THE REPUBLIC OF BULGARIA

SIXTH 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, 2017

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

AB – Auxiliary Building
ASUNE - Act on the Safe Use of Nuclear Energy
BAS – Bulgarian Academy of Science
BNRP –Basic Norms of Radiation Protection
CA – Controlled Area
CRAWSF – Conditioned Radioactive Waste Storage Facility at the SD RAW – Kozloduy
DSFSF - Dry Spent Fuel Storage Facility
EBRD – European Bank for Reconstruction and Development
EC – Evaporator Concentrate (Liquid Radioactive Concentrate)
EIA – Environmental Impact Assessment
EPA – Environmental Protection Act
EU – European Union
NF –Nuclear Fuel
FSAR – Final Safety Analysis Report
HLW – High Level radioactive Waste
HLST – High Activity Level Spent Sorbents Tank
HPA – Health Protection Act
IAEA – International Atomic Energy Agency
INRNE – Institute of Nuclear Research and Nuclear Energy
ISAR – Intermediate Safety Analysis Report
LILW – Low – and Intermediate Level radioactive Waste
LLST – Low Activity Level Spent Sorbents Tank
MS – Management System
NCRBRP – National Centre for Radiobiology and Radiation Protection
NDF – National Disposal Facility
NF – Nuclear Facility
NPP – Nuclear Power Plant
NRA – The Bulgarian Nuclear Regulatory Agency
PD – Personal Dosimetry
RAW – Radioactive Waste
RAWPP – Radioactive Waste Processing Plant
RCC – Reinforced Concrete Container
RH –Reactor Hall
RR – Research Reactor
SAR – Safety Analysis Report
SD RAW – Kozloduy – Specialized Department “RAW – Kozloduy”
SD RAW – Novi Han - Specialized Department “RAW - Novi Han”
SE RAW – State Enterprise “Radioactive Waste”
SF– Spent Fuel
SFP – Spent Fuel Pool
SIR – Sources of Ionizing Radiation
WSFSF – Wet Spent Fuel Storage Facility
WWER – Water Cooled Water Moderated Energy Reactor

SUMMARY

This report was prepared up 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 progress in SF and RAW management and the advancement in the decommissioning of nuclear facilities within the scope of the sixth review under the Joint Convention.

1. General Framework

The Act on the Safe Use of Nuclear Energy (*ASUNE*) governs the public relations in terms of state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel as well as the rights and obligations of the entities carrying out such activities to ensure nuclear safety, security and radiation protection.

Nuclear energy and ionizing radiation are used in observance of the principles of nuclear safety and radiation protection in order to ensure the protection of human life, health and living conditions of present and future generations, and environment and property against the harmful effects of ionizing radiation.

The state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel are carried out by the Chairman of the Nuclear Regulatory Agency, which is an independent specialized body of the executive power.

2. Nuclear facilities

The following nuclear facilities exist in the Republic of Bulgaria:

- 2 power reactors in operation;
- 4 power reactors in the process of decommissioning;
- 2 SF storage facilities in operation;
- 1 research reactor in extended shut-down;
- National Disposal Facility for the disposal of low and intermediate level short-lived RAW under construction;
- Novi Han storage facility in operation for RAW from nuclear applications;
- RAW management facility – SD RAW - Kozloduy in operation;
- Plasma Melting Facility – in the commissioning stage.

SF from the two operated power reactors is stored in at-reactor pools and in the spent fuel storage facilities on-site ofKozloduy NPP.

All the SF is removed from the power reactors under decommissioning and is stored in SF storage facilities on Kozloduy NPP site.

There is no SF in the research reactor.

A National Disposal Facility for low and intermediate level short-lived RAW is under construction.

The Novi Han storage facility for receives all the RAW from nuclear applications generated outside the NPP.

The RAW management facility SD RAW – Kozloduy is used for the conditioning and storage of RAW generated by the operation of Kozloduy NPP.

3. SF and RAW management Matrix of the Republic of Bulgaria

Type of Liability	Long-term management policy	Funding of Liabilities	Current Practice/ Facilities	Planned Facilities
SF	Reprocessing abroad	Financing by the NPP operator	Reprocessing abroad; Interim Storage in a Wet and Dry Spent Fuel Storage Facilities on KNPP site	
RAW from the nuclear-fuel cycle	Disposal	RAW Fund	LILW Processing - and storage facility on KNPP site	National Disposal Facility for short-lived LILW - at the stage of construction; Interim long-term storage facilityfor HLW and long-lived LILW
RAW from nuclear applications	Disposal	RAW Fund	Novi Han storage facility	National Disposal Facility for short-lived LILW - at the stage of construction; Interim long-term storage facilityfor HLW and long-lived LILW
Decommissioning	Strategy for continuous decommissioning	RAW Fund Decommissioning Fund KIDS Fund	Decommissioning of KNPP Units 1 – 4	National Disposal Facility for short-lived LILW - at the stage of construction; Plasma Melting Facility – at the stage of commissioning
Disused sealed sources; orphan sources	Returning to the manufacturer; disposal	RAW Fund	Novi Han storage facility	National Disposal Facility for low and intermediate level short-lived RAW - at the stage of construction; Facility for intermediate long-term storage of HLRAW and long-lived low and intermediate level RAW

4. Challenges to the Republic of Bulgaria identified during the fifth review

The following challenges were identified during the fifth review under the JC:

- The technical specification of the waste form of HLW subject to return from the Russian Federation should be defined;

A draft methodology was prepared for assessment of the volumes and the activity of HLW, arising from the SF reprocessing abroad and subject to return in Bulgaria. A draft version is currently under evaluation by Kozloduy NPP experts.

- A strategy for long-term management and disposal of HLW and long-lived low and intermediate level RAW should be developed and implemented;

A program for the feasibility study and implementation of a facility for a deep geological disposal of HLW and LILW long-lived RAW, category 2b, is under development.

- Completion of the works for Buhovo site remediation;

The designed civil works for Buhovo site recultivation are being carried out.

- Up-date of the cost estimate for NPP decommissioning and for the disposal facilities for provision of sufficient financial resources in the funds;

In 2014, the estimated cost for the decommissioning Kozloduy NPP Units 1&4 as part the final decommissioning plan, was adjusted.

Regarding Kozloduy NPP Unit 5-6, an initial decommissioning option has now been developed, and the activities that should be carried out and their sequence and duration are generally defined.

A methodology for decommissioning cost estimate of Units 5 and 6 will be developed and approved. Based on that methodology, reassessment of the annual contributions in the state funds will be made in order to ensure sufficient financial resources for the decommissioning activities.

- Maintenance of adequate staffing of NRA with competent personnel.

Permanent efforts are made to attract and appoint competent personnel at NRA.

5. Major changes after the fifth national report

5.1. Regulations

NRA has the permanent task of maintaining the legal framework.

In 2015 the Council of Ministers adopted amendments to the *Regulation on the conditions and procedure of Transport of Radioactive Materials*.

They correspond to the latest amendments made to the Act on the Safe Use of Nuclear Energy in transposing the EU Directives and Regulations and in implementation of the international agreements on the transport of dangerous goods ratified by the Republic of Bulgaria (in the part for Class 7), as well as the documents of the International Atomic Energy Agency.

The *Regulation on the Terms and Procedure for the Transfer of Radioactive Waste to the State Enterprise "Radioactive Waste"* and the *Regulation for the provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances* were adopted.

In 2016, the *Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy* was amended.

With that amendment, the functions of the different state authorities in the field of radiation protection were clearly distinguished. A regulatory requirement for releasing nuclear facility sites from regulatory control after their decommissioning was laid down.

In 2016 a completely new *Regulation on ensuring the safety of nuclear power plants* was adopted. The regulation introduces the newest requirements and safety standards of IAEA with reference to site selection, design and safety assessment both for power plants in operation and for the design of new power plants. Directive 2014/87/EUROATOM was transposed and the conceptually new requirements for safety assurance of nuclear power plants were introduced in line with the report „Safety of New NPP Designs, Study by Reactor Harmonization Working Group RHWG“, WENRA, March 2013. The reference levels for harmonization of the safety of the power plants in operation revised according to the report of WENRA „Updated Reference Levels for existing NPP и Updating WENRA Reference Levels for existing reactors in the light of TEPCO Fukushima Dai-ichi accident lessons learned“ were introduced.

In 2017, amendments to the *Regulation of the conditions and procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation* were made.

The work on the draft *Regulation on Safety during Decommissioning of Nuclear Facilities* continues.

Five regulatory guides of NRA have been developed or updated.

5.2. Spent Fuel management

SF is stored under water in the at-reactor pools of Kozloduy NPP Units 5 and 6 and in a Wet Spent Fuel Storage Facility on Kozloduy NPP site.

In 2016, a license for the operation of a Dry Spent Fuel Storage Facility (DSFSF) was issued.

SF is transported to the country–manufacturer of nuclear fuel for re-processing.

5.3. Decommissioning of nuclear facilities

The objective of the decommissioning is to remove the sources of ionizing radiation and to release the site from regulatory control.

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

Four nuclear power reactors are in the process of decommissioning. For Kozloduy NPP Units 1 and 2, decommissioning licensees were issued in 2014 and for Units 3 and 4 – in 2016.

The SF is removed from the reactors and activities for RAW management, and preparation works for dismantling of the equipment in the controlled area are being carried out. Most of the equipment in the turbine hall was dismantled. Clearance of material from dismantling is currently in process.

5.4. RAW management

5.4.1. Framework

The short-lived LILW are subject to disposal in the National Disposal Facility. Some of these RAW are conditioned and brought into a form corresponding to the criteria for acceptance in NDF. Other part of RAW, generated in the past, will undergo processing. The operational RAW from the two nuclear power reactors in operation are conditioned in due time.

The HLW from SF re-processing are stored in the Russian Federation. Till the construction of a geological disposal facility, is planned interim long-term storage on Kozloduy NPP site of all the HLW and long-lived LILW.

5.4.2. Facilities

National Disposal Facility for short-lived LILW– a near-surface, multi-barrier engineered facility of modular type gradual construction of the separate modules and gradual increase in capacity respectively. The capacity of the first stage is 50 000 m^3. A construction permit has been issued and the civil works have started.

The Novi Han storage facility is intended for the storage of 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.

Kozloduy NPP RAW management facility

Since 2001 a separate RAW management facility is in operation on Kozloduy NPP site. Operator of the facility for processing and storage of LILW dry- and wet solid RAW is SE RAW. The processing includes volume reduction methods and conditioning via packaging and immobilization in a cement matrix.

The conditioned RAW packages are stored in a separate storage facility.

5.4.3. Waste from uranium mining

Uranium mining was terminated by a decision of the Government of the Republic of Bulgaria in 1992.

The mitigation of the consequences from uranium mining and milling aims at restoring of the environment in the area of the closed sites and elimination of the health risk for the population in these areas.

The scope of work includes remediation activities, as well as monitoring. Most of the activities have been completed. The outstanding activities are related to remediation of the Buhovo tailings pool and some contaminated terrains in the area.

Treatment of uranium-contaminated mine waters is carried out on three sites.

5.5. Funding

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

The financing of the decommissioning and RAW management (including RAW from nuclear applications after it is transferred to SE RAW) is provided by the Decommissioning fund and the RAW fund. The funds are special purpose funds and are managed in line with the applicable legal regulations in order to guarantee:

- sufficient funds;
- fund revenues from contributions made by the generators of RAW and SF;
- cost effectiveness;
- transparency in the financial management.

5.6. Peer reviews

Following an invitation of the Government of the Republic of Bulgaria a team of international experts completed a Full Scope Integrated Regulatory Review Service (*IRRS*) mission in Republic of Bulgaria in the period April 6-19, 2013.

The objective of the mission was to review the efficiency of the Bulgarian regulatory body and to exchange information and experience about regulatory activities in the fields of nuclear safety, radiation protection, radioactive waste safety and the transport of radioactive materials.

The mission report established that the Republic of Bulgaria has a national safety policy and safety strategy supported by a clear legislative and regulatory framework, NRA is functioning as an independent regulator and is implementing its regulatory processes in an open and transparent way.

The mission identified good practices and some areas that required additional attention or improvement, mainly related to: allocation of the responsibilities between the competent authorities in radiation protection; optimization of the inspection process; public consultations in the final phase of

the licensing process; up-date of some of the procedures for safety assessments and analyzes; elaboration of additional regulatory guidance for sites with SIR.

In April 2016, an IRRS follow-up mission was completed to review the implementation of the recommendations and proposals from IRRS Mission 2013. The team concluded that the recommendations and proposals were included in a detailed action plan and that significant progress had been made, and that the 13 of the 15 recommendations and 31 of the 34 proposals had been implemented.

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 Second, Third, Fourth and Fifth 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.

In this Sixth National Report of the Republic of Bulgaria under the Joint Convention, the information presented in the previous reports is updated and the significant changes to RAW and SF policies and practices are presented.

The Act on the Safe Use of Nuclear Energy (ASUNE) and the secondary legislation for its implementation govern the public relations in terms of safety of spent nuclear fuel management and radioactive waste management. In the period after the presentation of the previous report, the work on updating the acts and secondary legislation continued in order to continuously maintain the regulatory framework in compliance with the safety standards of IAEA and the European legislation related to the EURATOM treaty. This activity, along with the licensing and the regulatory control on activities and facilities, was among the main and permanent responsibilities of the Bulgarian Nuclear Regulator - NRA. NRA continued to strengthen its regulatory capacity, marking its 60th anniversary in 2017.

The National Strategy for SF and RAW management, which in fact is the National Program of the Republic of Bulgaria for SF and RAW management and which determines the specific policies and guidelines in the long term by 2030, was updated. Also the responsibilities of the competent state authorities and of the licence holders, as well as the deadlines for the implementation of key activities were allocated.

The operation of the existing nuclear facilities and the activities with SF and RAW have been performed by the licenees in compliance with the stipulated safety requirements

In accordance with the conditions of the decommissioning licenses issued in 2014 and 2016, dismantling and all other main and auxiliary activities have been carried out at Kozloduy NPP Units 1&4.

The activities on planned nuclear facilities, which are at different stages of their life cycle, have been successfully completed.

The financial and human resources necessary for SF and RAW management are provided.

In view of the challenges and in seeking adequate SF and RAW management solutions, the Republic of Bulgaria has invited IAEA to conduct an ARTEMIS mission, which is an international peer review within the meaning of Council Directive 2011/70 /Euratom of the EU Council on the establishment of a European community framework for responsible and safe management of SF and RAW. The independent review mission of the National Program for SF and RAW Management will be held in 2018.

The international cooperation in the field of SF and RAW management is particularly important for the Republic of Bulgaria. Close contacts with the regulatory authorities of the other EU 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.

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. 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 improvement activities that are currently executed 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.

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 ASUNE, 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 NRA;
- SF management shall be carried out only by entities that have obtained an NPP operation licence;
- enact the responsibility of the entities, that are generating RAW, for their safe management until it is transferred to the state, i.e. the SE RAW;
- state monopoly is established over RAW management activities - RAW management outside the sites where RAW is generated is assigned to SE RAW;
- the RAW generating entities shall incur the costs for waste management, including its final disposal, following the "the polluter pays" principle;
- 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 ASUNE (reimport of disused sealed sources of ionizing radiation (SIR) manufactured in the Republic of Bulgaria, and when RAW is generated as a result of the material processing carried out as a service for the benefit of the Republic of Bulgaria or a Bulgarian legal entity);
- application of the principle for returning back certain categories of spent radioactive sources to the manufacturer.
- SF may be classified 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;
- timely processing of RAW until their conditioning for safe storage and disposal

The policy of the Republic of Bulgaria in the field of SF and RAW management is based on the moral principle of avoiding the imposing of undue burden on future generations. The RAW and SF management principles are stated in the *National 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 .

The National Strategy was updated by a decision of the Council of Ministers in 2015 in line with the requirements of Directive 2011/70/Euratom of the Council of EU for establishing a Community framework for responsible and safe management of spent fuel and radioactive waste and it is in fact the national program of the Republic of Bulgaria under the Directive.

The *Strategy* defines the long-term specific policies and basic guidelines until 2030 for the management of:

Spent fuel and high level radioactive waste

- The spent fuel generated in the country 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;
- The spent fuel for which reprocessing has proven cost ineffective shall be classified as radioactive waste pursuant to ASUNE, and may be managed in line with the concept of "deferred decision for subsequent use", if it is stored in a manner allowing its retrieval.
- In the case of long-term storage under the "deferred decision" option, the spent fuel shall be stored using the "dry storage" technology;
- Deep geological disposal is considered the most suitable option for sustainable guarantied safety for isolation 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

- Minimization of RAW generation, RAW reuse and recycling, and release from regulatory control;
- Use of approved RAW processing technologies;
- Assurance of long-term waste disposal ahead of time compared to waste generation;
- Management of disused sealed radioactive sources;
- 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 highest priority.

SF management practices

SF Management at Kozloduy NPP

According to the plant design, SF at Kozloduy NPP is stored for a period of 3 years in at-reactor spent fuel pools and it is then returned to the former Soviet Union for reprocessing. In 1985 a decision was made the term for storage in reactor pools of SF from NPPs with WWER reactors to be increased from 3 to 5 years. This fact required the construction of a separate Wet Spent Fuel Storage Facility (WSFSF) on the site of Kozloduy NPP which was commissioned in 1989.

In 1988, the last return of SF from WWER-440 to Russia was carried out under the initial contract conditions (free of charge), and since then all SF from Units 1&4 has been mainly transferred to the WSFSF for temporary storage.

Regarding the return of SF for its technological storage and reprocessing in Russia with subsequent reimport of HLW obtained upon its reprocessing, long-term framework agreements were

signed with the Russian company Techsnabexport JSC in 1998 for SF from WWER-440 and in 2000 for SF from WWER-1000. By an order of the Government of the Russian Federation in the end of 2008, the performance of the activities for acceptance of SF for reprocessing in Russia, and the respective contracts, were transferred from Techsnabexport JSC to Federal Centre for Nuclear and Radiation Safety FSUE. These contracts refer to SF delivered as fresh nuclear fuel (FNF) till 2002. The possibility for reprocessing of SF delivered as FNF after 2002 was provided in the FNF supply contract with the Russian company TVEL JSC. Under the two long-term contracts (for reprocessing of SF from WWER-440 and WWER-1000), 240 SF assemblies from WWER-440 or about 27.5 tons of heavy metal were transported from 2014 to 31.12.2016, and the total transported amount for the period from 1998 till 31.12.2016 is 4048 SF assemblies from WWER-440 reactors and 959 SF assemblies from WWER-1000 reactors, or 891 tons of heavy metal in total.

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

Currently SF ponds of units 1 to 4 are emptied of SF and are handed over to SE RAW for decommissioning as part of Units 1 to 4.

The spent fuel from Units 5&6 is stored in SFP 5 and 6 till its shipment to Russia or transfer to WSFSF. The SF pools are located in the containment of the respective Unit. They consist of 4 sections, physically separated by walls. Three sections are designated for immediate storage of SF assemblies, while the fourth section is used for fresh and spent fuel handling. Internally within the sections, the SF assemblies are placed on racks or in hermetical casks for decay storage..

At Kozloduy NPP there are two SF storage facilities for fuel from WWER-440 and WWER-1000 reactors. In the Wet Spent Fuel Storage Facility (WSFSF) the spent fuel is stored in transport baskets under water in 4 pools. In 2006 the facility was equipped with a refuelling machine for spent fuel from WWER-1000 in addition to the equipment for spent fuel from WWER-440 reactors.

According to the national strategy for SF and RAW management and the updated strategy for decommissioning of Units 1&4 at Kozloduy NPP a Dry Spent Fuel Storage Facility (DSFSF) for the fuel from WWER-440 was constructed. In 2012 the commissioning of the storage facility started with a design lifetime of 50 years and a capacity of 72 casks or 6048 assemblies from reactors WWER-440. The storage technology is a container storage system with air-cooled containers trough natural convection CONSTOR 440/84 type with a capacity of 84 assemblies. The containers are loaded with spent nuclear fuel and are prepared for transport for storage within the existing WSFSF. The capacity of WSFSF equipment for SF assembly handling, needed for their preparation for storage, is 420 assemblies per year, which is equivalent to 5 CONSTOR-440/84 casks. The storage facility obtained a 10-year licence for operation on 28.01.2016.

Till 30.06.2017, 11 CONSTOR-440/84 casks of the totally delivered 34 casks were loaded in the DSFSF.

Long-term SF management

According to the Technological Regulations for safe operation a sufficient number of free slots in SFP 5 and 6 should be provided for emergency core unloading. For this purpose SF assemblies should be regularly removed from SFP-5 and/or SFP-6.

WSFSF clearing of all available SF from WWER 440 is envisaged and 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, i.e. SF from WWER-1000.

WSFSF capacity for WWER-1000 baskets is 152 baskets, this capacity will be sufficient till the end of 2030.

The principles of HLRAW and SF management are laid down in the Strategy for SF and RAW Management by 2030", approved by the Council of Ministers on 02.09.2015.

Detailed information regarding the main technical characteristics and the safety assurance 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. SF is not considered RAW.

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 for activities with other SIR perform treatment (to a different extent) and interim storage on their sites of all generated RAW until their transfer to SE RAW.

SE RAW as nuclear facility operator for RAW management carries out processing and storage, and after the construction of the National Disposal Facility, will also perform activities for disposal of conditioned RAW. Till the commissioning of the National Disposal Facility, conditioned RAWare stored in SE RAW interim storage facilities.

RAW management at Kozloduy NPP

RAW generated at Kozloduy NPP fall into RAW category 2 – low and intermediate level waste according to the classification in the *Regulation on Safety of Radioactive Waste Management* .

Solid RAW in the controlled area are collected separately at collection points for conditionally "non-contaminated" waste and points for RAW and are 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 management facility has been operated on the Kozloduy NPP site. The operator of the facility for processing and storage of low and intermediate level solid and liquid waste is SE RAW 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 compaction of the drums itselfs 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 treated solid RAW in a cement-radioactive matrix;
- incorporation of the treated solid RAW in a non-radioactive cement matrix;
- packing of the treated solid RAW without their immobilization in a matrix.

The conditioned RAW is stored in a storage with a capacity of 1920 RAW packages.

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

Management of RAW from nuclear applications

About 2000 different sites of national industrial, medical, agricultural and scientific research use sources of ionizing radiation (SIR). In SD RAW - Novi Han the received RAW are treated in installations for cementing, abrasive decontamination, compaction of solid RAW. Both treated and untreated waste are stored in the facility. Disused sources are handed over to SD RAW – Novi Han without preliminary treatment. Due to the high number of the received fire detectors for storage - over 100 000 (mainly with Pu and Am sources), technological solutions have been developed to reduce their volume which include source extraction and its further placement in a fire-proof package.

The stored contaminated liquid solutions on the site of the research reactor IRT- 2000 (from radiochemistry laboratories, radioactive drains and the spent fuel pool) have been timely transported to Kozloduy NPP for treatment. The solid operational RAW including disused SIR that were used in different INRNE laboratories are stored in the at-reactor storage facilities of IRT-2000 till their transportation to SD RAW – Novi Han for subsequent treatment and/or storage. The RAW generated during the partial dismantling of IRT-2000 equipment have been processed and are stored after packaging in reinforced concrete containers RCC type on the site of the research reactor.

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

RAW from uranium mining and processing

Over 40 mining sites and two hydrometallurgical plants were operated as part of the uranium industry in the Republic of Bulgaria. The generated waste materials with increased content of natural radionuclides are stored in tailings ponds and dirt piles. Uranium mining was suspended by a decision of the Bulgarian Government in 1992.

The measures in the field of uranium industry are aimed at mitigation of the consequences from uranium ore mining and processing within the environmental management scope. The main objective is environmental restoration in the areas of closed uranium mining sites and elimination of the health risk for the population in these regions.

RAW from uranium industry are stored safely on-site and/or is disposed in trenches at the piles and the tailings ponds. Disposal in the uranium mine galleries is admissible.

The disposal technologies and sites are defined in the design for technical liquidation and recultivation.

RAW classification criteria

The Classification of RAW in accordance with the *Regulation for Safe Management of RAW* is presented in the previous national reports. It is emphasized that the Classification system is oriented towards RAW disposal.

The classification of RAW is presented in Appendix L7

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 be declared as RAW for the purposes of the Joint Convention.

RAW generated from nuclear applications on sites of the Ministry of Defence 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 in operation are the following SF management facilities with reference to the respective characteristics and quantities of stored SF (as at 31.12.2016):

Facilities operated by Kozloduy NPP

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 (number of assemblies): 612
SF stored (number of assemblies/kg heavy metal): 344/ 139 677

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 (number of assemblies): 612
SF stored (number of assemblies/kg heavy metal): 307/ 125 550

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 (baskets): 168, conditionally - 200
SF stored (number of assemblies/kg heavy metal): 2976 / 523 153

Dry Spent Fuel Storage Facility(DSFSF)
Location: At the Kozloduy NPP Site, nearby the existing building of the SFSF;6
Purpose: long term storage of WWER-440 SF;
Storage method: dry, in reinforced concrete casks type CONSTOR 440/84;
Capacity (containers): 72
Stored SF (number of assemblies/kg heavy metal): 756 / 87 396

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 in operation are the following RAW management facilities with reference to the respective characteristics and quantities of stored RAW (as at 31.12.2016):

Facilities 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;
Capacity of the storage facilities / volume of the stored solid RAW, m^3: 2486 +213 / 444
Capacity of the storage facilities / volume of the stored liquid RAW, m^3:

- Liquid radioactive concentrate: 3600 / 1565
- Spent ion exchange resins: 200 / 167

Facilities operated by SE RAW – SD RAW - Kozloduy

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;
Capacity of the storage facilities / volume of the stored solid RAW, m^3: 1010 / 236
Capacity of the storage facilities / volume of the stored liquid RAW, m^3:

- Liquid radioactive concentrate: 2350/ 2170
- Spent ion exchange resins: 1076 / 209

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;
Capacity of the storage facilities / volume of the stored solid RAW, m^3:1010 / 290
Capacity of the storage facilities / volume of the stored liquid RAW, m^3:

- Liquid radioactive concentrate: 2350/ 1920
- Spent ion exchange resins: 1076 / 266

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;
Capacity of the storage facility / volume of the stored solid RAW, m^3: 81.6 / 52

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;
Capacity of the storage facility / volume of the stored solid RAW, m^3: 81.6 / 32

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, m^3 /year: liquid - 450, solid - 1500

Storage facility for conditioned RAW (SFCRAW)
Location: on the Kozloduy NPP site, close to RAWPP;
Purpose: storage of conditioned in RAWPP RAW category 2;
Capacity / volume of the stored RAW, number of RAW packages: 1920 / 1577.

