The Safety assessment reports are subject of detail regulatory review and evaluation on the bases of which the respective construction permit and operation licence are issued.

In the case of investment proposal for disposal facility the Environment Impact Assessment report shall be developed, on the basis of the Terms of Reference, approved by MEW and public hearings on

the EIA report shall be conducted in the settlements of the region. These requirements apply to a RAW predisposal management facility also.

The National practice in case of disposal facility's safety assessments for the National Disposal Facility was presented in the sixth JC Report as an example for procedure that shall be applicable for future developments also.

Activities performed after the previous report

In 2019 by SERAW was performed a periodic safety review and update of the Safety assessment report of the centralized storage facility for RAW from the nuclear applications.

The updated Safety assessment reports have passed the BNRA regulatory review for renewal the licence for operation. The term of validity of the licence - until the end of 2025, is in accordance with the planned decommissioning of that facility.

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."

Licence for operation of RAW management facilities

According to the Nuclear Act the nuclear facility operation is carried out solely by legal entity, possessing licence for operation.

The licence to operate a RAW management facility is based upon the FSAR as presented above in that report under Article 15. A prerequisite for issuance of operation licence is the completion of the commissioning program in order to demonstrate that the facility, as build, is consistent with the design approved by the BNRA and with the safety requirements. The detailed requirements for issuance of an operation licence are provided in the *Regulation on Safety of Radioactive Waste Management*, the *Regulation on Safety during Decommissioning of Nuclear Facilities*, *the Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*.

The operation licence is issued for a maximum term of 10 years. For renewal of the operation licence, an updated Safety assessment report of the facility shall be elaborated concerning the actual condition of the facility and the envisaged operating term.

Following the Technical design approval in 2015, the BNRA Chairman issued to SERAW a permit for construction of a new RAW treatment facility - Plasma Melting Facility and in 2018 permit was issued for commissioning of that facility. The Program for commissioning of the Plasma Melting Facility is currently under implementation.

Operational limits and conditions

According to the *Regulation on Safe Management of Radioactive Waste*, the operation of the facility shall be carry out in observance of the operational limits and conditions. The operational limits and conditions are derived and justified on the basis of the design and ISAR, of the FSAR and the

commissioning tests, and shall be updated if necessary in order to reflect the operational experience, the design modifications made to safety-related SSCs, the new safety analyses and the technology developments. The licencee may also establish administrative control levels below the operational limits which are used as target values for improvement of operation.

The *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* requires the application for issuance of a permit for commissioning of a nuclear facility to be submitted to BNRA along with the defined limits and conditions including:

- safety limits,
- values of the parameters for actuation of the safety systems,
- operational limits and conditions,
- tests, inspections, supervision and operational control of safety-related systems,
- procedures in case of deviations from the normal operation.

The operational limits and conditions are an integral part of the main operational document – the Technical Specifications for Operation of the nuclear facility that contains the rules for safe operation and the standard procedure for execution of the safety-related technological operations.

As a licence document, the Technical Specifications for Operation, respectively the operational limits and conditions may be only amended under separate permission, according to the authorization regime.

Procedures for operation of the facility

The requirements for availability of procedures for the nuclear facility operation stage are specified in the regulations.

According to the *Regulation on Safe Management of Radioactive Waste*, the operation, maintenance, repair, monitoring, surveillance and testing shall be conducted according established written procedures and instructions. The maintenance, surveillance and testing for the safety-related SSCs shall be performed on regular basis to guarantee the reliability and availability of the facility. Procedures are required also for implementation of corrective measures in the case of non-conformities of the processed RAW or of the stored waste packages with regard to the approved technical specifications.

The compliance with the regulatory requirements and the adequacy of the procedures is verified by BNRA during the licencing process both at the time of the issuing licences and permits as well as by ongoing supervision for fulfilment of the operation licence conditions.

The implementation of the procedures is also subject to particular inspections within the annual inspection plan of the BNRA, as well as to subsequent regulatory control for fulfilment of the its recommendations and prescriptions.

During the operation of the facility, the licencee is obliged to analyse, under the written procedures, the performance of the SSCs, the operational experience, as well as the processes of its management system.

Technical support

The Nuclear Act requires that respective technical support is available in all areas related to safety throughout the operating lifetime of the facility.

According the *Regulation on Safe Management of Radioactive Waste*, during the operation of the facility, the licencee shall ensure engineering support in the activities with the aim of analyzing the status of the safety-related SSCs, of safety analyses for justification of the proposed modifications in the design and operational documentation, of the operational feedback for planning and

implementation of measures for safety improvements, as well as of the efficiency of the RAW management.

Waste characterization and sorting

According to the *Regulation on Safe Management of Radioactive Waste,* the waste acceptance criteria (for processing, storage and disposal) shall be established by the operator of the facility and are subject to regulatory approval. The licencee has to develop and apply procedures for waste characterization and sorting in consideration the specificities of the technological process and the interfaces between the different steps in RAW management.

The procedures for characterization of RAW from Kozloduy NPP are required by the regulator and applied by the operator for the purposes of its effective subsequent sorting, processing and conditioning, as well as for the purposes of radiation protection of the personnel during its handling. Wide range investigations have been carried out for characterization of liquid and solid RAW from Kozloduy NPP to establish operational procedures for evaluation of the difficult to measure radionuclides, important for long-term safety of the conditioned waste.

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.

