THE REPUBLIC OF BULGARIA

THIRD NATIONAL REPORT

ON FULFILLMENT OF THE OBLIGATIONS

ON THE JOINT CONVENTION ON

THE SAFETY OF SPENT FUEL MANAGEMENT AND ON

THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Sofia, September 2008

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TABLE OF CONTENT

List of Abbreviations

AB – Auxiliary Building

ASUNE - Act On The Safe Use Of Nuclear Energy

BAS – Bulgarian Academy Of Science

BNRP – Regulation On The Basic Norms For Radiation Protection

CA – Controlled Area

CRAWS – Conditioned Radioactive Waste Storage Facility At The SE RAW – Kozloduy SD

DSFSF - Dry Spent Fuel Storage Facility

EBT – Emergency Boric Acid Tank

EC – Evaporator Concentrate (Liquid Radioactive Concentrate)

EIA - Environmental Impact Assessment

EPA – Environmental Protection Act

FSAR – Final Safety Analysis Report

HLRAW – High Level Radioactive Waste

HLST – High Level Sorbent Tank

IAEA – International Atomic Energy Agency

INRNE – Institute Of Nuclear Research And Nuclear Energy

ISAR – Intermediate Safety Analysis Report

LLST – Low Level Sorbent Tank

NCRBRP – National Centre for Radiobiology And Radiation Protection

NF – Nuclear Facility

NPP – Nuclear Power Plant

NRA –Nuclear Regulatory Agency

PD – Personal Dosimetry

PP – Power Production Of Kozloduy NPP

QMS – Quality Management System

RAW – Radioactive Waste

RAWPW – Radioactive Waste Processing Workshop At The SE RAW – Kozloduy SD

RCC – Reinforced Concrete Container

RCCGIS - Reinforced Concrete Container For Gamma Irradiator Storage

RCCSS – Reinforced Concrete Container For Spent Sources Storage

RH – (Central) Reactor Hall

RPLC – Receipt And Preparation Laboratory Complex At SE RAW – Novi Han SD

RR – Research Reactor

SAR – Safety Analysis Report

SE RAW – Kozloduy SD – SE RAW – Kozloduy Specialized Department

SE RAW – Novi Han SD - SE RAW – Novi Han Specialized Department

SE RAW – State Enterprise “Radioactive Waste”

SF – Spent Fuel

SFP – Spent Fuel Pond

SFSF – Spent Fuel Storage Facility (Wet Type)

SIR – Sources Of Ionising Radiation

WWER – Water Cooled Water Moderated Energy Reactor

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 as of 18 June 2001.

In fulfilment of its responsibilities as a party to the Joint Convention, in 2003 the Republic of Bulgaria prepared its First National Report that demonstrated 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 National Report of the Republic of Bulgaria presented the progress made by the country in the implementation of the Convention requirements over the period from the first progress review meeting. The Report emphasized the changes occurring in the regulatory basis, the national infrastructure of spent fuel (SF) and radioactive waste (RAW) management and the status of the facilities. The Report took into account the Recommendations made to our country during the first meeting reviewing the obligations towards the Joint Convention.

The purpose of this Third National Report of the Republic of Bulgaria on the Joint Convention is to describe the progress made through implementing the Convention provisions over the period since the second review meeting. One of the goals during the preparation of the Report was to avoid repeating information already included in the first two reports and to highlight the practical implementation of the normative and regulatory legislation in the management of spent nuclear fuel and radioactive waste. Special attention was paid on the questions addressed to our country at the second progress review meeting dedicated on how the country had implemented its obligations ensuing from the Convention.

The ASUNE and the secondary legislation regarding its application have governed the public relations as regards the safety of spent nuclear fuel management and radwaste management. Over the period since the first two reviews on the implementation of the Convention obligations special attention has been paid on the application in practice of the regulations and identification of the changes they require through drafting of regulatory guides. While preparing amendments to the ASUNE, the regulations and the guide drafts all the best international practices have been taken into consideration as well as the recommendations ensuring the observance of internationally approved principles such as: Maintaining the exposure as low as reasonably achievable, clear assigning of responsibilities regarding the use of nuclear energy and the management of SF and RAW, minimization of the RAW generation, considering the interdependence between the separate stages in the management of SF and RAW, implementing the defence in depth principle for nuclear facilities (NF), improvement of the radiation protection and the emergency planning.

On 1 January 2007 Bulgaria became a member of the European Union and since then the national nuclear programme has developed within the framework of the acquis communautaire and in cooperation with the European institutions. Harmonization of the national legislation with the EU one has been undertaken and representatives of the Republic of Bulgaria have already taken part in the work of a number of organizations, commissions and work groups dealing with the problems of safety within the frames of the union. The obligations to inform the European Commission about the implementation of the requirements of the acquis communautaire have been observed. A document entitled National Report on the Radiation Protection in the Republic of Bulgaria has been drafted to present the current status of radiation protection in our country, the existing problems in this area and the actions required for their resolution. By the end of 2009 it has been envisaged to develop, revise and update a total of 18 regulatory documents on radiation protection, including making amendments to the ASUNE.

Over the period following the submission of the Second national Report an Order has been issued approving the selected site for Belene NPP together with design permits for units 1 and 2.

In 2008 the design for the Dry Spent Fuel Storage Facility (DSFSF) on site of Kozloduy NPP was approved and a construction permit for the facility was issued.

During the reporting period a joint project was completed among Bulgaria, the Russian Federation, USA and IAEA regarding removal of spent nuclear fuel from the research reactor site. In July 2008 the Russian Federation received back the whole quantity of SF from the research reactor IRT-2000 at the Bulgarian Academy of Science (BAS), stored over the period from the reactor's commissioning in 1961 until its shut-down in 1989.

Re-structuring of SE RAW has been complete by assigning to it the SE RAW – Novi Han SD, in compliance with the provisions in the ASUNE. The enterprise consists of a Headquarters Office and three specialised departments (SD) responsible, respectively, for RAW processing and storage on-site of Kozloduy NPP (KNPP), for processing and storage of institutional RAW at the storage facility near Novi Han, and for implementation of the activities related to the construction of a national radwaste repository.

In 2005 the Bulgarian Government took a decision to build a national repository for low and intermediate level waste by 2015. In the reporting period the SE RAW was issued a permit for selecting a site for the RAW National Repository. Currently, there is a procedure in progress for the characterisation of 5 potential sites.

In 2006 the Nuclear Regulatory Agency issued an operating licence to SE RAW – Novi Han SD for a term of 5 years, and in 2008 the operating licence of SE RAW – Kozloduy SD has been renewed valid for 7 years.

International cooperation in the field of SF and RAW management is of particular significance for the Republic of Bulgaria. Close contacts have been established with the regulatory authorities of the EU member countries. The Bulgarian government institutions, scientific organizations and operators of nuclear facilities generating SF and RAW have taken part in a number of international initiatives related to SF and RAW management. The programmes of IAEA and the European Commission have been of particular importance and significance to us and our country will continue to participate in them.

This Report has been drafted in compliance with the Guidelines Regarding The Form And Structure Of National Reports, INFCIRC/604, 19 July 2006. Section B describes the policies and practices in the Republic of Bulgaria regarding management of SF and RAW, in accordance with the requirements of article 32, paragraph 1 of the Convention. Section C presents the understanding of the Republic of Bulgaria for implementing the scope of the Convention to the situation in our country. Section D contains data on the facilities for management of SF and RAW and accounting of SF and RAW as provided in article 32, paragraph 2. The application of Convention articles 4 through 28 is described in Sections E through J. Section K reports on the fulfillment of safety enhancement activities planned in the first two National Reports and it also lists the future actions scheduled. Section L contains annexes to the Report that provide more detail on some of the issues dealt with.

SECTION B. POLICIES AND PRACTICES

ARTICLE 32. REPORTING (paragraph 1)

"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 practices;

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

Bulgarian policy of SF and RAW management

The policy of the Republic of Bulgaria regarding the management of SF and RAW is defined in the ASUNE and the Environmental Protection Act.

The SF and RAW management policy comes down to as follows:

- Ban on RAW import to the country except for the cases defined in the ASUNE;
- Assigning of responsibility to the entities generating RAW for the safe management of radwaste until it has been transferred to the RAW State Enterprise;
- The RAW generating organizations shall incur the costs for waste management including its final disposal;
- RAW management outside the sites where they are generated is assigned to the Radwaste State Enterprise;
- In the case of RAW with unknown owner, it is the state that bears the responsibility for its management;
- SF management is carried out only by entities that have received an operating licence for a nuclear facility;
- SF may be declared to be RAW when conditions are available for its safe storage and disposal in the respective repository, and provided that the operating organization has made the appropriate payment to the RAW Fund.

The policy of the Republic of Bulgaria regarding the management of SF and RAW has been based on the moral principle of avoiding to impose undue burdens on future generations. Initially, the principles of RAW and SF management were defined in the National Strategy of Spent Nuclear Fuel and Radioactive Waste Management, in 1999, and later in the Strategy for Spent Nuclear Fuel and Radioactive Waste Management, approved in 2004 By the Ministerial Council. These documents also identify the strategic tasks before our country in the field of radwaste management, including the time schedules for site selection and construction of a facility for final disposal of low and intermediate level waste, and for preliminary studies regarding a high level waste repository. The Strategy offers solutions for flexible and effective management of the spent nuclear fuel and the radioactive waste in conformity with the requirements for health and environmental protection. The Republic of Bulgaria has been oriented to a fuel cycle in which the activities of the initial stage (fresh fuel production) and the final stage (processing of SF and its waste) are performed outside the territory of the country.

The Goals and actions identified in the Strategy are based on an analysis of the current status and expert assessments of future trends. In the process of defining the actions due consideration has been given to the operating experience of Bulgarian organizations taking part in the SF and RAW management process, internationally approved practices and currently effective regulatory requirements.

The SF management goals shown in the Strategy are based on the search for balance among economy, social aspects and environmental impact. A conservative analysis has been made on the funding necessary for SF management and two alternatives have been compared processing and long-term storage followed by direct disposal. Results from this analysis show that direct disposal is impossible to implement in the medium term. The Strategy defines as the most acceptable option the alternative of transporting SF outside the Kozloduy NPP site to be further technologically stored and processed outside of the country. The reasons for this are that the alternative is technically feasible, based on approved technologies and is financially ensured, while also avoiding the imposing of undue burden on future generations. It is envisaged to remove all spent nuclear fuel from the KNPP site by 2040.

The dry spent fuel storage facility casks may be used to store high level waste from the spent fuel processing.

By 2012 a concept will have been developed for HLW final disposal, detailed study of the waste characteristics, the geological restrictions and the existing conditions for building a repository in our country.

SF management practices

SF from nuclear power plants

The design requirement at KNPP is that SF is stored for a period of three years in the reactor ponds, following which it is transported back to Russia for processing. In 1985 a decision was passed that the reactor pond storage period for SF from WWER reactors should be increased from 3 to 5 years. This necessitated the construction of a wet storage facility on-site of Kozloduy NPP and it was commissioned in 1989.

In 1988, SF from WWER-440 was returned for the last time to Russia under the old contract conditions (free of charge), and since then all the SF from units 1-4 has been mainly transferred to the wet storage facility (SFSF) for temporary storage.

For the return of spent nuclear fuel from KNPP units 1-6 (initially supplied as fresh nuclear fuel up to 2002) long-term framework agreements were signed with the Russian company OAO Techsnabexport in 1998 for WWER-440 and in 2000 for WWER-1000; currently spent fuel is regularly transported to Russia under these contracts. For the SF originally supplied as fresh fuel after 2002, contracts have been placed with the Russian company OAO TVEL. By 31.07.2008 a total of 2367 (1408+959) spent fuel assemblies have been transported under the two long-term agreements (for SF from WWER-440 and WWER-1000).

The Nautilus barge transports SF for processing in Russia. The barge is suitably equipped to transport 8 containers loaded with SF from WWER-440 (240 assemblies) and WWER-1000 (96 assemblies).

The SF from units 1-4 is stored in the spent fuel ponds by the time it is transferred to the SFSF or to Russia. The SFP for WWER-440 assemblies is designed in two rows of racks: the upper row can be dismantled, while the lower one is fixed. Currently, units 1-4 hold operational licences for operation in E mode - storage of SF in the reactor ponds. The fuel in reactor ponds 1 and 2 is placed on one row of racks and they will be fully emptied by the end of 2008. The fuel in reactor ponds 3 and 4 occupies two rows of racks and it will be removed by the end of 2009.

SF from units 5 and 6 is being stored in reactor ponds 5 and 6 pending its transport to Russia or the SFSF . The ponds are located in the containment of the respective unit. They consist of 4 parts and are physically separated by partition walls. Three bays are allocated for immediate storage of the spent assemblies, while the fourth bay is used for transport and handling operations with fresh and spent fuel. The racks and hermetic panels for placing and storage of assemblies are inside the fuel storage areas.

The spent nuclear fuel storage (SFSF) on-site of KNPP is a wet type, i.e. the fuel is stored underwater in four ponds. The spent fuel assemblies are arranged in transport baskets. In 2006 the storage facility was furnished with a refuelling machine for spent fuel from WWER-440 and WWER-1000.

More detailed information on the main technical characteristics and safety assurance in the reactor ponds 1-6 is provided in Section G of this Report and Annex L-1.

Construction of DSF

Pursuant to the national strategy for SF and RAW management, the Updated Decommissioning Strategy of KNPP Units 1-4 and the Framework Agreement with EBRD for funding, Stage 1 of the dry spent fuel storage facility is currently being built. This stage envisages storage of 2800 WWER-440 assemblies for a period of 50 years. Commissioning is scheduled for 2009. The storage technology will use a system of CONSTOR 440/84 casks cooled through natural air convection and having a load capacity of 84 assemblies. The casks will be loaded with spent fuel and prepared for storage in the existing SFSF . The capacity for handling and preparation for storage is 420 assemblies per year, which is equivalent to 5 CONSTOR 440/84 casks.

More detailed information on the main technical characteristics of the DSF and the licensing process is provided in Sections G and K of this Report.

SF of the research reactor IRT-2000 of the Bulgarian Academy of Science

The spent fuel used to be stored in the reactor repository facility (shaft storage facility), pool type, built within the reactor shielding.

During the period following the issuance of the Second National Report participants from Bulgaria, the Russian Federation, the USA and IAEA completed the project for SF removal from the research reactor site. In July 2008 the entire quantity of spent fuel accumulated from the commissioning of IRT-2000 in 1961 until its shutdown in 1989 was transported back to Russia.

The transportation was performed within the frame of the Russian Research Reactor Fuel Return Program (RRRFR) funded by the US Department of Energy, and in accordance with the Agreement between the government of the Republic of Bulgaria and the government of the Russian Federation for cooperation on the import of research reactor spent fuel to the Russian Federation signed in January 2008.

The full removal of spent fuel from the site of the research reactor considerably reduces any risks for the public or the environment and paves the way for carrying out the decision made by the Council of Ministers for partial decommissioning and further reconstruction into a low power reactor.