Trench storage facility
Location: Lime Plant on the Kozloduy NPP Site;
Purpose: storage of processed and unprocessed solid RAW category 2;
Capacity / volume of the stored RAW, m^3: 3860 / 2035.

Storage facility for processed solid RAW
Location: Lime Plant on the Kozloduy NPP Site;
Purpose: storage of processed solid RAW category 2;
Capacity / volume of the stored RAW, m 3: 1130 / 261;

Sites (No.1 and No.2) for storage of solid RAW in reinforced concrete containers
Location: Lime Plant on the Kozloduy NPP Site;
Purpose: buffer storage of processed solid RAW category 2-I and 2-II, packaged in reinforced concrete containers;
Capacity / volume of the stored RAW, number of packages: 2100 / 342.

Site for storage of solid RAW in freight containers
Location: Lime Plant on the Kozloduy NPP Site;
Purpose: Storage of unprocessed and processed low level solid RAW category 2-I in standard ISO-containers;
Capacity / volume of the stored RAW, m^3: 420 / 292.

Storage facility for contaminated soil
Location: Lime Plant on the Kozloduy NPP Site;
Purpose: Storage of soil, construction and other bulk technological waste with very low level of contamination;
Capacity / volume of the stored RAW, m^3: about 8000 / 0.

Facilities operated by SE RAW – SD Novi Han

Storage facility for solid RAW
Purpose: storage of unconditioned solid low and intermediate level short-lived RAW, category 2a
Capacity / volume of the stored RAW, m^3: 237 / 71

Storage facility for biological RAW
Purpose: storage of conditioned low and intermediate level short-lived biological waste, after treatment with formaldehyde and stabilization in a gypsum matrix, category 2a.
Capacity / volume of the stored RAW, m^3: 80 / 64.

Storage facility for disused sealed sources
Purpose: storage of unconditioned disused sealed sources, category 2a and 2b.
Capacity / volume of the stored RAW, m^3: 1 / 0.65.

Engineered trench for solid RAW

Purpose: storage of unconditioned solid low and intermediate level short-lived wastes, category 2a
Capacity / volume of the stored RAW, m^3: 200 / 160

Storage facility for liquid RAW

Purpose: storage of low level short-lived liquid RAW, Capacity / volume of the stored RAW, m^3: 48 / 12.

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 / volume of the stored RAW, m^3: 442 / 250

Site No. 2 for storage of solid RAW

Purpose: storage of low and intermediate level RAW category 2a and 2 b in reinforced concrete containers type PEK, StBKUB, RCC, StBGOU.
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 / volume of the stored RAW, m^3: 80/ 47.

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: cementing of solid and liquid RAW, packing and overpacking of solid RAW.

Facilities operated by INRNE - BAS -2000

Storage facility for reactor equipment

Location: separate building on the site of **IRT-2000**;
Purpose: storage of operational low level solid RAW, category 2;
Capacity / volume of the stored RAW, number of RAW packages: for the overall lifetime of IRT-2000 / 6 pcs. 200-litter drums, dismantled equipment.

Site for storage of solid RAW in RCC

Location: on the site of IRT-2000;
Purpose: storage of processed solid RAW from the partial dismantling, category 2, packaged in RCC;
Capacity / volume of the stored RAW, number of packages: 14 / 6.

Facilities from closed uranium mining

Buhovo-1 tailings pond

Location: 1 km to the east of the town of Buhovo;
Purpose: storage of the tailings generated as a result from the activity of the „Metalurg“ Hydrometallurgy Plant in Buhovo, from 1956 and 1960;
Capacity / volume of the stored RAW, million m^3: 1.3 / 1.3.

Buhovo-2 tailings pond

Location: 1 km to the east of the town of Buhovo;
Purpose: storage of the tailings generated as a result from the activity of the „Metalurg“ Hydrometallurgy Plant in Buhovo, from 1960 to 1992;
Capacity / volume of the stored RAW, million m^3: 10 / 4.5 Mt

Eleshnitsa tailings pond

Location: 3.0 km to the south-east of the village of Eleshnitsa;
Purpose: storage of the tailings generated as a result from the activity of the „Zvezda“ Hydrometallurgy Plant in the village of Eleshnitsa;
Capacity / volume of the stored RAW: 23.1 ha / 9 Mt

Installation for mine water treatment at Chora site

Location: 1 km to the north-west of the town of Buhovo;
Purpose: purification of uranium contaminated mine water;
Treatment methods: ion exchange.

Installation for mine water treatment at Byalata Voda site

Location: 22 km west-northwest from the town of Kostenets in the lands of the village of Ochusha;
Purpose: purification of uranium contaminated mine water;
Treatment methods: ion exchange.

Installation for mine water treatment at Iskra site

Location: 5 km to the north of the town of Novi Iskar;
Purpose: Purification of uranium contaminated mine water;
Treatment methods: ion exchange.

Line for regenerative purification of ion-exchange resins

Location: on the territory of the former Zvezda uranium processing plant, approximately at 2.0 km to the south-east of village of Eleshnitsa;
Purpose: regeneration of the sorbents used in the water treatment installations for uranium contaminated mine waters of the Chora, Byala Voda and Iskra sections.

More detailed information about the facilities and a report about the stored and disposed RAW are provided in Appendices L-3 and L-4 of the report.

Nuclear facilities under decommissioning

Four nuclear power reactors are in the process of decommissioning in the Republic of Bulgaria.

Kozloduy NPP Units 1 and 2 have decommissioning licences since 2014 and Units 3 and 4 since 2016.

The reactors are emptied of SF and activities for reducing the radiological inventoryand preparation works for dismantling of the equipment in the controlled area are carried out.

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

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

SECTION E. LEGISLATIVE AND REGULATORY FRAMEWORK

Article 18. Implementing Measures

"Each Contracting Party shall take, 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."

Overview of the information presented in the previous national reports

An overview of the legislative and regulatory framework in the field of use of nuclear energy for peaceful purposes in the Republic of Bulgaria was made in the previous national reports. ASUNE and the Health Protection Act as well as the regulations for NRA regulatory control and for the application of ASUNE were presented. The requirements for the issuance of permits and licences, as well as NRA Chairman's responsibilities, related to the issuance, amendment, renewal and termination of licenses and permits were specified. The requirements for state control in RAW and SF management were also presented.

The key participants in the RAW and SF management process at national level (Council of Ministers, NRA, SE RAW together with its specialized divisions and the holders of permits and licenses) were described as well as the relations between them pursuant to the law.

The amendments to ASUNE implemented in 2010 and the activities of harmonization of the regulatory requirements in the WENRA member states were also presented.

Amendments to the legislative and regulatory framework

NRA maintains a program for review of all secondary legislation for ASUNE application including a review and update of the existing regulations, as well as the development of new ones. The review of secondary legislation is carried out periodically in the case of amendments to the act and following transposition of international documents into the national legislation.

ASUNE and its implementing regulations assign the NRA Chairman with responsibilities for enforcing the law and provide interpretation and guidance on the implementation of the legislative requirements.

By Decree No. 17 of 17.02.2015 of the Council of Ministers amendments and supplements to the *Regulation on the conditions and procedure of Transport of Radioactive Materials* were adopted.

This reflected the latest amendments and supplements made to the Act on the Safe Use of Nuclear Energy regarding transport in line with the amendments to the Regulations and Directives of the European Commission, the international agreements on the carriage of dangerous goods ratified by the Republic of Bulgaria (in the part class 7), as well as the documents of the International Atomic Energy Agency in the field.

The requirements of Directive 2006/117/Euroatom of the Council from 2006 were introduced regarding the international transport within the European Union for import, export or transit through the European Union of spent nuclear fuel or radioactive waste as well as the requirements of the Commission for establishing a standard document for supervision and control on the transport of radioactive waste and spent fuel.

In 2015, the updating of the regulatory requirements in line with the development of the international standards and the European legislation continued. The applicable secondary legislation for ASUNE implementation was reviewed in terms of its compliance with the amendments and supplements to the act, the new documents of IAEA and the WENRA reference levels. Following a proposal of the Chairman of the Nuclear Regulatory Agency, the Council of Ministers adopted *Regulation on the Terms and procedure for the Transfer of Radioactive Waste to SE RAW* and the *Regulation for the provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances*.

In 2016, following a proposal of the Chairman of the Nuclear Regulatory Agency, the Council of Ministers adopted a Decree which amended and complemented the *Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy.*

With the amendments to the *Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy* in the part concerning the licensing of the sources of ionizing radiation, the experience gained by the Agency and the recommendations and proposals from the report of the Integrated Regulatory Review Service mission on safety and radiation protection in the Republic of Bulgaria (IRRS mission), concerning the division between the functions of the different state bodies in the field of radiation protection are reflected. A regulatory requirement for releasing the sites of the nuclear facilities from regulatory control following their decommissioning is introduced.

In 2016 a new *Regulation on ensuring the safety of nuclear power plants* was adopted. The regulation introduced the latest safety standards and requirements with reference to the requirements for the power plants in operation as well as for the design of newly constructed plants. In the preparation of the Regulation contents compliance with the directly applicable norms of Directive 2014/87/EUROATOM of the Council of July 8, 2014 on amendment of Directive 2009/71/EUROATOM for the establishment of a community framework of the nuclear safety of nuclear installations was ensured. Conceptually new requirements for the safety assurance of nuclear power plants were introduced that corresponded to the higher safety standards applicable to newly constructed NPPs in line with the report Safety of New NPP Designs, Study by Reactor Harmonization Working Group RHWG, WENRA, March 2013. The revised reference levels for harmonization of the safety of the operating plants according to the report of WENRA, Updated Reference Levels for existing NPP and Updating WENRA Reference Levels for existing reactors in the light of TEPCO Fukushima Dai-ichi accident lessons learned, were introduced. The contents of the regulation were brought in compliance with the new IAEA standards concerning the layout, design and safety assessment of the new power plants and to the extend the respective requirements were practically applicable to the power plants in operation by using Safety of Nuclear Power Plants: Design, Specific Safety Requirements No. SSR-2/1 and Safety of Nuclear Power Plants: Commissioning and Operation, Specific Safety Requirements No. SSR-2/2.

The work on the draft of *Regulation on Safety during Decommissioning of Nuclear Facilities* continued.

In connection with the transposition of DIRECTIVE 2013/59/EUROATOM of the EU Council, laying down the basic safety standards for protection against the hazards arising from exposure to ionizing radiation, amendments to two acts and several regulations were prepared which are in the process of interinstitutional accord. In addition to detailing the radiation protection norms and requirements the existing licensing regime was differentiated for the purpose of efficient implementation of the graded approach.

The following NRA regulatory guides were developed /updated in 2016: *Guide for release of buildings and sites of nuclear facilities from regulatory control, Guide for safe transport of nuclear materials – management of the non-conformities, Guide on the contents and form of the required documents for issuance, renewal, amendment and termination of licences and permits for activities with SIR and Guide for periodic review of the safety of nuclear power plants.*

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."

Overview of the information presented in the previous national reports

The previous national reports stipulated that according to ASUNE the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel are implemented by the Chairman of NRA which is an independent specialized body of the executive power and has competence as set by the law. The Chairman of the Agency is nominated by a decision of the Council of Ministers, is appointed by the Prime Minister for a term of five years and may be appointed for one additional mandate. It was pointed out that according to the Act on the ratification of the Joint Convention, the NRA Chairman is designated as a regulatory authority pursuant to Art. 20 of the Convention, and as a coordinator for the preparation of the national reports on the fulfilment of the obligations of the Republic of Bulgaria under this Convention.

An appendix showed the NRA organizational and management structure. More detailed information on the number of the Agency's staff and funding was provided. The Advisory Councils on nuclear safety and radiation protection established pursuant to ASUNE were described.

It was specified that ASUNE ensures effective independence of the regulatory functions from the SF and RAW management functions. The functions of the Minister of Energy who implements the state policy in the field of RAW and SF management were described.

Following the amendments to ASUNE, the provision of the regulatory body with sufficient resources was highlighted as a basic principle in Art. 3 of the Act. It was specified that the competent authority performing state regulation of the safe use of nuclear energy and ionizing radiation should be provided with adequate human and financial resources to carry out its responsibilities in full scope.

Amendments to the legislative and regulatory framework

In the period 2014 – 2017 no amendments in the legislative framework related to the regulatory body were made.

Development of the regulatory body after the presentation of the fifth national report

No changes to NRA functions were made in the last three years and respectively there were no changes to the organizational structure. According to the Rules of Procedure, NRA has 114 job positions. At the end of 2016, 101 job positions were occupied of which 79 are civil servants.

Staff structure by age:

Age/ Positions	Up to 29 years	30-59 years	60 years and above 60 years	Total
Management	-	9	7	16
Experts	2	68	12	82
Technical staff		2	1	3
Total for NRA	2	79	20	101
Percentage	2 %	78 %	20%	100 %

The implemented policy of knowledge and skills transfer from more experienced to younger employees in the Agency ensures consistency in the organization and preservation of the well-established professional practices.

All expert positions are occupied by employees with university education – Master‘s degree, and some hold a PhD scientific degree. In general, 91% of all employees have university education and all other employees - 9 % have secondary education. The employees holding a university degree are mainly in the field of technical and natural sciences. The ratio for management and expert positions occupied by women and men is preserved (56:44 in favour of women).

The professional recruitment of personnel in NRA is made in compliance with the requirements of the Civil Servants Act, the Labour Code and the Regulation on carrying out competitions for appointment of civil servants. The applicants' requirements concern not only professional competence, but the personal qualities of the applicants, the ability to work in a team, the desire for development, the communication skills, leadership and managerial competence - for management positions etc.

The general training of NRA employees is carried out in the form of training courses and workshops for the employees in different areas of administrative activity. The training is conducted by the Institute for Public Administration and European Integration according to an annual plan. The newly appointed employees in the state administration attend a course on "Induction to Civil Service" which is part of the professional development training. The foreign language training includes development of the communication skills based on specialized vocabulary as well as courses providing the opportunity for better communication with the European institutions.

The holding of a series of national and international technical meetings, training courses and seminars is aimed at familiarizing the employees with the international and national practices for the application of the regulatory approach, the requirements of the new regulatory framework, the development of secondary legislation in accordance with ASUNE and the European legislation.

The attestation of employees is carried out according to the Regulation on the terms and procedure for appraisal of civil servants.

NRA financing

The revenues obtained by NRA are revenues from fees pursuant to ASUNE and the Tariff of the fees, collected by the NRA pursuant to ASUNE.

The NRA budget is negotiated directly with the Ministry of Finance of the Republic of Bulgaria. The Law on the State Budget of the Republic of Bulgaria for 2016 allocates expenses to the amount of BGN 4,194,147 to NRA. For the current year, the NRA income from state taxes amounted to BGN 10,722,947 and the income from interest to BGN 32,821.

The reported costs cover the maintenance costs of the agency, staff remuneration, social and health contributions, membership fee in international organizations, acquisition of long-term tangible assets etc.

About 30% of the total agency costs were the current maintenance costs in 2016. About 10 % of the total agency costs for 2016 were the costs for membership fee for the participation of the Republic of Bulgaria in the International Atomic Energy Agency in Vienna, Austria.

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."

Overview of the information presented in the previous national reports

ASUNE requirements related to the activities for RAW and SF management were presented. It was specified that radioactive waste and spent fuel management is performed by legal entities only after they have obtained a permit and/or a license for the safe conduct of the respective activity. The obligations and responsibilities of the licence holders pursuant to ASUNE were presented in detail.

It was stated that RAW and SF whose owner was not known should be considered as state property (Art. 73 of ASUNE) and that Chairman of the NRA should designate the entity to whom they will be transferred and the conditions for this.

The requirements of the secondary legislation related to the liability of the holder of the permit or the license were presented.

Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations was transposed in ASUNE and the fundamental safety principles established by IAEA document SF-1 "Safety Fundamentals" were implemented. The responsibility for ensuring nuclear safety and radiation protection lies fully with the entities responsible for the facilities and activities, and cannot be transferred to other entities.

The requirements of *Regulation for Safe Management of RAW* were presented which stipulated that the entities as a result of whose activities RAW is generated bear responsibility for its safe management from its formation till its transfer to State Enterprise "Radioactive Waste" or its release from regulatory control. The requirements for the licence holder were presented in detail. The licence holder should have the organizational structure for maintaining a high safety level and should have provided compliance of the facilities and the declared activities with the requirements, norms and regulations for nuclear safety and radiation protection; it should have developed a system for maintaining a high level of safety culture and work organization which allows to maintain the exposure doses of the staff and population as low as reasonably achievable.

Amendments to the legislative framework related to the responsibility of the licence holder

In the period 2014 – 2017 no changes in the legislative framework related to the responsibility of the licence holder were made.

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."

Overview of the information presented in the previous national reports

ASUNE requirements for the availability of adequately qualified and competent personnel with the relevant level of education and training for all activities related to the operation of the SF and RAW management facilities were presented. The system for gaining competence and for conducting specialized training of personnel in nuclear facilities was presented.

The conditions for the issuance of a nuclear facility operation licence pursuant to the Act were described, which are related to the availability of sufficient financial and material resources for maintaining a high level of safety for the overall operating lifetime of the facility as well as for the purpose of decommissioning of facilities for SF and RAW management.

It is specified which documents shall be submitted by the applicant together with the application for the issuance of a licence or a permit and by which it certifies the availability of sufficient financial and human resources. As part of the licence issuance procedure, the regulatory authority evaluates the compliance of the submitted documents and the declared data and circumstances with the requirements of ASUNE and the secondary legislation issued for its implementation.

The requirements of the *Regulation on the Terms and Conditions for Acquiring a Professional Qualification and on the Procedure for the Issuance of Licenses for Specialized Training and Certificates of Competence in Nuclear Energy Use* were presented.

Amendments to the legislative framework related to human and financial resources

In the past period there were no amendments to the legislative framework related to human and financial resources.

Financing of the decommissioning and the RAW management

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

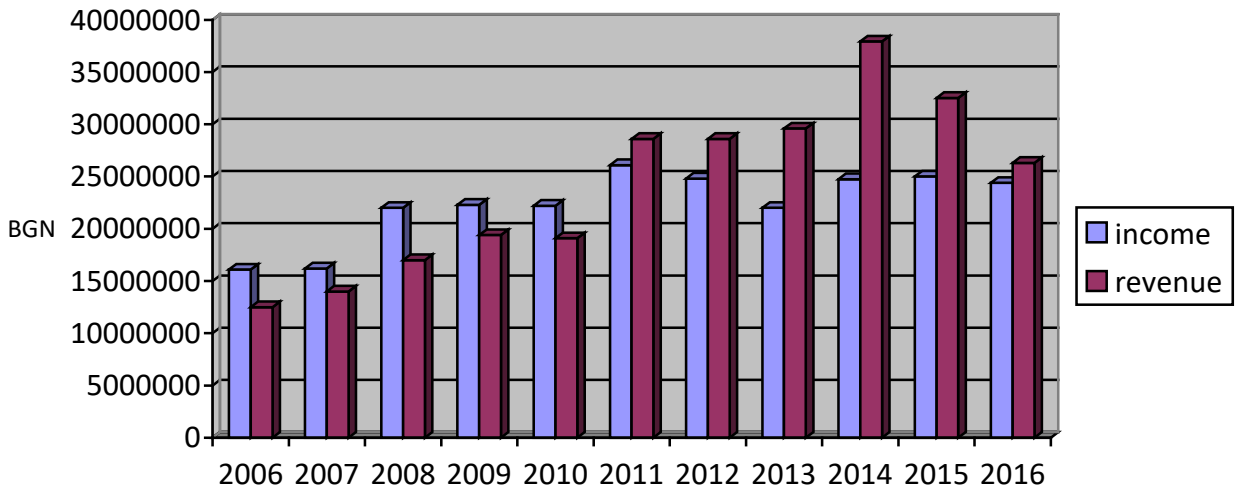
The financing of the decommissioning and RAW management after their transfer to SE RAW is provided from the Decommissioning fund and the RAW fund. The funds are special purpose funds and are managed in accordance with the applicable legislation to ensure the following:

- sufficient financial resources which will always be available in order to avoid the imposing of undue burden on the future generations;
- fair proportional distribution of the RAW and SF management expenses between their sources of origin;
- efficiency of the management costs per RAW or SF unit;
- 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 amount of the expenses of the RAW fund depends on the envisaged terms for the planned activities in the "Strategy for safe management of spent fuel and radioactive waste" in force and the current annual work programs of SE RAW. The financial resources accumulated in the funds may be spent in an indefinite period of time. At the end of 2016 the cumulated financial balance of the RAW fund is BGN 110 million.

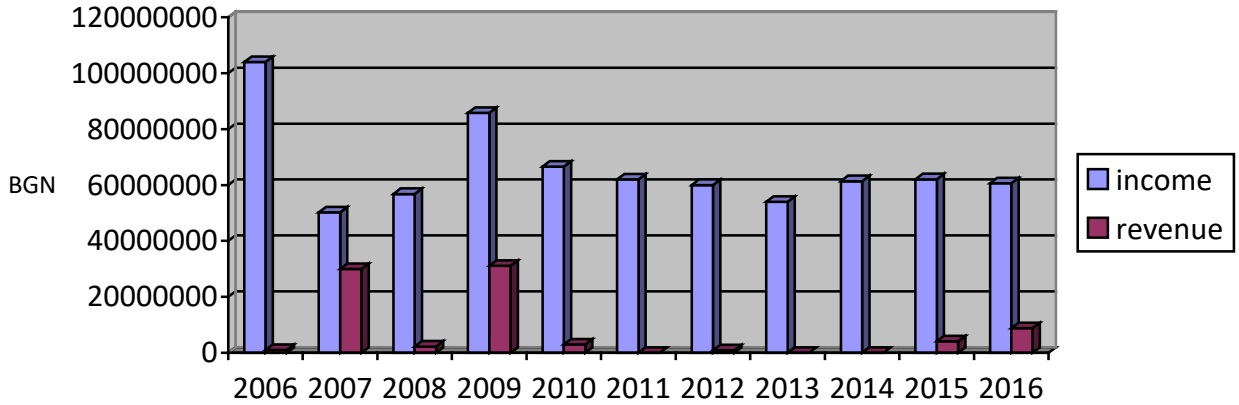
Currently the main financial resources accumulated in the RAW fund come from contributions from KNPP as the company with the highest percentage of generated radioactive waste. Assuming that the production volume, the amount of the contribution and the price of electricity will remain the same it is expected that about 120 million BGN, undiscounted and without calculated interest will be accumulated in the RAW Fund in the next five years.

Fund RAW



At the end of 2016, BGN 1,444,933,286 were accumulated in the Decommissioning Fund.

Fund Decommissioning



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."

Overview of the information presented in previous national reports

In the previous national reports the ASUNE requirement was presented that the entities carrying out RAW and SF management activities should maintain high quality of the activities implemented by them. The requirements of the regulations applicable at that time were also presented. It was specified that the implementation of the quality assurance program is inspected by NRA during the regulatory inspections. Information about the quality management systems implemented at KNPP and SE RAW was presented.

The quality management systems were presented and the activities undertaken by the licence holders for transfer to an integrated management system were described in connection with the requirements of the new safety standard of IAEA GS-R-3 „The management system for facilities and activities".

With the *Regulation for Safe Management of RAW* the requirements of GS-R-3 are applied in the national legislation with reference to the management system of the operators of the RAW management facilities.

Amendments to the legislative framework

With the adopted new *Regulation on ensuring the safety of nuclear power plants* in 2016 the requirements for the management system (MS) of the nuclear power plant operator were specified in detail. The requirements regulate the MS integration and are in full compliance with IAEA standards.

Development of the quality management systems of the operating organizations

Quality assurance at Kozloduy NPP

An integrated management system is implemented in Kozloduy NPP which is continuously measured and improved. Over the past period, based on specific changed circumstances and conditions, modifications were made to the respective management documents and the managements system processes, as follows:

The KNPP EAD RAW Safe Management Program was updated in line with the National policy on SF and RAW management, the main purpose of which is defined in the SF and RAW Management Strategy till 2030: "to guarantee that effective protection measures against potential hazards are ensured at all SF and RAW management stages so that individuals, the society and the environment are protected against harmful impact of ionizing radiation in the present and in the future".

Updated were the KNPP Safety Maintenance and Improvement Program for the period 2017-2019, which includes measures for fulfilment of the conditions of the issued licence for operation of the Dry Spent Fuel Storage Facility for nuclear fuel from reactors WWER-440, as well as the Program for implementation of measures for safety improvement of WSFSF, addressing provision 26.1 of the licence for WSFSF.

The Quality Assurance Program for safe operation of the spent fuel storage facilities /WSFS and DRSF/ of KNPP EAD, Revision 3 and the Quality Assurance Program for safe operation of Units 5 and 6, Revision 5 were updated and some of the activities of processes MP.5 Nuclear fuel cycle management and AP.19 RAW and SIR management were updated in view of the occurring changes;

The KNPP EAD Quality Assurance Program, Transportation of spent nuclear fuel, Revision 3 and Integrated RAW Management Program, Revision 8 were updated.

Quality assurance at SE RAW

An integrated management system, developed in accordance with the standards listed below is applied at the State Enterprise Radioactive Waste:

- ISO 9001:2008 Quality Management System. Requirements;

- ISO 14001:2004 Environmental management systems. Requirements with guidelines for use;

- OHSAS 18001:2007 Occupational health and safety management systems;

- GS-R-3:2006, IAEA Management system for facilities and activities.

The integrated management system for the enterprise is in a period of transition to meet the requirements of the new versions of ISO standards from 2015, as well as the new standard GSR part 2 – Leadership and management of safety, IAEA.

The new revision of GSR part 2 focuses on the responsibilities in safety assurance and achievement in observation of the fundamental principles of safety, leadership, management, safety culture, measurement requirements, assessment and improvement of the management system.