Reporting of events and analysis of operating experience

The obligation of the licencee for reporting the operational events (deviations from the normal operation, incidents or accidents) to the BNRA is established by the Nuclear Act, Art.19, and the particular requirements are set by the *Regulation on the Conditions and Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionising Radiation and during Transport of Radioactive Material*. The regulation also defines the sequence and time-limits for notifying the regulatory body, the methodology to be implemented for events classification according the IAEA INES and for its evaluation, and the analyses report's structure and content.

According to the *Regulation on Safe Management of Radioactive Waste,* during the operation of a RAW management facility analysis shall be performed of the operational events significant to safety and corrective measures shall be implemented to prevent event reoccurrence. A program for operating experience feedback shall be implemented in order to document, classify, analyze, and archive process and radiological parameters, SSCs failures, operating events, and safety indicators. Based on the results from the analyses the licencee shall plan and implement corrective and preventive measures for improvements in equipment, operational documents and staff performance.

A tool for review and analysis of own operating experience is the system of safety indicators, developed by the operator of each nuclear facility as a condition under the issued licences for operation. The results from the review of the status and the trends are presented periodically to the regulatory body.

In the period following the Sixth National Report, no operating event, related to radiation protection and subject to reporting according to the criteria of the Regulation, was registered at SERAW.

Plan for facility decommissioning / closure

According to the *Regulation on Safety during Decommissioning of Nuclear Facilities* and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy,* the decommissioning plan shall be periodically updated for the issuance and for subsequent renewal of the operation licence. In parallel, the decommissioning costs estimation shall be updated. In the case of a disposal facility for RAW, a closure plan is required.

When updating the decommissioning or closure plan, account shall be taken of the current regulatory requirements, of the actual state of the nuclear facility and the information obtained during the operating lifetime of that facility. The updated plan (for decommissioning/closure) has to be evaluated in the updated SAR. The updated SAR itself is subject to regulatory review and evaluation as part of the procedure for issuance/renewal of the operation licence.

The requirements for the closure plan (structure and content) are specified in Art. 43 of the *Regulation on Safe Management of Radioactive Waste*. The closure plan shall contain: operational history of the facility, including description of important operating circumstances and events relevant to the closure.

Article 17. Institutional Measures after Closure

"Article 17. Institutional Measures 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 a closure plan, traceability of RAW and records keeping, for post-closure institutional controls and intervention measures in case of unplanned releases are established in the *Regulation on Safe Management of Radioactive Waste* after the First review under the Convention.

Keeping records

The *Regulation for Safe Management of RAW* stipulates with Art. 44 the requirement that the activities for closing a RAW disposal facility shall include update and archiving of all operation information about the previous stages of the disposal facility life cycle, including the initial design documentation and the design modifications of the facility's SSCs made during operation and closure.

The operator of the facility for disposal of RAW is obliged to develop and apply in the scope of its management system operational procedures for maintaining the process for control of the documentation and records keeping in order to ensure traceability for the entire inventory of that facility, in particular of each individual waste package also – its characteristics (radiological, chemical, physical and mechanical) and its emplacement/location.

Institutional controls

The *Regulation for Safe Management of RAW* provides for two types of institutional controls – active and passive, and sets the requirements for elaboration within the closure plan of organizational measures, necessary for control and preservation of the disposal information. For a surface disposal facility the duration of the active control phase is not less of 50 years and the overall duration of the institutional controls cannot exceed 300 years.

The active control includes monitoring, access control, minimal technical support of the infrastructure of the facility. During the period of passive control it is necessary to apply administrative measure for control over the use of the land.

The disposal facility closure plan shall elaborate also the particular measures for institutional controls - for radiation monitoring, site survey and for the applicable site use restrictions.

The institutional controls after the closure of the facility for disposal of RAW is performed by state authorities empowered to apply the planned measures. According to Art. 45 of the *Regulation for Safe Management of RAW,* the responsibilities for the institutional controls shall be assigned by a decision of the Council of Ministers. It specifies also the entities, responsible to identify and address and to implement active restoration works and corrective actions on site.

Intervention measures

According to Art. 60(3) of the *Regulation for Safe Management of RAW* intervention in case of an unplanned release of radioactive materials after the closure of a disposal facility shall be based on intervention levels as established in the *Regulation for emergency planning and emergency preparedness in case of nuclear and radiological accident.*

The execution of active restoration works and corrective on-site intervention measures during active control in case of an established non-conformity between the results of the provided monitoring and

the safety assessment of the facility shall be admissible only in the case of proven necessity, based on assessments and analyses and efficiency of the planned activities.

SECTION I. TRANSBOUNDARY MOVEMENT

Article 27. Transboundary Movement

"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. "

The export and transport of nuclear material and in particular of SF are subject to authorization regime and the requirements for the issuance of a SF export and transport permit are specified in the Nuclear Act. The transboundary movement may be performed only after prior notification to and confirmation by the State of destination.

Prior to a shipment to a third country the Republic of Bulgaria is arranged to be assured that the safety of SF and RAW management infrastructure (administrative and technical capacity) and the regulatory framework of the country of destination is equivalent to the safety standards established by the EU legislation or that the country of destination is a party to the Joint Convention.

The Republic of Bulgaria has practical experience as a state of origin of spent fuel. The international agreements related to the acceptance of spent fuel for reprocessing abroad and its transit through the territory of third country are in place. The transport scheme for the transport of spent fuel by rail and waterway is determined and proven.