RAW Management practices

RAW management at Kozloduy NPP

The radwaste generated at Kozloduy NPP is category 2 – low and intermediate level waste according to the categorization made in the *Regulation on the safety of RAW management.*

The current RAW management activities at Kozloduy NPP include as follows:

- Pretreatment and and temporary storage of liquid and solid RAW at the units and the auxiliary buildings to them;

- Transfer of low and intermediate level liquid and solid RAW for processing, conditioning and storage at the RAW - Kozloduy Specialised Department of the SE RAW;

- Release of liquid and gaseous radioactive discharges to the environment according to limits approved by the regulator.

The solid radwaste is sorted at the place where it is generated as per radiometric characteristics and type of material. The solid radwaste comprising activated material category 2b is stored in specially designed facilities - storage pits with pipe structure - located in the main halls of units 1-4, and in the auxiliary building of units 5 and 6. Category 2a radwaste is stored in specialised auxiliary buildings, built adjacent to the units.

The liquid RAW generated at KNPP is mainly aqueous waste and a comparatively small volume of organic waste. The contaminated process water releases is collected via special systems and treated thus producing a final product consisting of distillate and concentrate. Following additional treatment and monitoring to ensure the distillate meets the required limits it is then released to the environment. The liquid radioactive concentrate is stored in tanks, placed in the KNPP auxiliary buildings. The organic liquid RAW (spent sorbents) are collected and stored in separate tanks, also inside the KNPP auxiliary buildings.

The gaseous radioactive substances generated during the operation of the plant nuclear facilities undergo preliminary cleaning and on-line monitoring following which they are discharged to the environment as free release emissions, exempt from regulatory control.

The legislation has provided clearance levels for solid radioactive material and contaminated metal, but this mechanism has not been practically implemented as yet due to difficulties to identify the contamination radionuclide inventory. A Manual is being prepared to regulate the measuring procedures for estimating conformity with the clearance levels. The manual will take into account the KNPP proposals regarding free-release practices.

The first four KNPP units have been shut down and preparation is in process for their decommissioning. A permit has been issued for partial dismantling of the clean equipment. Meanwhile, programmes are being drafted for RAW management during decommissioning including selection and furnishing of suitable sites and facilities for temporary RAW storage. In compliance with the respective decommissioning plans, RAW will be stored either unprocessed or partially processed (regarding only the liquid RAW - preliminary evaporation and adjusting the boric acid strength to the acceptance criteria of the SE RAW) in specially furnished facilities and sites at the reactor units until waste transfer or final disposal takes place.

RAW management at the SE RAW - Kozloduy SD of the SE RAW

The facilities of the SE RAW - Kozloduy SD are located on the KNPP site. They consist of solid RAW processing line, liquid RAW processing line and RAW conditioning line, temporary storage room for conditioned RAW, buffer storage for unprocessed RAW and a temporary storage for low level soil.

The SE RAW - Kozloduy SD accepts for treatment, conditioning and storage category 2 low and intermediate level liquid and solid waste. The compactible low and intermediate level solid waste is processed to achieve volume reduction and ensure structural stability. Waste is compacted in 200-l drums in two stages: precompaction applying 50-t pressure on the drums, and super compaction with a 910-t pressure. The compacted solid radwaste is further packaged in reinforced concrete container, and grouting in active or clean cement matrix is also applied. At present two cementation recipes are used with different additives of pusolite and slag cement. The conditioned RAW are then stored in a storage room with a holding capacity of 1920 concrete containers.

The solid uncompactible waste is placed in 200-l drums and without any further treatment are then stored in reinforced concrete containers on the site of the lime supply facility.

RAW Management at the INRNE, BAS

On the site of the research reactor IRT-2000 low level liquid RAW is stored; this RAW is in fact distillated water from the reactor tank. This liquid waste is placed in two underground tanks made of stainless steel, having a total volume of about 300 m^3 and located adjacent to the reactor building. When tanks are full, the water is transported to the Kozloduy - RAW SU for processing.

The ionizing radiation sources (SIR) used in different laboratories at the INRNE are subject to strict management and control at the institute until they are discarded and declared radwaste, following which they are transferred to the SE RAW – Novi Han SD for temporary storage. This RAW is mainly mixtures of varying isotope composition, tritium targets and neutron sources.

Management of RAW from nuclear application at the SE RAW – Novi Han SD

Ionizing radiation sources are used at nearly 2000 different national sites of industrial, medical, agricultural and research nature. Their operation generates the so-called "institutional" RAW. All of it is accepted and stored at the SE RAW – Novi Han SD, a branch of the SE RAW, in accordance with the Strategy for RAW and SF Management Approved by the Council of Ministers in 2004.

Over the past years the "institutional" RAW have arisen mainly from spent sealed sources such as measuring devices for level, density, thickness, static electricity neutralisers, smoke detectors, etc. The sources that are no longer in use are transferred directly to the SE RAW – Novi Han SD, without any pretreatment.

Due to the large number of fire sensors - over 100 000, mainly with Pu and Am sources - SE RAW – Novi Han SD has developed some technological solutions for reducing their volume and further placing in a fire-proof packages.

As regards the neutron sources, a storage facility has been equipped with additional shielding from paraffin and concrete. Suitable protection for the transport vehicles has also been designed and implemented in view of reducing the dose of the personnel engaged in their receiving and transfer to the storage site.

Data on the rates of RAW generation and processing is presented in the text on article 11, in the Report, and regarding the radioactive discharges - in text on article 24.

RAW from the mining and processing of uranium raw material

Uranium extracting industry in the Republic of Bulgaria operates more than 40 mining sites and two hydrometallurgical works. Over 20 tones of waste has been generated, and it has been stored in 3 tailing ponds and nearly 300 back water ponds. In 1992, uranium extracting was suspended with a decision of the Government of the Republic of Bulgaria.

The measures in the field of uranium industry have been directed to eliminating the consequences from mining and processing of uranium ore within the framework of environmental management. The main objective is to rehabilitate the environment in the areas of the closed uranium mining sites and eliminate the public health risks in these regions.

Radwaste from uranium industry are stored in safe places and/or disposed in trenches in the waste heaps or the tailing ponds. Disposal is allowed in mining sites of uranium extracting sites. All the technologies and the disposal sites are defined together with the designs for technical liquidation and remediation. The spent radioactive sources - the standard and the process control ones are managed just like the rest in the remaining nuclear applications.

RAW identification and categorization criteria

The Second National Report presents the RAW categorization as per the *Regulation on the safe management of radioactive waste*. It has been highlightes that according to the ASUNE, spent nuclear fuel is not considered radioactive waste. The RAW categories are as follows:

1. Category 1 – transitional RAW that may be cleared following suitable treatment and/or temporary storage for a period of not more than 5 years during which their specific activity decreases below the clearance levels.

2. Category 2 – low and intermediate level waste containing radionuclide concentrations that do not require special measures for heat removal during storage and final disposal; this radwaste category is further subdivided into as follows:

a) category 2a – short-lived low and intermediate level waste that contain mainly short-lived radionuclides (with a half life period shorter or equal to that of Cs-137), and long-lived alpha radionuclides with a specific activity lower or equivalent to 4×10^6 Bq/кg for each package, and lower or equivalent to 4×10^5 Bq/кg for the entire RAW volume;

b) category 2b - long-lived low and intermediate level waste containing long-lived alpha radionuclides (with a half life period longer than that of Cs-137), with a specific activity exceeding the limits for category 2a;

3. Category 3 – high level waste with radionuclide concentration such that it requires heat release to be considered for the purpose of storage and disposal.

For the purpose of RAW management before disposal the RAW-generating organizations may introduce additional categorizations that are subject to review and approval by the regulatory body. Such additional categorization process that takes into account the specificity of the RAW processing techniques applied has already been adopted at KNPP, the RAW – Kozloduy SU and the SE RAW – Novi Han SD depending on the dose rate on the package surface, the radionuclide composition and the type of radwaste.

SECTION C. AREA OF APPLICATION

The entire spent nuclear fuel quantity on the territory of our country falls within the scope of the Convention.

The radioactive waste containing radioactive substances of natural origin only, generated outside the nuclear fuel cycle, except for the sealed radioactive sources, is not declared as radioactive waste for the purpose of this Convention.

RAW from nuclear applications on sites of the Ministry of Defence are managed as civil nuclear applications programmes and are declared for the purpose of the Convention.

SECTION D. INVENTORIES AND LISTS

ARTICLE 32. REPORTING (paragraph 2)

"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 of; 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."

Facilities for SF management and accounting

The Republic of Bulgaria has the following SF management facilities with the respective SF quantities and characteristics (by 31.07.2008):

Facilities of Kozloduy NPP Plc.

SF reactor storage at unit 1 (Reactor pond - 1)
Location: the central reactor hall of units 1 and 2, adjacent to unit 1;
Purpose: storage of SF from unit 1;
Storage method: under water in two racks;
Storage capacity (number of assemblies): 701
SF stored (number of assemblies/kg heavy metal): 305 pcs./35 226 kg

SF reactor storage at unit 2 (Reactor pond - 2)
Location: the central reactor hall of units 1 and 2, adjacent to unit 2;
Purpose: storage of SF from unit 2;
Storage method: under water in two racks;
Storage capacity (number of assemblies): 728
SF stored (number of assemblies/kg heavy metal): 81 pcs./9,449 kg

SF reactor storage at unit 3 (Reactor pond - 3)
Location: the central reactor hall of units 3 and 4, adjacent to unit 3;
Purpose: storage of SF from unit 3;
Storage method: under water in two racks;
Storage capacity (number of assemblies): 728
SF stored (number of assemblies/kg heavy metal): 567 pcs./65,634 kg

SF reactor storage at unit 4 (Reactor pond - 4)
Location: the central reactor hall of units 3 and 4, adjacent to unit 4;
Purpose: storage of SF from unit 4;
Storage method: under water in two racks;

Storage capacity (number of assemblies): 726
SF stored (number of assemblies/kg heavy metal): 591 pcs./68,365 kg

SF reactor storage at unit 5 (Reactor pond - 5)
Location: the central reactor hall of units 5, adjacent to the unit;
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): 217 pcs./83,397 kg

SF reactor storage at unit 6 (Reactor pond - 6)
Location: the central reactor hall of units 6, adjacent to the unit;
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): 299 pcs./117,977 kg

Separate facility storing spent nuclear fuel under water (SFSF)
Location: On-site of KNPP, close to units 3 and 4;
Purpose: to store SF from all reactors on site;
Storage method: under water, in a pool divided in 4 sections;
Capacity (number of baskets): 168 or under specific conditions - 200
SF stored (number of assemblies/kg heavy metal): 4216 pcs./492,269 kg

Facilities of the INRNE, at the BAS

Storage shaft for spent fuel from the research reactor IRT-2000
Location: on-site of the research reactor in the town of Sofia;
Purpose: to store spent nuclear fuel from IRT-2000;
Storage method: under water;
Storage capacity (number of assemblies): 108
SF stored (number of assemblies/kg heavy metal): 0 pcs./0 kg

More detailed information regarding the SF management facilities and the accounting of SF has been provided in Annexes L-1 and L-2 of the report.

Facilities for RAW management and accounting

In the Republic of Bulgaria, the facilities for RAW management including its characterisation, processing, conditioning and storage are as follows:

Facilities of Kozloduy NPP Plc.

Auxiliary Building - 1

Location: a separate building located adjacent to KNPP units 1 and 2;

Purpose: processing of liquid RAW and storage of solid and liquid RAW;

Processing methods: evaporation, filtration;

Storage facility capacity / volume of the RAW stored[*]:

- solid RAW volume – 534 m^3[*];

[*] by 30.06.2008

Physical components (volume %) - textile (0 %), metal (22 %), metal shavings (1 %), wood (4 %), construction debris (0 %), polymers (42 %), wool (1 %), rubber (0 %), paper (0 %), mixed (56 %),

- liquid radioactive concentrate (evaporator concentrate) – 2240 m^{3*};

The liquid radioactive concentrate has a total salt content of 28 – 35 %, boric acid concentration - 7 %, pH 8 –9, and availability of solid phase deposit.

The key radionuclides in the evaporator concentrate are: ^{134}Cs, ^{137}Cs, ^{60}Co, ^{54}Mn, ^{58}Co and ^{110m}Ag. The first three isotopes prevail while the remaining ones have specific activities lower than the detectable minimum. In all the ECTs (evaporation concentrate tanks) the prevalent activity is that of ^{137}Cs - 70 ÷ 90 %, spent sorbents – category 2.

volume - 347m^3 (HLST (high level sorbents tank) - 131m^3; LLST (low level sorbents tank). - 216m^3)

The spent sorbents can be organic and inorganic. The activity levels vary considerably depending on the ratio of the different radionuclides absorbed in the sorbents. Sorbents are stored under water in tanks.

The physicochemical characteristics are similar to those of the initial sorbents used for operational activities. Small quantities of activated coal are available. About 70% volume parts of sorbent and about 30% volume parts of water.

The low level sorbents tank contains mainly ^{134}Cs, ^{137}Cs and ^{60}Co. The registered activity ranges from 2.0E+05 to 2.0E+07 Bq/kg for the individual radionuclides. The prevailing activity is that of ^{137}Cs.

The nuclide inventory of the high level sorbents tank consists of ^{134}Cs, ^{137}Cs and ^{60}Co, ^{110m}Ag and ^{54}Mn. The activity ranges from 5.0E+04 to 8.0E+07 Bq/kg for the individual radionuclides. The prevailing activity is that of ^{137}Cs.

Auxiliary Building -2

Location: a separate building located adjacent to KNPP units 3 and 4;

Purpose: processing of liquid RAW and storage of solid and liquid RAW;

Processing methods: evaporation, filtration;

Storage facility capacity / volume of the RAW stored:

- Solid RAW – 219,7 m^3;

Physical components (volume %) - textile (4%), metal (1%), metal shavings (1%), wood (4%), construction debris (0%), polymers (42%), wool (1%), rubber (0%), paper (0%), mixed (47%).

Processing complete - 1313 drums (200 l).

- Liquid RAW - category 2.

Liquid RAW volume - 1955 m^3.

The liquid radioactive concentrate has a total salt content of 28 – 35 %, boric acid concentration - 7 %, pH 8 –9, and availability of solid phase deposit.

The key radionuclides in the evaporator concentrate are: ^{134}Cs, ^{137}Cs, ^{60}Co, ^{54}Mn, ^{58}Co and ^{110m}Ag. The first three isotopes prevail while the remaining ones have specific activities lower than the detectable minimum. The activity of ^{137}Cs is prevalent in all the ECTs - 70 ÷ 90 %.

- Spent sorbents - category 2;

Spent sorbents volume - 238 m^3 (HLS – 108 m^3; LLS – 130 m^3).

The spent sorbents can be organic and inorganic. The activity levels vary considerably depending on the ratio of the radionuclides absorbed in the sorbents. Sorbents are stored under water in tanks.

The physicochemical characteristics are similar to those of the initial sorbents used for operational activities. Small quantities of activated coal are available. There is about 70 volume % sorbent and 30 volume % of water.

The low level sorbents tank contains mainly ^{134}Cs, ^{137}Cs and ^{60}Co. The registered activity ranges from 4.0E+05 to 2.0E+07 Bq/kg for the individual radionuclides. The prevailing activity is that of ^{137}Cs.