Quality assurance is based on the quality management principle by applying a process approach. Quality assurance programs are developed in all SE RAW specialized departments which cover respectively all aspects of the main activities during: RAW management facility operation, nuclear facility decommissioning; nuclear facility operation; working with SIR, as well as for quality assurance during NDF construction.

The enterprise activities are organized into processes and are implemented through the application of procedures and instructions in observation of the requirements of the legislative documents and the international standards, as well as the adopted good practices for RAW management and decommissioning of nuclear facilities.

The quality assurance in the implementation of a specific project, project stage, etc. are provided through the development and implementation of programs, plans and schedules in consideration of the requirements of BDS EN ISO 10006:2003 for quality management of projects. The quality assurance for a product, activity and service is based on the monitoring of indicators, data analysis, use of data and document control mechanisms, testing and measurement, etc.

The management system provides mechanisms for carrying out independent assessments, self-assessments, inspections and audits with completion of the stages of planning, implementation, inspection and operation.

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."

Overview of the information presented in the previous national reports

In the previous national reports the legislative and regulatory framework in the field of radiation protection in the Republic of Bulgaria was presented, in which the internationally recognized principles of justification of the practices, optimization of the radiation exposure and establishing exposure dose limits are applied.

The general requirements for the licence 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 power plants are set out in *ASUNE*, the *Regulation on Basic Norms of Radiation Protection (Regulation on BNRP) the Regulation on ensuring the safety of Nuclear Facilities* and the *Regulation on Radiation Protection during Activities with Sources of Ionizing Radiation*. All quoted NRA regulations are published, including in English on the website of the NRA - http://www.bnra.bg/.

Exposure limitations

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

- effective dose of 20 mSv per year;
- annual equivalent doses in observance of the limit of the annual effective dose: 20 mSv for the eye lens; 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); 500 mSv for the hands to the elbows, feet and ankles,
- specific requirements have been introduced for women subjected to occupational exposure 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,
- limits of the annual equivalent doses in observance of the limit of the annual effective dose for a member of the population as follows: 15 mSv for the eye lens and 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).

Measure for non-exceedance of the dose limits and optimization of the radiation protection

In order to implement the principle of optimization of the radiation protection, *the Regulation on BNRP* regulates the method for determining and justification of the dose constraints for exposure of the population to different sources.

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, in fulfilment of the *Regulation on BNRP*. In connection with the implementation of these legal requirements, in the licences the regulatory body has specified detailed conditions. 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 control administrative 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 of optimization of occupational exposure.

The established ALARA councils and the involvement of managers from all levels demonstrate the commitment of the management to the process. The result is a clear trend of decreasing the personnel exposure to stable low levels.

Measures for prevention of the unplanned and uncontrolled release of radioactive materials

The *Regulation on BNRP* and *the Regulation on Radiation Protection during Activities with Sources of Ionizing Radiation* regulate the measures that the licence holder 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 of the sites and premises where exposure may exceed 1 mSv per year or the equivalent dose may reach 1/10 of the dose limits for the eye lens, skin and limbs due to the value of the dose rate, the surface contamination or air contamination. The requirements for organization of the flows, velocity, sub-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 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 legislation.

According to Art. 10 of the *Regulation on BNRP* 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 NRA individually for nuclear facilities and sites. The levels of the permitted releases into the environment are determined on the basis of the dose constraints for the population and are agreed with the Minister of Health.

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 technological regulations 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 population exposure dose below 50 μSv/y.

The *Regulation for Safe Management of RAW* 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 was developed. Information about the system was presented in the previous reports under the Convention and in the Report of the Republic of Bulgaria pursuant to Art. 35 of the Euratom Treaty. The networks for radiation monitoring of the environment of the licence holders as well as information about the radiation monitoring conducted by the central government institutions were presented.

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 and liquidation of their consequences, as presented in the report pursuant to Art. 25

Operational experience following the presentation of the Fifth 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 and the number of persons who received doses above the established limits; 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 SE RAW 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 2014-2016.

Kozloduy NPP

Personnel exposure dose

The control on the personnel exposure dose from external and internal irradiation is carried out by the “Personal Dosimetry” Control Centre accredited by the “Bulgarian Accreditation Service” Executive Agency as an Inspection Authority of type C.

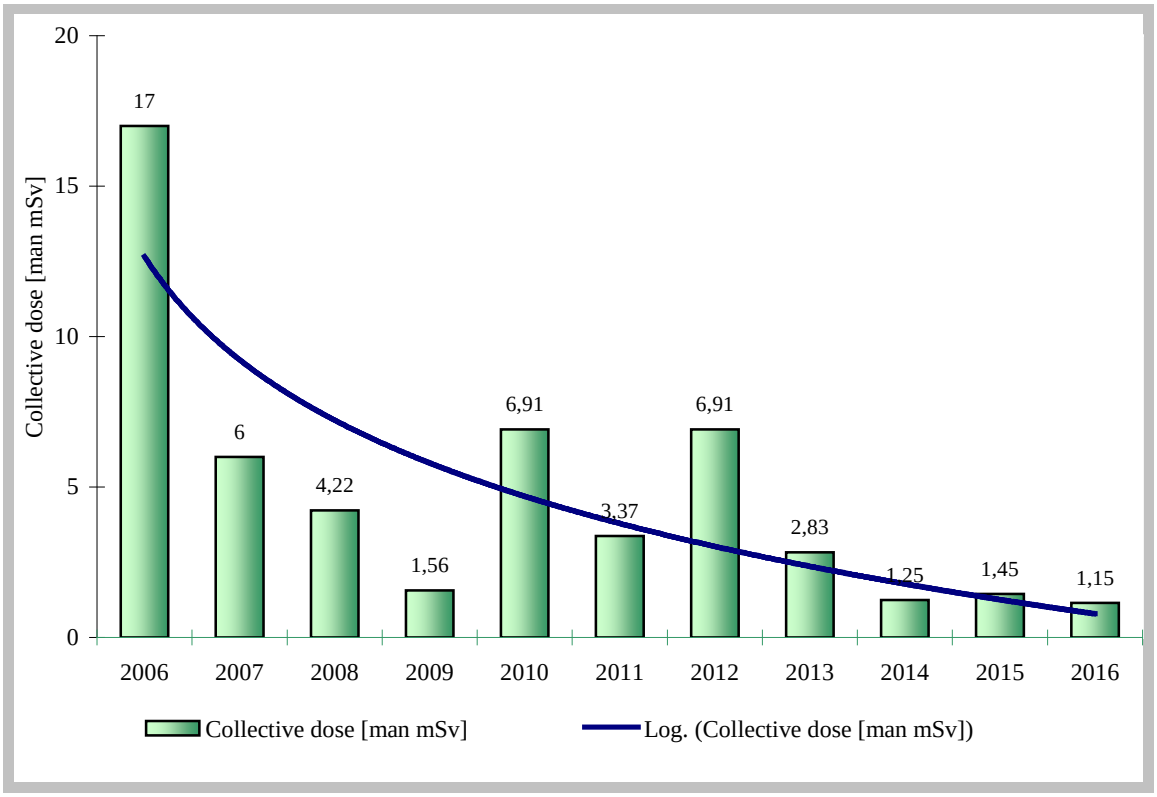
The main measurement method for external exposure doses is the thermoluminescent method with a detection limit of 0.10 mSv. For the purposes of the operative dosimetric control, dosimeters with direct reporting with a sensitivity of 0.01 mSv are used.

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 for using the biokinetic models of ICRP. The level of minimum detectable activity for the whole body is 200-300 Bq for the different nuclides. The entered dose recording level during the individual measurement is 1 mSv/y from internal exposure and 0.20 mSv from external exposure pursuant to *Regulation on the Terms and Conditions for Carrying out Individual Dosimetric Control of the Persons Working with Sources of Ionizing Radiation* of the Ministry of Health.

For the period 2014÷2016 the exposure dose of the personnel (*own and on assignment)*, involved in SF management and RAW handling in the controlled areas of Kozloduy NPP is the following:

Year	2014	2015	2016
Collective effective dose [man.mSv]	1.25	1.45	1.15
Average individual effective dose [mSv]	0.01	0.01	0.01
Maximum individual dose [mSv]	0.26	0.32	0.32

In the period 2006÷2016 the collective effective dose of the personnel involved in SF and RAW management at KNPP is the following:



Collective dose of the personnel involved in RAW and SF management [man mSv]
Log. (Collective dose of the personnel involved in RAW and SF management [man mSv])

After 2007, the annual collective dose has followed a decreasing trend and has reached levels of about 1.5 man.mSv in recent years. There have been no violations of the dose limits, the values show a reached steady state at a sufficiently low level, which is an indicator of the degree of optimization of radiation protection in the execution of these activities.

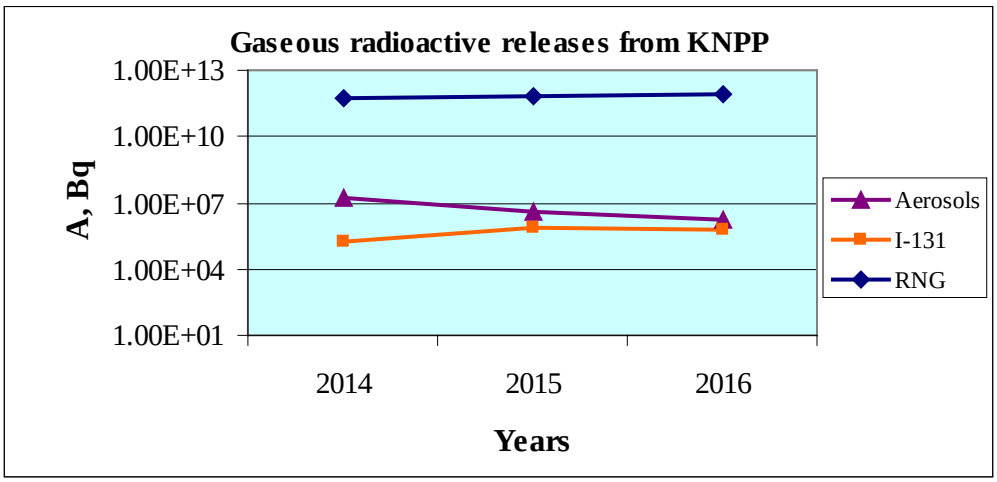
Releases from Kozloduy NPP site

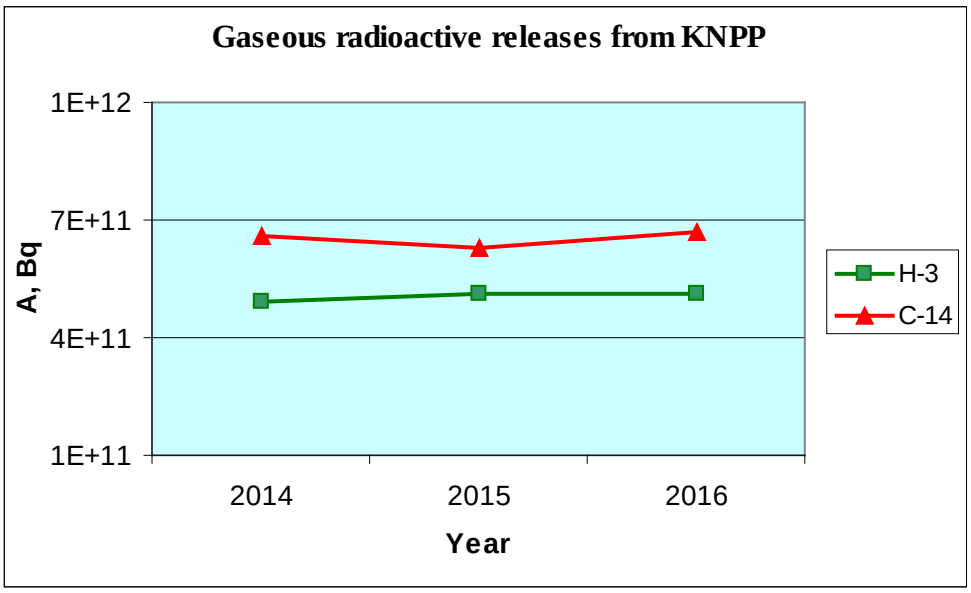
Summarized data for the gaseous and liquid releases into the environment

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

The activity released through the ventilation stacks of Kozloduy NPP for the period 2014-2016 is the following:

Gas aerosol emissions	2014	2015	2016
Radioactive noble gases, Bq	$5.1.10^{11}$	$6.7.10^{11}$	$8.6.10^{11}$
Iodine-131, Bq	$1.6.10^{5}$	$8.2.10^{5}$	$6.7.10^{5}$
* Radioactive aerosols, Bq	$1.6.10^{7}$	$3.7.10^{6}$	$1.6.10^{6}$
Tritium, Bq	$4.9.10^{11}$	$5.1.10^{11}$	$5.1.10^{11}$
Carbon-14, Bq	$6.6.10^{11}$	$6.3.10^{11}$	$6.7.10^{11}$





Liquid discharges in the Danube river in the period 2014-2016:

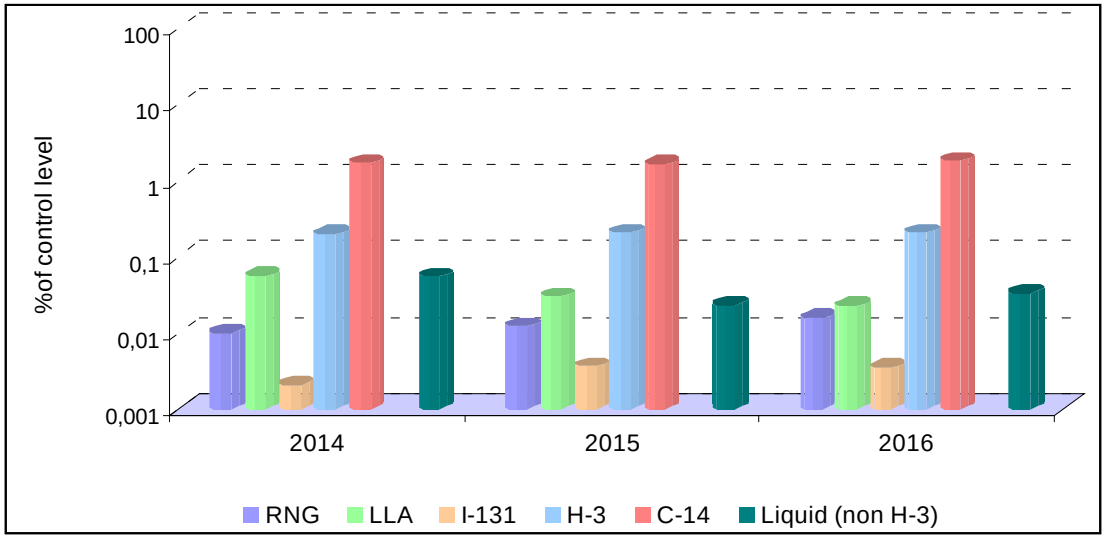
Year	2014	2015	2016
**Total activity, Bq (without tritium)	$5.7.10^7$	$5.3.10^7$	$4.7.10^7$
^{3}H, Bq	$1.8.10^{13}$	$2.1.10^{13}$	$2.3.10^{13}$

**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.

In the last 10 years the amount of tritium in the liquid releases varies between 10% and 13% of the specified limit. For the same period the total activity of the liquid releases (without tritium) is below 1% of the limit set by NRA.

SD RAW - Kozloduy located on the site of EP-2 generates during its activity waste waters and air which are released in the environment through the facilities of Units 5 and 6 and are reported in the presented data.

The trends in the activity of gaseous and liquid releases from Kozloduy NPP (as % from control levels) for the period 2014-2016 are presented below.



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

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 methodology adopted by the European Union (EU) CREAM and adapted to the respective geographical and hydrological characteristics of the Kozloduy NPP area.

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

The values of the maximum individual dose of the gaseous releases from Kozloduy NPP site in consideration of the contribution of ^{3}H and ^{14}C are the following:

Gaseous releases	
Year	Individual effective dose [Sv]
2014	$1{,}38.10^{-8} – 1.46.10^{-6}$
2015	$1{,}41.10^{-8}$ - $1{,}25.10^{-6}$
2016	$1{,}25.10^{-8} – 1.29.10^{-6}$

The results regarding the population exposure to liquid discharges by years are the following:

Liquid releases		
Year	Individual effective dose	
	max 30 km zone [Sv]	Critical group [Sv]
2014	$4.73.10^{-7}$	$3.34.10^{-6}$
2015	$6{,}27.10^{-7}$	$4{,}08.10^{-6}$
2016	$6.16.10^{-7}$	$4.37.10^{-6}$

In the last years the maximum individual effective dose in the 30 km zone is in the interval 0.47-0.63 μSv/y, and the values of a representative of a crucial group of the population along the Danube river vary from 3.3 to 4.4 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). The low levels of radioactive releases from the Kozloduy NPP determine exposure values with negligible radiation risk to the population in the area of the power plant.

SE RAW

Personnel radiation exposure dose

In the period 2014–2016 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 personnel radiation exposure dose was maintained at levels considerably below the dose limits for occupational exposure.

The maximum annual individual effective dose in recent years has been 0.96 mSv for SD RAW - Kozloduy and 1.05 mSv for SD RAW – Novi Han which is about 5% of the annual limit for occupational exposure according to the *Regulation on BNRP*.

Occupational exposure dose at SD RAW - Kozloduy

Year	2014	2015	2016
Collective effective dose [man.mSv]	6.99	8.22	3.82
Average individual effective dose [mSv]	0.04	0.05	0.02
Maximum individual dose [mSv]	0.5	0.61	0.66

Occupational radiation exposure dose at SD RAW – Novi Han

Year	2014	2015	2016
Collective effective dose [man.mSv]	2.76	2.89	5.09
Average individual effective dose [mSv]	0.04	0.04	0.08
Maximum individual dose [mSv]	0.38	1.05	0.37

Radioactive releases into the environment by SE RAW facilities

There are no direct gaseous and liquid releases from SD RAW - Kozloduy into the environment. Their separation is performed through the respective facilities 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 aerosol releases from the site is less than 0.1% at full load of the facilities. 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 on the population by 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 on the site of the nuclear facility and the industrial site of Kozloduy NPP due to radioactive waste management is negligible.. No unacceptable impacts upon the environment have been detected.

Own radiation monitoring is held monthly at SD RAW - Novi Han with measurement of: water samples from the control wells; soil and plant samples from the radiation protection and the surveillance zones; gaseous aerosol measurements at the site where RAW is stored and from the Laboratory complex where waste is accepted and identified.

Nuclear facility operation complies with the regulatory requirements. There is no violation of the dose limits, the values show reached steady state at an acceptable low level, 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."

Overview of the information presented in the previous national reports

The emergency preparedness in case of nuclear or radiological emergency in Republic of Bulgaria is part of the general national organizational measures for disaster protection. The basic legislative and regulatory requirements for the structure and organization of emergency preparedness are defined in the *Disaster Protection Act (DPA), the Act on the Safe Use of Nuclear Energy (ASUNE), the Act of the Ministry of Interior (AMI)* and the *Regulation on Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiological Emergencies.*

DPA establishes a common approach and organization at national level for planning, emergency preparedness and response in case of disaster, including incidents and accidents which may occurr in the management of SF and RAW.

According to DPA, the National Plan for protection in case of disasters is developed by the Council for mitigation of the risk for disasters and is approved by Council of Ministers. In the National Plan for protection in case of disasters, approved with a Decision № 973 of the Council of Ministers from 2010, Part III - Off-site emergency plan of Kozloduy NPP is included.

The protective actions for the public in the case of disaster are performed by the *Unified Rescue System (URS).* The main components of URS are the General Directorate "Fire Safety and Civil Protection" within the Ministry of Interior, the regional directorates of the Ministry of Interior and the medical aid emergency centers and The Bulgarian Red Cross. The URS structure is developed throughout the country in accordance with the administrative and territorial division. The other URS components - executive bodies, legal entities, medical aid emergency centers, other health care facilities etc., provide assistance upon request of the Ministry of Interior, according to their departmental plans for conducting Life-saving Urgent Emergency-Restoration Works.

ASUNE establishes the requirements for developing on-site emergency plans for nuclear facilities and off-site emergency plans at national level. The obligations of the operator and competent authorities in the licensing process are set and organization is established for emergency planning and preparedness, as well as requirements for periodic review of the emergency plans.

The persons who are dealing with RAW and SF activities are obliged to take measures to prevent incidents and accidents and also to mitigate and possible consequences.

The *Regulation on Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiological Emergencies* specifies:

- the terms and procedures for the development of emergency plans; the persons implementing the emergency plans and their responsibilities; the actions and measures for mitigation of the consequences of a nuclear or radiological emergency; the ways of informing the public; the procedures for maintaining and review of emergency preparedness;
- threat categories of sites, facilities and activities as well as emergency classification;
- intervention levels in terms of estimated dose and avertable dose for a certain period of time, dose rate and specific activity, for which if reached, protective measures should be implemented.

Emergency plans on the sites of nuclear facilities

The emergency plans of all nuclear facilities for SF and RAW management are maintained:

- KNPP Emergency Plan, Revision 2013. It includes the nuclear facilities in operation, the on-site SF management facilities (SFP, WSFSF and DSFSF) and also takes into account SE RAW facilities located on the site of Kozloduy NPP;
- SD RAW- Kozloduy Emergency Plan, Revision 2008;
- On-site emergency plan of the SD Decommissioning of Units 1 - 4, Revision 2014;
- SD RAW - Novi Han Emergency Plan, Revision 2011;
- Plan for mitigation of the consequences and protection of the population and the environment in the case of a radiation accident during the transport of spent nuclear fuel, Revision 2011;

The emergency plans of SE RAW (SD RAW- Kozloduy and SD Decommissioning - Kozloduy are related to the plans of Kozloduy NPP. In case of an operating event the Chief Engineer of KNPP Units 5 and 6 shall be informed and he/she will make an assessment of the emergency situation on the basis of the received data and if the criteria are reached will activate the KNPP emergency plan. The plans have been checked during exercises.

Emergency exercises and drills

A full-scale national exercise "Protection 2014" was held in November 2014 on the following topic: *"Severe accident at KNPP - accident management and mitigation of the consequences"* to train the coordination and response between the institutions which have responsibilities according to the National plan for protection in case of disasters. During the exercise was checked the following:

- skills and practical habits of the participants for carrying out the activities for notification, gathering information, preparation of proposals for protective actions and mitigation of the consequences from the accident;
- the national early warning system, the interaction and coordination between the management bodies and the forces of the Unified Rescue System;
- procedures for notification and actions according to the obligations of Republic of Bulgaria under international agreements in case of nuclear accident at Kozloduy NPP;
- interaction with the mass media and their role for informing the public about the situation and necessary actions.

Some nonconformities were identified in the communication between the institutions and the subsequent organization of the activities as well as some deficiencies of the prepared documentation with reference to the obligations and responsibilities of the different institutions. Specific measures have been envisaged to improve the activity of the management bodies and the response forces from URS which will be included in the updated KNPP Off-site Emergency Plan. An inter-institutional workgroup was created for updating *part III- Off-site KNPP Emergency Plan* of the *National plan for protection in case of disasters.*

The Republic of Bulgaria takes active participation in international emergency exercises and drills for action in case of a nuclear and radiological emergency. In the period 2015 - 2017 the country took part in the following national and international exercises and drills.

- International exercises – IAEA ConvEx, INEX, ECUREX – 16;
- Joint emergency exercises between NRA and Kozloduy NPP - 7.

The participation in international exercises under the aegis of IAEA and EC has improved the coordination between the participants and the international organizations as well as between the

regulatory bodies of neighbouring or nearby countries mostly in terms of the timely communication about occurring events as well as requests for/provision of support.

The joint exercises between NRA and Kozloduy NPP have demonstrated good coordination between the participants and compliance with the practical requirements. The periodic organization of joint exercises resulted in improved internal rules and procedures of the operator and the regulatory body regarding the actions of the emergency teams.

In execution of a measure from the Updated National Action Plan*: Plan for systematic training of the employees involved in emergency planning and preparedness in NRA*, in 2015 NRA completed an IAEA project on *Development of a program for systematic training and preparation of training materials for the members of the NRA Emergency Team (BUL/9/024*) and implemented a plan for systematic staff training, training programs and instructions for training the members of the emergency team. The results from the project were presented at a one-day seminar to experts in the field of emergency preparedness and response from the Ministry of the Interior, Ministry of the Environment and Water, Ministry of Energy, Ministry of Health, the National Institute of Meteorology and Hydrology, the Institute of Nuclear Research and Nuclear Energy – Bulgarian Academy of Sciences and Kozloduy NPP.

Regulatory inspections on emergency preparedness

NRA has developed requirements for emergency preparedness and response in case of nuclear and radiological emergencies in compliance with IAEA recommendations. Inspections in nuclear facilities are carried out according to an approved inspection activity plan. Within the scope of emergency planning and preparedness inspections, the following main subjects are covered:

- emergency plan, emergency instructions and procedures, interaction with the local authorities, exchange of information with the regulatory body;
- initial assessment of the accident, source-term estimation, intervention levels and implementation of protective actions;
- personnel training according to the emergency plan, organization and preparation of exercises and drills, documentation and feedback;
- notification of the public, preliminary information, notification and testing of the system.

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. he 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."

Overview of the information presented in previous reports

The basic requirements of ASUNE and the applicable regulations for its implementation in the field of decommissioning of nuclear facilities were presented.

The existing licensing regime for decommissioning of nuclear facilities was presented, and in particular the two main legislative documents – the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* and the *Regulation on Safety during Decommissioning of Nuclear Facilities*, which contain requirements related to decommissioning in the course of the licensing process for the stages of the lifecycle of nuclear facilities.

The strategy for decommissioning the shutdown KNPP Units was presented with a subsequent strategy update. Comprehensive information was presented about the progress of the decommissioning preparation activities: radiological investigation of the nuclear facilities for the purpose of planning decommissioning; development of the main documents related to the decommissioning – Decommissioning Plan, Safety Analysis Report, Environment Impact Assessment Report; the implementation of engineering designs related to the clearing of the nuclear facilities from non-processed historical RAW with provision of the necessary methodological and technical means to carry out dismantling, decontamination and RAW management activities. Information was provided about the dynamics of financial resources in the Decommissioning fund and on the amount and sources of funding for the decommissioning preparation activities.