The requirements of the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* specify that for the application for a permit for nuclear material transport to BNRA must be submitted:

- transport permits or their corresponding administrative acts issued by the competent authorities of the state of destination and the states of transit - in the case of export of nuclear material,
- documents regulating the relations between the consignor and consignee and between the carrier related to the transport on the territory of the state,
- administrative acts issued by the respective competent authorities for approval of the transport packages in accordance with the requirements of the *Regulation on the Terms and Condition for Transport of Radioactive Materials*,
- documents certifying that if the shipment cannot be made or the transport conditions cannot be met, re-entry is allowed and the carrier will return the shipment to the starting point and the consignor will accept it.

The safety requirements for SF transport are defined in the *Regulation on the Terms and Conditions for Transport of Radioactive Material*, which is in accordance with the IAEA safety standards for transport of radioactive materials, as well as with the requirements of the relevant international regulations for the transport of dangerous goods:

- European Agreement concerning 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 concerning International Carriage by Rail (COTIF);
- European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN);
- Technical Instruction for the Safe Transport of Dangerous Goods by Air (ICAO – Technical Instructions);
- International Maritime Dangerous Goods Code (IMDG Code by IMO).

In the national legislation was transposed the Directive 2006/117/EURATOM which introduced the use of the so-called "standard document".

The *Regulation on the Terms and Conditions for Transport of Radioactive Materials* reflects the amendments to the Regulations and Directives of the European Commission, the international agreements on the transport of dangerous goods ratified by the Republic of Bulgaria (in the part for Class 7), as well as of the documents of the International Atomic Energy Agency in this field. The requirements of Council Directive 2006/117/ Euratom regarding international transport within the European Union for import, export or transit through the European Union of spent fuel or radioactive waste had been implemented, as well as the requirements of the European Commission for establishing of a standard document for supervision and control of the shipments of radioactive waste and spent fuel.

The Republic of Bulgaria is respecting its obligation not to licence a shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

In the period after the presentation of the Sixth National Report no permits were issued for transboundary movement of SF.

SECTION J: DISUSED SEALED SOURCES

Article 28. Disused Sealed 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 involving sealed sources are subject to the authorization regime, established by the Nuclear Act and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*. The specific safety requirements of the *Regulation on Radiation Protection* are also to be observed.

BNRA maintains a *National register of the Sources of Ionizing Radiation in the Republic of Bulgaria* containing data about all sealed sources from category 1 to 5 and the respective licencees.

If a disused sealed source is not intended to be re-used or re-cycled than it is considered radioactive waste and according to the Nuclear Act it shall be transferred by its owner to SERAW. BNRA shall be informed about each of such transfers.

In cases the owner is not known or the owner is declared insolvent, the sealed source becomes state property and shall be transferred to SERAW based on an order issued by the BNRA Chairman. The Nuclear act states that before the import of a sealed source its owner shall deposit in the Radioactive Waste Fund a lump-sum contribution to ensure financial availability for RAW management in the case of owner's bankruptcy.

The transfer of radioactive sources declared as RAW is carried out in compliance with the *Regulation on the Conditions and Procedures for Transfer of Radioactive Waste to the State Enterprise "Radioactive Waste*". In the period 2017-2019, the total number of 5755 SIR with total activity 2,2E+14 Bq were transferred to Centralized storage facility - Novi Han.

The capacity of SERAW is sufficient for the storage of disused sealed sources from industry, science and medicine. The National Disposal Facility for low and intermediate level RAW may accept for disposal appropriate conditioned disused sources currently stored in SD RAW - Novi Han.

The reuse of disused sealed sources category 1, 2 and 3 in the Republic of Bulgaria is carried out under the conditions of a licence issued by BNRA for the use of a source for a specific purpose other than the original purpose for which the source was produced and delivered.

Re-entry of disused sealed sources

The Bulgarian legislation does not prohibit the re-entry of disused sealed sources to the territory of the Republic of Bulgaria, if they were manufactured in the country. Applications for authorization of such import have not yet been submitted to BNRA as long as there are currently no licenced manufacturers of sealed Sources of Ionizing Radiation in the Republic of Bulgaria.

Section K: General efforts to improve safety

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.

The present report includes the measures that are currently executed and/or planned for execution in the next five-year period.

1. Construction of a National disposal facility for low and intermediate level RAW

Construction and regulatory supervision over the construction process according to the granted permission

Currently about 40% of the construction of the first phase is completed.

2. Disposal of high level RAW

HLW in Bulgaria is arising from the SF reprocessing. According to the existing agreements HLW from SF reprocessing are subject to return to the Republic of Bulgaria within 10 years after the specific HLW volume is determined according to a HLW from SF reprocessed up to 1989 is not subject to return to the Republic of Bulgaria.

WWER-1000 SF reprocessing in connection with the signed agreements is envisaged to start after 2025 in the radiochemical plant RT-2 in the town of Jeleznogorsk, Russia. The possibility for SF reprocessing in other countries is being investigated also.

In line with the national legislation, geological disposal in the Republic of Bulgaria shall be the option to guarantee the long-term safety of the HLW and long-lived LILW.

The construction of interim long-term storage facility for HLW and long-lived LILW is planned for the period till implementation of the geological disposal facility.

Projects for HLW disposal under regional and international initiatives are subject of interest also, along the considerations of the national requirements, public attitude, financial capacity and HLRAW volume, including high-activity DRS. Investigating international solutions is not an obstacle to the implementation of the planned activities in this field.