The HLST nuclide inventory consists of ^{134}Cs, ^{137}Cs and ^{60}Co, ^{110m}Ag and ^{54}Mn. The activity ranges from 2.0E+05 to 4.0E+07 Bq/kg for the individual radionuclides. The prevailing activity is that of ^{137}Cs.

Auxiliary Building - 3

Location: a separate building located adjacent to KNPP units 5 and 6;

Purpose: processing of liquid RAW and storage of solid and liquid RAW;

Processing methods: evaporation, filtration;

Storage facility capacity / volume of the RAW stored:

- solid RAW - category 2.

Solid RAW volume by 30.06.2008 – 971.53m^3.

Physical components (volume %): metal (22%), wood (2%), polymers (20%), mixed (56%).

Processing complete - 4565 drums (200 l).

Radionuclide composition (Bq/kg): ^{54}Mn – 3.10^4 , ^{110m}Ag – 2.10^4, ^{59}Fe – 2.10^4, ^{134}Cs – 2.10^4 , ^{58}Co – 2.10^4, ^{137}Cs – 6.10^4, ^{60}Co – 2.10^5, ^{95}Nb – 5.10^3

- RAW – activated coal, ion exchange resins and oil stored at AB-3:

RAW volume by 30.06.2008:

activated coal – 10.92m^3

ion exchange resins – 5.25m^3

oils – 0.2m^3

- Cubicle 332/1 of AB-3

Solid RAW – category 2b

RAW volume by 30.06.2008 – 14,187 m^3.

Physical composition – metal RAW mainly.

- liquid RAW - category 2.

RAW volume by 30.06.2008 - 2553m^3.

There is 1365 m^3 liquid radioactive concentrate available, with a total salt content of 80 ÷ 355 g/l, boric acid strength of 17 ÷ 63 g/l and pH 8 ÷12. The volume of sediment is 1152 m^3 in the form of solid phase.

The liquid RAW radionuclide composition is as follows: ^{134} Cs – 1,5.10^5÷2,5.10^6 Bq/dm^3, 137 Cs – 1,9.10^5÷1,1.10^7 Bq/dm^3, ^{60} Co – 1,1.10^4÷4,0.10^4 Bq/dm^3.

- Spent sorbents - category 2

RAW volume by 30.06.2008: – 146 m^3.

These are organic spent sorbents. The activity levels vary considerably depending on the different radionuclides absorbed in the sorbents. Sorbents are stored under water in tanks. Their physicochemical characteristics are similar to those of the initial sorbents. Small quantities of activated coal are available. There is about 70 volume % sorbent and 30 volume % of water.

The spent sorbents radionuclide composition is as follows: ^{134}Cs–1,5.10^4÷1,4.10^7 Bq/dm^3, ^{137}Cs–5,9.10^4÷3,7.10^7Bq/dm^3, ^{60}Co–1,5.10^6÷2,2.10^6 Bq/dm^3, ^{54}Mn–2,2.10^5÷5,5.10^5 Bq/dm^3

Repository pit at RH-1

Solid RAW – category 2b

RAW volume by 30.06.2008 – 51.75 m^3.

Repository pit at RH-2

Solid RAW – category 2b

RAW volume by 30.06.2008 – 31.87 m^3.

Temporary storage facility for spent SIR at Kozloduy NPP

By 30.06.2008, a warehouse at the Metrological Assurance Department stores 20 faulty control sources, Blenker type. The physical components (in volume %) are steel (60%), copper (20%), bakelite (20%). The prevalent radionuclides are ^{90}Sr /^{90}Y with a total activity of ≈ 2.10^6 Bq.

Two warehouses store fire detectors, type MHG181 –900 pcs. and type MHG185-1 pc.

The physical components (volume %) are as follows: stainless steel (100% - following recharge). The radionuclide composition of the source is ^{241}Am with total activity of 7.10^7Bq.

Facilities of SE RAW– RAW - Kozloduy Specialised Department

RAW processing workshop (RAWPW)

Location: on the site of KNPP;

Purpose: treatment and conditioning of solid and liquid RAW category 2;

Processing methods: compaction of solid RAW and evaporation of liquid RAW;

Conditioning methods: cementation, packaging in a reinforced concrete container.

Conditioned RAW storage facility

Location: on the site of KNPP, adjacent to RAWPW;

Purpose: storing of the category 2 RAW conditioned at the RAWPW;

Storage facility capacity / volume of the RAW stored: 1920 reinforced concrete containers / 737 reinforced concrete containers (38.385%).

Trench repository

Location: the Lime Plant on-site of KNPP;

Purpose: temporary storage of solid, category 2 RAW;

Storage facility capacity / volume of the RAW stored: 3860 m^3 / 3118.82 m^3.

Warehouse storing the processed solid RAW

Location: the Lime Plant on-site of KNPP;

Purpose: temporary storage of treated, solid RAW, category 2;

<u>Storage facility capacity / volume of the RAW stored:</u> 1130 m^3 / 454.52 m^3 ;

Site No 1 for storing of solid RAW in reinforced concrete containers

<u>Location:</u> the Lime Plant on-site of KNPP;

<u>Purpose:</u> temporary storage of treated, solid RAW, category 2, packaged in reinforced concrete containers;

<u>Storage facility capacity / volume of the RAW stored:</u> 130 concrete containers / 0 concrete containers.

Site No 2 for storing of solid RAW in reinforced concrete containers (RCC)

<u>Location:</u> the Lime Plant on-site of KNPP;

<u>Purpose:</u> temporary storage of treated, solid RAW, category 2, packaged in reinforced concrete containers;

<u>Storage facility capacity / volume of the RAW stored:</u> 2000 concrete containers / 155 concrete containers.

Site for storing of solid RAW in large freight containers

<u>Location:</u> the Lime Plant on-site of KNPP;

<u>Purpose:</u> temporary storage of low level RAW, category 2;

<u>Storage facility capacity / volume of the RAW stored:</u> 14 large freight containers / 13 large freight containers, loaded.

Contaminated soil repository

<u>Location:</u> the Lime Plant on-site of KNPP;

<u>Purpose:</u> storage of low level contaminated soil;

<u>Storage facility capacity / volume of the RAW stored:</u> about 8000 m^3 / 0 m^3.

Data on the RAW volumes stored in various facilities and sites of Kozloduy - RAW SU are shown in the table below:

№		2005	2006	2007	2008 – by 30.06
1.	**Conditioned RAW storage facility – conditioned RAW packages [pcs.]**				
	RCC – 1	186	261	276	287
	RCC – 3	182	284	415	450
	TOTAL	**368**	**545**	**691**	**737**
2.	**Trench repository - [m^3]**				
	Untreated	3018	2791	2638	2397
	Treated	528	528	658	722
	TOTAL	**3546**	**3319**	**3296**	**3119**
3.	**Warehouse storing processed solid RAW - [m^3]**				
	Treated	467	464	455	455
4.	**Site No 1 for storing of solid RAW in RCC – conditioned RAW packages - [pcs.]**				
	RCC – 1	99	59	25	-
5.	**Site No 2 for storing of solid RAW in RCC - [pcs.]**				
	RCC – 2	28	73	132	155
6.	**Site for storing of solid RAW in large freight containers - [m^3]**				
	Untreated	129	104	101	101
	Treated	125	127	127	127
	TOTAL	**254**	**231**	**228**	**228**

These data provide a picture of the nature and the implementation of the activities for RAW treatment and conditioning at the RAWPW by the type and number of RCC located in the CRAWS, as well as the RAW management programme on-site of the Lime Plant - through the RAW quantities transferred and/or placed in the respective repositories or dedicated sites.

Facilities of the SE RAW – Novi Han SD

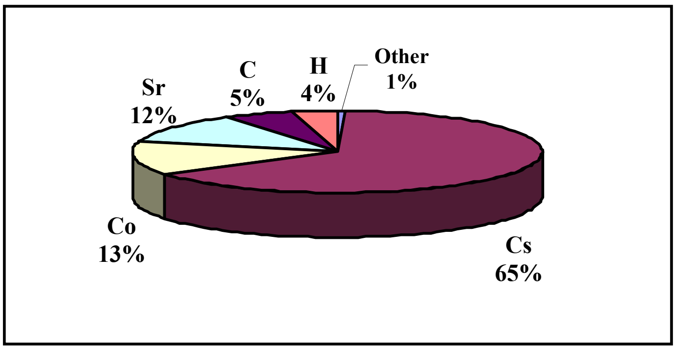
Solid RAW repository

The repository was intended for disposal of solid low and intermediate waste from nuclear applications, excluding those generated by KNPP. Since 1994 RAW disposal in the facility has been suspended.

Volume of the deposited RAW: 120 m^3 untreated RAW;

Total activity of the RAW deposits: 6.58 x 10^{12} Bq;

Key radionuclides: ^{137}Cs (4.29 x 10^{12} Bq), ^{60}Co (8.63 x 10^{11} Bq), ^{90}Sr (7.71 x 10^{11} Bq), ^{14}C (3.70 x 10^{11} Bq), ^{3}H (2.42 x 10^{11} Bq) and minimum amounts of ^{55}Fe, ^{65}Zn, ^{106}Ru, ^{134}Cs, ^{144}Ce, ^{204}Tl.



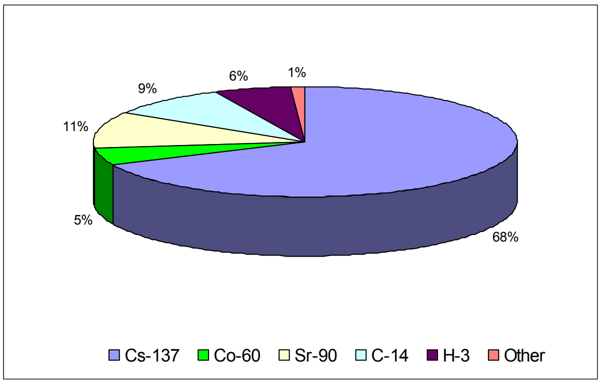
Biological RAW repository

This repository was intended for the disposal of low and intermediate level waste from nuclear applications, following treatment with formaldehyde and immobilization in a gypsum matrix. Since 1994 the repository has stopped receiving any more waste. The holding capacity of the repository is 80 m^3.

Volume of the deposited RAW: 25 m^3 of conditioned RAW;

Total activity of the RAW deposits: 1.65 x 10^{11} Bq;

Key radionuclides: ^{137}Cs (1.12 x 10^{11} Bq), ^{90}Sr (1.85 x 10^{10} Bq), ^{14}C (1.55 x 10^{10} Bq), ^{3}H (1.02 x 10^{10} Bq), ^{60}Co (8.28 x 10^{9} Bq) and mimimum quantities of ^{65}Zn, ^{54}Mn, ^{106}Ru, ^{134}Cs, ^{144}Ce.



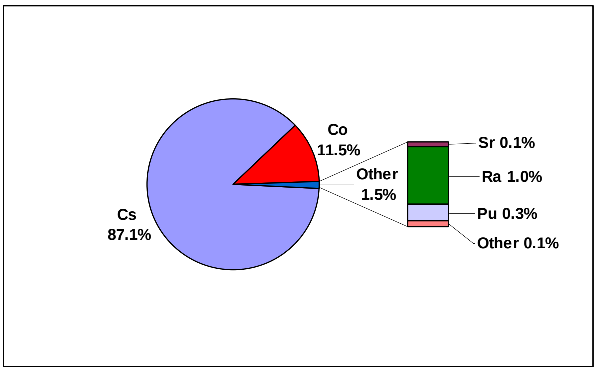
Repository for sealed sources

The repository was designed for the disposal of sealed sources from different nuclear applications with various nuclide composition and without being conditioned. The greater part of the sources were deposited in their original overpacks or transport containers. No more waste has been deposited in the facility since 1994. This repository unit has been currently conserved. The storage capacity is 1 m^3.

Volume of the deposited RAW: 0.65 m^3 untreated RAW.

Total activity of the RAW deposits: 6.19 x 10^{13} Bq;

Key radionuclides: ^{137}Cs (5.39 x 10^{13} Bq) and ^{60}Co (7.09 x 10^{12} Bq), ^{90}Sr (6.57 x 10^{10} Bq), ^{226}Ra (5.97 x 10^{11}), ^{239}Pu (1.82 x 10^{11} Bq), and minimum quantities of ^{3}H, ^{22}Na, ^{55}Fe, ^{63}Ni, ^{85}Kr, ^{133}Ba, ^{147}Pm, ^{170}Tm, ^{204}Tl, ^{241}Am.



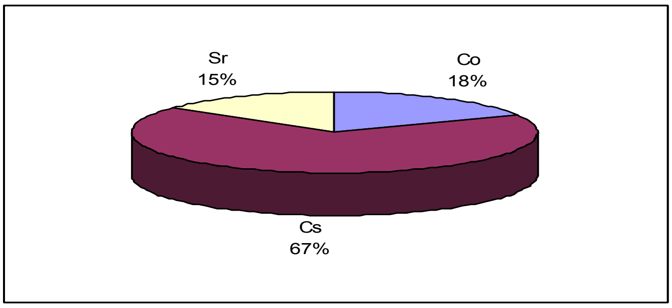
Engineering trench for solid RAW

The engineering trench was additionally built in the 80s of the past century for the disposal of RAW generated from emergencies or accidents. However, it actually stores low and intermediate level solid waste from nuclear applications. Since 1994 г waste disposal to the trench has been terminated. The trench has a capacity of 200 m^3.

Volume of the deposited RAW: 100 m^3 untreated RAW;

Total activity of the RAW deposits: 1.04 x 10^{12} Bq;

Key radionuclides: ^{137}Cs (7.00 x 10^{11} Bq), ^{60}Co (1.84 x 10^{11} Bq), ^{90}Sr (1.54 x 10^{11} Bq).



Repository unit for liquid RAW

The repository units consist of 4 stainless steel tanks. It is intended to store liquid radwaste both from nuclear applications, and those resulting from decontamination activities of the repository and from laboratory research activities. The capacity of the four tanks is 48 m^3.

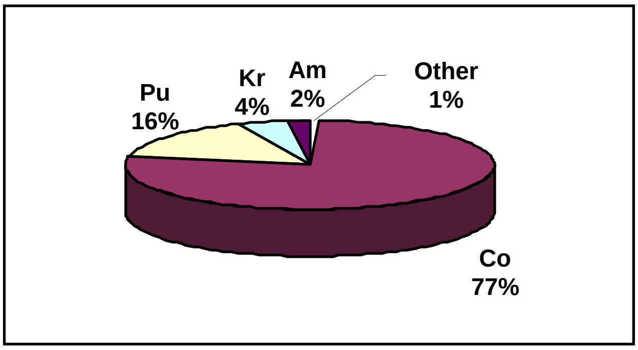
Stored quantity: 48 m^3;

Key radionuclides: low level solutions of ^{134}Cs, ^{137}Cs, ^{60}Co, ^{90}Sr;

Storage site for RAW packed in railway containers

The storage has 14 railway containers for temporary storage of low and intermediate level short- and long-lived radwaste (category 2a and 2b) – fire detection sensors in overpacks, solid RAW and β,γ-spent sources, neutron sources and α-sources in overpacks. The containers total capacity is 462 m^3.