Following the amendments to ASUNE in 2010, the requirements for the issuance of a decommissioning licence were introduced which eliminated the double authorization regime. Responsibility of the licence holder with reference to the safety of the facility in the entire period of decommissioning is ensured and the need the decommissioning entity to be the operator of the nuclear facility is avoided. The decommissioning licence is to be issued for a period up to 10 years.

With reference to the implementation of the concept of releasing from regulatory control, a mechanism has been introduced according to which release of materials (clearance) shall not be subject to a separate authorization process but any specific clearance shall be approved by an order of the NRA Chairman.

Amendments to the legislative framework related to decommissioning of nuclear facilities

In the past period there were no changes in the legislative framework related to decommissioning of nuclear facilities.

Personnel and financial resources

The requirements for availability of adequate human and financial resources for decommissioning is a legal requirement pursuant to ASUNE. The basis for resource planning are the estimated decommissioning costs. On this basis, NRA should obtain conclusive evidence that the provided financial resources are sufficient for the implementation of the decommissioning plans.

Cost estimation is made by the licence holder at a very early stage (design of the nuclear facility) during the preliminary planning of the decommissioning. The preliminary decommissioning plan is a basic document that needs to be presented to NRA together with the application for issuance of an

operating license. The periodical update of the estimated decommissioning costs is a requirement for the operator during each update of the plan for decommissioning of nuclear facilities.

For financing the activities for decommissioning of nuclear facilities, the Decommissioning of Nuclear Facilities fund managed by the Minister of Energy was set up. The main revenues come from contributions from the entities operating the nuclear facility. The amount of the contributions is set so that at the end of the operating lifetime, the necessary funds to cover the decommissioning costs are accumulated.

The mechanism for calculation of the amount of the contributions in order to accumulate the necessary funds to finance the activities 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*.

The decommissioning cost estimation also includes the maintenance costs for personnel, including training and drills.

Pursuant to ASUNE, the activities in nuclear facilities and the activities with sources of ionizing radiation, which have an impact on safety, can only be carried out by professionally qualified personnel with a certificate of competence The terms and conditions for acquiring a professional qualification, the job positions for which a professional qualification 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 Licenses 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

Pursuant to Art. 20 of the *Regulation on Safety during Decommissioning of Nuclear Facilities*, the radiation protection in the process of decommissioning of a nuclear facility shall be carried out in accordance with the requirements, principles and standards of the *Regulation on BNRP*. For radiation protection assurance during activities for decommissioning of a nuclear facility, the licensee holder shall develop a concept and programs for radiation protection of the personnel, the population and the environment as part of the decommissioning plan.

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 on the condition that liquid and gas releases will not exceed the prescribed values for permitted releases during the decommissioning activities.

The *Regulation on BNRP, the Regulation on Safety Assurance of Nuclear Facilities* and the *Regulation on Radiation Protection during Activities with Sources of Ionizing Radiation*, which are applicable in the decommissioning of the nuclear facilities, specify in detail the provisions of Art. 24 of the Convention regarding the dose limits and restrictions for the personnel and the population, including as a result of authorized radioactive releases.

Emergency Planning

The requirements of ASUNE and the *Regulation on Emergency Planning and Emergency Preparedness in Case of a Nuclear and Radiologycal Emergencies* which are related to implementation in the national legislation of the provisions of Art. 25 of the Convention are applicable to all nuclear facilities, including the facilities in a stage of decommissioning.

For the issuance of a license for decommissioning of a nuclear facility, the applicant is required under the *Regulation on Safety during Decommissioning of Nuclear Facilities* to submit to the NRA an on-site emergency plan for preparedness and actions for protection of the personnel, the population and the environment in the event of a radiological accident. The on-site emergency plan shall be developed on the basis of analyses of the possible emergency events and their consequences in

consideration of the current state of the nuclear facility, its safety-related systems and equipment and the activities on decommissioning and the technical and organizational measures for safety assurance envisaged in the plan. The on-site emergency plan shall be developed under the conditions and according to procedure specified by the *Regulation on Emergency Planning and Emergency Preparedness in the Case of a Nuclear and Radiologycal Emergencies*.

Storage of information important for the decommissioning

Pursuant to Art. 33 of the *Regulation on Safety during Decommissioning of Nuclear Facilities*, the licence holder shall develop a quality program for the decommissioning stage.

For the design and construction, commissioning, operation and decommissioning stages, the holder of the respective permit or licence shall collect, process, distribute and store the documents and information related to the decommissioning planning and the completed decommissioning activities for the nuclear facility. The scope of the stored information, important for the decommissioning, shall cover the full design documentation and the relevant design modifications related to reconstruction and modernization during operation, as well as all operational documents. All this documentation shall be provided to the operator of the nuclear facility subject to decommissioning and shall be stored by him.

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."

Overview of the information presented in the previous national reports

It was specified that the main safety requirements for spent fuel management are laid down in ASUNE and the applicable regulations for its implementation.

The requirements of the Environmental Protection Act regarding the Environmental Impact Assessment (EIA) of investment proposals concerning SF management were described. In the development of EIA, the biological, chemical and other risks that may be related to SF management were taken into account.

The measures planned by the Republic of Bulgaria to ensure reduced radiation impact on the Kozloduy NPP site and to avoid the imposing undue burden on future generations were presented.

The provisions of the *Regulation on Safety of Spent Fuel Management*, the *Regulation on ensuring the safety of nuclear power plants*, the *Regulations on Safety Assurance of Research Nuclear Installations*, and the *Regulation on EIA of Investment Proposals for Construction, Activities and Technologies* related to the fulfilment of the obligations under Art. 4 of the Convention were reviewed in detail.

It was specified that the implementation of the main safety functions – assurance of sub-criticality and residual heat removal were provided by the design of the SF management facilities. 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 control on the burn-up of spent fuel entering the SF facilities is executed through technical means.

The design of the SF management facilities envisages technical means and organizational measures preventing 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.

The regulatory requirements stipulating that SF management and RAW pre-treatment technological processes should be designed so that RAW quantities are minimum. The design should ensure restriction of the volume and activity of the liquid RAW to a reasonably achievable level. The RAW management systems are designed in consideration of the requirements for safe SF management

throughout the lifetime of the facility. It was pointed out that the RAW minimization principle during SF management had also been adopted in the National Strategy for SF and RAW management.

It was pointed out that according to ASUNE and the regulations on its implementation, the exposure of the personnel and the population in SF management has to be kept as low as reasonably achievable and that the effective protection of the personnel, the population and the environment is ensured by applying the defense-in-depth principle through establishing a system of physical barriers along the path of ionizing radiation spreading into the environment and a system of technical and organizational measures for protection of the barriers and maintaining their effective performance.

The regulatory requirements for the annual individual effective dose limits for internal and external exposure of the public caused by liquid and gaseous releases into the environment from SF management facilities and also from releases due to design-basis and beyond design-basis accidents are presented.

The legislative and regulatory measures for protection of future generation and avoidance of the imposition of undue burden on them were presented. It was pointed out that the avoidance of undue burden on future generations is a main principle in the SF and RAW management strategy adopted by the Council of Ministers. In the consideration of different SF management options, the Strategy specifies the option for SF transport for reprocessing and HLRAW return for storage as most acceptable with a view to non-imposing undue burden on future generations.

The structures and technologies used in SFP of Units 1-6 and WSFSF of Kozloduy NPP used for ensuring sub-criticality and residual heat removal were described.

It was pointed out that, according to the legislative requirements, the design should ensure limitation of the volume and activity of the generated liquid RAW to a reasonably achievable low 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.

Information was presented regarding the regulatory requirements for:

- consideration of the interdependence of the different SF management stages;
- protection of the individuals, public, environment and future generations;
- consideration of biological, chemical, and other risks.

The general principles of the Strategy for SF and RAW Management until 2030 were presented with reference to: minimization of the generated RAW; provision of efficient protection of the individuals, the population and the environment; avoidance of actions that lead to predictable consequences for future generations, *exceeding* the ones admissible for the present generation and avoidance of the imposition of undue burden on future generations.

The amendments to the *Regulation on Safety of Spent Fuel Management,* adopted in August 2013 were described. It was specified that the amendments introduce the following general SF management principles: minimization of RAW generation; passive safety; application of a graded approach; assurance of sub-criticality and residual heat removal; maintenance of ionizing radiation impact on personnel, the population and the environment at a level as low as reasonably achievable. Respective changes to bring the provisions of the regulation in line with the WENRA reference safety levels in SF management were made.

Amendments to the legislative and regulatory framework

In the period after the presentation of the fifth national report, no amendments related to the general requirements for SF management were made to the legislative and regulatory framework.

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

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 1-6 (it is 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).

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."

Overview of the information presented in previous national reports

The existing SF management facilities as at the date of entry into force of the Joint Convention were described. Information was presented about the completed and the planned analyses of the safety of WSFSF and SFPs of KNPP Units. The transitional provisions of the *Regulation on Safety of Spent Fuel Management* regarding the implementation of modifications leading to changes to safety-related structures, systems and components of existing SF management facilities, commissioned prior to the Regulation enforcement, were presented. It was stated that for the existing SF management facilities the provisions of the regulation were applied to the maximum extent.

Detailed information about the carried out "accelerated corrosion tests" was provided; assessment of the condition of the structural materials of the lining of the pools and the transport baskets for storage, as well as analysis to determine the lifetime of the building and the equipment.

The results from the safety review of the SFP-5 and SFP-6 within SAR update after the modernization of the respective Units, were presented.

The results from the completed "Analysis and safety assessment of the operations in the existing SF facility related to the DSFSF project" were presented.

Detailed information about the held stress tests in connection with the accidents in the Japanese Fukushima NPP was presented and the measures undertaken to improve the safety of the SF management facilities were described.

Completed safety reviews and improvement of the existing facilities

In 2016, the periodic review of the safety of Unit 5 was completed, including for the SF and RAW management facilities, and as a result an Complex program for implementation of measures for Periodic review of the safety of Unit 5 was developed. This program and Safety analysis report for Unit 5, updated in accordance with the results from Stage 2 of the lifetime extension project were submitted to NRA in the end of 2016 as part of the package of documents required for renewing the licence of the Unit. For Unit 6 these activities should be completed by the end of 2018.

KNPP increased the burn-up and achieved a reduction of the generated SF quantity during the transition to a 4-year fuel cycle. These design changes resulted in reduced specific consumption of natural uranium. In 2016 KNPP introduced new fuel assemblies with improved technical characteristics and the potential for achieving a greater burn-up. As a result from this transition SF generation will be additionally reduced – up to 12.5%.

A series of measures for safety improvement of the SF management facilities have been implemented in the period after the publication of the fifth national report.

In October 2015 a system for seismic monitoring and control was implemented on the site of WSFSF which extended the scope of application and increased the safety of nuclear facilities. The seismic monitoring and control system on WSFSF and DSFSF has the function, in the case of exceeded predefined seismic acceleration levels, to switch off the automation of the handling equipment intended for nuclear fuel handling – a refueling machine and 160-ton and 16-ton cranes in WSFSF and a 145-ton crane in DSFSF.

In 2015, a pipeline for direct water supply to WSFSF pool from an external source (diesel fire pumps or fire vehicle) was constructed. This pipeline ensures emergency water filling of WSFSF sections in extreme situations. This alternative filling procedure has improved the options for management of beyond-design basis accidents related to SF sections dewatering due to failure to perform their filling with the available plant equipment. The measure is the result from the held stress tests in connection with the Fukushima NPP accident.

Another measure as a result from the held stress tests in connection with the Fukushima NPP accident has been partially completed. An additional pipeline was installed at SFP-5 and SFP-6 cooling system to provide redundancy from an external source. The measure will be finalized in 2019.

In March 2016, a Burn-up Control System was installed, calibrated and commissioned for SF from reactors WWER-440. The measurements of SF assemblies are taken immediately before their loading in the CONSTOR 440/84 cask in order to assess the burn-up and to comply with the safety criteria for long-term storage.

Upgrade of WSFSF radiation monitoring system is envisaged (provision of additional equipment for monitoring radiation background, replacement of radioactive contamination monitors and state-of-the-art dosimeters).

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.

Overview of the information presented in previous national reports

The requirements of the *Regulation on Safety of Spent Fuel Management* and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* regarding the site selection for SF management facilities were described. It was specified that in the selection of sites for SF management facilities, the site characteristics that may affect the safety of the facilities, and the effect of the SF management facilities on the population (at present and in the future) and on the environment should be investigated and evaluated. A list of the documents that the applicant should submit with the application for a site selection permit and a site approval order were presented. The data that should be included in the preliminary safety analysis report to be submitted with the request for a site approval order were specified. It was also stated that when the nuclear facility was envisaged to be located on the site of another already constructed and commissioned nuclear facility, the preliminary safety analysis report should consider the potential impact of the other nuclear facilities built on the same site on the safety of the proposed new nuclear facility.

The Environmental Protection Act (EPA) requirements for the conduct of a public hearing on the EIA results organized jointly by the municipal authorities and the competent body that issues the EIA decision were presented. The procedure for carrying out EIA, as laid down in the *Regulation on Environmental Impact Assessment of Investment Proposals for Construction, Activities and Technologies,* was described. The competent authority for making EIA decision is the Minister of the Environment and Water. The EIA decision is made on the grounds of the prepared environmental impact assessment, the results from the conducted consultations and public hearing, and in compliance with the legislation in force. If necessary, the decision contains measures for mitigation or prevention of the negative impacts on the environment which are formulated as a Plan and are mandatory for implementation by the investor/operator during the designing, construction, operation and the eventual shutdown of the installation/facility.

The responsibilities of the Minister of Environment and Water were specified in connection with the notification of other countries about investment proposals for construction, activities and technologies on the territory of the Republic of Bulgaria that may cause a significant environmental impact on their territory.

It was specified that the Republic of Bulgaria is a party to the Convention on Environmental Impact Assessment in a transboundary context. The agreements for operational notification in case of nuclear accident and exchange of information about nuclear facilities with neighbouring countries were listed.

Information was provided about the issued permit for site selection and the order for approval of the selected site for DSFSF;

It was specified that the *Strategy for SF and RAW Management until 2030* prescribes the implementation of measures for:

- increasing the interactions via direct communication with representatives of the civil society forming the public opinion;
- holding public discussions on the EIA reports which are assessed as a positive mechanism to achieve public acceptance;
- informing the citizens about the environmental conditions during the execution of activities associated with SF and RAW management and creating a positive image and trust in these activities.

Issued permits for site selection and site approval orders for SF management facilities

No permits for site selection or site approval orders for SF management facilities have been issued in the period following the Fifth National Report.

Amendments to the legislative and regulatory framework

In the period following the Fifth National Report, no amendments have been made to the legislative or regulatory framework related to site selection for SF management facilities.

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."

Overview of the information presented in previous national reports.

The requirements of the *Regulation on Safety of Spent Fuel Management* и *Regulation on Safety during Decommissioning of Nuclear Facilities* regarding the design and construction of SF management facilities were described. It was specified that the safety of the spent fuel management facility is provided through:

- application of a conservative approach in establishing the barriers and the protection levels;
- high quality of the design, construction and equipment;
- application of technologies proven in practice.

It was specified that the design of the SF management facilities should include a preliminary SAR for normal operation and for design-basis and beyond design-basis accidents. Following the construction of the facilities, SAR will be updated according to the current status.

The obligation of the design or construction permit holder for the development of preliminary and intermediate concepts and plans for decommissioning of the nuclear facility was presented. The requirements for the content of the Concept including the requirement for completion of preliminary analysis and assessment of the impact of decommissioning of the nuclear facility on the population and the environment were presented.

Detailed technical information about the constructed DSFSF on the Kozloduy NPP site was provided. The most important provisions of the DSFSF technical design approval order and DSFSF construction permit, issued by the NRA Chairman were presented. Information about the construction progress of the storage facility and its forthcoming commissioning was presented.

Facilities under design and construction

At the time of development of this report, there are no SF management facilities in the stage of design or construction in the Republic of Bulgaria. In the period after the submission of the Fifth National report, a licence for DSFSF was granted.

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".

Overview of the information presented in the previous national reports.

The requirements of the *Regulation on Safety of Spent Fuel Management* and the *Regulation on Safety during Decommissioning of Nuclear Facilities* regarding safety assessment of SF management facilities were described. It was specified that the execution of safety analysis is a main responsibility of the licence holder and that the designs of SF management facilities should include preliminary safety analysis reports. Information about the completion of an environmental impact assessment was presented.

It was specified that the design the SF management facilities should contain a preliminary SAR, which should be updated according to its current status after the facility has been constructed. SAR should contain technical and organizational measures, safety analysis and assessment, proof of the fulfillment of the main safety functions, identification of the risk of initiating events considered in the design, demonstration of achieved safety objectives and safety criteria. The Safety analysis report should reflect the physical condition of the facilities throughout their operating lifetime and in the period of decommissioning.

The most important requirements were reviewed regarding the contents of the preliminary SAR, which is submitted with the request for issuance of an order for approval of the selected site for the nuclear facility. It was stated that a decision according to Chapter 6 of the Environmental Protection Act should be attached to the request of an order for approval of the selected site for the nuclear facility.

It was specified that the applicant should also enclose to the request for the issuance of an approval order of the developed Technical design of the nuclear facility, an Interim SAR elaborated on the basis of the preliminary SAR and of the technical design of the facility. The Final SAR elaborated on the basis of the intermediate report containing the results from the commissioning of the nuclear facility should be enclosed to the application for issuing a licence for the operation of a nuclear facility.

The main stages of SAR review and assessment, according to the national legislation and internal NRA regulations, were presented. The main results from the ISAR review and assessment, made under the procedure for the DSFSF technical design approval were also presented.

Information about the review and assessment of the Belene NPP technical design and the accompanying ISAR and PSA was presented.

The main amendments to the *Regulation on Safety of Spent Fuel Management*, adopted in August 2013 were specified. It was stated that according to the regulation SAR should reflect the actual condition of the facilities throughout their lifetime and in the period of decommissioning and review the safety aspects related to: the site; the design; the construction and the decommissioning. The cases in which SAR should be updated were presented.

It was specified that in view of the forthcoming renewal of the operating license of WSFSF, NRA reviewed the amendment / addition to SAR of WSFSF and the Report on the periodic safety assessment of WSFSF presented by Kozloduy NPP

Amendments to the legislative and regulatory framework

In the period following the submission of the fifth national report, no amendment related to the safety assessment of the SF management facilities have been made to the legislative and regulatory framework.

Review and assessment of safety analysis reports

In 2015, NRA performed review and assessment of the Final Safety Analysis Report for DSFSF in connection with the issuance of an operating licence.

NRA's conclusion was that the review of the Final Safety Analysis Report as a whole does not show potential safety problems of the storage facility. The results from the safety assessment were in compliance with the established regulatory safety criteria. The found non-conformities were related mainly to the way of documenting the safety assessment and analysis and should be corrected in the following report revision.

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."

Overview of the information presented in the previous national reports

Information on ASUNE requirements regarding the issuance of an operation licence for nuclear facilities was presented. The requirements of the *Regulation on Safety of Spent Fuel Management*, the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* and the *Regulation on Safety during Decommissioning of Nuclear Facilities* for the commissioning and operation of SF management facilities were described.

The requirements for the Program for commissioning of a nuclear facility, which should be enclosed to the application for issuance of a commissioning permit for a nuclear facility, were specified. It was stated that the licence for nuclear facility operation is issued after fulfilment of the conditions in the permit for commissioning of the nuclear facility, established by a commission of NRA inspectors appointed by order of the NRA Chairman, which checks the documents supplied by the applicant and performs an on-site inspection. A list of the most important documents which should be provided together with the application for issuance of a nuclear facility licence is provided.

It was specified that the Technological regulations for operation which contain the operating limits and conditions, are developed on the basis of the design of the facilities and the preliminary SAR and shall be adjusted after commissioning, after design changes and after SAR update.

The operator's responsibilities for the development and application of indicators and methodology for assessment of the safety level during operation, including a program for safety self-assessment that contains an assessment of the achieved safety level, a comparison with the planned safety level and specific tasks for safety improvement, were described.

It was specified that the operator should develop and implement a system for preserving, processing and analysis of the information related to the operation of the facilities, the status and failures of the systems and components as well as the errors made by personnel. The results from the analyses should be reported regularly and used to improve operational practice, staff qualification and maintenance optimization.

The KNPP system of procedures for assessment and analyses, as well as the procedure for making a decision about corrective measures and assessment of their efficiency with regard to

feedback from operational experience was presented. The reported events in the on-site SF management facilities and the implemented corrective measures were reviewed.

The modifications in the WSFSF operation licence were presented in connection with the preparation for loading of CONSTOR 440/84 casks for dry SF storage.

Information about the renewal of WSFSF licence for a period of 10 years, performed in June 2014 was presented, including information about the review of the documents presented by the licence holder.

Information about the DSFSF permit for commissioning issued in November 2011 was presented with description of the scope of the permitted activities.

Operation of SF management facilities

DSFSF

In January 2016, the NRA Chairman issued a licence for DSFSF operation with a validity of 10 years. The licence provides KNPP with the right to carry out the following activities:

- SF storage in CONSTOR 440/84 casks and their handling;
- SF transportation from WSFSF to DSFSF and if required back to WSFSF in CONSTOR 440/84 casks;
- handling, pre-processing, processing and storage of Radioactive Wastes (RAW), resulting from the permitted activity, as well as preparation for their further processing and conditioning;
- tests, diagnostics, maintenance; repair, inspections and operational control of the structures, systems and components;
- any other activity connected to the operation of the spent fuel storage facility, unless such requiring a special permit or licence under the Act for Safe Use of Nuclear Energy (ASUNE).

Till 30.06.2017 a total of 11 casks of the type CONSTOR 440/84 were loaded and transferred to DSFSF.

Event reporting and analysis of operational experience

In the period after the publication of the Fifth National Report, one operating event related to spent fuel management was reported which was rated as INES level 0.

On 14.09.2015 during the planned annual outage of Unit 6 temporary disturbance in the cooling of spent fuel pool was admitted due to the closing of the pneumatic valves of the pipelines of SFP cooling systems. Measures for restoring the condition of the closed pneumatic valves were taken.

The staff acted in accordance with the procedures. In the short period in which cooling was not provided the water temperature in the pool increased insignificantly and the operating limits were not reached.

The conducted inspection established and eliminated the direct reason for the event – a fault of the electronic valve control units. The root cause for the event was that the technical design in the completed modernization did not foreseen the connection of the “neutral” cable wire. In order to remove the root cause and prevent re-occurrence of the event corrective measures were taken in the form of systematic review of analogical technical designs for modernization of the other safety systems of the two Units. Analogical deficiencies in some designs were found and eliminated.

Decommissioning plans

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.

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

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."

Overview of the information presented in the previous national reports

The previous national reports specified the main regulatory acts - *ASUNE, HPA* and *EPA* and the subordinate legislation for their implementation to ensure the protection of individuals, society and the environment against radiological and other risks. The basic amendments made to them in connection with the more precise regulation of the requirements under Art. 11 of the Convention were also commented.

The control on the compliance with the regulatory requirements in the field of nuclear safety and radiation protection is carried out by the competent state bodies – NRA, Ministry of Health (State health control on the compliance with the requirements for the protection of people against the impact of ionizing radiation carried out by Regional Inspectorates for Protection and Control of Public Health and the National Centre for Radiobiology and Radiation Protection) and the Ministry of Environment and Water in the framework of the licencing process.

The *Regulation for Safe Management of Radioactive Waste* specifies the safety requirements in detail, including the main responsibilities of the licence holder.

Assurance of sub-criticality and residual heat removal

Art. 37 of the *Regulation for Safe Management of RAW* requires, in the case that this is necessary, the design of the RAW disposal facility to contain technical solutions to maintain sub-criticality and ensure residual heat removal.

The existing as well as the planned facilities and activities for RAW treatment in the Republic of Bulgaria do not require special measures to ensure sub-criticality and residual heat removal. This was justified in the respective safety reports and was assessed during the licencing process, and is controlled via the authorization system for the implementation of safety-related modifications in the design of the nuclear facility. In the cases, when RAW is a fissile material, the SF national legislation is also applicable.