3. National legislation in the field of SF and RAW management

The national legislative and regulatory framework is maintained in line with the IAEA safety standards and the EU legislation in the field of SF and RAW management.

The work on the development of new and updating of the existing regulatory guides for implementation of the regulations continues. The planned regulatory guides will cover the issues related to the release from regulatory control, for safety assessments and for closure of a disposal facility.

4. Planned activities for safety improvement of the existing nuclear facilities

4.1. SERAW - Kozloduy

Under implementation is a project for landfill disposal of VLLW category 1„c" in an decommissioned structure at Kozloduy NPP site. This activity has been permitted by BNRA based on the results of the required safety assessments..

A design modification for optimization the management of the process waste generated by a super-compaction is under implementation.

A method for sludge conditioning was developed and is under implementation.

4.2. SD Decommissioning – Kozloduy

A technical design is developed for retrieving and processing of the solid phase from the tanks for evaporator concentrate and for spent ion-exchange resins. The design foreseen implementation of polymer matrix for RAW immobilization. The demonstration phase of the project shall be completed by 2024 according to the conditions of the issued a permit.

An installation for Plasma melting of solid RAW was constructed and the program for commissioning of the facility is under implementation.

For dismantling in the restricted areas in the reactor buildings of units 1 to 4 a technical design is under development.

The specific operations for dismantling the SSCs are defined, the processes and technical solutions are described, a list of engineering and technical measures has been drawn up. The system for management of generated RAW and RAM has been developed. Organizational and technical measures have been developed to ensure radiation safety during dismantling activities.

The implementation of the activities is separated in different project packages and is planned by 2030.

5. International cooperation in the management of RAW and SF

In view of the multiple benefits, the Republic of Bulgaria will continue its participation in international organizations, initiatives and projects.

SERAW is participating in international projects for exploration of various options for deep geological disposal of RAW and SF.

From 2019, the coordinated four-year research project of the IAEA "Standartized framework for borehole disposal" is launched, where participates BNRA and SERAW.

SECTION L: APPENDICES

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,
- 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.

To justify the WSFSF safety, respective analyses have been made. Within the PHARE programme, an additional assessment of the WSFSF safety was made in 1999. As a basis for the safety analysis, a standard list of accident scenarios, based on the IAEA document – Safety Series No. 118 "Safety Assessment for Spent Fuel Storage Facilities", was adopted.

After analysis of the seismic stability of the building structure, including the foundations of the equipment related to the WSFSF safety, and determination of the fields of permissible safety, an antiseismic strengthening of the building structure, the safety-related equipment, the 125 t crane and the bar with the lighting was performed.

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

SFAP - 5 and 6 are designed for spent fuel storage after its removal from the reactor core and serve for storage and cooling of spent fuel (until decrease of residual heat to permissible level). They are

situated adjacent to the corresponding reactor WWER-1000. They ensure sub-criticality, spent fuel decay heat removal and biological protection.

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 residual heat removal is provided by cooling through heat exchangers with service water. The cooling system consists of three chanals 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.

The SFAP –1 to 6 safety analyses are a part of the safety analysis report of the relevant unit.

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 SSCs 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. Between the facing and the lining are placed intermediate layer of CONSTORIT (granulated material with cement mortar), as well as tensioning bolts. The protective shielding from gamma radiation is ensured by the lining, the CONSTORIT layer and the facing, and the neutron radiation is reduced mainly by means of the water in the cement mortar.

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

Kozloduy NPP

The accumulated spent nuclear fuel on the Kozloduy NPP site, stored in SFP, WSFSF and in DSFSF, amounted to 955.7 tons of heavy metal as of 31.12.2019. This quantity is distributed in 2864 spent fuel assemblies from WWER-440 and 1545 spent fuel assemblies from WWER-1000, or a total of 4409 assemblies.

Inventory of WSFSF as of 31.12.2019

Reactor type	TOTAL	
	Number of assemblies	Heavy metal weigh [kg]
WWER-440	**1604**	**185462**
WWER-1000	**804**	**319894,3**
TOTAL	**2408**	**505356,4**

Inventory of DSFSF as of 31.12.2019

Reactor type	TOTAL	
	Number of assemblies	Heavy metal weigh [kg]
WWER-440	**1260**	**145447,9**

Inventory of SFP 5 and 6 as of 31.12.2019

Reactor type	SFP-5		SFP-6		TOTAL	
	Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weight [kg]
TOTAL	**380**	**156419,5**	**361**	**148451,4**	**741**	**304870,9**

Total for Kozloduy NPP

Reactor type	Number of assemblies	Heavy metal weight [kg]	Approximate activity [Bq]
WWER-440	2864	330 910,0	$0,3.10^{19}$
WWER-1000	1545	624 765,1	$2,5.10^{19}$
TOTAL	**4409**	**955 675,1**	**$2,8.10^{19}$**

Description of spent fuel assemblies construction

1. Fuel assembly for WWER-440 Reactor.

The fuel assembly is a non-dismountable construction and consists of a bundle of 126 fuel rods, fuel assembly spacer grids, upper grids, support grid, central pipe, casing pipe, FA head and bottom nozzle.

The assembly form is hexagonal with wrench dimension 144 mm. The total length of the FA is 3217 mm. The fuel assembly consists in approximately 120 kg heavy metal. For the regulating and shim fuel assembly the fuel rod is 10 cm shorter, which results in 115 kg heavy metal contained.