Volume of the deposited RAW: 310,4 m^3 partially treated (dismantling, re-packing)



RAW;

Total activity: 1.43 x 10^{13} Bq;

Key radionuclides: ^{60}Co (1.10 x 10^{13}Bq), ^{239}Pu (2.27 x 10^{12} Bq), ^{85}Kr (6.4 x 10^{11} Bq), ^{241} Am (2.6 x 10^{11}Bq), and minimum quantities of ^{3}H, ^{14}C, ^{36}Cl, ^{90}Sr, ^{241}Am/Be, ^{239}Pu/Be, ^{226}Ra/Be;

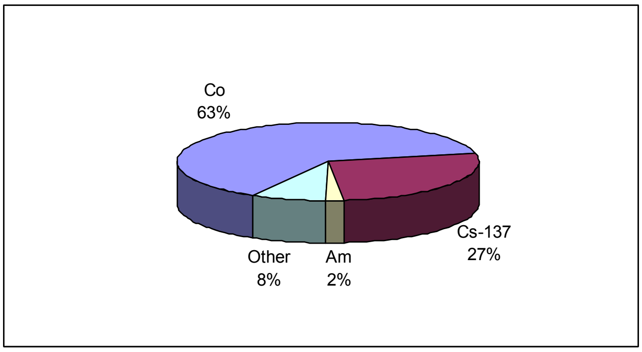
RAW storage site using concrete receptor units type PEK, reinforced concrete RCCCubes (reinforced concrete container, cube type for storage of spent sources) and reinforced concrete containers type GOU (for storage of undiluted gamma radiation devices)

The site was erected during the refurbishing of the repository in 1997-2000 with the purpose of safety improving. It is equipped with type PEK concrete receptacles and reinforced concrete containers types RCCCube and RCCGOU, holding low and intermediate level short- and long-lived radwaste (category 2a and 2b) – spent sealed sources in overpacks and work packages, as well as undiluted gamma-radiation devices. The site has a capacity of 6 containers type PEK (74 m^3), 171 pcs. of RCCCube (248 m^3), 18 pcs. of RCCGOU / 114 m^3.

Volume of the deposited RAW: 164 m^3 partially treated (dismantling, re-packing) RAW;

Total activity of the deposits: 1.79 x 10^{15} Bq;

Key radionuclides: ^{60}Co (1.14 x 10^{15} Bq) and ^{137}Cs (4.76 x 10^{14} Bq), ^{241}Am(2.2 x 10^{12} Bq) and minimum quantities of ^{239}Pu, ^{3}H, ^{14}C, ^{85}Kr, ^{90}Sr, ^{232}Th, ^{252}Cf, ^{192}Ir, ^{241}Am/Be, ^{239}Pu/Be.



Storage site for low level RAW

The purpose of the site is to store temporarily low level RAW in 200-l drums and in palettes, as well as newly received radwaste, until receiving inspection has been performed to assign suitable placement location and further storage. The site can hold 400 drums and 100 palettes.

Volume of the long-term stored RAW: 331.1 m^3 - mainly low level contaminated soil.

Facilities for receiving inspection, initial preparation of RAW for their further storage, radiation monitoring of liquid RAW, cells for discharging of smoke detectors, liquid RAW cleaning system

Location: receipt and preparation laboratory complex at the repository;

Purpose: Receiving inspection and identification of RAW, sorting, partial re-packing, RAW preparation for storing, decontamination of equipment and vehicles, treatment of low level waters from the radioactive drain on-site and of liquid RAW, as well as 'discharging' (removing the source from its package) of smoke detectors.

Facilities of the INRNE, IRT-2000

Liquid radwaste tanks

These include the tanks for temporary storage of liquid RAW generated in the radiochemical laboratories and the radioactive drain, as well as the water quantities from the reactor pond. They are located adjacent to the building of the research reactor – IRT. The two tanks have a capacity of

300 m^3. Once the greater part of the volume available has been filled, action is taken to transport the liquid RAW to RAW – Kozloduy SU for treatment.

Volume of the stored RAW: 50 m^3.

Facilities for underground uranium mining

Buhovo-1 tailing pond

Location: 1 km to the east of the town of Buhovo;

Purpose: storage of the tailing generated as a result from the activity of the Metalurg Hydrometallurgy Plant in Buhovo, from 1956 to 1960;

Capacity/ Volume of the stored RAW: 1.3 M m^3 / filled up.

Buhovo-2 tailing pond

Location: 1 km to the east of the town of Buhovo;

Purpose: storage of the tailing generated as a result from the activity of the Metalurg Hydrometallurgy Plant in Buhovo, from 1960 to 1992;

Capacity/ Volume of the stored RAW: 10M m^3 / 4.5 M t of tailing and solid RAW.

Eleshnitsa tailing pond

Location: 3.0 km south-east of the village of Eleshnitsa;

Purpose: storage of the tailing arising from the activity of the Zvezda Hydrometallurgy Plant in the village of Eleshnitsa;

Capacity/ Volume of the stored RAW: 23.1 ha / 9 M t of tailing and solid RAW.

Water cleaning installation for mining pit waters at the Chora mining area

Location: Close to the town of Buhovo;

Purpose: Purification of uranium contaminated mine pit water;

Processing methods: Ion exchange.

Water cleaning installation for mining pit waters at the Byalata Voda mining area

Location: 30 km to the west of the town of Dolna Banya;

Purpose: Purification of uranium contaminated mine pit water;

Processing methods: Ion exchange.

Water cleaning installation for mining pit waters at the Iskra mining area

Location: 10 km to the north-west of the town of Novi Iskur;

Purpose: Purification of uranium contaminated mine pit water;

Processing methods: Ion exchange.

Ion exchange resins regeneration clean-up line

Location: On-site of the former uranium processing plant Zvezda, about 30 km to the south of the village Eleshnitsa;

Purpose: Regeneration of the anion sorbents used at the water treatment installations for uranium contaminated mine pit water at the Chora, Byalata Voda and Iskra mining areas.

More detailed information regarding the RAW management facilities and the accounting of RAW in storage and in disposal facilities is provided in Annexes L-3 and L-4 of the Report.

Nuclear facilities in decommissioning

The first 4 units at KNPP have been shutdown and maintained in E mode (the nuclear fuel has been removed from the core and kept in the reactor ponds) while preparing the units for decommissioning (developing of the required documentation and providing the necessary decommissioning equipment and measuring devices). In compliance with the effective licenses, units 1 - 4 of Kozloduy NPP may not be used for energy generation and the activities related to them are limited to storage of irradiated and spent nuclear fuel at the reactors spent fuel ponds and preparatory activities for partial dismantling of the clean equipment.

Detailed information on the upcoming decommissioning of these units is presented in this Report, in article 26.

SECTION E. LEGISLATIVE AND REGULATORY SYSTEM

ARTICLE18. 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

"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 of licensing of 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 license;

(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 licenses;

(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."

Brief review of the information, presented within the frames of the First and Second National Reports

Legislative and regulatory framework in the field of use of nuclear energy for peaceful purposes in the Republic of Bulgaria has been described in both previous National reports. The Act on the Safe Use of Nuclear Energy (ASUNE) and the Act on Public Health, as well as the regulations for implementation of the ASUNE (21 regulations) have been presented. The requirements for issuing of permits and licenses as well as the responsibilities of the NRA chairman, related to the issuance, amendment, renewal and withdrawal of such permits and licenses has been presented in details.

The state control requirements for management of radioactive waste and management of spent nuclear fuel have been described. Special attention has been paid to the *Instruction for the NRA Inspection Activity* where the authorities of the NRA chairman and inspectors in conducting the regulatory control have been pointed out. The compulsory administrative measures and the administrative penalties for violations in the field of nuclear safety and radiation protection have been presented.

The main participants in the process of RAW and SF management on national level (Council of Ministers, NRA, SE RAW and its specialized units, owners of permits and licenses) have been described, including the relationship between them as specified by the legislation.

Changes in the legislative and regulatory framework

The basic legislative and regulatory framework on the management of radioactive waste and spent fuel was adopted and enforced in 2003-2005. Those legislative and regulatory acts have been presented in details in the previous National Reports.

During the period 2005-2008 the following changes in the legislative framework took place:

Regulation № 28 of the Ministry of Health (MH) on the conditions and procedure of medical provision and health norms for personal protection in cases of radiological emergencies was adopted in 2006 clarifying the requirements of the Act on Public Health. The Regulation specifies the medical provision in case of a general radiological emergency, actions during accidents with sources, control mechanisms and activities to prevent radioactive contamination, and health norms for protection of the population in the case of a radiological emergency.

Regulation № 29 of the MH on health norms and requirements for labor conditions in ionizing radiation environment has been adopted at the end of 2005. The Regulation defines the conducting of the obligatory medical screening of personnel working with sources of ionizing radiation, for protection from deterministic health effects and reducing the likelihood stochastic effects to an acceptable level.

Regulation № 32 of MH on the conditions and procedure for performance of individual dose control has been adopted in 2005. The Regulation defines the control over the personnel working with sources of ionizing radiation, as well as the conditions and procedure for performance of individual dose control.

The *Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Nuclear facilities decommissioning" Fund* and the *Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Radioactive waste" Fund* have been amended and supplemented. The changes concern the methodology of determination of the license amounts dues to both funds.

Complete list of the existing normative acts, applicable to the management of radioactive waste and spent fuel, is given in Appendix L-5.

Experience in applying the new legislation and planned changes of the ASUNE

Six years have past since the ASUNE was enacted. In applying the policy of NRA for periodical review of the legislation in the field of nuclear safety and radiation protection, a decision has been taken to prepare amendments and supplement to the law. The changes are based on the gained experience in applying the law, implementing the new EU directives in the field of radiation protection, as well as the changes in the Convention on the Physical Protection of the Nuclear Material (CPPNM). The main changes and supplements comprised by the draft are in the following areas:

- Physical Protection of the Nuclear Material:
  - Taking into consideration the changes in CPPMN
- Radiation protection:
  - Facilitation of the licensing regimes for import and export of radioactive substances;
  - Implementation of the clearance and exemption methodologies ;
  - Improvement of the National system for the management of orphan sources and the financing activities;
- Emergency planning and preparedness
  - Special-statutory areas;
- Transport of radioactive substances and nuclear material:
  - Harmonization of the provisions for the transboundary transport of SF and RAW with Directive 2006/117/EURATOM;
- Decommissioning of nuclear facilities, etc.

The draft law on amendment and supplementment of the ASUNE is expected to be prepared for discussion with the competent state authorities, licensees and the public by the end of 2008.

Activities on harmonization of the regulatory requirements in WENRA countries.

The Western European Nuclear Regulator's Association /WENRA/ is created in 1999 as a non-governmental organisation comprised of the Heads and senior staff members of Nuclear Regulatory Authorities of European countries with nuclear power plants.

After the approval of the new ASUNE and the set of regulations, a regulatory basis for the development of the public relations in the field of the safe use of the nuclear energy was created. The further development of the regulatory basis in this area is related to the EU legislation and the obligation of Bulgaria to transpose European directives. The improvement of the documents, developed by the international organizations such as the International Atomic Energy Agency (IAEA) the West European Nuclear Regulatory Authorities (WENRA) is also a precondition for the review of the regulatory acts adopted as for the development of new ones. To harmonize the approaches to safety in the European countries, WENRA created two working groups – on the safety of nuclear power plants (Reactor Harmonisation Working Group) and on the safety of the decommissioning and radioactive waste and spent fuel management (Working Group on Waste and Decommissioning). The aim of their creation is the permanent improvement of the safety and decrease of the differences among different countries..

Immediately after the NRA's admission as member of WENRA (March 2003) the participation of the Agency's experts in the working groups activities started on the organization for comparison and harmonization of the nuclear power plants safety requirements and on the requirements for the safe management of radioactive waste, spent fuel and decommissioning. The working group on safety during decommissioning and on the radioactive waste and spent fuel management continues its work on the preparation of positions on the compliance with the reference levels for harmonization. The results will be used in the preparation of the action plans up to 2010. More detailed information on the reference levels and on the actions taken by Bulgaria may be found at the Internet site of the NRA.

Guides for implementation of the regulations

NRA continues the development of the guides for implementation of the regulations. Most priority guides (mentioned in the Second National Report) have been drafted and have been discussed with the operators.. It is expected to be approved till the middle of 2009.

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 fulfil 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.'

Review of the information, presented within the frame of the First and Second National Reports

First and Second National Reports explain that, in accordance to the provisions of the ASUNE, the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel is exercised by the NRA chairman, an independent specialized authority of the executive power, having competence, determined by the law. The chairman of the agency is appointed with a decree of the Council of Ministers for a term of 5 years and may be re-appointed for one more term. It is pointed out that, with the Law of Ratification of the Joint Convention, the chairman of NRA is appointed as a regulatory body in the sense of Article 20 of the Convention and is responsible co-coordinator for preparation of the national reports on the fulfillment of the obligations of the Republic of Bulgaria, pertinent to this Convention.

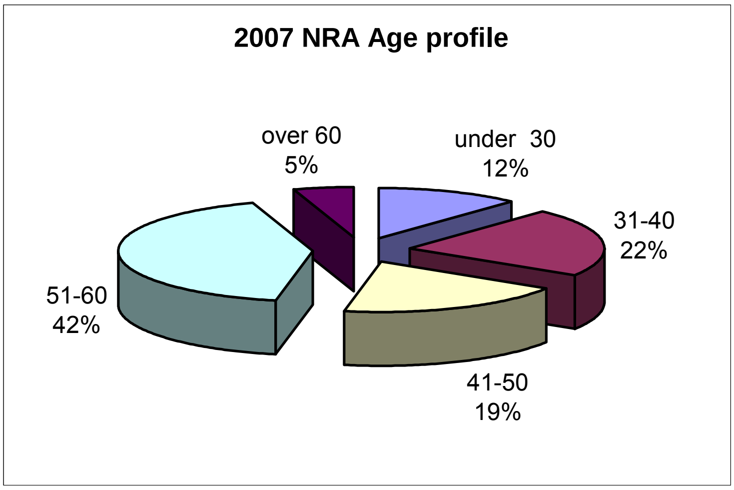
The NRA organizational and management structure is appended. Detailed information on the agency's staff personnel and financing is given. The advisory councils on nuclear safety and radiation protection, establish according to the ASUNE, are presented.

It is stated that ASUNE guarantees effective independence of the regulatory functions from the radioactive waste management functions. The functions of the Minister of Economy and Energy, conducting the state policy in the field of RAW and SF management, are also described.

Development of the regulatory authority after the presentation of the Second National Report

The structure, activity, organization and personnel of the Agency are determined by the *Rules of Procedure of the NRA* adopted by the Council of Ministers. In August 2007 the Rules of Procedure were amended and changed. The main changes included the EU membership of Bulgaria requiring a change in the European integration units' functioning and the execution of the EURATOM Agreement providing a number of post-accession obligations for the Chairman of the NRA.