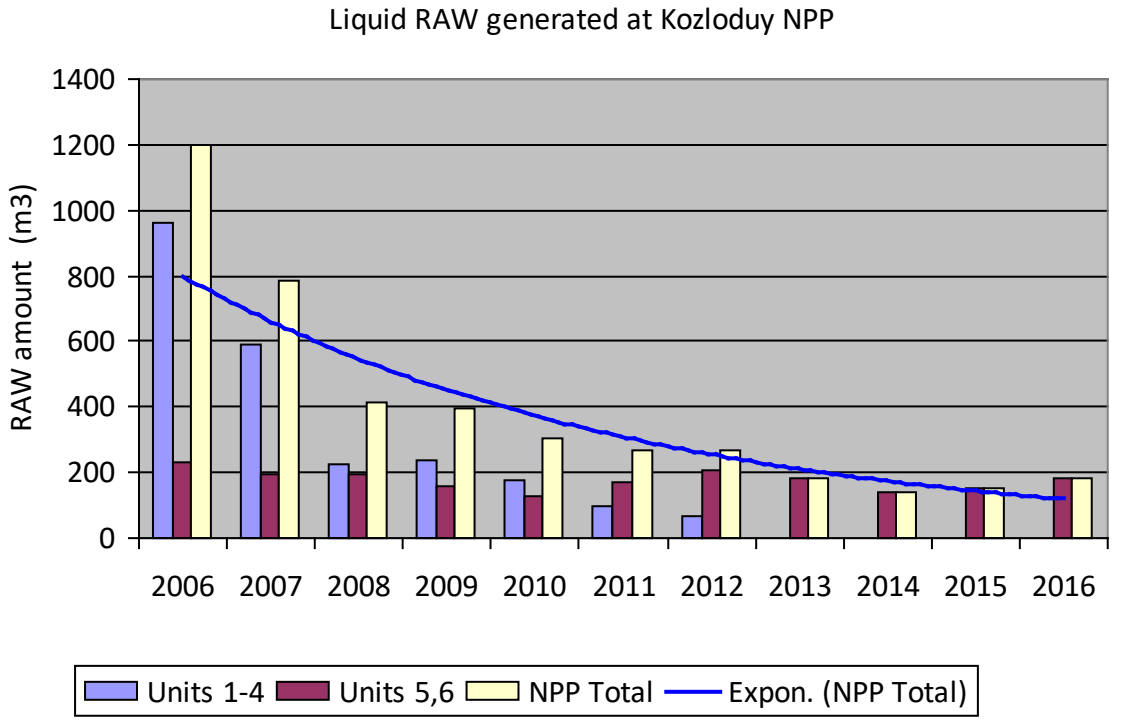
RAW minimization

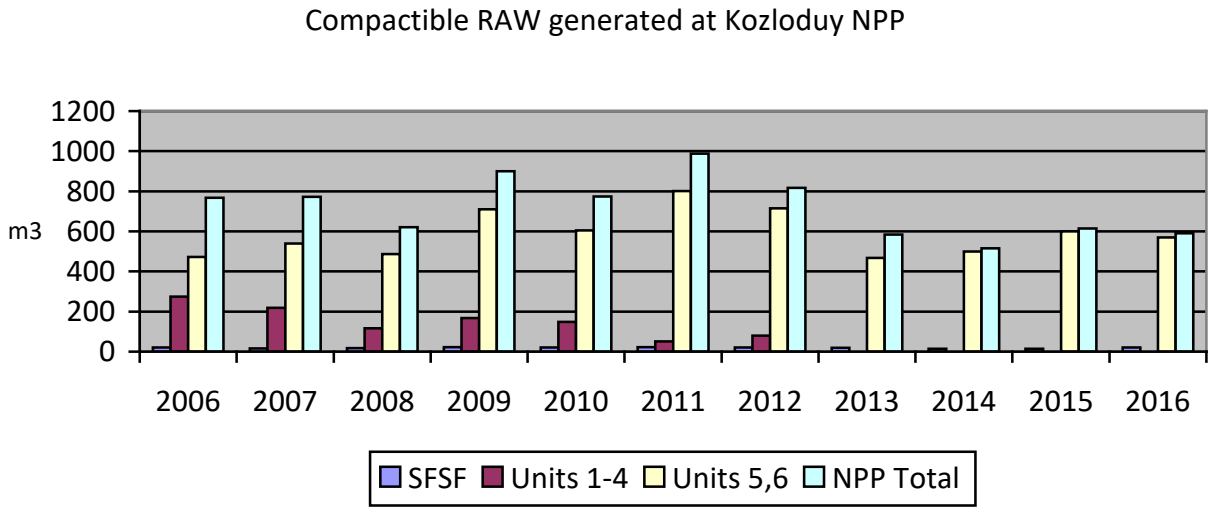
The requirement for the minimization of RAW generated in the result of the permitted practices is laid down in ASUNE and is presented in detail in Art. 5(1), Art. 10 and Art. 11 of the *Regulation for*

Safe Management of RAW. Limiting the generation of RAW at the source of formation has priority to the measures for the reduction of the volume and activity of RAW during their subsequent management and is performed through the following:

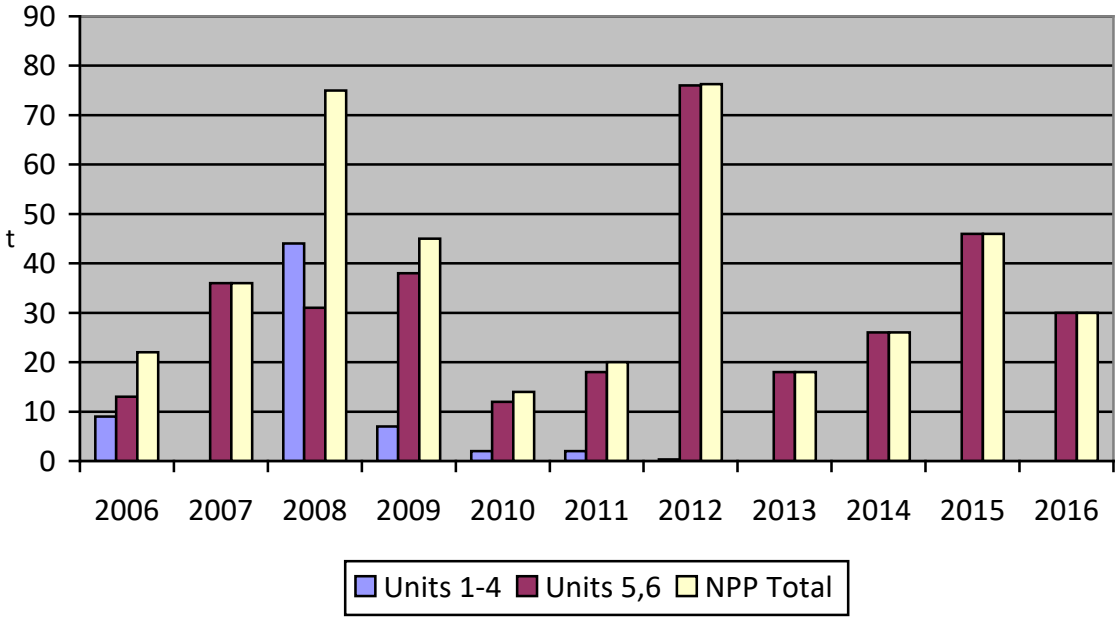
- the requirements for RAW minimization should be taken into account at the stages of design, construction, operation, and decommissioning of the nuclear facility;
- the observance by the nuclear facility operators of the regulatory requirements is established by the regulatory body through the mechanisms of preventive, current and subsequent control in the licencing process.

An indicator of the application of the requirements for RAW minimization is the data for the period 2006-2016 presented in a table form below. It demonstrates an achieved acceptable stable level of the amount of RAW generated during Kozloduy NPP operation.





Non-compactible solid RAW generated at Kozloduy NPP



After the final shutdown of Units 1&4, the amount of the generated liquid RAW has decreased drastically. 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 from the implemented measures for minimization of the currently generated RAW, the capacity of the existing RAW treatment facilities is sufficient for their timely treatment together with the historical RAW. In the period 2014-2016 the amount of treated RAW continuously exceeded the amount of RAW generated by Kozloduy NPP. As a result the amount of RAW stored in untreated form on KNPP site was reduced.

In parallel with limiting RAW generation, the necessary attention was paid to the requirements for minimization of the volume of RAW intended for disposal, through the application of special methods for treatment and conditioning and through the application of the concept for releasefrom 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 compactible RAW. Procedures for releasefrom regulatory control (unconditionally or conditionally for recycling) of materials from decommissioning of nuclear facilities and of decontaminated metal RAW were implemented.

Consideration of the interdependency between the different RAW management stages

Consideration of the interdependency between the RAW management stages is one of the main responsibilities of the operators of nuclear facilities according to Art. 5, para 1, item 11 of the *Regulation for Safe Management of RAW*. RAW management activities shall be performed in a way facilitating the future stages of RAW management. The applied RAW treatment methods shall guarantee compliance with the acceptance criteria for storage and/or disposal.

The Regulation requires the RAW generating entities to develop and present comprehensive programs for management of all generated RAW, including:

- existent and expected RAW sources, flows, amounts and characteristics;

- the selected option for management of each RAW flow, including deadlines and activities for treatment, storage and disposal or releasefrom regulatory control;
- demonstration of the compliance with the National strategy for RAW management and with the general RAW management requirements pursuant to ASUNE (as well as the regulations on its application);
- description of approach used to ensure the safety in RAW management;
- administrative organization and infrastructure for implementation of the program;
- finance resources, sources of financing and risk assessment needed for the program implementation.

According to its nature and purpose, the program is a practical approach for application of the principles of optimization and justification of the RAW management activities.

In the cases when RAW management is carried out by more than one entity, the program shall be agreed between the different operators.

Since 2005, Kozloduy NPP has maintained such programs agreed with SE RAW and has presented them to NRA following the implementation of modifications.

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

A RAW disposal facility is currently being constructed in Bulgaria. In the selection of the RAW disposal site and technology, the characteristics of the produced packages by using the existing technology and the conditioning methods for which there are technical specifications, recipes and procedures approved by NRA, have been considered.

Protection of individuals, society, environment, and future generations

Detailed information about the implementation in the national legislation of the generally adopted principles for doses limitations, the justification of practices and the activities, to protect the personnel and the population is presented in Section F of this report (Art. 24 of the Convention).

The adopted in the Bulgarian legislation for doses limitations for the future generations that may results from the RAW disposal are not more liberal than the currently applicable doses limitations for the population. The specific values as well as the used methods to limit exposure are discussed in Section F of this Report.

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 for Safe Management of RAW*, 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 the closure of the facilities and monitoring according to the results from the made assessments. The plans for the construction of a National Disposal Facility for low and intermediate level waste and a concept for disposal of high level and long-lived RAW confirmed with the *Strategy for SF and RAW Management* adopted in 2011 fulfill the 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 understanding 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. 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* regulate the collection, spending and efficient control of the necessary resources.

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. Generally KNPP RAW management is not related to other types of excessive risk except radiation risk. Nevertheless, during the licencing process, NRA verifies whether the applicable legislation in these areas is observed. The assessment of the risks in these areas 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.

In the cases of institutional RAW, generated in medicine and scientific research, conventional risks are considered in specifically developed procedures for RAW management in observation of the requirements of the applicable regulatory acts.

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."

Overview of the information presented in the previous national reports

The existing facilities as at the Convention entry into force were presented.

It was specified that the safety assessment of the existing facilities is regulated in the national legislation as a basic requirement for re-issuance of an operation licence for the facility whose validity term may not exceed 10 years.

It was specified that the results from the safety assessment of the RAW management facilities, operated by Kozloduy NPP, SD RAW - Kozloduy, and SD PPRAW – Novi Han of SE RAW demonstrate protection of the personnel and the population in normal operation and in an emergency conditions.

Information was presented 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.

Existing facilities

The process of SAR review is part of the scope of activities provided by the regulatory body and may also include external experts.

Facilities operated by Kozloduy NPP

Kozloduy NPP operates RAW storage and processing facilities built according to the power plant design. The operation of these facilities is regarded as part of NPP operation and is subject to a common licencing regime. Review of the safety of the RAW storage and processing facilities is made under the scope of the periodic reviews of NPP safety.

In 2016 a periodic review of the safety of Unit 5 was completed and as a result an Integrated program was developed for implementation of the measures identified during the periodic review of the safety of Unit 5. This program and the updated Unit 5 Safety Analysis Report based on the results from Stage 2 of the Unit 5 lifetime extension project were submitted to NRA as part of the document package required for renewal of the Unit licence.

Facilities operated by SE RAW

Periodic safety review were carried out for the RAW management facilities operated through the SD RAW Kozloduy, SD PRRAW Novi Han and SD Decommissioning Units 1÷4, which performs activities at Kozloduy NPP Units 1&4 which are in the process of decommissioning.

SAR for the decommissioning of KNPP Units 1&4 was developed.

Safety assessment of separate installations of these nuclear facilities was carried out, including safety assessment of the storage facility for low level contaminated soil which is part of SD RAW – Kozloduy.

In all assessments, generally recognized analytical approaches were applied, including analysis of potential events (internal and external), and on the basis of detailed analysis the probable events were filtered and the possible scenarios were generated in the assessments.

The results from the assessments have proven that personnel and population protection in normal operation and in emergency conditions is ensured and that the contribution of the facilities in the population radiation exposure is negligible.

The updated safety analysis reports were submitted for review to NRA as part of the procedure for renewal and issuance of the respective licenses.

In 2014 licences for the decommissioning of KNPP Units 1 and 2 were issued to SD Decommissioning Units 1&4.

In 2016 licences for the decommissioning of KNPP Units 3 and 4 were issued to SD Decommissioning Units 1&4.

As a result from the completed regulatory review of the documents, transitional licence conditions were formulated that imposed mandatory organizational and technical measures with respective deadlines. Thus an ongoing process of continuous improvement of the safety of the nuclear facilities was ensured. The results from the assessments demonstrated that personnel and population protection in normal operation and in emergency conditions is ensured and that the contribution of the facilities in the population radiation exposure is negligible.

Past practices

In accordance with the *Regulation on the Terms and Conditions for the Transfer of Radioactive Waste to SE RAW,* 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.

RAW from the 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, modified and amended in 2007 which includes measures for mitigation of the environmental impact at an expanded list of uranium mining sites. In accordance with the program developed by the Ministry of Environment and Water, the 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 for their greater part. Activities have been carried out for remediation and conservation of Buhovo tailings pond and uranium contaminated terrains known as „Yana flood“.

Purification of uranium contaminated ore waters is carried out on the “Chora”, “Byalata voda” and “Iskra”. In view of the completed risk assessments and the decision of the Advisory Board to the Ministry of Energy, Economy and Tourism, the construction of new purification facilities on other sites is not envisaged.

Detailed information about past practices is presented in the Appendices L-3 and L-4 of this Report.

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."

Overview of the information presented in the previous national reports

The previous national reports presented the requirements of ASUNE regarding the licencing regime for the siting of new facilities and the requirements of EPA for elaborating EIA for these facilities. The reports contain information about the legal requirements for informing the public and consulting the potentially affected neighbouring countries. The significant role of the high quality of the preliminary safety assessment during the approval of a site for the construction of a storage facility was pointed out. Special attention was paid to the requirements for sites of RAW disposal facilities regulated in the *Regulation for Safe Management of RAW*. The four main site selection phases defined in the same regulation were specified as well as the necessary documentation required by the regulator.

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 as discussed in article 6 of the Joint Convention. For the site approval by NRA, the submission of a preliminary safety analysis report is required, that takes into account all factors, related to the safety of the site, which can have an impact on the safety of such a facility during its operation lifetime, as well as of a disposal facility after its closing.

According to the *Regulation for Safe Management of RAW* the site selection for a RAW processing and storage facility is made on the basis of assessment of:

- the impact of man-made 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 population 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 the technical design which shall guarantee the integrity of the protection barriers for a maximum period of time and demonstration of the site capability, in a combination with the selected disposal concept, to ensure protection of the population in observation of the dose limits and restrictions for the population.

Siting of the proposed facility – NDF

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 NRA Chairman.

Following a Decision of the Supreme Administrative Court of 2013, in the period 2014-2016 a completely new procedure for environment impact assessment in accordance with the requirements of the Environment Protection Act of the Republic of Bulgaria was carried out.

The process was successfully completed with the issuance of a positive decision on the environment impact assessment by the Ministry of the Environment and Waters.

In the middle of 2016, NRA issued a permit for NDF construction.

Access to safety information and consulting neighbouring 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.

An Environment Impact Assessment report for the investment proposal for NDF construction was developed, on the basis of the Terms of Reference, approved by MEW that defined the scope and content of the EPA.

Public hearings on the EIA report have been conducted in the settlements of the region.

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, the Terms of Reference defining the EIA scope and contents and the EIA Report related to the investment intention for NRRAW construction and the Appendices to the report were sent, and a public hearing of the EIA report was held.

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

Article 14. Design and Construction of Facilities

"Article 14. Design and Construction of Facilities

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

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

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

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

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

Reduction of potential radiological impacts during the design development and construction of a facility for radioactive waste management

The basic exposure dose limits that should be fulfilled by the design are regulated in *the Regulation on Basic Norms of Radiation Protection.* The set of more detailed specific technical requirements and the criteria for the degree of optimization of the radiation protection in the design of a nuclear facility are generally laid down in the *Regulation for Safe Management of RAW.*

The control over the application of the legislative requirements is a regulated action mechanism . Design and construction, as stages of the facility lifetime, are subject to licensing regime and according to ASUNE and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* the compliance of the design with all applicable safety requirements shall be demonstrated at a very early stage.

The procedure for the issuance of a design permit and approval of the Technical design requires the licence holder to prepare an Intermediate Safety Analysis Report (ISAR), which is subject to review by NRA and shall contain all required information to confirm that the potential radiological impacts are limited to the regulated acceptable levels. Provision of results from an independent review (verification) of the safety analysis is required.

Measures related to decommissioning and closure during design development for nuclear facility

At all stages of the lifetime cycle of the RAW processing and storage facilities, including design stage, the licence holder shall plan and implement measures to facilitate decommissioning.

ASUNE and the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* require for the Technical design approval, ISAR to include a section Decommissioning - for nuclear facilities that will be subject to decommissioning, which shall justify the decommissioning concept, the suitability for implementation of deactivation and dismantling works and the possibilities for releasing from regulatory control.

For a disposal facility, 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 activities on the site.

Facilities under design and construction

Following the Technical design approval in 2015, the NRA Chairman issued a permit for construction of a new RAW treatment facility - Plasma Melting Facility.

In the beginning of 2014, the NDF Technical Design including ISAR, was submitted to NRA. The regulatory review of the documents by NRA supported by an external consultant - RISKAUDIT IRSN\GRS International established compliance with the safety requirements and as a result the NDF

Technical Design was approved in 2017. Subsequently a construction permit was issued and with this the actual construction works for building the new nuclear facility started.

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)"

Overview of the information presented in the previous national reports

In the first review of the fulfilment of the obligations of the Republic of Bulgaria under the Convention, the existing deficiencies were highlighted and they were also addressed in the Second National Report where the basic principles in this area were presented according to the adopted at that time new *Regulation for Safe Management of RAW*. It laid down the requirements for the safety criteria related to RAW management facilities, the compliance with which is subject to verification by using safety assessments. The types of safety assessments at the different stages of the lifetime cycle of the facility are regulated. Respective principles and criteria are also determined for RAW disposal facilities after their closure.

The requirements pursuant to EPA for the completion of EIA were presented.

The amendments to the legislative framework were described, i.e. the *Regulation for Safe Management of RAW* from 2013 which provided a more detailed and precise description of the requirements related to the safety assessment of nuclear facilities.

The safety assessment shall include a systematic analysis of all radiation hazards in order to prove the capability of the facility and of the developed management system to ensure safety in normal operation of the facility or in performance of its activities, as well as in the case of anticipated operating events and design basis accidents.

The scope of the safety assessment is determined by using a graded approach, depending on the radiation risk that the facility or the activity may cause.

In the application of the graded approach, the available RAW inventory and the possible radiation releases to the environment in all operating conditions and in emergency conditions shall be taken into account, including events with very low occurrence but with considerable radiation consequences, the complexity of the facility and the carried out activities, as well as to what extent the used technologies and facilities are proven in practice.

The safety assessment shall cover all stages of the lifetime cycle of the facility or the activities, and include both the facility as well as RAW in the facility with their characteristics and packaging.

Amendments to the legislative framework

In the period 2014 – 2017 no changes related to safety assessment of the facilities have been made to the legislative framework.

Measures for performance of safety assessments before the RAW facility construction and before its operation

The regulatory safety criteria for RAW management facilities are discussed in the Report under Art. 24 and Art. 11 iv.

A mechanism to control the fulfilment of these requirements is set in legislation. The *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy* specifies the requirements for the stages in which the safety assessment should be developed and updated.

Before the construction of RAW management facilities, the development of safety assessments is required for each stage of site selection and design. For the site approval, a Preliminary Safety Analysis Report (PSAR) shall be submitted to the regulatory body. The design stage is completed with the Technical design approval by NRA. It may be approved only on the basis of ISAR. These requirements apply both to RAW processing and storage facilities, and to disposal facilities.

According to Art. 60 of the *Regulation for Safe Management of RAW*, the safety assessment of a RAW disposal facility shall cover a period, sufficient for reaching the maximum predicted dose of population exposure. The used safety assessment models shall be verified and evaluated in order to confirm their applicability for the assessed time period. The safety assessment shall determine and justify the measures for limiting the spreading of radionuclides in the environment due to human activity after the closure of the disposal facility and shall consider events of low probability and human activity, which may affect the functioning of the facility.

Before the operation of a nuclear facility, its safety assessment shall be updated according to the results obtained during the process of its commissioning. The Final Safety Analysis Report (FSAR) shall be submitted for review to the regulatory body along with the application for the issuance of an operation licence.

The requirements for the structure and contents of the safety analyses reports are specified in the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*. The information, necessary to determine whether the possible radiological impacts are within the regulatory limits and whether they have been optimized to acceptable levels, is specified in detail.

Safety assessments of RAW management facilities

In connection with the renewal of the licence for operation of SD RAW – Kozloduy, review and update of the *Safety Analysis Report of the nuclear RAW management facility* was made. In 2014, in fulfilment of a licence condition, *a Safety Analysis Report* of the *Contaminated Soil Storage Facility* was prepared and submitted to NRA.

The safety analysis reports have passed the NRA regulatory review process as part of the scope for renewal and issuance of the respective operation licences and permits.

Generally recognized analytical approaches including analyses of potential events (external and internal) were applied in all safety assessments, the probable events were selected on the basis of detailed analyses and the possible scenarios were generated in the assessments.

The results from the assessments demonstrate that the protection of the personnel and population is ensured in normal operation and in emergency conditions, and that the contribution of the facility to the population exposure is negligible.

1. Updated Safety Analysis Report of SD RAW Kozloduy

On 28.05.2015 a new licence for operation of the RAW management facility of SD RAW Kozloduy was issued. For this a review and update of the Safety Analysis Report of the nuclear facility was made.

The objectives of the completed analysis were to:

- review and compare the existing list of initiating events for SD RAW - Kozloduy with the general list of potential initiating events and if new initiating events are identified during the review they should be analyzed;
- assess the impact on safety of the design modifications made so far;

- update the report data in connection with amendments to legislation, regulatory framework, gained experience, etc.

The main results from the analysis were the following:

- no new initial events have been identified;
- no changes are required to the Updated Safety Assessment Report of SD RAW -Kozloduy with regard to the reviewed initiating events;
- recommendations for safety improvement organization measures were made.

Safety assessments of RAW disposal facilities

Preliminary Safety Analysis Report in the process of selection of a site for a National Disposal Facility (NDF)

Pursuant to the requirements of Art. 37 of the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*, as part of the request for an issuance of an approval order of the selected site, a Preliminary Safety Analysis Report was developed that was presented in 2013 with a request for approval of the selected site. As reported in the previous national report, deficiencies were identified in the report which were corrected in 2015 by the way to demonstrate completely the capability of the site to guarantee the integrity of the protection barriers for a maximum period of time and to prove the site capability combined with the selected disposal concept to ensure population protection in observance of the population dose limits.

Intermediate Safety Analysis Report in the process of National Disposal Facility (NDF) site selection

During the development of the Technical Design for NDF construction, an Intermediate Safety Analysis Report of the nuclear facility was developed on the basis of the Preliminary Safety Analysis Report and the Technical Design of the facility. The scope of the report was determined according to the requirements of Art. 40 of the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*.

The safety analysis was developed by using the ISAM methodology and based on the completed assessments the normal system evolution scenarios as well as the probable alternative evolution scenarios were developed.

Based on the results from the assessment of the different scenarios the operating limits of the facility were defined and it was proven that the natural site characteristics in interaction with the engineering barriers envisaged in the Technical Design meet fully the requirements of the design permit under Art. 39 of *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*, and that complete population protection and environment preservation is ensured in observance of the dose limits.

Procedure for environmental impact assessment

Following a decision of the Supreme Administrative Court in 2013, a completely new procedure for environmental impact assessment was carried out in the period 2014-2016 according to the requirements of the Environment Protection Act of the Republic of Bulgaria.

The process was completed successfully with the issuance of a positive decision regarding environment impact by the Ministry of the Environment and Water.

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."

Overview of the information presented in the previous reports

The amendments to the national legislation, implemented in connection with the provisions of Art. 16 of the Convention were presented.

The safety requirements in the operation of RAW management facilities are specified in ASUNE and mainly in the *Regulation for Safe Management of RAW*. Some of the requirements are common for all nuclear facilities and some are specific for the RAW management facilities.

Licence for operation of RAW management facilities

The RAW management facilities are subject to the general licensing regime in the Republic of Bulgaria for the operation of a nuclear facility according to the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*. The issuance of a licence for operation and the required conditions for this are discussed in detail in the present report under Art. 9.

The main document, on the basis of which the licence is issued, is the Final Safety Analysis report (FSAR), which reports the results from the commissioning of the facility. The reporting documents about the implementation of the Program for commissioning and the fulfilment of the conditions of the issued permits are also presented for review. The RAW management facility is commissioned in accordance with the program of the licence holder defining the activities on the verification of the compliance of the existing structures, systems and components with the design requirements. The program should include tests with mockup and real RAW. The fulfilment of the conditions of the commissioning permit is established by a commission of NRA inspectors, appointed by the NRA Chairman which examines the documents submitted by the applicant and performs an on-site inspection.

In addition, for the issuance of an operation licence of a RAW management facility, it is necessary to provide criteria for RAW acceptance in the facility.

For the issuance of an operation licence of a RAW disposal facility, a plan for closure and for post-closure monitoring is also required.

In this case the safety analysis report should include safety assessments of the facility both for the operation period and after its closure.

The operation licence is issued for a maximum term of 10 years. For renewal of the operation licence, an updated safety report of the facility should be enclosed to the request in which the applicable regulatory requirements, the actual condition of the facility and the envisaged operating term are described.

Operational limits and conditions

According to Art. 41 of the *Regulation for Safe Management of RAW,* the operation of the facility should be carried out in observance of the operational limits and conditions. The operational limits and conditions should be determined and justified on the basis of the project design, safety analyses and the commissioning tests, and if necessary, shall be periodically reviewed in order to reflect the operational experience, modifications made to safety-related structures, systems and components, the new safety analysis and the development of science and technology. The licensee holder 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 the nuclear facility to be presented to NRA along with operational 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;

- actions of the personnel during deviations from the normal operation.

The operational limits and conditions are an integral part of the main operational document – the Technological Regulations 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.

Any amendment to the Technological Regulations, respectively the operational limits and conditions is subject to an authorization regime.

Compliance with the established operating procedures

The requirements for availability of procedures for operation, maintenance, monitoring, etc. are specified in the legislation.

According to Art. 42 of the *Regulation for Safe Management of RAW,* diagnostics, maintenance, repair, testing and supervision of safety-related structures, systems and components shall be provided during the operation of a RAW management facility according to schedules, maintenance and supervision procedures and instructions for maintaining the design reliability and availability parameters, as well for application of corrective measures for correction of the non-conformities of the processed RAW or of the stored packages with regard to the technical specifications.