2. Fuel assembly for WWER-1000 reactor

The FA consists of a head with spring unit, central pipe, 18 casing pipes, 15 spacer grids, 312 fuel rods, and a bottom nozzle.

The assembly form is hexagonal with wrench dimension 234 mm. The total length is 4570 mm. The assembly contains heavy metal in range 400 to 435 kg depending of its type. The fuel rods are filled with UO_2 tablets with central hole diameter 1,5 mm or 2,35 mm depending of its type. In a FA for four year cycle 6 of the fuel rods are with burnable absorber Gd (Gd_2O_3).

Appendix L-3

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

1. KOZLODUY NPP RAW MANAGEMENT SSCs

1.1 Auxiliary building-3

A building with reinforced concrete structure located on KNPP site with a main purpose also for pre-treatment and interim storage of RAW category 2 - solid RAW, liquid radioactive concentrates and spent sorbents from 5&6 reactors operation.

For solid RAW are available bunker-type rooms with upper hatch and total net volume of 2700 m^3. The reinforced concrete structure ensures radiation shielding. Operating conditions: ambient temperature, atmospheric pressure, systems for fire alarm and automatic fire extinguishing.

For liquid radioactive concentrates are 7 stainless steel tanks with total net volume of 3584 m^3 located each in a separate room with metal lining. Operating conditions: temperature up to 100 °C, atmospheric pressure; concentrate transfer by a montejus; tank level monitoring system and exhaust filter-ventilation of the tank rooms.

For spent sorbents are intended 2 stainless steel tanks with net volume of 180 m^3 located each in a separate room with metal lining. Operating conditions: temperature up to 40 °C, atmospheric pressure; spent sorbents transfer by a hydrotransport; tank level and temperature monitoring system, fire extinguishing system and exhaust filter-ventilation systems of the tank rooms.

2. SERAW FACILITIES AND ITS SSCs FOR RAW MANAGEMENT

2.1 Units 1 to 4 under decommissioning

2.1.1 Auxiliary building-1

A building with reinforced concrete structure located close to units 1&2 on KNPP site with a main purpose interim storage of RAW category 2 - solid RAW, liquid radioactive concentrates and spent sorbents.

For solid RAW are available 7 bunker-type rooms with upper hatch and total net volume of 1010 m^3. The reinforced concrete structure ensure radiation shielding. Operating conditions – ambient temperature, atmospheric pressure, systems for fire alarm and automatic fire extinguishing.

For liquid radioactive concentrates there are 5 stainless steel tanks, with a diameter of 10 m, height of 7 m and operating volume of 470 m^3, each one located in a separate room with metal lining. Operating conditions: temperature up to 100 °C, atmospheric pressure; concentrate transfer by a montejus; tank level monitoring system and exhaust filter-ventilation of the tank rooms.

For spent sorbents are intended 4 stainless steel tanks – 2 tanks of 350 m^3 for “higher activity level” and 2 tanks of 188 m^3 for “low activity level” sorbents located each in a separate room with metal lining. Operating conditions: temperature up to 100 (resp.40) °C, atmospheric pressure; spent sorbents discharge by a hydrotransport; tank level and temperature monitoring system, fire extinguishing system and exhaust filter-ventilation systems of the tank rooms.

2.1.2 Auxiliary building-2

AB-2 is located close to units 3&4 on KNPP site and its technical characteristics are practically the same as of AB-1.

2.1.3 At-reactor storage for RAW from Units 1&2

It is located in the reactor hall (RH-1) of Units 1&2, for storage of solid RAW category 2 from reactors operation. In the solid reinforced concrete structure are concreted four hundred steel tubes with upper hatch, with a diameter of 0.18 m and height of 8 m each and total net volume of 81.6 m^3. Operating conditions – ambient temperature, atmospheric pressure.

2.1.4 At-reactor storage for RAW from Units 3&4

It is located in the reactor hall (RH-2) of Units 3&4. Its purpose and characteristics are the same as for RH-1.

2.2 *RAW processing & storage facility and its SSCs*

It is located on the Kozloduy NPP site and includes:

2.2.1 RAW processing plant

It is located close to AB-3 with a main purpose for processing of KNPP operational RAW category 2. There are three technological lines in the facility:

- *"Solid RAW" Line* - for sorting and compaction of solid RAW in order to reduce the volume and to prepare them for further conditioning. The treatment includes compaction of solid RAW in 200-l drums by 50-t compactor and super-compaction of the drums by 910-t super-compactor.
- "Lliquid RAW" - for treatment and conditioning of liquid radioactive concentrates, including packaging in containers.
- *Decontamination line* - for decontamination of metal RAW by mechanical (abrasive), chemical and electro-chemical methods

For conditioning of both solid and liquid waste is applied the cementation method.
A reinforced concrete container is the element of the conditioned RAW packages as approved by the BNRA. The container itself has external dimensions of 1.95x1.95x1.95 m and net volume of 5 m^3. According the RAW characteristics, the waste form of the RAW package is:

- solid RAW and liquid radioactive concentrates immobilized together in cement matrix
- super-compacted solid RAW immobilized in non-radioactive cement matrix
- super-compacted solid RAW and/or non-compacted metal RAW non-immobilized in a matrix.

The so conditioned waste packages are stored on the site for subsequent disposal without any additional processing.