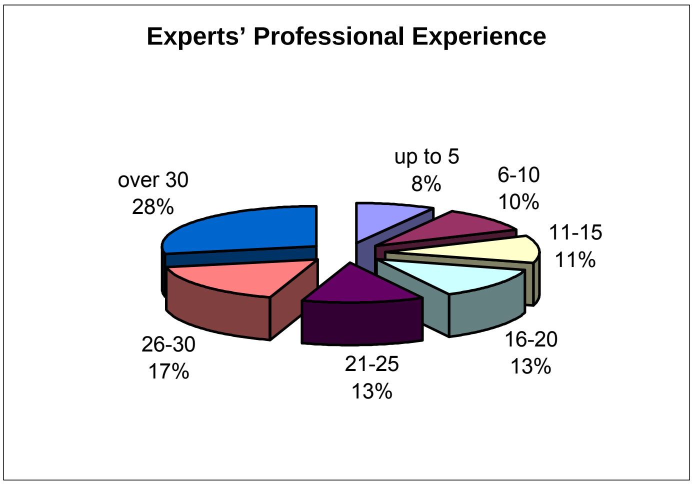
At the end of 2007, 100 persons were employed by the NRA on civil service and employment contracts, 82 of them on civil service contracts (civil servants). The status of the civil servants provides the positions of experts and inspectors with a security in terms of their relations with the employer, a clear procedure for career development, and opportunities for increase of qualification.



Competitive admission procedures are organized in the process of selection of candidates for the existing vacancies in compliance with the Act on Civil Servants, the Labour Code, and the Regulation on Competitive Admission Procedures for Civil Servants. High requirements are placed for the candidates for civil service, including not only technical competence but also personal qualities, such as teamwork skills, communication skills, willingness to increase one's qualification, knowledge of legislative documents, etc. High requirements are placed for the candidates for civil service, including not only technical competence but also personal qualities, such as teamwork skills, communication skills, willingness to increase one's qualification, knowledge of legislative documents, etc. This will result in building a team of skilled employees able to complete their assignments regardless of the level of difficulty.

	Under 30	31-40	41-50	51-60	Over 60	Total
Management	-	3	4	14	1	22
Experts	11	17	11	22	2	63
Support	-	1	4	5	2	12
Executive	1	1	-	1	-	3
Total NRA	12	22	19	42	5	100

The policy of transfer of knowledge and skills by the more experienced (over 58% with more than 20 years of professional experience) to the younger employees followed by the NRA ensures the organization's succession and the preservation of well-established professional practices.



Almost all expert positions (over 95%) are taken by university graduates with Master's degrees, and some of them with PhD degrees. The employees with higher education are involved mainly in the field of technical sciences and humanities.

The proportion of management positions taken by women and men is the same as with the expert positions (55:45 in favour of women).

	Management staff		Experts		Total
	Women	Men	Women	Men	
Civil servants	7	12	39	24	82
Employees	-	3	9	6	18
Total NRA	7	15	48	30	100

The common training of the NRA employees is conducted in the field of specialized training in aspects related to the management and organization of administration and administrative processes, mainly in its legislative aspects, strategic planning, information technologies, foreign languages courses. The courses, seminars and annual meetings held by the Institute of Public Administration and European Integration.

The employees appointed in the state administration for the first time, undergo a training course entitled "Introduction in Civil Service" which is part of the professional development training.

The foreign language training is focused on the development and improvement of communication skills of employees, based on specialized lexis and facilitating communication with EU Institutions.

The specialized training of the NRA employees conducts NRA's Personnel Training Center opened 2003. The performance of a sequence of national and international technical meetings, training courses and seminars aim at introducing the employees to the international practices for application of regulatory approaches, the requirements of the new regulatory framework, the development of the normative basis at a secondary level in accordance with the ASUNE and the European legislation.

In accordance with the annual plans for mandatory required and specialized training, the total number of employees who successfully completed the training in 2005, 2006 and 2007 are as follows:

- 2005 - 20 employees;

- 2006 - 29 employees, 23 specialized training;

- 2007 - 34 employees, 21 specialized training.

An average of four employees each year have graduated successfully in foreign languages courses.

NRA Financial Resources

The revenue of the NRA represents income from taxes collected under the Act on the safe use of nuclear energy (ASUNE) and the Rate of Charges collected by the NRA under ASUNE (Appendix No. 2 to Article 2 of CMD No. 206 of 17 September 2003, published in the State Gazette No. 85 of 26 September 2003).

The Law on the State Budget of the Republic of Bulgaria for 2007 determined the NRA income from state fees to BGN 6,150,000 and expenses to BGN 4,791,131. For the period from 1 January 2007 to 31 December 2007, the NRA budget income from state fees amounts to BGN 11,749,973 , and the income from interests and penalties amounts to BGN 19,996. The over fulfilment of the income from state fees is mainly associated with the amount of BGN 4,000,000 paid by the NEC-PLC for permits issued for the design of a new nuclear power plant.

The total amount of the expenses during this year is BGN 4,762,131. The incurred expenses include costs of materials, hired services, staff remunerations, social security payments, subscription to memberships in international organizations, short- and long-term business trips abroad, business trips in the country, etc. A significant portion of the expenses during the year accounts for the consulting services. They are conditioned by the nature of the NRA’s activity and are related to the surveys, researches and professional reports assigned to hired consultants with regard to the control exercised over the safe use of nuclear energy and sources of ionizing radiation.

SECTION F. OTHER GENERAL SAFETY PROVISIONS

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 license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.

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

Brief review of the information, presented within the frame of the First and Second National Reports

The First National Report presents the ASUNE requirements, related to the RAW and SF management activities. It is stated that the radioactive waste management and spent fuel management is executed solely by juridical persons after receiving a permit and/or license for the safe performance of the respective activity. The licensee obligations and responsibilities following from the ASUNE are presented in details.

The report describes the legislative provisions (art. 73 of ASUNE) for assignment of responsibility to the state when the person, responsible for the spent fuel or radioactive waste management cannot be identified.

The Second National Report presents the legislative changes, related to the responsibility of permit or license holder. It is stated that according the Regulation for safety of radioactive waste management, the persons, as a result of whose activities RAW are generated, are responsible for the safe management of these RAW until the moment of their transfer to the SE "RAW" or of exclusion from regulatory control. In compliance with the *Regulation for the conditions and procedure for delivery of radioactive waste to the state enterprise "Radioactive Waste",* subject of transfer are:

- radioactive waste, generated as a results of activities of licensee and permit holders in the sense of ASUNE (RAW manufacturers);
- radioactive waste from past practices;
- radioactive waste with unknown owner
- radioactive waste, imported in the territory of the Republic of Bulgaria, which may not be returned;
- radioactive waste, generated as a result from activities of RAW manufacturers of declared bankruptcy or liquidation.

In all cases, the licensee bears the responsibility for provision of nuclear safety, radiation protection and physical protection during license termination until issuance of new license or until safe decommissioning of the facility (art. 22, par. 3 of ASUNE).

After the Second National Report there are no additional changes in the legislative and regulatory framework connected with the responsibilities of the license holder.

ARTICLE 22. HUMAN AND FINANCIAL RESOURCES

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

(i) qualified staff is 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."

Brief Review of the information, presented within the frame of the First and Second National Reports

The ASUNE requirements for availability of sufficiently qualified and certified personnel with the respective educational and training level, for all operation activities of SF and RAW management facilities has been presented. The system for qualification and performance of specialized training of NF personnel has been presented.

The ASUNE conditions for issuance of a NF operation license related to availability of financial and material resources for maintenance of high safety level throughout the entire operation period, as well as for decommissioning of the SF and RAW management facilities have been described. Correspondingly, information on the human and financial resources of the operator of SF and RAW management facilities has been appended.

Information for the financing of the RAW management activities through establishment of the Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund is presented, too.

The legislative changes, related to the availability of human and financial resources have been introduced. The *Regulation for the procedure for issuing licenses and permits for safe use of nuclear energy*, adopted in 2004, specifies the documents, which the applicant must present together with license or permit application, and by which he certifies the compliance with the above-stated requirements. Within the scope of the licensing procedure, the regulatory authority evaluates the correspondence of the presented documents to the requirements of ASUNE and of the regulations issued on its implementation.

The provisions of the *Regulation of the conditions and procedure for acquiring professional qualification and for the procedure for issuing licenses for specialized training and certificates for qualification for use of nuclear energy* specifies:

- the conditions and procedure for acquisition of professional qualification for activities in nuclear facilities and with sources of ionizing radiation;
- the procedure for qualification acquisition;
- the procedure for issuance of specialized training licenses;
- the requirements for the system of personnel selection and qualification;
- the requirements for qualification and mandatory specialized training of the NF personnel, including the minimal requirements for training programs content and for the training duration for specific positions in the various NF types.

Legislation changes, related to the availability of human and financial resources

Changes have been made in the regulations for collecting and spending financial resources in RAW Fund and NFD Fund. Information about those changes is presented in Convention paragraph 19 in this report.

Financing of Decommissioning and RW management

The financing of the SF and RAW management during the facilities operation is provided by the operator. The financing of the decommissioning and management of RAW after their transfer to SE "RAW" is provided by the Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund. The Funds are independent, the available assets are managed transparently and in a manner, assuring their profitability, and, according to the valid legal regulations, expenditure control is exerted, with the expenditures being allowed only for justified purposes, consistent with the fees paid to the Funds.

Information on the Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund

Fund	**Amounts, in BGN to 01.01.2008**	**Amounts, in BGN to 30.06.2008**
Nuclear Facilities Decommissioning Fund	132 738 877.59	137 056 359.83
Radioactive Waste Fund	884 070 524.63	925 059 172.18
Total	**1 016 809 402.22**	**1 062 115 532.01**

The Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund Expenses Prognosis

	2008	**2009**	**2010**	**2011**
Grants for RAW management and NFD activities	20 003 000	53 301 845	55 244 547	28 456 774
Capital transfers for RAW management and NFD activities	3 602 400	6 437 435	7 613 300	6 174 630
Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund Management	631 730	904 283	994 716	1 094 185
Total	**24 239 138**	**60 645 572**	**63 854 573**	**35 727 600**

Information on the Nuclear Facilities Decommissioning Fund and Radioactive Waste Fund Revenues

	2008	**2009**	**2010**	**2011**
Total	**57 454 000**	**70 151 000**	**76 833 000**	**84 310 000**

Information on the Nuclear Facilities Decommissioning Fund and the asset activity of the Fund is presented in the texts on Article 26.

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

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.”

Brief Review of the information, presented within the frame of the First and Second National Reports

The First National Report has presented the ASUNE requirements for the persons conducting activities of radioactive waste and spent fuel management to maintain high level of the quality of the performed activities. The requirements of the regulations in force at that time have also been presented. It has been pointed out that the implementation of the quality assurance program is controlled by NRA during the regulatory inspections. Information on the quality management systems in place in Kozloduy NPP, SE RAW - Novi Han SD and the research reactor of BAS is presented.

The Second National Report has presented the Legislation changes, related to the quality assurances. The provisions of the *Regulation for providing the safety of spent nuclear fuel management* and *Regulation for Safety of Radioactive Waste Management* concerning the mandate of the license holders quality assurance programs (QAP) have been pointed out.

Quality assurance programs of the operating organizations

Quality assurance at Kozloduy NPP

The NPP Kozloduy PLC at its capacity of the operating organization and holder of all necessary licenses and permits, elaborates, introduces and sustains an integrated management system. The System combines all inherent organizational elements aiming fulfillment of the management strategic goals. The above mentioned system has been developed in compliance with the requirements of BDS EN ISO 9001:2000 and IAEA Safety Series No.50-C/SG-Q (1996), with consideration of the specification of the organizational structure, Company’s management traditions and good practices.

The quality management system is documented by:

- Declaration of the Kozloduy NPP managers for long term policy for facility management;
- Kozloduy NPP Safety Policy;
- Quality assurance programs for nuclear safety operation;
- Management and operational documents;
- Quality records.

Actual basic documents for RAW and SF management:

- Maintaining and improving safety Program in Kozloduy NPP for 2008, 2009 and 2010, Edition 6;
- Quality assurance program for RAW Management facility operation at Kozloduy NPP, Edition 1;
- Quality assurance program for SF management, Edition 3;
- Complex program for RAW management in Kozloduy NPP, Edition 2.

Management system documents are kept up to date with the documentation management mechanisms of Kozloduy NPP.

During the period after the Second National Report the following documents have been developed and implemented:

- Quality rules. Records Management in Kozloduy NPP;
- Safety Instruction on the fulfillment of the Kozloduy NPP's obligations as operator;
- Quality Instruction on signing and management of contracts in Kozloduy NPP.

During the same period the Complex program for RAW management in Kozloduy NPP has been updated twice. At present the Third Edition of the Program is in adopting process.

The *Rules for environmental management* with set instructions have been developed (according the requirements of BDS EN ISO 14001) and their implementation is foreseen.

Quality assurance at the BAS Institute for Nuclear Research and Nuclear Energy

The quality management system, existing in INRNE at the time of the presentation of the First National Report, has been transformed into Integrated Management System, certified according to the ISO 9001:2000 и ISO 14001:1996 standards. The system structure includes the following document types:

- Declaration for policy and goals for quality, environmental protection and nuclear safety;
- Management system manual;
- Procedures;
- Instructions;
- Forms and records.

The Management System Manual reflects the requirements of the Bulgarian nuclear legislation as well as those of the IAEA documents 50-C/SG-Q for quality assurance of safety of nuclear installations.

Quality assurance at SE RAW

The quality management system, existing in SE RAW is developed according to the BDS EN ISO 9001:2001 and the IAEA documents 50-C/SG-Q. The requirements of the BDS EN ISO 14001:2005 for environmental management and BDS EN ISO 10006:2003 for project management were adhered to.

The main principles and requirements for implementation of the basic and support processes have been described in the *Quality Management Manual of the State Enterprise RAW (DP.UK.NK.001)*. The specific activities of all departments are described in Quality management programs, developed in compliance with the requirements of the Bulgarian legislation on RAW management and the IAEA documents 50-C/SG-Q.

, The development of the QMS was initiated in compliance with ISO 9001 „Quality Management System. Requirements" and IAEA GS-R-3 „Facilities and Activities Management System" during the SE "RAW" structuring process and in particular for the incorporation of the SE RAW – Kozloduy SD and SE RAW – Novi Han SD in the company structure.

The step by step separation of SE RAW – Kozloduy SD QMS from those in the Kozloduy NPP and the SE RAW – Novi Han SD such from the Institute for Nuclear Research and Nuclear Energy has been conducted, as well as their integration with the QMS of SE RAW in the period 2005-2007. For this purpose a respective review of the Departments documentations of the QMS was conducted as well, and update was performed according to the demands of QMS of the SE RAW.

In accordance with the publishing of the new IAEA documents on the management systems - GS-R-3 "The Management System for Facilities and Activities" and GS-G-3.1 "Application of the Management System for Facilities and Activities" such as in implementation of NRA's recommendations, the Quality System of SE "RAW" have been setup in Integrated Quality Management System in compliance with the above mentioned Standards and Guidelines. The process includes review and gradual update of the Quality management Manual, Specialized Units Quality Insurance Programs as well as the other internal SE RAW quality system documents. The update of the QMS of the SE RAW is included in the licenses conditions of the SE RAW – Kozloduy SD and SE RAW – Novi Han SD.

The System is defined by Manual for the Headquarter and for the specialized units. The documentation has the following elements:

- Quality System Manual – separated in chapters. Each Chapter describes one separate process and is related to instructions for implementation of stages of the process in the different structural units;
- Instructions - documents that describe the stages or separate activities from a process. In this group two types of instructions have been considered: managerial and technological. The managerial Instructions assist towards the implementation of the enterprise’s management processes and the technological cover the operational and maintenance activities.
- Check lists –forms to the chapters or instructions. The filled out forms become evidences for the preformed operations.