The compliance with the regulatory requirements and the adequacy of the procedures is verified during the licensing process both at the time of the issuing licences and permits as well as during the ongoing monitoring for fulfilment of the requirements of the issued licences and permissions.

The implementation of the procedures is also subject to thematic reviews in line with the annual inspection plan of the regulatory body, as well as to subsequent monitoring for fulfilment of the made recommendations and prescriptions.

Engineering and technical support

The Act on the Safe Use of Nuclear Energy requires that respective engineering and technical support is available in all areas related to safety throughout the operating lifetime of the facility.

According to Art. 39 of the *Regulation for Safe Management of RAW,* during the operation of the facility, the licence holder shall also provide engineering support in the activities with the aim of analyzing the behaviour of the safety-related SSC, justification of the proposed modifications to the design and operational documentation, analysis of operating experience and operating events as well as the efficiency of the RAW management.

A licence is issued to a legal entity that has the financial and technical resources and adequately qualified and competent personnel with the relevant level of education and training for all activities under the licence.

Waste characterization and sorting

The requirements are laid down in the *Regulation for Safe Management of RAW,* and according to Art. 42 during the RAW management facility operation incoming control shall be provided of the RAW received for processing or storage to establish its compliance with the acceptance criteria, including testing and inspection of the processed RAW (or packages) before their storage.

The licence holders have developed and applied procedures for waste characterization and sorting in consideration of the specificities of the technological process and the interfaces between the different stage of RAW generation and management.

The purpose of the procedures for characterization of RAW from Kozloduy NPP is to define their characteristics in view of the options for its subsequent sorting, processing and conditioning, as well as for the purposes of radiation protection of the personnel during its handling. Material release from regulatory control is also an important aspect which is considered increasingly by the operators.

Wide-scope investigations have been carried out for characterization of liquid RAW from Kozloduy NPP to establish difficult to measure radionuclides, important for long-term safety.

The activities on characterization of spent ion-exchange resins from the KNPP Units 1&4 continue.

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

According to Art. 19 of ASUNE, all issued licences for nuclear facilities operation specify requirements for reporting of safety-related incidents. The procedure and conditions for reporting are laid down in the *Regulation of the Terms and Procedure for Notification of NRA about Events in Nuclear Facilities and Sites with SIR.* In the period following the Fifth National Report, one operating event subject to reporting, according to the criteria of the Regulation was registered at SD RAW-Kozloduy.

According to Art. 42 of the *Regulation for Safe Management of RAW,* during the operation of a RAW management facility analysis shall be performed of the operating events significant to safety, they shall be reported to NRA and corrective measures shall be implemented to prevent event reoccurrence, and also a program for operating experience feedback shall be implemented in order to document, classify, analyze, and archive the technological and radiation parameters, SSC failures, operating events, and safety indicators.

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.

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 reissuance of the operation licence. In parallel, the decommissioning costs estimation shall be updated. The updated plans are subject to review by the regulatory body as part of the procedure for issuance/reissuance of the operation licence.

For a RAW disposal facility, a closure plan shall be presented.

For update of the decommissioning/closure plan, the up-to-date regulatory requirements shall be taken into account along with the actual status of the nuclear facility.

Information about the stage of development of the decommissioning plans of shutdown nuclear facilities is included in the Report under Art. 26 of the Convention.

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

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."

Overview of the information presented in the previous national reports

Requirements for institutional control following the closure of RAW disposal facilities had been introduced in the national legislation after the First review of the fulfilment of the obligations of Republic of Bulgaria under the Convention.

The subsequent national reports specified the regulatory requirements on the duration of the institutional control after the closure of the facility – active and passive control, and the maximum and minimum term of their implementation.

Information storage

The *Regulation for Safe Management of RAW* stipulates the requirement that the activities for closing a RAW disposal facility shall include update and archiving of all operation information about the nuclear facility.

Institutional control and intervention measures

According to Art. 45 of the *Regulation for Safe Management of RAW,* the responsibilities for control after the closure of a RAW disposal facility are determined by a decision of the Council of Ministers. It specifies the entities, responsible for identification of the need and execution of active restoration works and corrective actions on the site of the RAW disposal facility.

According to Art. 60(3) of the *Regulation for Safe Management of RAW* in the case of unplanned releases after the closure of a RAW disposal facility, the intervention levels set in the *Regulation on Emergency Planning and Emergency Preparedness in the Case of Nuclear and Radiation Accident* shall be observed.

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."

Overview of the information presented in the previous national reports

It was specified that the export and transport of nuclear material and in particular of SF are subject to authorization regime and that the requirements for the issuance of a SF export and transport permit are specified in ASUNE.

It was pointed out that the Republic of Bulgaria has had practical experience only as a state of origin of spent fuel. The international agreements related to the acceptance of spent fuel for treatment by the Russian Federation and its transit through the territory of Ukraine were presented.

The transport scheme for the transport of spent fuel by rail and waterway was described.

The requirements of the *Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy*, related to the implementation of the obligations under this Article of the Convention were presented. It was specified that the application for a permit for nuclear material transport must be accompanied by:

- 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 applicant and subcontractors related to the transport on the territory of the state;
- administrative acts issued by the respective competent authorities for approval of the transport packaging 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, the applicant will return the goods to the starting point and the consignor will accept the cargo.

It was specified that the safety requirements for SF transport are defined in the *Regulation on the Terms and Conditions for Transport of Radioactive Material*, which was developed in accordance with the requirements of IAEA document "Regulations for the Safe Transport of Radioactive Materials" TS-R-1, as well as with the requirements of the relevant international regulations for the transport of dangerous goods:

- 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 Road (ADR);
- 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);

It was specified that in 2010 the national legislation was harmonized with the requirements of Directive 2006/117/EURATOM which introduced the use of the so-called "standard document" in compliance with the requirements of the Directive. The requirement of ASUNE stating that transit of RAW and SF shall be carried out only following a decision of the Council of Ministers was repealed.

The amendments to the *Regulation on the Terms and Conditions for Transport of Radioactive Materials* adopted in 2014 were described, which reflected the additions made in 2010 to ASUNE regarding the transport of radioactive substances, reflecting 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. It was specified that 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.

Practice in SF transboundary transport

In the period after the presentation of the Fifth National Report two permits were issued in 2014 and 2017 and one transboundary movement of SF from reactors WWER-440 was carried out in 2014.

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."

Overview of the information presented in the previous national reports

It was specified that activities involving radioactive sources are subject to an authorisation regime, established by ASUNE and the *Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy*. The specific safety requirements of the *Regulation on BNRP* and the *Regulation on Radiation Protection during Activities with SIR* are also observed.

NRA maintains a *National register of the Sources of Ionizing Radiation in the Republic of Bulgaria* containing data about all sealed radioactive sources from category 1 to 5 and about the licensee and permit holders who store and use them.

When a source is not used anymore it is considered radioactive waste and according to *ASUNE* shall be transferred by its owner to SE RAW which is licensed to manage RAW. NRA shall be informed about all such transfers.

In the cases in which the owner is not known or the licence holder is declared insolvent, the sealed source becomes state property and is transferred to SE RAW based on an order issued by the NRA Chairman.

The measures taken by the Republic of Bulgaria to identify orphan sources and to prevent illegal transboundary movement of sealed sources were presented. A great part of these measures are being implemented jointly with the US government and EU.

Management of disused sealed sources

The import of disused sealed sources of category 1, 2 or 3, whose half-life is greater than 5 years, can be carried out only upon the condition that their return to the respective manufacturers after termination of their use is ensured.

The storage of disused sealed sources is subject to a licensing regime. In order to motivate the licence holders to transfer without delay the disused sealed sources to SE RAW for centralized long-term storage in SD RAW - Novi Han, which is a radioactive waste management facility licenced by the NRA, the state taxes have been reduced in the last years.

With the construction of the National Disposal Facility for low and intermediate level RAW, the issue of the disposal of the currently stored disused sources will be resolved.

In the period 2014-2016, SD RAW - Novi Han accepted for storage the following SIR by type and activity:

YEAR	2014	2015	2016
Concluded contracts [number]	39	37	31
Received smoke detectors/SIR [number]	353/493	1114/1659	1129/1253
Received other SIR [number]	289	430	1092
Total activity [Bq]	8.7E+14	4.4E+14	8.0E+14

The capacity of SE RAW is sufficient for the acceptance, processing and storage of spent sources from industry, science and medicine.

The transfer of radioactive sources declared as RAW is carried out in compliance with the *Regulation on the Terms and Conditions for Transfer of Radioactive Waste to the State Enterprise "Radioactive Waste"*.

The reuse of spent high-level sources in the Republic of Bulgaria is carried out under the conditions of a licence issued by NRA for the use of a source for a specific purpose other than the original purpose for which the source was produced and delivered.

Reimport of disused sealed sources

The Bulgarian legislation does not prohibit the reimport 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 NRA as long as there are currently no licenced manufacturer of sealed Sources of Ionizing Radiation in the Republic of Bulgaria.

Section K: Planned safety improvement activities

In 2015 The Council of Ministers approved an updated Strategy for Spent Fuel (SF) and radioactive Waste (RAW) Management. This strategic document with perspective till 2030 was developed in line with the priority for updating the existing nuclear fuel management strategy as part of the government program for stable development of the Republic of Bulgaria for the period 2014-2018. The strategy was developed 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 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

This is the most important national project for implementation in the medium term as defined in the National Strategy in the field of RAW management. The construction of a national facility was approved by a decision of the Council of Ministers in 2005.

The design refers to a modular, near-surface, multi-barrier engineering facility of a modular type, which will enable the gradual construction of individual elements and gradual increase of capacity. The capacity of the first stage of its construction is 50 000 m^3.

The process of NDF site selection was completed in 2012. It was completed in accordance with the requirements of the legislative documents and the conditions of the permits for the nuclear facility site selection issued by the NRA Chairman.

In 2013, a request was submitted for approval of the selected site by NRA. The site approval order could be issued only if there was an EIA report decision in force.

In 2017, an order for approval of the selected NDF site and Technical design was issued and then a building permit for the facility was issued.

2. Disposal of high level RAW

According to the existing agreements HLRAW from SF processing are subject to return to the Republic of Bulgaria within 10 years after the specific HLRAW volume is determined according to a Methodology agreed between the contracting parties in line with the international practices in this field. HLRAW from SF transported for processing up to 1989 is not subject to return to the Republic of Bulgaria. For the SF transported for processing in the period 1998 - 2013 the exact volume with the respective quality and quantity characteristics will be specified by signing respective agreements.

SF processing from WWER-1000 reactors in connection with the signed agreements valid until 2020 is envisaged to start after 2025 by the radiochemical plant RT-2 planned for construction in the town of Jeleznogorsk, Russia. The possibility for SF processing in other countries having the potential to extract components from SF for reuse in nuclear reactor installations is being investigated.

Our country participates in investigations for possible technical solutions for the end stage of management of HLRAW and long-lived intermediate level RAW (ILRAO). Projects for HLRAW disposal under regional and international initiatives are subject of interest, along the considerations of the national requirements, public attitude, financial capacity and HLRAW volume, including high-level SIR. Investigating international solutions is not an obstacle to the implementation of the national program in this field.

At this stage, the solution based on the construction of a buffer long-term storage facility is considered as acceptable. It is assumed that in the period of controlled HLRAW storage, new data and technical solutions will become available which could significantly change the methods of managing such waste. In this way serious mistakes with their final disposal in stable geological formations will be avoided.

The strategy of SF and RAW management till 2030 envisages analysis of the inventory and amount of HLRAW from SF processing as well construction of a long-term storage facility for HLRAW containers obtained from SF processing on Kozloduy NPP site which to be commissioned by 2025.

In line with the national legislation, geological disposal in the Republic of Bulgaria shall be regarded as the most suitable option for long-term guaranteed safety with the isolation of high level and long-lived RAW.

In this respect a program for investigation and construction of a facility for deep geological disposal of high-level and intermediate-level long-lived RAW, category 2b has been developed. The program envisages the approval of a methodology for determining the amount and quantity of the products (the inventory) from SF processing subject to return into the country. Analysis of the possible options for long-term storage in the country will be performed by setting-up a laboratory for investigation of the experimental storage of HLRAW and the low and intermediate level RAW, category 2b.

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

A balanced approach towards the continuous improvement of the legal and regulatory framework has been adopted.

The work on the development of new and updating of the existing regulatory guides in connection with the procedure for implementation of the regulations continues. Development of regulatory guides has been planned regarding:

- the releasing of nuclear facilities and related activities from regulatory control;
- the conditions for closing RAW disposal facilities;
- the requirements for safety assessment of RAW disposal facilities.

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

4.1 SD RAW - Kozloduy

The activities planned in the Program for safety improvement of the RAW management facility were completed by Kozloduy NPP.

A RAW management program on the site of the “Lime” Plant is implemented, which allows to maintain a steady rate of processing of the currently stored historical RAW in unprocessed form.

In 2015, a Contaminated Soil Storage Facility was commissioned for storage of soil, construction and other waste of inert materials with a very low level of radioactive contamination. Rehabilitation measures were carried out according to the design documentation and the issued by NRA permit.

In 2016, NRA issued a permit for the implementation of a technical solution for the storage of waste with a very low level of radioactive contamination, category 1„c” in an engineering facility on Kozloduy NPP site.

A technical solution for optimization of the process of reprocessing of the generated by a super-compactor HHS–1000-3R secondary RAW is in the process of implementation.

A method for sludge and deposit conditioning was developed by Kozloduy NPP which will be subject to technical implementation.

A technical solution for gradual upgrading of the Automated Information System for Radiation Monitoring at Radioactive Waste Processing Plant is in the process of implementation.

4.2 SD Decommissioning - Kozloduy

A new integrated design is developed for extraction and processing of the solid phase from the tank of evaporator concentrate, the spent ion-exchange resins and sludge and deposit.

An installation for plasma melting of solid RAW was constructed. Tests with non-radioactive waste were carried out. The implementation of the program for commissioning of the facility is upcoming.

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.

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, in which equipment and systems ensuring subcriticality, SF residual heat removal and biological protection are located.

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 pools at reactors. 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 subcriticality is ensured by the baskets design (the step of placing the SF assemblies and the basket inventory) and the 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 means of:

- heat exchangers cooled with process water;
- evaporation of water from the pool;
- ventilation of the above-water volume;
- heat loss through the building structure.

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;
- emergency alarm system;
- processing and storage of radioactive and non-radioactive waste.

The technical design of the existing WSFSF has been elaborated pursuant to the regulatory documents valid in the 70s of the last century in the former USSR. The safety during spent fuel storage is practically based on the application of the "defence-in-depth" principle. The main design solutions applied during WSFSF construction are:

- the fuel assemblies are stored under water (demineralized, with temperature below 40 °C) that protects them from damage, suppresses the processes of degradation of materials of fuel elements cladding and of structural materials of assemblies; the parameters of the water chemical composition and activity (the limit level of radioactive contamination is 1.11×10^5 Bq/l) are maintained by the water treatment system;

- the cooling system (removes the spent fuel residual heat) has been designed with high degree of redundancy – the cooling water is supplied in the pools from above, their emptying because of siphon effect is impossible; there is a possibility for quick water supply from tanks with a speed 10 times higher than the maximum design leakages from the pool;
- the double lining of the pools ensures high tightness and reliable monitoring of leakages (the lining is supported by a porous concrete layer; in case of leakage from the lining, the water trickles through the porous concrete layer to special collection points at all sides of a pool and is collected at the bottom center by the controlled leakage system and supplied to the purification system);
- the solid building structure (a reinforced concrete frame and reinforced concrete walls) of WSFSF ensures the biological protection (the reinforced concrete walls and the pools bottom are 1.5 m thick);
- the tightness of the spent fuel assemblies during transport and storage under normal and emergency conditions of operation is ensured by the terms and conditions for transport and storage; the untight spent fuel assemblies are stored in hermetical casks;
- the subcriticality is ensured by the transport baskets design (by means of geometrically safe configuration during fuel loading) and the conditions for storage in the pools and does not depend on any permanent or burning absorber. The assessment for subcriticality does not take into account the fuel burn-up;
- the transport of the fuel assemblies from the reactors spent fuel pools (after a minimum of 3-year storing of WWER-440 assemblies and after a minimum of 5-year storing of WWER-1000 assemblies) to WSFSF is performed with a transport container in a transport basket; during the operations for loading and transport of the container, the personnel acts pursuant to specially elaborated instructions; the fuel assemblies are stored vertically the way they were also located in the reactor;
- availability of ventilation systems, fire-prevention systems and monitoring and control systems;
- availability of 12 instrumentation wells around the WSFSF building for monitoring of the underground water activity.

To justify the WSFSF safety, respective analyses have been made. The maintenance of the spent fuel assemblies tightness and integrity in case of completely drained pools and air cooling for a time interval sufficient to undertake restoration actions (100 hours in case of most unfavourable temperature conditions of the environment), are ensured by the structural and neutron-physical characteristics of the assemblies.

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. During the performed check of the seismic stability of the transport baskets in the WSFSF pools, no necessity of additional strengthening of the transport baskets was established.

To justify the possible term for long-term safe storage under water of the spent fuel assemblies, “accelerated corrosion tests” were performed again in 2006 after especially elaborated methods allowing modelling of the impact of the aggressive (water) environment in case of storage period already for 50 years. The integrated destructive and non-destructive tests of the fuel rods and of the other structural elements of a typical spent fuel assembly from WWER-440 and WWER-1000 after

long-term storage under water, the investigations with artificial saturation with hydrogen and the determination of the mechanical properties of the metal of the fuel rods cladding, the accelerated corrosion tests and the analysis of the results of other investigations confirmed the satisfactory condition of the cladding after 50-year storage in water environment, provided that the set chemistry is observed.

An assessment of the condition of the structural materials of the lining of the pools and transport baskets for storage was also made. Their integrity was also retained. Their corrosion resistance during 50-year operation of WSFSF was also confirmed.

In 2004, WSFSF safety analysis report" was performed, on the basis of which NRA issued a licence for WSFSF operation until 2014.

In 2005, a Technological regulation for WSFSF operation was adopted, reflecting the requirements of the new regulatory documents. The project "Modernization of the radiation monitoring system (replacement of devices with modern ones with automatic recording of readings in a database)" was implemented.

In 2006, the compartments for acceptance and refuelling of SF were equipped with a refuelling machine for SF from WWER-1000 and WWER-440. The protection and interlock system was replaced with a digital one (on the basis of programmable logical controllers, PC or others).

In 2007, analyses were made to determine the service life of the WSFSF building and equipment.

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

The spent fuel pools (SFPs) are located in the containment area and serve for storage and cooling of spent fuel (until decrease of residual heat to permissible level) and for temporary storage of control rods for reactor control and protection system (CPS CRs) and burning absorber rods (BARs).

SFP consists of 4 sections physically separated by partition walls up to elevation 28.93, above elevation 28.93 up to elevation 36.2 the volume above the pool is common. Three sections are intended immediately for storage of spent FAs, and the fourth sections – for performance of transport operations with fresh and spent fuel. Placed in it are – a transport container for SF, the shipping containers with fresh fuel and the casks with hermetical casks.

In the internal space of the sections for SF storage, the racks and the leak-tight bottles for placing and storing of FAs are located. The storage racks are made of boron steel and ensure subcriticality in SFP not less than 0.05, at design-basis initial events, including fall of a heavy object on them. The absorption capacity of the cells of the storage racks is retained during the whole operation life. The structure of the racks ensures:

- vertical placement in it of FAs and of the hermetical casks;
- it excludes mechanical damage to surfaces of FAs during their placement and taking out of the rack pockets;
- fixing of FAs and leak-tight bottles placed in the rack;
- reliable residual heat removal from spent FAs;
- the racks retain their operability during seismic load of SSE.

The capacity of each pool is 612 FAs and ensures storing of the spent FAs for not less than three years pursuant to the requirements of GOST.95.7.5-87.

SPF division into three sections allows maintenance works to be performed in one section while the spent fuel assemblies are located in the other two sections.

The transport container (TC) loading area is called "universal loading area" (ULA) and is separated from the FA storage area, so that the fuel elements are not damaged if the container falls down or the protection level or boric acid solution above FAs is not reduced if the TC is removed.

The enclosing structures of SFP are intended for confinement of the cooling boric acid solution (that may contain radioactive products), as well as for reduction of the ionizing radiation.

The enclosing structures of SFP consist of the following elements:

- double metal tight lining with drain for possible leakages. The gap between the two lined walls is filled with drainage (porous) concrete and forms a closed common cavity with the floor and the walls and allows looking out for possible leakages through the lining. Into the floor between the two walls, drains are cut (one from each SFP section and from the universal loading area), which are brought to a room where there is a possibility for periodic visual inspection of the possible leakages;
- reinforced concrete enclosing structures;

When developing the enclosing structures of SFP, the following main principles were taken into account:

- to retain the set functions (tightness and strength) during different operation modes, including during SSE;
- to ensure biological protection during normal operation modes and during design-basis accidents.

The spent fuel pool and the entire system are filled with boric acid solution with a concentration of 16 g/kg.

The pool filling is performed up to elevation 28.83 in fuel long-term storage mode. In refuelling mode (when transport operations with the fuel are envisaged), the pool is filled up to elevation 35.7. In this way, movement of the spent fuel under water is ensured. In order not to allow pool overfilling, two overflow drains are placed in each section, one at the water level during long-term fuel storage (28.8), and another one at the water level during fuel refuelling (36.2). If necessary to maintain the level at elevation 35.7, the operator shall close the isolating valves corresponding to level 28.8. The fuel storage sections have no technological drainage in their lower part, which ensures that they cannot be emptied and leave SF without coolant.

In the modes where there is no fuel movement in SFP, the upper part of the pool is covered with plates. In order to avoid destruction of plates and their fall into SFP, they have been designed taking into account an earthquake of magnitude 9 on the MSK-6 scale and a shock wave impact across the whole area of the plate with intensity of 148 kN (14.8 ts/s) in case of break of a pipeline of the reactor coolant circuit. The plates shall withstand impact loads in case of fall of 5 kg objects from 10 m height (i.e. small tools from the height of the crane substructures).

In the upper part of the pool, a ventilation plenum-exhaust system has been provided, which provides an air curtain and, in this way, prevents the spread of gaseous aerosol products from the SFP surface into central hall. In this way, the attending personnel in the containment area is protected during modes when refuelling and maintenance of the Unit are performed.

The cooling system consists of three canals 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 heat exchangers of the system are cooled by process water system for safety-related consumers, with each canal of TG system being cooled by an individual canal.

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

I.3 Dry Spent Fuel Storage Facility (DSFSF)

Within the borders of the Kozloduy NPP fence, to the west of the existing WSFSF building, the Dry Spent Fuel Storage Facility is located.

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

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

The general characteristics of DSFSF are:

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

- The floor slab of DSFSF, the external walls of the storage hall and the walls between the acceptance area and the storage hall are made of reinforced concrete. The building structure of the acceptance area is built in combination of reinforced concrete columns and welded steel sections. The protection from atmospheric effects and the heat insulation of the building are achieved by means of lining made of corrugated sheet iron with fire-resistant insulation. The storage hall has the same characteristics of the floor slab as those of the acceptance area. Reinforced concrete columns are used as a support of the roof and the crane. Steel structures are used for the main supporting beams of the roof (trusses) and for crane runway beams. The roof covering represents metal three-layer panels installed from the ridge to the eaves with inclination of the longitudinal beams.

- The acceptance 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 places for 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, an intermediate layer of CONSTORIT (granulated material with cement mortar), as well as tensioning bolts are placed. 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. A total of 124 steel cooling ribs are welded to the facing surface.

The primary lid closes the cask cavity at its upper end. The seal plate that represents the first independent barrier sealing hermetically is located between the primary lid and the secondary lid. After placing the seal plate in the seat of the main sealing ring, the plate is welded hermetically to the cask body.

The secondary lid represents the second independent barrier sealing hermetically. It is located above the seal plate and above the intermediate steel plate and closes the cask at its upper end at the main ring. It is made of weldable fine-grained steel and ensures additional protective shielding. The second lid is welded hermetically in the seat of the main ring to the cask body.

The system of leak-tight coatings ensures a hermetic coating of the spent fuel under conditions of operation and accident. The qualified volumetric welds and the procedure for welding the seal plate and the primary lid guarantee the same quality of welds as that of the factory welds of the cask body, and have a standard for pressurized body.

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

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

Appendix L-2

SPENT FUEL REPORT

Kozloduy NPP

The accumulated spent nuclear fuel on the Kozloduy NPP site, stored in SFP, WSFSF and in DSFSF, amounted to 899.9 tons of heavy metal as of 31.12.2016. This quantity is distributed in 3096 spent fuel assemblies from WWER-440 and 1287 spent fuel assemblies from WWER-1000, or a total of 4383 assemblies.

SF quantities by inventory and heavy metal in WSFSF as of 31.12.2016

Reactor type	Assembly type	Initial enrichment with respect to ^{235}U [%]	WSFSF		TOTAL	
			Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weigh [kg]
WWER-440	116	1.6	3	355	**2340**	**269960**
	124	2.4	38	4436		
	136	3.6	2061	238485		
	216	1.6	6	670		
	224	2.4	191	21444		
	236	3.6	41	4570		
WWER-1000	A	2.0	12	5138	**636**	**253193**
	V	3.0	2	780		
	G	3.3	105	44000		
	GV	3.13	2	842		
	E	4.4	156	59614		
	ED	4.23	180	69074		
	N3536	3.53	110	45394		
	N3996	3.99	5	2073		
	N4306	4.3	64	26278		
TOTAL					**2976**	**523153**

SF quantities by inventory and heavy metal in DSFSF as of 31.12.2016

Reactor type	Assembly type	Initial enrichment with respect to ^{235}U [%]	DSFSF		TOTAL	
			Number of assemblies	Heavy metal weight [kg]	Number of assemblies	Heavy metal weigh [kg]
WWER-440	116	1.6	1	118,1	**756**	**87396,5**
	124	2.4	21	2453.4		
	136	3.6	716	82807		
	236	3.6	18	2018		

SF quantities in SFP 5 and 6 by inventory and heavy metal as of 31.12.2016

Reactor type	Assembly type	Initial enrichment with respect to ^{235}U [%]	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]
WWER-1000	ED (4230)	4.23	48	18426	16	6140	**64**	**24566**
WWER-1000	E (4400)	4.4	21	8042	16	6145	**37**	**14187**
WWER-1000	N 3536	3.53	3	1233	11	4535	**14**	**5768**
WWER-1000	N 3996	3.99	53	21910	49	20285	**102**	**42195**
WWER-1000	N 4306	4.3	219	90066	215	88445	**434**	**178511**
TOTAL			**344**	**139677**	**307**	**125550**	**651**	**265227**

Total for Kozloduy NPP

Reactor type	Number of assemblies	Heavy metal weight [kg]	Approximate activity [Bq]
WWER-440	3 096	357 356.5	$0.343x10^{19}$
WWER-1000	1 287	518 420.0	$2.102x10^{19}$
TOTAL	4 383	875 776.5	$2.445x10^{19}$

Description of spent fuel assemblies construction

1. Fuel assembly for WWER-440 Reactor.

1.1 Fuel assembly (FA)

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 head and bottom nozzle have dimensions 144 mm. The total length of the FA is 3217 mm. The fuel assembly consists in approximately 120 kg heavy metal. The fuel assemblies are produced with enrichment of 1.6%, 2.4% and 3.6% and respectively are labelled with code 116, 124 and 136.