2.2.2 Storage facility for conditioned RAW

It is located close to AB-3 with a main purpose for intermediate storage (until its disposal) of the conditioned RAW from Kozloduy NPP. The surface reinforced concrete structure ensures the necessary containment and isolation of the stored RAW with capacity of 1920 RAW packages (in 4 rows one on top of the other). The RAW packages handling is performed by two overhead cranes of 25 t lifting capacity each.

2.2.3. Trench storage

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

2.2.4. Storage for treated solid RAW

It is intended for storage of treated solid RAW of categories 2-I and 2-II from all nuclear facilities on the Kozloduy NPP site.

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

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

Open site for buffer storage of conditioned solid RAW of RAW package types StBK-1 and StBK-2 where the waste form is according to specifications of RAO.TR.-02/11.07.01 – solid RAW immobilized in non-radioactive cement matrix. The sites are with capacity of about 2100 packages.

2.2.6. Site for storage of solid RAW in ISO containers

Open site for buffer storage of unprocessed and processed solid RAW of category 2-I. It serves all nuclear facilities of Kozloduy NPP. The site is with capacity for placing of 14 ISO-containers with a side door and overall dimensions of 5.8x2.2x2.4 m and net volume of 30 m^3.

2.2.7. Storage for contaminated soil

For storage of soil, rubble and other residual material with very low level of contamination. The capacity is about 8000 m^3.

2.2.8. Depot for process waste (BB-1)

For landfill deposition of exempt waste from KNPP operations. The capacity for bulk waste is about 5350 m^3.

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

It is located 35 km to the south-east of Sofia and at 6.5 km from the village of Novi Han in the Lozen Mountain. It is intended for storage of conditioned and non-conditioned RAW from the nuclear applications from industry, medicine, agriculture and science and includes:

2.3.1 Storage for solid RAW

For storage of non-conditioned solid RAW category 2a with capacity of 237 m^3. It is a reinforced concrete structure consisting of three cells with dimensions 5 x 4.5 x 3.5 m and 7 upper hatches with diameters of 100 cm and 120 cm.

2.3.2 Storage for biological RAW

It is intended for storage of low and intermediate level short-lived biological RAW pre-treated with formaldehyde, processed by stabilization in gypsum matrix. The capacity of the storage is 80 m^3. It is a reinforced concrete structure with dimensions 8.35 x 4.00 x 2.5 m and 0.5 m height of the above-ground part, with 8 upper hatches with dimensions 80x80 cm.

2.3.3 Storage for disused sealed sources

For storage of non-conditioned higher activity sealed sources. Its capacity is 1 m^3. The reinforced concrete structure lined with stainless steel is at 5.5 m underground. The sources pass to the storage volume through stainless steel tube serpentine. The shielding is by heavy concrete and 50 mm lead plates, located between the storage facility and the surface, and a thick upper hatch.

2.3.4 Engineered trench for solid RAW

For non-conditioned solid RAW category 2a with capacity is 200 m^3 and dimensions: 29 m length and 4.1 m width. It consists of 8 cells with upper hatches with outer diameter of 130 cm, built of prefabricated reinforced concrete elements with 300 mm thickness, bitumen waterproofing, protected by brick wall.

2.3.5 Storage for liquid RAW

For storage of liquid radioactive waste categories 1 and 2a. It consists of four tanks 12 m^3 each made of stainless steel type X18H9T with 4 mm thickness, installed in reinforced concrete cell with dimensions 5.7 x 7.4 x 4.3 m; the cell is completely dug into the ground.

2.3.6 Site No. 1 and 1A solid RAW

It is intended for storage of solid RAW of categories 2a and 2b in standard ISO containers with dimensions 6.00 x 2.35 x 2.4 m. Fire alarm detectors in transport packing, solid RAW and β-, γ-spent sources with low specific activity, which do not require additional shielding, neutron sources and α-sources in transport packing are stored on the site. The site capacity is 14 ISO containers with 442 m^3 total volume.

2.3.7 Site No. 2 for solid RAW

For storage of low and intermediate level solid RAW of categories 2a and 2b in reinforced concrete containers of types PEK, RCCSS, RCC, StBGOU. The site capacity is for emplacement of 171 RCCSS with 248 m^3 total volume, 6 "PEK" with 74 m^3 total volume, 60 RCC and 18 StBGOU.

2.3.8 Site No. 4 for solid RAW

For storage of low level solid RAW of categories 1, 2a and 2b in 200-litre drums on Euro-pallets. The site capacity is for 400 drums, respectively 100 Euro-pallets.

2.3.9 RAW Receiving, preparation and laboratory complex

For characterization and processing of solid RAW of categories 1, 2a and 2b and of liquid contaminated media. It includes systems for: RAW sorting and fragmentation; processing of liquid RAW; cementation of liquid and solid RAW; compaction of solid RAW in 200-litre drums; abrasive decontamination; auxiliary systems and laboratories.

2.3.10. Hot cell

For handling (dismantling of technological devices) of DSS.

Storage of the DSS in shielded containers.