During the preparation of the QMS of the enterprise, efforts were made to implement the procedural and systematic approach, as recommended in IAEA documents, the national legislative requirements in the area of nuclear energy use, radioactive waste management, environmental management and public health and personnel safety. The main accent was put on ensurance of safety during nuclear facilities operation and on radioactive waste management.

The project for construction of the National Repository for Radioactive Waste, assigned to the SE”RAW”, impose the necessity to update the Integrated Management System by implementing a special project management process in compliance with ISO 10006 “Quality Management Systems. Direction for project management and/or environmental management”.

The Integrated Quality Management System is in process of approval and planned to be implemented not later than 30.10.2008. Subsequently and where necessary the revision of the documents of the specialized departments will be initiated. The objective is to incorporate the processes from the specialized departments into the integrated quality management system.

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."

Short review of the information, presented in the frames of the First and the Second National Report for this article

In the frames of the First and the Second National Report the basic requirements of Act on the Safe Use of Nuclear Energy (ASUNE) in the field of the radiation protection, including the legislative obligations on case of accident are presented. The Regulations for the basic standards for radiation protection from years 2000 and 2004 are presented together with the established in them limits for exposure of the staff and the population and the Regulation for radiation protection at work with sources of ionizing radiation. The following limits are given:

For the staff, working in nuclear facilities:

- the limit for the effective dose for the staff is 100 mSv during 5 consecutive years, with maximum effective dose foe every single year not exceeding 50 mSv;
- the limits for the annual equivalent doses keeping the limits for the effective doses are: 150 mSv for eye lenses; 500 mSv for the skin (this limit is for the average dose ,received by every surface witт area 1cm^2, independently of the area of exposed surface); 500 mSv for the hands, forearms, feet and ankles.
- additionally requirements for the exposure of the working women during pregnancy or lactation are introduced, the foetus to be protected like a person from the population and a possibility for radioactive contamination of the mother shall not exist

For the population:

- the limit of the annual effective dose for a person from the population is 1 mSv;
- an annual effective dose of 5 mSv can be allowed only in special circumstances and with condition that the average effective dose for 5 consecutive years will not exceed 1 mSv;
- limits for annual equivalent doses, keeping the limit for annual effective dose for the population, are the following: for eye lenses - 15 mSv, for the skin - 50 mSv (this limit is for the average dose, received by every surface with area 1cm^2, independently of the area of exposed surface)

It is stated that BNRP-2004 introduces the principle of quotas of the exposure of the population from different sources. For the purposes of the optimization of radiation protection in addition of introduced basic limits of the doses of exposure *The Regulation for Ensuring the Safety of Nuclear Power Plants* and *The Regulation for Safety at Management of RAW* introduce additional dose quotas for the population exposure.

The reports contain information for the mechanism for establishing of limits for the releases during normal and accidental circumstances.

The structure of the national regulatory and control bodies for radiation protection and their rights and functions are presented. In appendix the structures for radiation protection of the general operators of the facilities for management of spent fuel and radioactive wastes are presented - Kozloduy NPP, State Enterprise for Radioactive Waste with its specialized units SE RAW-Kozloduy SD and SE RAW – Novi Han SD and the Research Reactor IRT-2000 in the Institute for Nuclear Research and Nuclear Energy (INRNE).

An information for the environmental radiation monitoring networks of the licensees is presented and also an information for the radiation monitoring conducted by the central state institutions. A detailed information for the radiation exposure of the personnel of the big operators, the releases from the nuclear facilities and the radiological impact of the basic facilities on the population for the period of the two reports is presented.

Operational experience after the presentation of the Second National Report

Dose exposure of the personnel of Kozloduy NPP , involved in the management of spent fuel (SF) and RAW

The basic factors for the radiation impact on the personnel of Kozloduy NPP and SERW-Kozloduy are connected with the parameters of the working area in the premises of the controlled zone of EP-1, EP-2 and Spent Fuel Storage Facility (SFSF), that are:

- gamma dose rate ;
- beta flux density;
- neutrons flux density and neutrons equivalent dose rate ;
- concentration and radionuclide content of the radioactive gases and aerosols in the air of the working premises;
- surface contamination with radioactive substances of constructions, equipment and working cloths of the personnel.

The performed investigations of the factors determining the total dose exposure show that the basic is the external exposure with leading gamma radiation. The beta radiation has a contribution in the total dose from external exposure only in separate cases and can be estimated maximum to be not much than 10% on the base of the results of the independent expert evaluation made by the National Center for Radiobiology and Radiation Protection (NCRBRP), which is conducting individual dosimetric control (IDC) with film dosemeters. The contribution of the thermal neutrons during the period of the transportation of the SF is negligible and the individual doses from neutrons, evaluated by independent experts does not exceed the level for registration (0,20 mSv) according to the *Regulation 32 for the conditions and the order for performing of the individual dosimetric control of the persons, working with sources of ionizing radiation.*

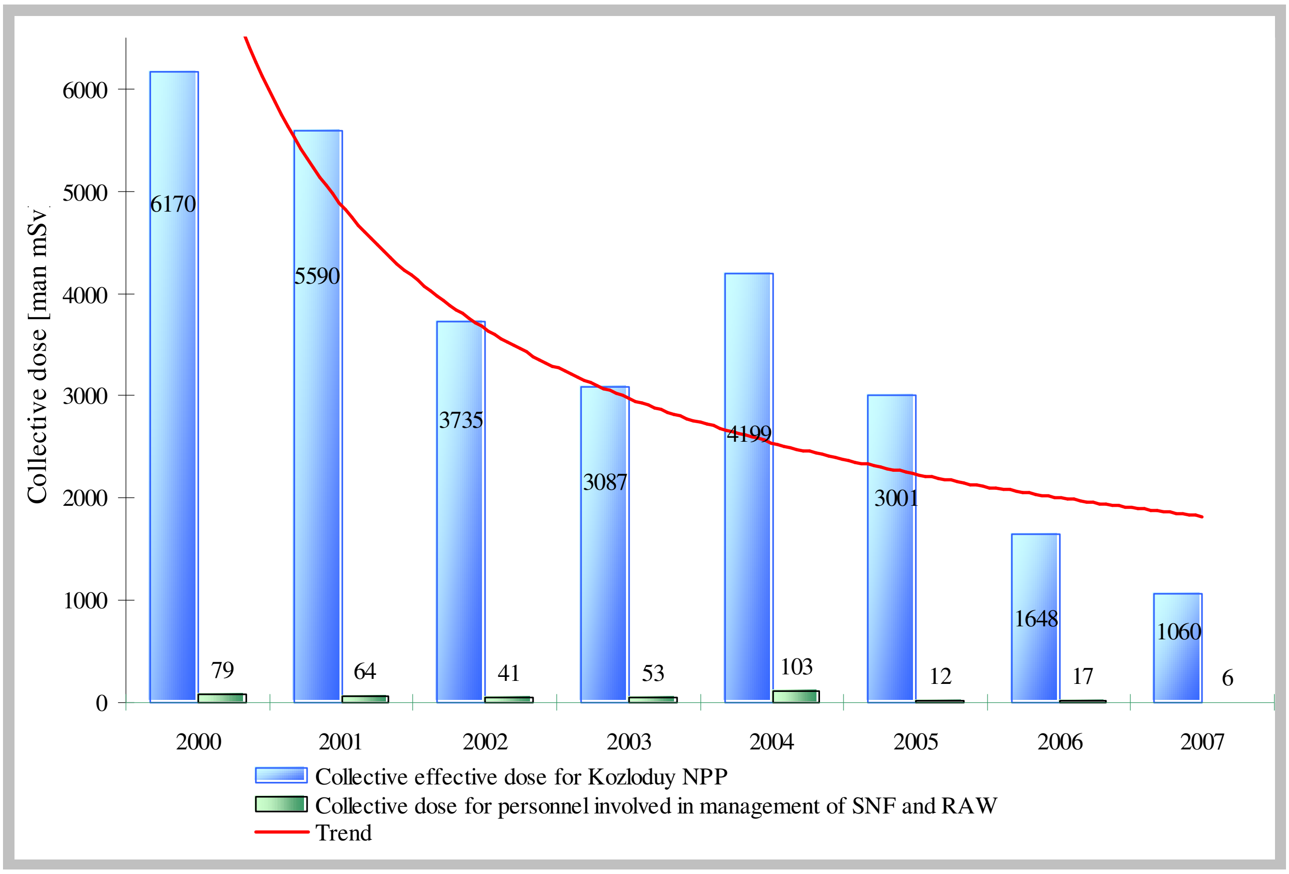
The basic method for measurement of the doses from external exposure is the thermo-luminiscent individual dosimetric control with sensitivity 0.10 mSv. Electronic dosemeters with sensitivity 0.01 mSv are used for the purposes of operational dosimetric control.

The internal exposure from incorporated radionuclides (fusion products and activation products) is controlled with whole body counters with shielding type “shadow” and geometry of measurement “linear scanning”. Gamma emitters with minimum detectable activity for the whole body 340 Bq for ^{60}Co and 330 Bq for ^{137}Cs are detected. In 2007 year there are not doses from internal exposure above the level of registration 1 mSv for an year according to the *Regulation 32 for the conditions and the order for performing of the individual dosimetric control of the persons, working with sources of ionizing radiation.*

The collective effective dose only for the personnel of SERAW-Kozloduy, registered after work in the controlled zone of Kozloduy NPP related to the manipulating of RAW in EP-1 and EP-2 during the period 2005 – 2007 are the following: 10.48 man.mSv, 8.24 man.mSv и 2.30 man.mSv, which is 3.5%, 5.0% and 2.2% of the annual collective dose in Kozloduy NPP. The average annual individual effective dose during the last three years decreases from 0.17 mSv to 0.01 mSv, the maximum dose – from 2.69 mSv to 0.76 mSv.

The collective effective dose of the personnel of Spent Fuel Storage Facility (SFSF) in Kozloduy NPP during the period 2005 - 2007 year is: 1.96 man.mSv, 8.86 man.mSv и 3.86 man.mSv, which represents 3.4%, 5.4% and 3.6% of the annual collective dose in Kozloduy NPP. The average individual effective dose during the last three years increases from 0.02 mSv to 0.08 mSv, and the maximum dose – from 0.31 mSv in 2005 year to 3.95 mSv in 2006, and decreasing to 0.42 mSv in 2007.

After 2000 the collective dose of the personnel occupied with the management of RAW and SF, as the collective dose of the personnel of Kozloduy NPP, follow a tendency of decreasing. The higher doses in 2004 are because of the bigger volume of maintenance activities, related to the modernization of units 5 and 6.



Collective effective dose of the personnel occupied with the management of RW and SF and the whole personnel of Kozloduy NPP during the period 2000÷2007

Occupational exposure of the personnel in the period 2005-2007.

Indicator	2005 .			2006			2007		
	Staff of SERW working with RW in controlled zone of Ep-1 and EP-2	SFSF	KNPP	Staff of SERW working with RW in controlled zone of Ep-1 and EP-2	SFSF	KNPP	Staff of SERW working with RW in controlled zone of Ep-1 and EP-2	SFSF	KNPP
Collective effective dose [man.mSv]	10.48	1.96	3001	8.24	8.86	1648	2.30	3.86	1060
Collective dose from internal exposure	0	0.32	29.35	0	0	1.04 *	0	0	0
Average individual dose [mSv]	0.17	0.02	0.63	0.05	0.16	0.38	0.01	0.08	0.33
Maxимum individual dose [mSv]	1.99	0.31	13.42	2.69	3.95	13.02	0.76	0.42	8.57
Number of individuals reached the controlled level 20 mSv	0	0	0	0	0	0	0	0	0

*After 1-st of January 2006 levels of registration for the annual expected individual effective dose from 1 mSv for the internal exposure and 0,20 mSv for the external exposure were introduced. (*Regulation 32 for the conditions and the order for performing of the individual dosimetric control of the persons, working with sources of ionizing radiation)*

Releases from Kozloduy NPP in the environment and assessment of the doses to the population

Summarized data for the gaseous and liquid releases in the environment

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

The activity released through the ventilation stacks of Kozloduy NPP for the period 2005-2007 is the following:

Gaseous emissions	2005	2006	2007
Radioactive Noble Gases , TBq	27.78	6.83	1.11
Iodine-131, GBq	0.32	0.26	0.10
Radioactive aerosols, GBq	0.073	0.074	0.068

Since 2006 the prognosticated releases of ^{3}H and ^{14}C have been determined. The determination is performed on the base of the generated energy by Kozloduy NPP and the data published in Appendix C of the Report UNSCEAR'2000 for the distribution of the releases for reactors type PWR. At the moment a preparation for the real measurement of those two nuclides, that will start in 2009, is performed.

The volume and the activity that were released during the period 2005-2007 in river Danube with the discharge waters are the following:

Year	2005	2006	2007
Volume, m^3	92 577	84 840	53 754
Activity, MBq *Without tritium*	1 881	1 114	273
^{3}H, GBq	17 447	20 159	22 117

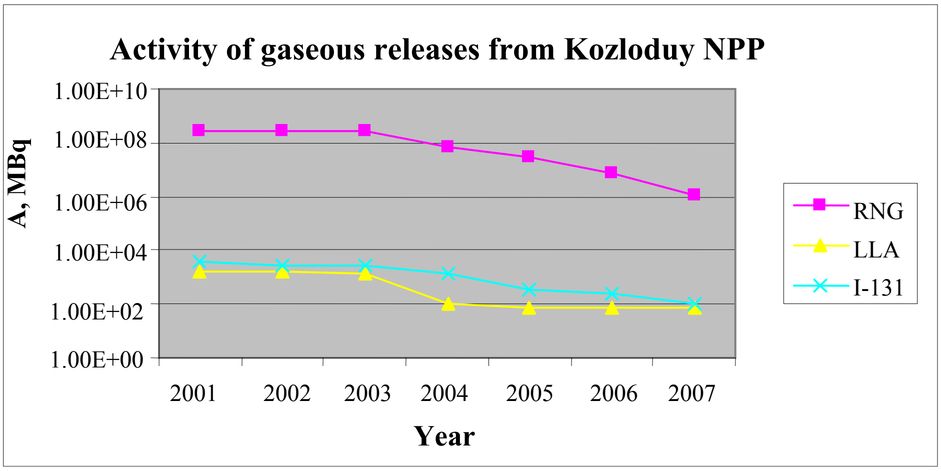
During the recent years the released liquid activity in the environment from Kozloduy NPP (without tritium) shows steady tendency towards decreasing. Basic source for tritium are the release waters from units 5 and 6 (WWER-1000). The registered increasing of ^{3}H during last years is due to the work of the units 5 and 6 at full power after the shutdown of the other units.

The activity released from Kozloduy NPP is comparable with the usual practice in other countries, operating nuclear reactors type WWER.