1.2 Regulating and shim fuel assembly (RSA)

Does not differ from a FA in general. The differences are as follows:

- the upper rod is 10 cm shorter, which results in 115 kg heavy metal contained;
- there is a bayonet clutch with a locking mechanism in the head;
- there is a mechanism in the bottom nozzle, which is pulled over the damper in the casing pipe at the bottom of the shaft in order to soften the shock;
- the wrench dimension of the top and bottom nozzles is 145 mm.

The regulating and shim fuel assemblies are produced with enrichment of 1.6 %, 2.4% and 3.6% and respectively are labelled with code 216, 224 and 236

2. Fuel assembly for WWER-1000 reactor

2.1. Assembly of TVS type for two year cycle:

The TVS assembly has steel non-dismountable construction and 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 of the TVS assembly is 4570 mm. The assembly contains approximately 430 kg heavy metal. The assemblies are produced with enrichment of 1.6%, 2,0%, 3,0%, 3,23% and 3,3% and are labelled with code: N, A, V, GV, G. In Kozloduy NPP are used assemblies with enrichment of 2,0%, 3,0%, 3,23% и 3,3%. The fuel rods are filled with UO_2 tablets with central hole with diameter 1,5 mm. The assembly consists in total 429,7 kg Heavy metal.

2.2. Assembly of TVS-M type – for a three year cycle:

The TVSA assembly has a steel skeleton and dismantling structure. It has 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 up to 235 mm. The total length of the assembly is 4570 mm. The fuel assemblies are produced with enrichment of 1,6%, 3,0%, 3,6%, 4,23% and 4,4% and are labelled with codes: N, V, D, ED, E respectively. In Kozloduy NPP are used assemblies with enrichment of 3,0%, 4,23% and 4,4%. The fuel rods are filled with UO_2 tablets with central hole with diameter 2,35 mm. The assembly consists in total 399,9 kg Heavy metal.

2.3. Assembly of TVSA type- for four year cycle:

The TVSA assembly has a zirconium skeleton and dismantling structure. It has a head with spring unit, central pipe, 18 casing pipes, 15 spacer grids, a bottom nozzle, as well as 312 fuel rods, including 6 fuel rods with burnable absorber Gd_2O_3.

The assembly form is hexagonal with wrench dimension up to 235 mm. The total length of the assembly is 4570 mm. The fuel assemblies are produced with enrichment of 1,3%, 2,2%, 3,53%, 3,9%. 3,99%, 4,3% and 4,38% and are labelled with codes N1300, N2200, N3536, N3906, N3996, N4306 and N4386 respectively. In Kozloduy NPP are used assemblies with enrichment N3536 (GD), N3996 (S, SS), N4306 (ES, SE).The assemblies consist from 431,9 to total 434,7 kg heavy metal.

Appendix L-3

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

1. KOZLODUY NPP EAD RAW MANAGEMENT FACILITIES

1.1 Auxiliary building-3

It is also intended for temporary storage of solid RAW category 2a, solid RAW category 2b, low and intermediate level liquid radioactive concentrates and spent sorbents from the reactors operation.

All rooms for RAW storage are located in a building with reinforced concrete structure, separate part of auxiliary building-3 (AB-3) serving Units 5&6.

The solid RAW category 2a are stored in hopper-type rooms with upper hatch. Eighteen rooms are in operation, with different volume (78 m^3 to 189 m^3) and total net volume of 1786 m^3. Operating conditions – ambient temperature, atmospheric pressure. They are equipped with systems for automatic fire alarm and fire extinguishing.

The solid RAW category 2b are stored in hopper-type rooms with upper hatch, solid reinforced concrete structure ensuring the necessary biological protection, too. Total net volume of 224 m^3. Operating conditions – ambient temperature, atmospheric pressure.

The liquid radioactive concentrates are stored in tanks made of stainless steel, each of which is located in a separate room lined with metal lining. The tanks are seven, with total net volume of 3584 m^3. Three of them are with a diameter of 6.4 m, height of 6.4 m and net volume of 200 m^3 each, the remaining four – with a diameter of 10 m, height of 10 m and net volume of 746 m^3 each. They are equipped with a level monitoring system. Operating conditions – temperature up to 100 °C, atmospheric pressure. The transport of the contaminated medium is carried out with a montejus. The exhaust ventilation system of the tank rooms also ensures gas cleaning.

The spent sorbents are stored in tanks made of stainless steel, each of which is located in a separate room lined with metal lining. The tanks are two, with a diameter of 4.5 m, height of 6.3 m and net volume of 95 m^3 each. They are equipped with level and temperature monitoring systems, for hydrotransport of the contaminated medium and for fire extinguishing. Operating conditions – temperature up to 40 °C, atmospheric pressure. The exhaust ventilation system of the tank rooms also ensures gas cleaning.

A room for storage of sources of ionising radiation at Metrological Support Department

The storage of sealed sources of ionising radiation is performed in a room separated for the purpose, located in the territory of Measurement of Ionising Radiation Laboratory, SAC-1.

The sources are stored in conformity with the requirements for radiation and physical protection.

Storage is performed on the grounds of a permit issued by NRA, which is renewed periodically and is related to a licence issued by NRA for use of sources of ionising radiation for economic purposes.

Sites for temporary storage of sources of ionising radiation in fire alarm detectors

Temporary storage of sources of ionising radiation, used in fire alarm detectors, is performed on the following sites: Radiometry Laboratory, FFSO Unit 5, Room 6 DE 3005 at elevation 30.00 – TH – eastern stairwell Unit 6, and Kulata storage facility.

The sources are stored in conformity with the requirements for radiation and physical protection.

Storage is performed on the grounds of a permit issued by NRA, which is renewed periodically and is related to a licence issued by NRA for use of sources of ionising radiation in fire alarm detectors, which are subject of regulatory monitoring by NRA pursuant to ASUNE.

2. SE RAW FACILITIES FOR RAW MANAGEMENT

2.1 SE RAW – Decommissioning Kozloduy SD

Since 2008, Kozloduy NPP Units 1&2, subject to decommissioning, have been declared facilities for radioactive waste management and committed for management to the State Enterprise "Radioactive Waste".

Licences for operation of Kozloduy NPP Units 1&2 as RAW management facilities that are subject to decommissioning were issued by NRA to SE RAW in October 2010 through SE RAW – Decommissioning Kozloduy SD.

Since 2012, Kozloduy NPP Units 3&4, subject to decommissioning, have been declared facilities for radioactive waste management and committed for management to the State Enterprise "Radioactive Waste".

Licences for operation of Kozloduy NPP Units 3&4 as RAW management facilities that are subject to decommissioning were issued by NRA to SE RAW in February 2013 through SE RAW – Decommissioning Kozloduy SD.

In 2014, licences for decommissioning of Kozloduy NPP Units 1&2 were issued.

In 2016, licences for decommissioning of Kozloduy NPP Units 3&4 were issued.

In the facilities, activities for extraction, storage, processing and transport within the borders of the facility of RAW that has remained from the operation of the Units and of secondary RAW, until the moment of its submission to SD RAW – Kozloduy, are performed.

2.1.1 Auxiliary building-1

Auxiliary building-1 is intended for temporary storage of solid RAW category 2 (2-I and 2-II according to the additional categorisation), low and intermediate level liquid radioactive concentrates, spent sorbents from the nuclear reactors operation.

The waste is stored in a building with reinforced concrete structure, separate part of auxiliary building-1 (AB-1) serving Units 1&2.

The solid RAW are stored in hopper-type rooms with upper hatch, seven rooms, with different volume (80 m^3 to 230 m^3) and total operating volume of 1010 m^3. Operating conditions – ambient temperature, atmospheric pressure.

The liquid radioactive concentrates are stored in tanks made of stainless steel, each of which is located in a separate room lined with metal lining. The tanks are five, with a diameter of 10 m, height of 7 m and operating volume of 470 m^3 each . They are equipped with a level monitoring system. Operating conditions – temperature up to 100 °C, atmospheric pressure. The transport of the contaminated medium is carried out with a montejus. The exhaust ventilation system of the tank rooms also ensures gas cleaning.

The spent “high level” sorbents category 2 (2-C according to the additional categorisation) are stored in tanks made of stainless steel, each of which is located in a separate room lined with metal lining. The tanks are two, with a diameter of 9.0 m and height of 6.5 m and operating volume of 350 m^3 each. They are equipped with a level monitoring system. Operating conditions – temperature up to 100 °C, atmospheric pressure. The transport of the radioactive sorbents is carried out by means of hydraulic discharge. The exhaust ventilation system of the tank rooms also ensures gas cleaning.

The spent “low level” sorbents category 2 (2-H according to the additional categorisation) are stored in two tanks lined with metal lining, with size of 5.0x4.6x8.2 m and operating volume of 188 m^3 each. Operating conditions – ambient temperature, atmospheric pressure. They are equipped with a leakage monitoring system. The exhaust ventilation system of the tank rooms also ensures gas cleaning.

2.1.2 Auxiliary building-2

Auxiliary building-2 is intended for temporary storage of solid RAW category 2 (2-I and 2-II according to the additional categorisation), low and intermediate level liquid radioactive concentrates, spent sorbents from the nuclear reactors operation.

It is stored in a building with reinforced concrete structure, separate part of auxiliary building-2 (AB-2) serving Units 3&4.

The characteristics of the rooms are the same as of AB-1.

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

Since 2010, operator of the facility has been SE RAW through SD – Decommissioning - Kozloduy.

It is intended for temporary storage of solid RAW category 2-III from the nuclear reactors operation.

It is located in the reactor (central) hall (RH-1) of Units 1&2.

The facility is of tubular type. It represents a solid reinforced concrete structure ensuring the necessary biological protection, too. The concreted steel tubes with upper hatch are four hundred, 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

Since 2013, operator of the facility has been SE RAW through SD Decommissioning - Kozloduy.

It is intended for temporary storage of solid RAW category 2-III from the nuclear reactors operation.

It is located in the reactor (central) hall (RH-2) of Units 3&4.

Its characteristics are the same as for RH-1.

2.2 SD RAW – Kozloduy

It is located on the Kozloduy NPP site and includes:

2.2.1 RAW processing plant

It is a separate site intended for performance of the activities for pre-processing, processing and conditioning of RAW from Kozloduy NPP.

The technology for RAW conditioning after the cementing method includes:

- extraction of the liquid RAW from the tanks for liquid radioactive concentrate;
- transport to the RAW processing plant (RAWPP);
- concentration of the liquid radioactive concentrate (if necessary) by means of evaporation;
- pH correction;
- dosing of the liquid radioactive concentrate, the cement and the additives;
- mixing, homogenisation and filling of the formed cement radioactive mixture into reinforced concrete container;
- sealing the package (lid placing and welding, lid hole sealing).

The reinforced concrete container has been licensed by the regulatory body for transport and storage of the conditioned RAW.

The RAW thus conditioned is stored temporarily on the Kozloduy NPP site and is subject to disposal without additional processing.

There are three separate processing lines in RAWPP:

2.2.1.1 "Solid RAW" Line

It is intended for sorting and processing by compaction of solid RAW in order to reduce its volume and prepare it for subsequent conditioning and includes:

- a centre for reception and unloading of the solid RAW;
- a sorting table;
- two 50 t compactors;
- a machine for sealing of 210-litre drums;
- a system for measuring of waste activity;
- a 910 t supercompactor;
- two drum depots;
- roller conveyors;
- a crane-manipulator;
- a 20 t transport carriage;
- two cranes with lifting capacity of 40 t.

2.2.1.2 "Liquid RAW" Line

It is intended for processing and conditioning of the liquid RAW, separately or together with the solid RAW, and includes:

- a specialized tank truck with capacity of 12 m^3 for transport of the liquid RAW from the auxiliary buildings;
- a centre for unloading of the liquid RAW;
- two 40 m^3 receiving tanks for liquid RAW;
- a two-stage evaporator with receiving tanks for distillate and condensate;

- two 12 m^3 tanks for concentrated liquid RAW;
- receiving silos for cement and chemical additives;
- batcher for cement and additives;
- a mixer;
- pumps, tanks, etc.

RAWPP is equipped with all necessary supporting systems and external connections.

2.2.1.3 Decontamination plant

It is intended for decontamination of metal RAW and includes:

- a compartment for reception and fragmentation of RAW;
- an alkaline treatment module;
- an acid treatment module;
- an electrochemical treatment module;
- a module for final monitoring of contamination;
- radiation monitoring systems, ventilation, radioactive drains and neutralization of solutions;
- tanks, transport and lifting equipment.

2.2.2 Storage facility for conditioned RAW

It is intended for intermediate storage (until its disposal) of the conditioned RAW from Kozloduy NPP.

It is a surface reinforced concrete facility ensuring the necessary engineering barriers between the stored RAW, the environment and the personnel. It has been built near RAWPP on the Kozloduy NPP site. Its capacity is 1920 reinforced concrete containers with conditioned RAW (960 each in two sectors "A" and "B", in 4 rows one on top of the other). The transport operations in the storage facility are performed by two overhead cranes of 25 t lifting capacity each (one for each sector), equipped with gripping devices for arrangement and positioning of the containers with RAW.

2.2.3 Lime plant Site

Part of the site, on which the following subsites for RAW management are separated:

2.2.3.1 Trench storage facility

It is intended 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.

The storage facility is near-surface type, reinforced concrete structure, hopper-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.

2.2.3.2 Storage facility for processed solid RAW

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

The storage facility is building-type, reinforced concrete panel 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.

2.2.3.3 Sites (No. 1 and No. 2) for storage of solid RAW in reinforced concrete containers

They are intended for buffer storage of processed solid RAW of categories 2-I and 2-II, packaged in reinforced concrete containers. They serve all nuclear facilities of Kozloduy NPP. The sites are with capacity for placing of about 2000 packages.

The reinforced concrete container licensed for transport and storage of solid RAW category 2a has overall dimensions of 1.95x1.95x1.95 m and net volume of 5 m^3. Container's walls ensure biological protection so that the equivalent dose rate does not exceed 2 mSv/h in any point on its external surface and 0.1 mSv/h at a distance of 1 m from the surface. Operating conditions – ambient temperature, atmospheric pressure.

The packing form is in conformity with Technical decision RAO.TR.-02/11.07.01 – solid RAW immobilized in non-radioactive cement matrix.

2.2.3.4 Site for storage of solid RAW in freight containers

It is intended 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 freight containers.

The freight standard ISO container has a side door and overall dimensions of 5.8x2.2x2.4 m and net volume of 30 m^3. Operating conditions – ambient temperature, atmospheric pressure.

2.2.3.5 Storage facility for contaminated soil

The facility is located on Lime plant site. It is intended for storage of soil, construction and other bulk technological waste with very low level of contamination. The capacity of the storage facility is about 8000 m^3. This facility is in process of reconstruction.

2.3. SE RAW – SD Novi Han

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 various branches of industry, medicine, agriculture and science and includes:

2.3.1 Storage facility for solid RAW

It is intended for storage of non-conditioned solid low and intermediate level short-lived RAW (category 2a). The storage facility has capacity of 237 m^3. It consists of three identical cells with dimensions 5 x 4.5 x 3.5 m. It is a reinforced concrete facility dug into ground with 15.7 m length, 5.83 m width and 1.2/1.6 m height of the above-ground part. Its walls are with a thickness of 300 mm, waterproofed on both sides with 20 mm bitumen insulation, with lining of 4 mm stainless steel sheets. The external waterproofing is additionally protected by brick wall 120 mm thick. The storage facility filling is performed from the surface through 7 hatches with external diameters of 100 cm and 120 cm. According to the design, after the filling of the cells with RAW, it can be grouted with cement.

2.3.2 Storage facility for biological RAW

It is intended for storage of pre-treated with formaldehyde low and intermediate level short-lived biological RAW category 2a, conditioned by stabilization in gypsum matrix. The capacity of the storage facility is 80 m^3. Its structure is similar to the one described under item

2.2.1, with geometrical dimensions - 8.35 m length, 4.00 m width, 2.5 m depth and 0.5 m height of the above-ground part (roof structure). The storage facility filling is performed from the surface through 8 hatches with dimensions 80x80 cm.

2.3.3 Storage facility for sealed sources

It is intended for storage of non-conditioned sealed sources category 2a. Its capacity is 1 m^3. The reinforced concrete facility lined with stainless steel is located at a depth of 5.5 m below the surface. The sources are received through a serpentine of stainless steel 5 mm thick. The protection against ionising radiation is realized by the heavy concrete and 5 lead plates, each 10 mm thick, located between the storage facility and the surface. The storage facility is additionally protected with heavy movable roof structure.

2.3.4 Engineering trench for solid RAW

For non-conditioned low and intermediate level short-lived solid RAW category 2a. Its capacity is 200 m^3 and dimensions: 29 m length and 4.1 m width. It consists of 8 cells built of prefabricated reinforced concrete elements with 300 mm thickness, bitumen waterproofing, protected by brick wall. A drainage system for removal of surface and ground water has been built. The placing of RAW is performed from the surface through hatches with outer diameter of 130 cm. Three of the cells are completely filled with RAW, stabilized with cement filling material and covered with temporary protective coating.

2.3.5 Storage facility for liquid RAW

It is intended for storage of liquid radioactive waste of categories 1 and 2a. It consists of four tanks made of stainless steel type X18H9T with 4 mm thickness, installed on concrete supports at 0.5 m above the floor of a reinforced concrete cell with dimensions 5.7 x 7.4 x 4.3 m; the cell is completely dug into the ground. Its capacity is 48 m^3.

2.3.6 Site No. 1 and 1A for storage of solid RAW

It is intended for storage of solid RAW of categories 2a and 2b in standard ISO containers. Ionization fire alarm detectors in transport packing, solid RAW and β-, γ-spent sources with low specific activity, which do not require construction of additional protection, neutron sources and α-sources in transport packing are stored on the site.

The containers are with dimensions 6.00 x 2.35 x 2.4 m. The site capacity is 14 RWCs with 462 m^3 total volume.

2.3.7 Site No. 2 for storage of 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. Disused sources in transport packing in concrete receivers of “PEK” type, sealed sources in reinforced concrete containers RCCSS and not completely discharged gamma irradiators in reinforced concrete containers RCCGIS are stored on the site. The site capacity is 171 RCCSS with 248 m^3 total volume, 6 “PEK” with 74 m^3 total volume and 18 StBGOU.

2.3.8 Site No. 4 for storage of low solid RAW

RAW is stored in 200-litre drums on Euro-pallets. The site capacity is 400 drums, respectively 100 Euro-pallets.

2.3.9 Receiving and preparation laboratory complex

For characterization and processing of solid RAW of categories 1, 2a and 2b and of liquid contaminated media. It includes following systems:

- a system for processing of liquid RAW;
- a system for cementation of liquid and solid RAW;
- a system for compaction of solid RAW in 200-litre drums;
- a system for abrasive decontamination;
- a system for ventilation and air-conditioning;
- a workplace for RAW sorting;
- a workplace for solid RAW fragmentation;
- a workplace for RAW pre-treatment;
- three rooms for RAW buffer storage;
- a laboratory complex.

3. INRNE FACILITIES FOR RAW MANAGEMENT – RESEARCH REACTOR IRT-2000

3.1 Storage facility for reactor equipment

For storage of the operational low level solid RAW, category 2. It has been set apart in a separate building – reinforced concrete structure with size 20x10 m, on the site of the IRT-2000. The capacity is in conformity with the operating lifetime of IRT-2000.

3.2 Site for storage of solid RAW in RCC

For storage of processed solid RAW category 2 from the reactor partial dismantling. RCC is used for the packaging of RAW. It has been set apart on the IRT-2000 site, immediately next to the storage facility for reactor equipment as a reinforced concrete site with size 16.7 x 6.5 m. A temporary tin roof is erected above the RAW packages. The capacity is 14 packages.

4. FACILITIES FOR MANAGEMENT OF RAW FROM THE CLOSED URANIUM MINING

4.1 Buchovo-1 tailings pond

It is located 1 km to the east of the town of Buchovo. From 1956 to 1960 it served the activity of the Metalurg hydrometallurgical plant, Buchovo. The tailings pond takes an area of 47 hectares and has a volume of 1.3 million m^3. About 171 thsd. m^3 of contaminated soil and percolation sands from the Metalurg hydrometallurgical plant site are stored in the storage facility. The tailings pond is filled, comparatively well compacted and partially recultivated.

4.2 Buchovo-2 tailings pond

It is located 1 km to the east of the town of Buchovo. Until 1992 it served the activity of the Metalurg hydrometallurgical plant, Buchovo. The tailings pond takes an area of 64 hectares and has a volume of 10 million m^3. Radioactive waste obtained from the technical liquidation of Metalurg plant are stored in trenches in the periphery of the tailings pond. The tailings pond is maintained in pre-liquidation state and is not in operation. A pump station for infiltrated water, which is in operation, was built.

4.3 Eleshnitsa tailings pond

The tailings pond is located 3 km to the south-east of the village of Eleshnitsa. Until 1997 it served the activity of the Zvezda hydrometallurgical plant in the village of Eleshnitsa.

It takes an area of 231 decares. In 2002/2003 the tailings pond was recultivated. A water treatment station for the drain water was built.

4.4 Plant for sorption treatment of uranium-contaminated mine water in the Chora sector

It is located near the town of Buchovo and intended for treatment of uranium-contaminated mine water formed from outflow of water from the outsets of the three of the adits and outflow of water from boreholes in the region. The water coming in for treatment has a flow rate of 800 m^3 to 2100 m^3 per day and uranium content of up to 1.9 mg/l. Main equipment of the plant:

- two pumping stations for the mine water;
- pressure tank with dimensions 10 x 39 x 2.5 m;
- two sorption columns with working volume of each of them of 25 m^3.

4.5 Plant for sorption treatment of uranium-contaminated mine water in the Byalata Voda sector

It is located 22 km to the west of the town of Kostenets, on the land of the village of Ochusha and intended for treatment of uranium-contaminated water formed from the barrage in the gully below the former waste banks, from the outset of an adit and from boreholes. The average flow rate of the water coming in gravitationally for treatment is 600 m^3/day. Main equipment of the plant:

- a barrage below the waste banks and heap leaching;
- a receiving shaft (sedimentation tank);
- a sorption column with volume of 28 m^3.

4.6 Plant for sorption treatment of uranium-contaminated mine water in the Iskra sector

It is located 10 km to the north-west of the town of Novi Iskar and intended for treatment of water flowing from the outset of an audit with a flow rate of about 25-30 m^3 per day and with uranium content of 1.4-4.5 mg/l, which comes in gravitationally for treatment. Main equipment of the plant:

- a sorption column with volume of 2 m^3;
- a container for water liming;
- a concrete sedimentation tank.

4.7 Plant for regenerative purification of ion-exchange resins

An integral part of the process flow diagram of sorption purification of uranium from mine water is the line for regenerative purification of ion-exchange resins (LRPIER). It is located in the territory of the former Zvezda uranium-processing plant, 2 km to the south of village of Eleshnitsa. The capacity of the line is 0.5 m^3/h regenerated resin.

The process flow diagram for regeneration of the anionite sorbents of AMP or Varion AP type includes:

- washing out from mechanical impurities of the saturated resin coming in;
- countercurrent regeneration of the sorbent with 110 g/l H_2SO_4 solution;

- extraction of uranium from the regenerating solution;
- re-extraction of the uranium and processing until production of crystalline ammonium uranyl tricarbonate $NH_4UO_2(CO_3)_3$.

Appendix L-4

RADIOACTIVE WASTE REPORT

1. KOZLODUY NPP PLC. FACILITIES FOR RAW MANAGEMENT

1.1 Auxiliary building-3

1.1.1. Solid RAW – category **2a**

RAW volume in RWSF as of 31.12.2016 – **444 m^3**

Physical components (vol. %) – metal (22%), wood (2%), polymers (20%), mixed (56%).

Processing

Performed processing – 1010 pre-compacted drums (210 l) have been submitted to SE RAW for processing.

	Processed waste (vol. %)	Volume reduction factor
Pre-compaction	100	3
Super-compaction		
Packing		
Unprocessed		

Radionuclide composition [Bq/kg]: ^{134}Cs – 2.10^4 , ^{58}Co – 2.10^4, ^{137}Cs – 6.10^4, ^{60}Co – 2.10^5

1.1.2 Solid RAW – category 2, additional category 2-III

RAW volume as of 31.12.2016 – **20 m^3**

Physical components – mainly metal RAW

1.1.3 Liquid RAW

Liquid radioactive concentrate – category 2a, additional category 2-C

RAW volume as of 31.12.2016 – **1565 m^3**

General description – the liquid radioactive concentrates have total salt content of 160 ÷220 g/l, boron acid concentration 20 ÷ 55 g/l, pH 10 ÷11. Presence of precipitated solid phase.

Radionuclide composition: ^{134}Cs – 4.7x10^6 Bq/dm^3, ^{137}Cs – 1.4x10^7 Bq/dm^3, ^{60}Co – 1.8x10^5 Bq/dm^3, ^{125}Sb – 1.6x10^5 Bq/dm^3.