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 161	Compacted in 210-l drums	metal (22%), wood (2%), polymers (20%), mixed (56%)	^{60}Co–2.10^5 ^{137}Cs– 6.10^4 ^{134}Cs–2.10^4 ^{58}Co–2.10^4
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 100	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 1950	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 22	non treated	metal (100%)	

II. *RAW storage SSCs at Kozloduy site*				
Storage for conditioned RAW	solid RAW 1655 RAW packages	conditioned via immobilization in cement matrix	conditioned RAW packages type StBK-2 and StBK-3 (radioactive cement matrix)	^{137}Cs - $2.10^4 \div 5.10^6$ ^{134}Cs - $3.10^2 \div 4.10^4$ ^{60}Co - $2.10^4 \div 5.10^4$ ^{54}Mn - $5.10^1 \div 1.10^2$ ^{110m}Ag-$3.10^1 \div 1.10^2$ ^{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 - 3.10^4 ^{60}Co - 2.10^4 ^{54}Mn - 2.10^1 ^{134}Cs - 8.10^1
Storage for treated solid RAW	solid RAW 224	super-compacted drums	metal (29%), construction bulk (20%), thermal insulation (14%), textile (8%), mixed (29%).	category 2a
Sites (No. 1 and No. 2) for storage of conditioned RAW package	solid RAW 533 RAW packages	super-compacted drums, immobilization in cement	Conditioned RAW packages type StBK-2 (non-radioactive cement matrix)	^{137}Cs-$2.10^4 \div 6.10^6$ ^{60}Co-$2.10^4 \div 4.10^6$ ^{134}Cs-$8.10^2 \div 7.10^4$ ^{54}Mn-$8.10^2 \div 3.10^3$ ^{110m}Ag-$3.10^2 \div 1.10^3$
Site for storage of solid RAW in ISO containers	155	mixed, compacted in 210-l drums and non-treated	textile (80%), metal (13%), construction bulk (2%)	^{137}Cs - 6.10^3 ^{60}Co - 2.10^3
Storage for contaminated soil	127	non processed	bulk waste	Total activity: 3.10^9 Bq
Depot for process waste (BB-1)	Exempt process waste 2000	landfill deposition	Non processed	Total activity: 5.10^9 Bq
III. Centralized storage facility for institutional RAW at the Novi Han site				
Storage for solid RAW	71	Non treated	mixed (100%)	Total activity: ^{137}Cs - 3.10^{12} ^{60}Co - 1.10^{11} ^{90}Sr - 5.10^{11} ^{14}C - 4.10^{11} ^{3}H - 7.10^{11}
Storage for biological RAW	64	Stabilization in gypsum matrix	biological waste from scientific research (100%)	Total activity: ^{137}Cs - 8.10^{10} ^{90}Sr - 1.10^{10} ^{14}C - 1.10^{10} ^{3}H - 4.10^{9} ^{60}Co - 2.10^{9}
Storage for disused sealed sources	0,65	Non processed	DSS	Total activity: ^{137}Cs – 4.10^{13} ^{60}Co –1.10^{13}
Engineered trench for solid RAW	160	Non treated	mixed (100%)	Total activity: ^{137}Cs - 5.10^{11} ^{90}Sr - 1.10^{11} ^{60}Co - 4.10^{10}
Storage for liquid RAW	4,3	Concentrated via evaporation		Total activity: ^{137}Cs – 1.10^7 ^{3}H - 1.10^7 ^{90}Sr - 2.10^6 ^{60}Co – 5.10^3
Site No. 1 and 1A solid RAW	220	Non treated	mixed (100%)	Total activity: Pu - 3.10^{12} ^{60}Co - 3.10^{12} Pu-Be - 2.10^{12} Am-Be - 2.10^{12} ^{137}Cs - 6.10^{11} ^{241}Am - 5.10^{11} ^{85}Kr – 2.10^{11} ^{90}Sr - 1.10^{11}

Site No. 2 for solid RAW	174	Non treated, over packed	Disused Sealed Sources from irradiation and technological devices	Total activity: $^{137}Cs – 2.10^{15}$ $^{60}Co - 4.10^{14}$ $^{3}H - 3.10^{13}$ $^{241}Am - 3.10^{12}$ $^{90}Sr - 1.10^{11}$
Site No. 4 for solid RAW	0	NA	NA	NA
Hot cell	NA	Sorting and packaging in shielding containers	DSS dismantled from devices	Total activity: $^{137}Cs – 1.10^{13}$ $^{60}Co –1.10^{13}$

Appendix L-5

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 of the Republic of Bulgaria and the Government of the Hellenic Republic on early notification in case of nuclear accident and exchange of information about nuclear facilities, 23 April 1989;
1.13. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Commission on Atomic Energy of the Hellenic Republic on early notification in case of nuclear accident and exchange of information about nuclear facilities, signed on 15 February 1991;
1.14. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Romania on early notification in case of nuclear accident and exchange of information about nuclear facilities;
1.15. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Turkey on early notification in case of nuclear accident and exchange of information about nuclear facilities;