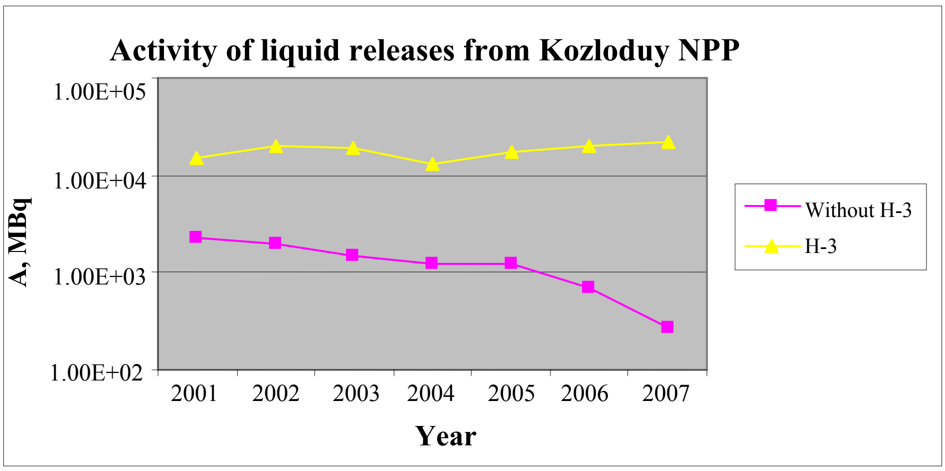
Due to the fact that SE RAW-Kozloduy SD is situated at the site of Kozloduy NPP and uses the facilities of Kozloduy NPP for its releases, the information for the measured values is included in the reports of Kozloduy NPP for the releases.

The tendencies for the gaseous and liquid releases from Kozloduy NPP for the period 2001-2007 are given in the figures below

Gaseous emissions:



Liquid emissions:



<u>Assessment of the dose exposure of the population from liquid and gaseous releases</u>

The maximum value of the annual individual effective dose in 30 км zone from gaseous releases from Kozloduy NPP for 2001-2007 is in the range from $1{,}43.10^{-8}$ to $3{,}76.10^{-7}$ Sv/a. This exposure is less than 0.02 % of the background exposure typical for the region of Kozloduy NPP.

The maximum annual collective effective dose of exposure of the population from 30 km zone as a result of gaseous releases from Kozloduy NPP is estimated in the range of from $3{,}00.10^{-4}$ to $7{,}21.10^{-3}$ man.Sv.

The maximum individual dose taking into account the contribution of ^{3}H and ^{14}C is the following:

Year	Maxumum dose RNG+ LLA+ ^{131}I, Sv	Maximum dose ^{3}H, Sv	Maximum dose ^{14}C, Sv	Maximum dose , Sv
2007	$1{,}43.10^{-8}$	$4{,}36.10^{-8}$	$4{,}05.10^{-7}$	$4{,}54.10^{-7}$

The assessments for the normalized collective effective dose for the population from the gaseous releases from Kozloduy NPP compared with the average value for a large number of PWR reactors in world scale show full comparability.

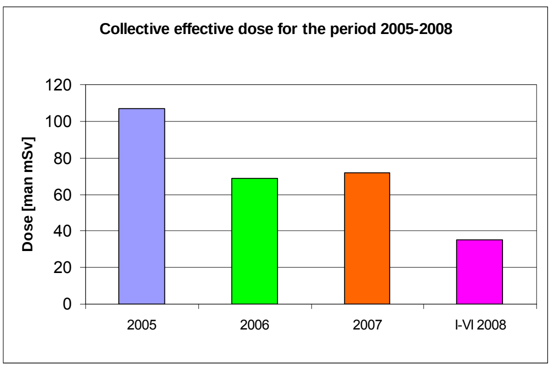
Since 2004 г. a program based on the adopted by the European Union methodology CRAEM is used for the calculation of the doses for the population in the 30 km zone and the critical group from the liquid releases in river Danube.

The results for the dose exposure of the population from the liquid releases in the aquatic environment are:

Year	Liquid releases		
	Collective dose, man.Sv	Individual effective dose	
		max. 30 km zone, Sv	Critical group, Sv/a
2005	$3{,}48.10^{-3}$	$4{,}61.10^{-7}$	$3{,}29.10^{-6}$
2006	$5{,}58.10^{-3}$	$5{,}33.10^{-7}$	$3{,}77.10^{-6}$
2007	$4{,}31.10^{-3}$	$5{,}84.10^{-7}$	$4{,}12.10^{-6}$

Occupational exposure of the personnel in the controlled zone of SE RAW-Kozloduy SD.

Data for the average individual occupational exposure of the personnel of SE RAW-Kozloduy SD are presented below. Data for the collective effective dose for the last three years and the first six months of 2008 year are given also.



Occupational exposure of the personnel of SE RAW – Novi Han SD

The data for the occupational exposure of the personnel of SE RAW – Novi Han SD for the period 2005-2008 are given in the table and figure below:

Dose/Year	2005	2006	2007	I-VI 2008
Minimum individual dose, mSv/a	0.56	0.3	0.2	0.53
Maхимum individual dose, mSv/a	3.05	1.93	2.84	1.6
Average dose exposure, mSv/a	1.86	1.08	1.8	1.27
Number individuals with doses above 20 mSv/a	0	0	0	0
Annual collective effective dose, man mSv	87.42	78.51	99.89	38.2
Dose from internal exposure to the collective dose, (%)	0	0	0	0

Releases in the environment from the facilities of SE RAW – SE RAW-Kozloduy SD and SE RAW – Novi Han SD and prognosis for the dose exposure of the population

SE RAW-Kozloduy SD

There are not direct gaseous and liquid releases from SE RAW-Kozloduy SD to the environment. Their release is trough the relevant facilities of Kozloduy NPP and is included in the Kozloduy NPP reports for the releases

The doses for the population from the operation of the SE RAW-Kozloduy SD are included in the evaluation of the total radiological impact on the population from all the facilities at the site. According to the Safety Analysis Report the contribution of SE RAW-Kozloduy SD to the gaseous releases from the site is less than 0.1% at full loading of the facilities. In reality the releases of long-lived radionuclides through the common collector are 0,01% from the level of the same nuclides for the site.

All waste liquid technological effluents, including distillation product from the evaporation apparatus for concentration of the liquid residues are passed for treatment in the special system of sewers in the Auxiliary Building -3 in PP-2 in Kozloduy NPP.

Following the conditions of the license for operation of the facility for management of radioactive wastes SE RAW-Kozloduy SD submits to the Nuclear Regulatory Agency periodical information about the radionuclide content of the gaseous releases at the input of the common collector of the sucking ventilation systems and summarized results from the radiation monitoring in SE RAW-Kozloduy SD.

SE RAW – Novi Han SD

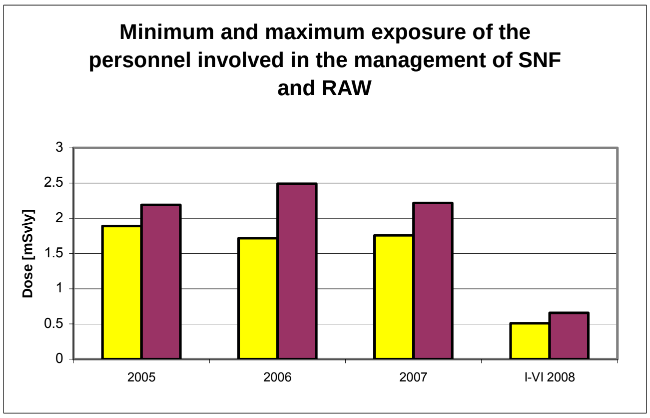
A monthly radiation monitoring is performed with measurement of:

- water samples from control boreholes ;
- soil and vegetation sample from the radiation protection zone and the surveillance zone;
- gaseous measurements at the site with the stored radioactive wastes and at the Laboratory Complex, where the wastes are accepted and identified .

The results from the radiation monitoring do not show presence of unnatural radionuclides in the measured samples.

Research Reactor IRT at INRNE in BAS.

Occupational exposure of the personnel



The results for the occupational exposure of the personnel dealing with the management of radioactive wastes and spent fuel in IRT-2000, measured with thermoluminiscent dose meters and electronic dose meters, are presented

After the shutdown of the reactor in 1989 the control of the releases had been stopped. In connection with the removal of the spent fuel and its transportation to Russia in 2006 the Nuclear Regulatory Agency prescribed restoration of the measurements of specific activity of aerosols and since the beginning of 2007 the control has been restored. The results from the measurements in the reactor hall show the following:

- The values for the measured aerosol total alpha specific activity vary in the interval – $2x10^{-4}$ – $3,7x10^{-2}$ Bq/m^3.
- The values for the measured aerosol total beta specific activity vary in the interval – $0,6x10^{-2}$ – 1,6 Bq/m^3.

In 2008 a program for continuous control during the removal of the fuel and moving of the containers with the fuel in the transport vehicle for transportation to Russia is conducted. In the table below the data for the measurements during the removal and transportation of the fuel in 6 control points in the surveillance zone are presented.

Radiation Monitoring										
		KT1		KT2		KT3	KT4	KT5	KT6	
Date	Time	Dose rate [µSv/h]	Total alpha [Bq/m3]	Dose rate [µSv/h]	Total alpha [Bq/m3]	Dose rate [µSv/h]	Dose rate [µSv/h]	Dose rate [µSv/h]	Dose rate [µSv/h]	Total alpha [Bq/m3]
4.07.2008	9:30	0,10	0,01	0,10	0,01	0,10	0,111	0,111	0,128	0,001
4.07.2008	13:45	0,12	0,01	0,15	0,01	0,11	0,11	0,12	0,13	0,010
4.07.2008	23:40	0,12	0,01	0,14	0,01	0,11	0,13	0,12	0,15	0,010
5.07.2008	10:30	0,12	0,01	0,12	0,01	0,13	0,11	0,12	0,12	0,010
6.07.2008	9:20	0,11	0,01	0,15	0,01	0,13	0,11	0,11	0,12	0,010

The results show that the measured values are not different from the background values, typical for the region.

The summarized conclusions for the status of the radiation protection and the radiation monitoring in the working premises and the environment for the Kozloduy NPP and the nuclear facilities for management of radioactive wastes and spent fuel are the following:

- The collective effective dose for the personnel, involved in the management of radioactive wastes and spent fuel, during the period 2005-2007 is in the frames of the planned dose budgets and exceeding above the regulated one are not found

- The individual occupational exposure does not exceed 8-10% from the regulated norms for the occupational exposure in BNRP;
- Non regulated releases in the environment from the facilities for management of radioactive wastes are not registered. Continuous control in the frames of the radiation monitoring is conducted.
- The activities in the management of spent fuel and radioactive wastes in Kozloduy NPP and SE RAW-Kozloduy SD determine negligibly small doses for the population in the region, hundred times below the exposure from the natural radiation background

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."

Brief review of the information presented within the First and the Second National Reports

Both the First and the Second National Reports on the Joint Convention comment on the requirements of the ASUNE for the developing and maintaining of on-site emergency plans of the nuclear facilities and off-site emergency plans functioning on a national level. These plans contain the obligations of the operators and the competent state licensing authorities, the arrangements made regarding the emergency planning and preparedness and requirements for periodic inspection of the plans.

It has been pointed out that individuals that perform activities in connection with RAW and SF management shall take action to prevent incidents or accidents, and restrict or remedy the consequences from them. The action taken for emergency planning and maintenance of emergency preparedness are determined by emergency plans as follows:

- Off-site (national) emergency plan for protection of the public in the event of a nuclear or radiation accident;
- On-site emergency plans for each nuclear facility including emergency plans for the respective ministries, institutions and local administrative and local self-government authorities.

A presentation has been made of the *Regulation on emergency planning and emergency preparedness in case of nuclear and radiation accident*, which defines the principles, the procedures and criteria for applying of protection measures and actions intended to limit, decrease and avert radiation exposure or the likelihood of it, and of any detrimental effects on human health, quality of living, property and environment in instances of accident, chronic exposure or past activities. The regulation defines the intervention levels in terms of values of the projected dose and the avertable dose for a set period of time, the dose rate and specific activity on achieving of which protection measures start to me implemented and analysis of the causes that have led to this condition is made.

Information has also been presented on the existing on-site and off-site emergency plans, the emergency response trainings held in 1996 – 2005, and the participation of our country in international projects on emergency planning.

Amendments to the legislative basis

In December 2006 a *Disaster Protection Act* was promulgated to establish a common rescue system for protection in case of disasters. The definition for disaster given in this law includes incidents and accidents occurring during the management of RAW and SF. The law establishes on a national level a common approach and organization of planning, maintenance of emergency preparedness and response to a disaster occurrence. The law is harmonized with the ASUNE as regards the requirements for preparing of on-site and off-site emergency plans, their contents, human resources and material-and-technical support.

The organization of the establishment, maintenance and coordination of the implementation of the national emergency plan is realized by the Ministry of Emergency Situations and the Civil Protection General Directorate set up at this ministry. The National Emergency Plan regulates the obligations and the responsibilities of ministries and institutions that participate in crisis management and protection in case of disasters, including nuclear or radiation accidents. An integral part of the national emergency plan is the off-site emergency plan for response action in the event of nuclear or radiation accident, which includes as follows:

- response in case of accident in nuclear facility;
- response in case of transbordery radioactive contamination;
- response to radiation accidents (radioactive contamination), in connection with the use, storage or transport of radioactive substances.

At a district or municipal level are developed emergency plans . Their structure and contents are similar to those of the national emergency plan, they are in compliance with it. However, they reflect the conditions specific to the district or the municipality.

Emergency Centres are maintained both at a national and local level, their task being to work with the emergency response teams in remedying the consequences from a nuclear or a radiation accident. The technical devices and tools have been ensured for radiation monitoring under normal and emergency conditions (34 mobile laboratories, more than 50 gamma spectrometric units, 1000 portable radiometric instruments, personal dosimeters to monitor external and internal exposure, automated monitoring systems and forecast of the radiation conditions in case of emergency).

The preparedness for action and response in case of nuclear or radiation accident is reviewed and maintained by periodic training and exercises held at institutional, local, national and international level.

Emergency planning on nuclear facilities sites

Currently, the following emergency plans are in place for the main SF and RAW management of facilities:

- Emergency Plan of Kozloduy NPP Plc., 2007 revision; it includes the SF facilities on-site (spent fuel ponds and the SFSF) as well as the RAW State Enterprise facilities;
- Plan for remedying the consequences and protection of the public and environment in case of radiation accident during transport of spent nuclear fuel, 2006 revision;
- Emergency Plan of SE RAW-Kozloduy SD, 2008 revision;
- Emergency Plan of the nuclear research reactor at the INRNE - BAS, revision 3, January 2008;
- Emergency Plan of the SE RAW – Novi Han SD, 2007 revision.

The Emergency Plan of SE RAW-Kozloduy SD has been harmonized with the one for Kozloduy NPP. According to the emergency arrangements made, the emergency plan and the location of the specialised unit on-site of KNPP, in case of emergency the Chief Unit Shift Supervisor of KNPP Units 5&6 must be informed; he shall evaluate the event on the basis of the data received and, if necessary, activate the KNPP Emergency Plan. Should the conditions be such that do not necessitate the implementation of the KNPP Emergency Plan, the action taken should only follow the Emergency Plan of the SE RAW-Kozloduy SD. Both plans have been tested during drills and exercises.