1.1.4 Spent sorbents – category **2a**

RAW volume as of 31.12.2016 – **167 m^3**

General description – Spent organic sorbents. The activity levels vary considerably, depending on the sorbents sources. The sorbents are stored under water in tanks. Their physicochemical characteristics are similar to those of the initial sorbents. There is presence of small amounts of activated carbon. About 70 vol. % sorbent and about 30 vol. % water.

Radionuclide composition: ^{134} Cs – 3.63x10^4 Bq/dm^3, ^{137}Cs – 2.44x10^5 Bq/dm^3, ^{60}Co – 2.28x10^6 Bq/dm^3 , ^{54}Mn – 3.15x10^5 Bq/dm^3

2. SE RAW FACILITIES FOR RAW MANAGEMENT

2.1 SD Decommissioning - Kozloduy

2.1.1 Auxiliary building-1

2.1.1.1 Solid RAW – category 2a, additional categories 2-I and 2-II

RAW volume as of 31.12.2016 – **236** m^3

Physical components (vol. %) – metal (22%), wood (2%), polymers (20%), wool (0%), mixed (56%).

	Processed waste (vol. %)	Volume reduction factor
Pre-compaction	-	-
Super-compaction	-	-
Packing	-	-
Unprocessed	100	-

2.1.1.2 Liquid RAW

Liquid radioactive concentrate – category 2a, additional category 2-C

RAW volume as of 31.12.2016 – **2170 m^3**

General description – Liquid radioactive concentrates with total salt content of the decantate of 28-35%, boron acid concentration up to 4%, pH 7-9 for the individual tanks. Presence of precipitated solid phase, mainly sodium borates, sludge and precipitates.

Radionuclide composition: ^{134}Cs, ^{137}Cs, ^{60}Co, ^{54}Mn, ^{58}Co and ^{110m}Ag have been recorded in the decantate. In the majority of cases, the first three radionuclides have been recorded, and for the remaining ones the specific activities are below the minimum detectable ones under the measurement conditions. The recorded activities are within following ranges: ^{134}Cs – $5x10^4$ – $2x10^6$ Bq/l, ^{137}Cs – $1x10^6$ – $4x10^7$ Bq/l, ^{60}Co – $3x10^4$ – $1x10^6$ Bq/l.

2.1.1.3 Spent sorbents – category 2

RAW volume as of 31.12.2016 – **209 m^3** (HLST – 92 m^3; LLST – 117 m^3)

General description – Spent organic and inorganic sorbents. The activity levels vary considerably, depending on the ratio of the sorbents from different sources. The sorbents are stored under water in tanks. They are distributed homogeneously in the volume and are easily transported. Their physicochemical characteristics are similar to those of the initial sorbents that are used in the operational activity. About 70 vol. % sorbent and about 30 vol. % water.

Radionuclide composition:

Spent sorbents in LLST of AB-1: ^{134}Cs – $1x10^5 \div 9x10^5$ Bq/kg, ^{137}Cs – $6x10^6 \div 3x10^7$ Bq/kg, ^{60}Co – $1x10^5 \div 5x10^6$ Bq/kg.

The radionuclide inventory of RAW in HLST includes the same radionuclides with activities respectively: ^{134}Cs – $5x10^5 \div 3x10^6$ Bq/kg, ^{137}Cs – $6x10^6 \div 6x10^7$ Bq/kg, ^{60}Co – $5x10^6 \div 8x10^6$ Bq/kg.

Inspection for assessment of the difficult-to-measure radionuclides is coming.

2.1.2 Auxiliary building-2

2.1.2.1 Solid RAW – category 2a, additional categories 2-I and 2-II

RAW volume as of 31.12.2016 – **290 m^3**

Physical components (vol. %) – textile (4%), metal (1%), chips (1%), wood (4%), construction debris (0%), polymers (42%), wool (1%), rubber (0%), paper (0%), mixed (47%).

Processing

Performed processing – 1313 drums (200 l)

	Processed waste (vol. %)	Volume reduction factor
Pre-compaction	-	-
Super-compaction	54.5	7
Packing	-	-
Unprocessed	45.5	-

2.1.2.2 Liquid RAW

Liquid radioactive concentrate – category 2a, additional category 2-C

RAW volume as of 31.12.2016 – **1920 m^3**

General description – Liquid radioactive concentrates with salt content of 8 – 35 %, boron acid concentration 20-75 g/l, pH 7-9 for the individual tanks. Presence of precipitated solid phase, mainly sodium borates, sludge and precipitates.

Radionuclide composition: In the majority of cases, the first three radionuclides have been recorded, and for the remaining ones the specific activities are below the minimum detectable ones under the measurement conditions. The recorded activities are within following ranges: ^{134}Cs – 1x10^4 – 2x10^6 Bq/l, ^{137}Cs – 6x10^6 – 4x10^7 Bq/l, ^{60}Co – 6x10^4 – 1x10^6 Bq/l.

2.1.2.3 Spent sorbents – category 2a

RAW volume as of 31.12.2016 – **266 m^3** (HLST – 119 m^3; LLST – 147 m^3)

General description – Spent organic and inorganic sorbents. The activity levels vary considerably, depending on the ratio of the sorbents from different sources. The sorbents are stored under water in tanks. They are distributed inhomogeneously in the volume and are easily transported. The physicochemical characteristics are similar to those of the initial sorbents that are used in the operational activity. About 70 vol. % sorbent and about 30 vol. % water.

Radionuclide composition: The radionuclide composition of the spent sorbents in LLST is: ^{134}Cs – 4x10^5 – 6x10^5 Bq/kg, ^{137}Cs – 6x10^5 – 4x10^7 Bq/kg, ^{60}Co – 3x10^5 – 9x10^6 Bq/kg.

The radionuclide inventory in HLST includes the same radionuclides with activities respectively: ^{134}Cs – 4x10^5 – 3x10^6 Bq/kg, ^{137}Cs – 6x10^6 – 1x10^7 Bq/kg, ^{60}Co – 2x10^6 – 7x10^6 Bq/kg.

2.1.3 At-reactor RAW storage facility of Units 1&2

2.1.3.1 Solid RAW – category 2, additional category 2-III, with dose rate above 10 mSv/h per contact.

RAW volume as of 31.12.2016 – **52 m^3**

2.1.4 At-reactor RAW storage facility of Units 3&4

2.1.4.1 Solid RAW – category 2, additional category 2-III, with dose rate above 10 mSv/h per contact.

RAW volume as of 31.12.2016 – **32 m^3**

2.2 SD RAW – Kozloduy

2.2.1 Storage facility for conditioned RAW

Solid RAW – category **2**a, additional categories 2-I and 2-II

Number of packages stored as of 31.12.2016.

• *Package of conditioned RAW, type*	• *Number of packages*
RCC-1	336
RCC-3	1153
RCC-2	88
Total	1577

Radionuclide composition of the conditioned RAW in RCC-1, [Bq/kg]:

$^{54}Mn – 4x10^{2}$	$^{134}Cs – 8x10^{2}$
$^{60}Co – 3x10^{4}$	$^{137}Cs – 4x10^{4}$

Radionuclide composition of the conditioned RAW in RCC-3, [Bq/kg]:

$^{54}Mn – 3x10^{2}$	$^{110m}Ag – 1x10^{2}$
$^{57}Co – 2x10^{1}$	$^{134}Cs – 2x10^{5}$
$^{60}Co – 2x10^{5}$	$^{137}Cs – 1x10^{7}$

Radionuclide composition of the conditioned RAW in RCC-2, [Bq]:

$^{54}Mn – 8x10^{8}$	$^{110m}Ag – 5x10^{7}$
$^{59}Fe – 1x10^{5}$	$^{134}Cs – 7x10^{8}$
$^{58}Co – 2x10^{6}$	$^{137}Cs – 4x10^{10}$
$^{60}Co – 6x10^{10}$	$^{95}Nb – 4x10^{5}$

2.2.2 Trench storage facility

Solid RAW – category 2a, additional categories 2-I and 2-II

RAW volume as of 31.12.2013 – **2035 m^3**

Physical components (vol. %) of RAW – textile (28.02%), metal (6.74%), chips (0.21%), wood (2.45%), construction debris (7.48%), polymers (1.7%), wool (5.25%), rubber (0.23%), paper (0.04%), mixed (47.88%).

Processing

Super-compacted – 2031 m^3
Packed in 210-litre drums – 4.20 m^3
Unprocessed – 0 m^3

	Stored waste (vol. %)	Volume reduction factor of the source RAW
Pre-compaction	-	-
Super-compaction	99.79	7
Packing	0.21	3
Unprocessed	-	-

Radionuclide composition of the processed RAW, [Bq/kg]:

$^{54}Mn – 7x10^{2}$	$^{110m}Ag – 4x10^{2}$
$^{59}Fe – 2x10^{2}$	$^{134}Cs – 6x10^{2}$

$^{58}Co - 3x10^{2}$	$^{137}Cs - 3x10^{4}$
$^{60}Co - 3x10^{4}$	$^{95}Nb - 3x10^{2}$

2.2.3 Storage facility for processed solid RAW

Solid RAW – category 2a, additional categories 2-I and 2-II

RAW volume as of 31.12.2016 – **261 m^3**

Physical components (vol. %) – textile **(**8%**)**, metal (29%), construction debris (20%), wool (14%), mixed (29%).

Processing

	Processed waste (vol. %)	Volume reduction factor of the source RAW
Pre-compaction	-	-
Super-compaction	100	7
Packing	-	-
Unprocessed	-	-

2.2.4 Sites (No. 1 and No. 2) for storage of solid RAW in reinforced concrete containers

Solid RAW – category 2a, additional categories 2-I and 2-II

Number of packages stored as of 31.12.2016 – RCC-2 – **342** on Site No. 2

Physical components (vol. %) – 200-litre drums with solid RAW super-compacted and immobilized in concrete non-radioactive matrix.

Radionuclide composition, [Bq]:

$^{54}Mn - 2x10^{8}$	$^{134}Cs - 2x10^{9}$
$^{60}Co - 4x10^{10}$	$^{137}Cs - 7x10^{10}$
$^{110m}Ag - 7x10^{7}$	

2.2.5 Site for storage of solid RAW in freight containers

Solid RAW – category 2a, additional category 2-I

RAW volume as of 31.12.2016 – **292 m^3**

Physical components (vol. %) – textile (44,69%), metal (19.89%), construction debris (32.89%), wool (0.07%), mixed (2.45%).

Processing

	Processed waste (vol. %)	Volume reduction factor of the source RAW
Pre-compaction	81	3
Super-compaction	-	-
Packing	-	-
Unprocessed	19	-

Radionuclide composition of the processed RAW, [Bq/kg]:

$^{54}Mn - 2x10^{3}$	$^{134}Cs - 5x10^{2}$
$^{60}Co - 6x10^{3}$	$^{137}Cs - 8x10^{3}$

-

2.3. SE RAW – Novi Han SD

2.3.1 Storage facility for solid RAW

Volume of **RAW** stored as of 31.12.2016 – **71 m^3**.

Radionuclide	**Activity, [**Bq]
H-3	1x10^{11}
C-14	4x10^{11}
Co-60	2x10^{11}
Sr-90	6x10^{11}
Cs-137	3x10^{12}
Total activity	4x10^{12}

2.3.2 Storage facility for biological RAW

Volume of **RAW** stored as of 31.12.2016 – **64 m^3**.

Radionuclide	**Activity, [**Bq]
H-3	5x10^{9}
C-14	1x10^{10}
Co-60	2x10^{9}
Sr-90	1x10^{10}
Cs-137	8x10^{10}
Total activity	2x10^{11}

2.3.3 Storage facility for sealed sources

Volume of **RAW** stored as of 31.12.2016 – **0.65 m^3**.

Radionuclide	**Activity, [**Bq]
Co-60	1x10^{12}
Sr-90	5x10^{10}
Cs-137	4x10^{13}
Ra-226	6x10^{11}
Pu-239	2x10^{11}
Total activity	5x10^{13}

2.3.4 Engineering trench for solid RAW

Volume of **RAW** stored as of 31.12.2016 – **160 m^3**.

Radionuclide	**Activity, [**Bq]

Co-60	$4x10^{10}$
Sr-90	$1x10^{11}$
Cs-137	$5x10^{11}$
Total activity	$6x10^{11}$

2.3.5 Storage facility for liquid RAW

Volume of liquid **RAW** stored as of 31.12.2016 – **12 m^3**.

Radionuclide	**Activity, [**Bq]
Co-60	$4.35x10^{6}$
Cs-137	$7.50x10^{7}$
Sr-90	$3.60x10^{5}$
H-3	$1.81x10^{7}$
Alpha emitters	$1.89x10^{5}$
Total activity	$9.80x10^{7}$

2.3.6 Site No. 1 and 1A for storage of solid RAW

- **Volume** of solid **RAW** stored as of 31.12.2016 – **250 m^3** in 13 standard RWCs.

Radionuclide composition of the stored RAW as of 31.12.2016.

Radionuclide	**Activity, [**Bq]
Am-241	$5.19x10^{11}$
Am-Be	$1.52x10^{12}$
Ba-133	$1.17x10^{4}$
C-14	$3.71x10^{8}$
Cl-36	$1.61x10^{2}$
Cm-244	$1.64x10^{9}$
Co-57	$3.18x10^{6}$
Co-60	$2.58x10^{12}$
Cs-137	$5.71x10^{11}$
Kr-85	$1.94x10^{11}$
Na-22	$2.85x10^{9}$
Pm-147	$1.54x10^{10}$
Pu*	$2.71x10^{12}$
Pu-239	$5.12x10^{10}$
Pu-Be	$5.02x10^{10}$
Ra-226	$1.48x10^{8}$

Sr-90	$1.29x10^{11}$
U-238	$6.24x10^{9}$
Total activity	$8.35x10^{12}$

- **Volume** of solid **RAW** stored as of 31.12.2016 – **8.99 m^3**, in 4 standard containers of RCCSS type.

Radionuclide	**Activity, [**Bq]
Am-Be	$3.22x10^{1}$
Pu-Be	$1.48x10^{1}$
Total activity	$3.37x10^{1}$

2.3.7 Site No. 2 for storage of solid RAW

Type of storage facility units: PEK – 3; RCC – 15; RCCGIS – 13; RCCSS – 45.

Radionuclide composition of the stored RAW as of 31.12.2016.

Radionuclide	**Activity, [**Bq]
Am-241	$3.07x10^{12}$
C-14	$8.59x10^{10}$
Co-60	$4.11x10^{14}$
Cs-137	$1.41x10^{15}$
Pu-Be	$6.47x10^{7}$
Pu*	$1.41x10^{10}$
Ra-226	$5.36x10^{10}$
Sr-90	$1.10x10^{11}$
Total activity	$1.82x10^{15}$

- **Radionuclide composition** of the solid RAW stored in storage facility units of **PEK** type as of 31.12.2016.

Radionuclide	**Activity [**Bq]
Cs-137	$2.04x10^{8}$
Pu-239/Be	$6.47x10^{7}$
Total activity	$2.69x10^{8}$

- **Radionuclide composition** of the solid RAW stored in storage facility units of **RCC** type as of 31.12.2016.

Radionuclide	**Activity [**Bq]
Am-241	$1.55x10^{12}$
Co-60	$2.16x10^{14}$
Cs-137	$1.05x10^{15}$
Kr-85	$2.13x10^{10}$
Pu*	$1.67x10^{8}$
Pu-238	$1.14x10^{10}$
Ra-226	$9.47x10^{7}$
Sr-90	$5.76x10^{10}$
Total activity	$2.69x10^{8}$

- **Radionuclide composition** of the solid RAW stored in storage facility units of **RCCGIS** type as of 31.12.2016.

Radionuclide	**Activity [**Bq]
Co-60	$1.27x10^{14}$
Cs-137	$3.92x10^{14}$
Total activity	$5.19x10^{14}$

- **Radionuclide composition** of the solid RAW stored in storage facility units of **RCCSS** type as of 31.12.2016.

Radionuclide	**Activity [**Bq]
Am-241	$1.52x10^{12}$
C-14	$8.60x10^{10}$
Co-60	$6.74x10^{13}$
Cs-134	$8.46x10^{6}$
Cs-137	$9.70x10^{12}$
Eu-152	$4.12x10^{8}$
Fe-55	$4.65x10^{6}$
H-3	$1.88x10^{8}$
Kr-85	$2.09x10^{10}$

Pm-147	$2.45x10^{7}$
Pu-239	$3.71x10^{7}$
Pu*	$1.34x10^{10}$
Ra-226	$3.04x10^{4}$
Sr-90	$1.00x10^{12}$
Tl-204	$2.13x10^{8}$
Total activity	$7.97x10^{13}$

2.3.8 Site No. 4 for storage of low active RAW

- **Volume** of **RAW** stored as of 31.12.2016 – **47 m^3**.

-

Radionuclide	**Activity [**Bq]
Am-241	$8.96x10^{9}$
Cm-244	$8.00x10^{9}$
Pm-147	$2.00x10^{9}$
Co-60	$3.00x10^{13}$
Cs-137	$3.00x10^{12}$
H-3	$2.00x10^{9}$
Pu*	$2.51x10^{8}$
Sr-90	$2.00x10^{9}$
Ra-226	$8.64x10^{8}$
Total activity	$3.30x10^{13}$

-

2.3.9 Hot cell

Specialized container SK 180-4 for Cs-137 and specialized container SK 220-1 for Co-60.

Radionuclide composition of the stored solid RAW as of 31.12.2016.

Radionuclide	**Activity [**Bq]
Cs-137	$1.42x10^{13}$
Co-60	$2.74x10^{11}$
Total activity	**$1.45x10^{13}$**

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3. INRNE - BAS

3.1 Storage facility for reactor equipment

Solid RAW – category **2a**

RAW quantity as of 31.12.2013 – two heat exchangers and five mechanical and ion-exchange filters from 1 circulation loop of IRT-2000.

Physical components (vol. %) – mainly metal RAW generated during the partial dismantling of IRT-2000; contaminated working clothes, personal protective equipment and materials and consumables from repair work.

Processing

Performed processing – sorting in 6 drums (200 l)

3.2 Site for storage of solid RAW in RCC

Solid RAW – category **2a**

RAW quantity as of 31.12.2013 – 9850 kg.

Physical components (vol. %) – mainly metal RAW generated during the partial dismantling of IRT-2000 – steel, aluminium and iron, smaller quantities of graphite, concrete, rubber and plastics.

Processing

Performed packing in 6 containers of RCC type

Radionuclide composition – mainly Co-60, C-14, Eu-152.

4. Uranium mining sites

4.1 Buchovo-1 tailings pond

Quantity of stored RAW – 1.3 million m^3 tailings.

4.2 Buchovo-2 tailings pond

Quantity of stored RAW – 10 million m^3 equal to 4.5 million tons of tailings and certain amount of solid RAW from the liquidation of the Metalurg hydrometallurgical plant, Buchovo.

4.3 Eleshnitsa tailings pond

Quantity of stored RAW – 9.0 million tons of tailings, of which 7.680 million tons of solid waste, 1700 m^3 of spent ion-exchange resins and unknown amount of solid RAW from the liquidation of the Zvezda hydrometallurgical plant, Eleshnitsa.

Estimated activity – $1.5x10^{15}$ Bq.

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. PROTOCOL ADDITIONAL (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. PROTOCOL ADDITIONAL 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.

3. Secondary Legislation

3.1. REGULATION on Basic Norms of 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 Acquiring a Professional Qualification and on the Procedure for the Issuance of Licenses for Specialized Training and Certificates of Competence in Nuclear Energy Use;
3.14. REGULATION on Emergency Planning and Emergency Preparedness in the Case of a Nuclear or Radiologycal Emergencies;
3.15. REGULATION on the Assurance of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances;
3.16. REGULATION on the Terms and Procedure for Establishing Zones of Special Status around Nuclear Facilities and Facilities with Sources of Ionizing Radiation;
3.17. 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;
3.18. REGULATION on Safety Assurance of Research Nuclear Installations;
3.19. REGULATION on the Terms and Procedure for Transport of Radioactive Materials;
3.20. REGULATION No. 1 of 15.11.1999 on Standards for Radiation Protection and Safety in the Elimination of the Consequences from Uranium Mining in the Republic of Bulgaria;
3.21. REGULATION on the Terms and Procedure for Implementation of Environmental Impact Assessment;
3.22. RULES OF ORGANIZATION of the Nuclear Regulatory Agency;
3.23. Regulation on the Procedure for Payment of the Fees pursuant to the Act on the Safe Use of Nuclear Energy;
3.24. Tariff for the Fees Collected by the Nuclear Regulatory Agency pursuant to the Act on the Safe Use of Nuclear Energy;
3.25. Regulation No. 9 of 21.03.2005 on the Terms and Procedure for Establishing and Maintaining a Public Register of the Sites of Public Use Controlled by the Regional Health Inspectorates;
3.26. REGULATION on Radiation Protection during Activities with Materials with Increased Content of Natural Radionuclides;
3.27. REGULATION on Radiation Protection during Activities with Sources of Ionizing Radiation.

Appendix L-6

HUMAN AND FINANCIAL RESOURCES IN THE MANAGEMENT OF SF AND RAW

I. Human Resources

Pursuant to the requirements of the ASUNE, the management of radioactive waste and spent fuel is performed only after obtaining a permit and/or a licence from the Nuclear Regulatory Agency for the safe performance of this activity.

The license holders are fully responsible for ensuring the safety of the facilities and activities. The responsibilities of the organizational units and the responsible officials in the Kozloduy NPP during operation of the nuclear facilities are clearly assigned and documented.

In fulfilment of these requirements of ASUNE, the license holders have a developed and functioning system for the selection and training of personnel.

To provide qualified and competent personnel, a selection system is applied that requires the following, namely:

- Checking the health status and permission to work in an environment of ionizing radiation, which is performed by own occupational health service.

- Conducting of psychophysiological examinations for establishing compliance of the personal qualities of the candidates for operational personnel working with RAW and SNF with the necessary requirements for occupying the position in question and issuing a certificate of competence – performed by qualified psychologists. The Ministry of Health provides methodological guidance for this process.

- Conducting of professional selection – checking the compliance of the applicants with the requirements of the job description for the level of education, the acquired specialty guaranteeing a minimum of acquired knowledge and the required working experience.

The job descriptions have been prepared in accordance with the requirements of the Regulation on the Terms and Procedure for Acquiring a Professional Qualification and on the Procedure for the Issuance of Licenses for Specialized Training and Certificates of Competence in Nuclear Energy Use and include the functions related to the safe operation of nuclear facilities, the minimum necessary knowledge in the field of nuclear energy use, nuclear safety and radiation protection and the necessary qualification.

To implement the specialized training and to maintain the qualification of the personnel, Kozloduy NPP has its own Training Centre and holds a licence for specialized training.

The activities on management of RAW and SNF are provided with a sufficient and qualified personnel. The specific positions, the number and the required minimum educational degree for holding the position are determined in the staffing tables of the licensees.

As of March 2013, the attending personnel of Units 3&4 of Kozloduy NPP was transferred to SE RAW – SD RAW Management Units 3&4.

As of the beginning of 2014, the personnel of Units 1&4 has been included in the structure of the SE RAW – SD Decommissioning.

II. 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 State 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 Fifth 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 2014 to 30 June 2017, the contributions of the Kozloduy NPP to the funds and the expenditure are given in Table 1 and Table 2.

Table 1. Contributed/spent amounts by Kozloduy NPP from RAW fund

Year	Contributed, BGN	Spent, BGN
2014	24,553,971	0
2015	24,828,258	0
2016	24,183,511	0
as of 30.06.2017	12,588,331	0
Total:	**86,154,071**	**0**

Table 2. Contributed/spent amounts by Kozloduy NPP from DNF fund

Year	Contributed, BGN	Spent, BGN
2014	61,384,926	0
2015	62,070,645	0
2016	60,426,971	0

Year	Contributed, BGN	Spent, BGN
as of 30.06.2017	31,470,827	0
Total:	**215,353,369**	**0**

Other sources of financing

The activities on decommissioning are financed mainly by the Kozloduy International Decommissioning Support Fund (Kozloduy International Fund - KIF) 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 KIF 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.

Appendix L-7

Classification of RAW pursuant to the Regulation for safe management of radioactive waste

A classification of RAW is introduced, which is based on the separation of solid RAW into categories and subcategories and is aimed at their long-term safe management and disposal.

In compliance with its activity and specific characteristics, solid RAW are classified as follows:

Category 1 – waste containing radionuclides with low activity, which do not require the implementation of measures for radiation protection or do not need a high level of isolation and containment; RAW of this category is additionally subdivided into:

category 1a – waste that meets the levels for exemption from regulatory control under ASUNE;

category 1b – very short-lived waste containing mainly radionuclides with short half-life (not more than 100 days), whose activity decreases below the levels for exemption from regulatory control under ASUNE as a result of appropriate storage on the site for a limited period of time (usually not more than several years);

category 1c – very low level waste with levels of specific activity exceeding by a minimal value the levels for exemption from regulatory control under ASUNE and with a very low content of long-lived radionuclides, which represent a limited radiological risk; for this category of waste, the application of specific measures for radiation protection or for isolation and containment is not required;

Category 2 – low and intermediate level waste: RAW containing radionuclides in concentrations that require measures for reliable isolation and containment, but do not require special measures for heat removal during storage and burial; RAW of this category is additionally subdivided into:

category 2a – low and intermediate level waste containing mainly short-lived radionuclides (with a half-life not longer than that of caesium-137) 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 value 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;

category 2b – low and intermediate level waste containing long-lived radionuclides at activity levels of long-lived alpha emitters, exceeding the limits for category 2a;

Category 3 – high level waste: RAW with such a concentration of radionuclides at which heat release must be taken into account during storage and burial; for this category, a higher level of isolation and containment, compared to the low and intermediate level waste, through burial in deep, stable geological formations is needed.

This classification is also applied to liquid and gaseous RAW depending on the characteristics and the form of the solid RAW suitable for disposal, that is expected to be generated after the conditioning of liquid and gaseous waste. When no technology for conditioning of liquid or gaseous RAW is available in the country, the classification shall be made, taking into account the best modern technologies for conditioning.

This classification does not take into account the non-radioactive hazardous constituents of the waste and their potential non-radiological impact.