1.16. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Federal Regulatory Authority of Russia on Nuclear and Radiological Safety;
1.17. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the State Nuclear Regulatory Committee of the Ukraine for co-operation in the field of the state regulation and control of safety during the use of atomic energy, signed on 30 January 2003;
1.18. 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;
1.19. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation for co-operation in the field of atomic power industry;
1.20. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes ate the Council of Ministers of the Republic of Bulgaria and the Federal Ministry of the Environment, the Protection of Nature and the Reactor Safety of the Federal Republic of Germany;
1.21. AGREEMENT between the Government of the Republic of Bulgaria and the Cabinet of Ministers of the Ukraine on early notification in case of nuclear accidents and on co-operation in the field of nuclear and radiation safety;
1.22. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Radiation Protection Directorate of the Republic of Macedonia for co-operation in the field of radiation protection matters;
1.23. AGREEMENT between the Government of the Republic of Bulgaria, the Government of the Russian Federation and the Cabinet of Ministers of the Ukraine in the field of transport of nuclear materials between the Russian Federation and the Republic of Bulgaria through the territory of the Ukraine;
1.24. 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 the Ukraine for co-operation in the field of transport 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;
1.25. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes and the Ministry of Economy of the Slovak Republic for co-operation in the field of state safety regulation during the use of atomic energy for peaceful purposes, signed on 29 of September 1999 in Vienna;
1.26. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Argentina for co-operation in the field of peaceful use of nuclear energy, signed on 1 August 2000 in Buenos Aires;
1.27. AGREEMENT between the Republic of Bulgaria and the United States of America for the use on nuclear energy for peaceful purposes, signed in Sofia in June 1994;
1.28. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Nuclear Regulatory Commission of the United States of America for exchange of technical information and co-operation in nuclear safety matters;
1.29. AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Nuclear Regulatory Commission of the United States of America for exchange of technical information and co-operation in nuclear safety matters;
1.30. 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 for co-operation in the field of nuclear and radiation safety regulation during the use of atomic energy for peaceful purposes;

1.31. AGREEMENT between the People's Republic of Bulgaria and the International Atomic Energy Agency for the application of safeguards in connection with Treaty on the Non-Proliferation of Nuclear Weapons;
1.32. ADDITIONAL PROTOCOL to the Agreement between the People's Republic of Bulgaria and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons;
1.33. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation for co-operation in the import into the Russian Federation of spent nuclear fuel from a research reactor;
1.34. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation for co-operation in the export from the Republic of Bulgaria and the import into the Russian Federation of spent nuclear fuel from a research reactor.

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 Radioactive Waste Fund;
3.7. 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;
3.8. REGULATION on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy;
3.9. REGULATION on Radiation Protection during Activities with Sources of Ionizing Radiation;
3.10. REGULATION on NPP Safety Assurance;
3.11. 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;
3.12. 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;
3.13. 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;
3.14. REGULATION on Emergency Planning and Emergency Preparedness in the Case of a Nuclear or Radiological Emergencies;

3.15. REGULATION on the Provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Material;
3.16. 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;
3.17. 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 on Radiation Protection during Activities with Materials with Increased Content of Natural Radionuclides;

Appendix L-6

FINANCIAL RESOURCES IN THE MANAGEMENT OF SF AND RAW

Kozloduy NPP

The activities on management of SF, RAW and decommissioning of nuclear facilities and assurance and maintenance of the safety of the facilities for SF and RAW management are financed from various sources as follows:

Own funds

The expenditure of Kozloduy NPP for the management of SF, for its storage, transport and technological processing in Russia are recognized as an expense when determining the price of electricity by the regulatory authority in this field – the Energy and Water Regulatory Commission. Accordingly, these costs are financed with own funds – from the proceeds from the sale of electricity.

The unspent funds recognized in the pricing during the current year, are provisioned. The management of these funds is as follows – they are deposited in a special-purpose account opened by Kozloduy NPP with a bank and under conditions approved by Ministry of Energy. The accumulated funds in the account shall be only used to cover expenses for the activities on transport, technological storage and processing of SF, left unimplemented from previous years.

RAW Fund and Decommissioning Fund

The procedure for collecting and spending the financial resources in the funds is defined in the *Regulation on the Procedure for Determination, Collection, Spending and Control of the Funds and the Amount of Due Contributions to the Radioactive Waste Fund* and the *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*.

After the presentation of the Sixth National Report, no changes have been made in the methodology for determining the amount of monthly contributions that Kozloduy NPP has to deposit in both funds. For the period from 1 January 2017 to 30 June 2020, the contributions of the Kozloduy NPP to the funds and the expenditure are given in Table 1 and

Table **2**.

Table 1. Contributed amounts by Kozloduy NPP in the RAW fund and financing of SERAW activities from the RAW fund

Year	Contributed, BGN	Spent, BGN
2017	26 947 410	20 474 665
2018	32 554 146	23 319 990
2019	39 193 693	24 719 141
as of 30.06.2020	12 588 331	NA
Total:	**86 154 071**	**NA**

Table 2. Contributed amounts by Kozloduy NPP in the DNF fund and financing of SERAW activities from the DNF fund

Year	Contributed, BGN	Spent, BGN
2017	67 242 389	17 533 600
2018	81 357 118	19 218 582
2018	97 901 520	21 282 000
as of 30.06.2020	31 470 827	NA

Year	Contributed, BGN	Spent, BGN
Total:	**215 353 369**	**NA**

Other sources of financing

The activities on decommissioning are financed mainly by the Kozloduy International Decommissioning Support Fund (Kozloduy International Fund - KIDSF) established in 2001 with the Framework agreement between EBRD and the Republic of Bulgaria, to support the activities on decommissioning of Units 1&4 of Kozloduy NPP. The Fund has been established with the purpose of management of the grant extended by the European Commission to mitigate the consequences of the early decommissioning of Units of Kozloduy NPP.

For activities on decommissioning and management of radioactive waste produced during those activities, EUR 505,270,000 have been provided for by KIDSF under Subsidizing agreements. With Council Regulation (EURATOM) No 1368/2013 on Union support for the nuclear decommissioning assistance programmes in Bulgaria and Slovakia, EUR 283 mln have been granted to the Republic of Bulgaria for the period 2014-2020 for decommissioning activities. In total, EUR 788 mln have been provided for the decommissioning activities through the Kozloduy International Fund for the period 2003-2020.