The nuclear facilities including those for the RAW and SF management have been assigned threat category I, II or III in accordance with the Regulation on emergency planning and emergency response in case of nuclear or radiation accident, as follows:

- Kozloduy NPP Plc – emergency planning threat category I;

This classification includes the potential sources of radioactive discharges, contamination and radiation exposure from KNPP, which means all the facilities and premises that use, store or process nuclear materials, or different radioactive sources, including RAW and SF:

- reactor units;
- fresh fuel storage facilities (FFSF) - one for each two reactor units;
- the reactor ponds - one for each reactor unit;
- spent fuel (wet) storage facility (SFSF);
- auxiliary buildings (AB) 1÷3 - repositories for high and medium level radwaste;
- water treatment systems (SVO) in the control room (CR) and the ABs;
- low level RAW repository (RAWR);
- SE RAW-Kozloduy SD, located on-site of the plant.

The threat category assigning on the plant site has used the conservative approach, selecting the highest risk level. A specificity of the plant emergency plan is the fact that the SE RAW-Kozloduy SD is located on-site of KNPP and is a separate legal entity. The KNPP Emergency Plan defines the procedure for interaction and assisting the SE RAW-Kozloduy SD in case of an emergency, and has been harmonized with the respective plan of the specialised unit.

- SE RAW-Kozloduy SD - threat category III as regards emergency planning;

The emergency plan of the SE RAW-Kozloduy SD has been harmonized with the KNPP one. According to the emergency arrangements made, the emergency plan and the location of the specialised unit on-site of KNPP, in case of emergency the Chief Unit Shift Supervisor of KNPP Units 5&6 must be informed; he shall evaluate the event on the basis of the data received and, if necessary, activate the KNPP Emergency Plan. Should the conditions be such that do not necessitate the implementation of the KNPP Emergency Plan, the action taken should only follow the Emergency Plan of the SE RAW-Kozloduy SD. Both plans have been tested during drills and exercises.

- SE RAW – Novi Han SD - threat category III as regards emergency planning;
- Nuclear research reactor at the INRNE-BAS - threat category III as regards emergency planning;

Emergency training and drills

The regulatory provisions require the licence holders and the holders of permits as per ASUNE to hold periodically emergency exercises and drills. Regarding sites and activities with threat category I, II and III at least one a year a general drill and emergency exercise shall be held under the observation of authorised representatives of the central government.

In December 2007 a drill was implemented entitled "Accident involving long-term drying of SF assemblies in the SFSF and administering specialised medical aid to injured personnel". In accordance with a time schedule of the subjects the SE RAW-Kozloduy SD has held four emergency training exercises. In 2007, the SE RAW – Novi Han SD conducted two drills on fire response on-site and in the off-site area, as well as a drill on radiation accident response on the site.

The implementation of the off-site emergency plan is tested by emergency drills and full-scale emergency exercises, with the latter being conducted at least once in five years. The last full-scale national exercise was conducted in 2002, and the next one is scheduled to take place in October 2008.

Bulgaria actively participates in international emergency exercises and drills for response actions in the event of a nuclear accident. In the period 2006 – 2008 the country has taken part in five international emergency exercises and drills.

In connection with the accession of the Republic of Bulgaria to the EU, in 2005, in the Emergency Centre of the NRA the European Community Urgent Radiation Information Exchange system (ECURIE) was installed. A formal testing of the system was conducted, and the officials of the EFP Department filled in the electronic information exchange forms following preliminary instructions of the EU. The Bulgarian NRA has filed a declaration about the successful installation and the functionality of the CoDecS software. In this way our country has fulfilled its obligations to the Agreement among EURATOM, the member candidate countries and Switzerland regarding the obligations for exchange of radiological information with the EU. Communication tests are performed on a daily basis.

Emergency preparedness inspections

The NRA exercises control over the emergency planning and preparedness of the nuclear facilities in consistence with an inspection plan prepared in advance. These inspections include as follows:

- review of the established procedures and instructions for emergency evaluation and of protection action implementation;
- inspection of the condition of the available technical and protection equipment, the work places of the emergency team members and the shelters;
- checks of the emergency exercises and drills in terms of results achieved, corrective measures and improvements.

In the period between the issuance of the two national reports, NRA inspected the status of emergency planning at Kozloduy NPP, the research nuclear reactor at the INRNE - BAS, the SE RAW and its Specialised Departments.

ARTICLE 26. DECOMMISSIONING

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

(i) qualified staff and adequate financial resources are available;

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

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

(iv) records of information important to decommissioning are kept.”

Brief review of the information presented in the First and the Second National Reports

The First and the Second National Reports present the main requirements of the ASUNE and the effective rules for its implementation in the area of nuclear facilities decommissioning.

The reports also describe the measures related to decommissioning of KNPP units 1 and 2. Special attention is paid to the need of ensuring financial and human resources required for the process. It is pointed out that the principal funding will come from the special Nuclear Facility Decommissioning fund managed by the state.

A description is provided of the existing licensing regime for decommissioning of nuclear facilities. A detailed description is also given of the two main regulatory documents, namely *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*, that contain requirements to the licensing process and the licensing documents, including the requirements to the structure and contents of the decommissioning plan. Clarifications are made as regards early planning of decommissioning and taking into consideration the safe decommissioning as early as designing, construction and operating of the facilities.

It is stated that a Conceptual Technical Design for Decommissioning of KNPP Units 1&2 has been established and information about it is presented. .

Developments in decommissioning following the issuance of the Second National Report

With a decision made by the Council of Ministers of the Republic of Bulgaria, KNPP units 3&4 were disconnected from the electrical power system in the end of 2006.

The Units 1-4 Decommissioning Plans have been updated consistent with the approved, in July 2006, *Updated Decommissioning Strategy* that envisages continuous dismantling of equipment to take place in two main stages:

- Stage 1 (2011–2018) - it commences after the removal of spent fuel from the reactor ponds and includes a period of preparation and safe storage of the primary circuit and dismantling of non contaminated equipment, the turbine hall and the auxiliary buildings;
- Stage 2 (2018–2035) – includes dismantling of the equipment in the control room, the reactors and facilities for RAW processing.

With due regard to the changed operating licenses following the shutdown of units 1-4 and the *Programme for preparatory activities for the decommissioning of KNPP units 1-4,* the following documents have been drafted:

Decommissioning Plan, Units 1 and 2 at KNPP

A decommissioning plan for units 1 and 2 has been prepared and it meets the requirements of article 59 of the *Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy*. The Plan was submitted to the NRA on 31.03.2008 and is undergoing review and evaluation.

Updated Safety Assessment Report for Stage 1 of the Decommissioning

Work on this document commenced in 2007. According to the Programme for Preparatory Activities for the Decommissioning of KNPP Units 1 and 2, the Safety Assessment Report for Stage 1 of the Decommissioning will be completed by 31.03.2010. A Safety Analysis Report for Stage 1 of Decommissioning, unit 1, revision 0 has been prepared and it is undergoing the approval process by the KNPP management.

Updating of the QAP for the decommissioning of units 1 and 2

In the framework of the *Decommissioning Plan of KNPP Units 1 and 2,* the *Quality Assurance Programme for the Decommissioning of units 1 and 2* has been drafted, and currently BNRA has returned it for revision and supplementing.

Report on EIA of the Decommissioning

A Terms of Reference is being prepared for an Environmental Impact Assessment of the Decommissioning of Units 1 – 4 (KPMU/EID/002). Kozloduy NPP has informed the Ministry of Environment and Water (MEW), the Kozloduy municipality and the public about its intention to decommission units 1 – 4. A tender is in progress to select a contractor.

Project for a comprehensive radiological investigation of units 1 and 2 in connection with the upcoming decommissioning

On 31.03.2008 the preliminary results from the *Project for Comprehensive Radiological Investigation of Units 1 and 2* were submitted to the BNRA. The project delivery date is scheduled for 30.09.2008.

As a part of the project implementation Methods for Radiological *investigation* were developed. On the basis of these methods and the *List of Potentially Contaminated Rooms and Areas in the RCA of Units 1 & 2* the following two sampling programmes were established*: Sampling Programme for the Turbine Hall of Units 1 & 2, and Sampling Programme for the RCA of Units 1 & 2*. These programmes served as the basis for the *Schedule for Dismantling, Sampling and Assembly of the Respective Equipment in the Turbine Hall* and *Schedule for Dismantling, Sampling and Assembly of the Respective Equipment in the RCA.*

Planning is in process for radiological investigation of KNPP units 3 and 4, and methodologies are being developed for free release of materials.

Funding of decommissioning

The funding of decommissioning is performed through the Nuclear Facilities Decommissioning Fund as provided in the *Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the Nuclear Facilities Decommissioning Fund* as described in the Second National Report. Additional funding is ensured through international funds.

The Fund proceeds are formed from payments by nuclear facility operators, state budget resources, etc. The accumulated funds are spent with the sole purpose of financing of decommissioning projects and activities in nuclear facilities.

Data on Nuclear Facilities Decommissioning Fund resources by years

Year	Payments, in BGN	Spent funds, in BGN	Available funds, in BGN
1999	552 200	21 858	530 341
2000	66 529 463	75 583	66 984 221
2001	101 972 530	1 797 011	167 159 740
2002	114 915 995	2 234 444	279 841 292
2003	157 292 123	1 997 363	435 136 052
2004	114 979 069	1 167 339	548 947 782
2005	102 719 951	1 329 000	650 338 733
2006	103 823 638	994 993	753 167 378
2007	50 173 786	29 546 000	773 795 164
By 30.06.2008	25 201 055	*By the time of Report drafting there is no data on the funds spent*	798 996 219
Total	**838 159 810**	**39 163 591**	**798 996 219**

The Kozloduy International Decommissioning Support Fund established by the European Commission on the basis of agreements with the Republic of Bulgaria is used for financing and co-financing, through subsidies for the preparation and implementation of selected projects supporting the decommissioning of KNPP units 1-4 as well as other projects in the energy sector. The subsidies are granted in correspondence with the rules of the Fund, depending on the available funds and subject to approval by the competent authorities of the Fund. The mechanism of giving the grants to the corresponding recipients is set out in the Framework Agreement between the Republic of Bulgaria and the European Bank for Reconstruction and Development (EBRD) signed on 15.06.2001. EBRD administers these subsidies.

By 30 June 2008, the funding of projects preparing the decommissioning of KNPP units 1-4 has been carried out through Grant Agreements with costs booked on the respective projects to the total amount of 67,299,000 BGN.

The accounts book give data on the financing so far through the KIDS Fund as follows:

Year	2003	2004	2005	2006	2007	Total
Amount (thousands BNG)	6 529	6 382	1 513	1 578	51 297	67 299

Detailed information on the projects funded from the international KIDSF fund is presented in Annex L-7.

SECTION G: SAFETY OF SPENT FUEL MANAGEMENT

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."

<u>Brief review of the information, presented within the frame of the First National Report</u>

It is noted, that the main safety requirements for spent fuel management were defined in the ASUNE and the regulations in force for its application.

The reports describe the requirements of the Environmental Protection Act regarding the assessment of the environmental impact (EIA) of the investment proposals connected with spent fuel management. During the drafting of the EIA the biological, chemical and other risks that may be connected with the SF management have been taken into account.

Consideration is given to the action envisaged by the Republic of Bulgaria to ensure reducing of the radiation impact on-site of Kozloduy NPP and avoid imposing of undue burden on the future generations.

A detailed examination is provided of the *Regulation on ensuring the safety of spent fuel management, Regulation on ensuring the safety of nuclear power plants, Regulation on ensuring the safety of research nuclear installations,* and the *Regulation of EIA of investment proposals for construction, activities and technologies* related to the implementation of article 4 of the Convention.

The reports indicate that the basic safety functions - ensuring of subcriticality and residual heat removal is assured by the design of the SF management facilities. To ensure subcriticality under normal operating conditions and in the event of design accidents, the neutron multiplication of effective coefficient has to be below 0.95. The burn-up of SF may be used as a parameter justifying nuclear safety only if technical means are implemented to control the burn-up of the SF that is transferred to the facilities.

The design of the facilities for SF management envisages technical means and organizational measures that prevent the possibility of temperature rise of the spent fuel elements cladding above the design limits under normal operating conditions and in the event of design accidents.

Consideration is given to the regulatory requirements to the technological processes for SF management and preliminary treatment that have to be designed so that the RAW quantities should be minimum practicable. The design shall ensure limitation of the volume and activity of the liquid RAW arising to a level as low as reasonably achievable. The RAW management systems are designed taking into account the requirements for SF safe management throughout the entire lifetime of the facility. It is highlighted that the RAW minimisation principle during SF management has also been adopted in the National Strategy for management of SF and waste.

It has been explained that according to the ASUNE and the regulations on its implementation, for the purpose of SF management the exposure for the personnel and the public has to be kept as low as reasonably achievable. Effective protection of the personnel, the public and the environment is ensured by applying the defence in depth principle through establishing a system of physical barriers along the way of ionizing radiation spreading in the environment and a system of technical and organizational measures for protection of the barriers and preserving their effective performance.

The normative requirements are listed regarding the annual individual dose limit for internal and external exposure of the public caused by liquid and gaseous discharges to the environment from SF management facilities and also from discharges resulting from design and beyond design accidents.

Consideration is given to the legislative and regulatory measures for protection of the future generations and avoidance of the imposing of undue burden on them. The latter principle, avoidance of the imposing of undue burden on future generations, is stressed to be the key principle in the Strategy for SF and RAW management approved by the Council of Ministers. While considering the various options for SF management, the Strategy identifies as the best one in terms of avoidance of the imposing of undue burden on future generations, to be the option of transporting the SF back to Russia for processing and return of the radwaste for storage.

Ensuring of subcriticality and residual heat removal

SFSF on-site of Kozloduy NPP

The subcriticality is assured by the design of the baskets (the spacing distance of the SF assemblies and the material for the baskets) and the spacing distance of the baskets within the pond. This permits filling of the spent fuel pond with demineralised water without soluble neutron absorber. When subcriticality is evaluated the burn-up is not taken into account.

The residual heat removal is ensured by as follows:

- heat exchangers cooled with service water;
- evaporation of the water in the pond;
- ventilation of the room above the water;
- heat loss through the building structure.

The cool down system has been designed with a high level of redundancy of the active components. The cooling water is fed into the ponds from the top, due to which their draining on account a syphon effect is not possible; the possibility exists to transfer water from tanks at a rate 10 times higher than that of the maximum design leaks from the pond. The double lining of the ponds ensures high tightness level and reliable leak control. The lining is supported by a porous concrete layer. In case of a leak through the lining water oozes through the porous concrete layer to special collection points from all the sides of the pond and in the centre on the bottom. These water quantities are then collected in a system of controlled leakage, and further transferred to the water treatment system.

Reactor ponds at the KNPP units 1-4

The subcriticality is ensured by the design, namely by the spacing of the grid, which provides a minimum of 5% subcriticality during the SF storage and at a maximum effective multiplication coefficient (the pond fully taken by fresh fuel, absence of soluble neutron absorbent in the water, and at 20˚C water temperature)

According to the design, the cooling system consists of two independent channels. Each channel provides heat removal and maintains the temperature in the reactor ponds within the 20÷50˚C range, with the pond completely filled with SF, including holding the assemblies from the full "hot" core.

Emergency cooling of the reactor pond heat exchangers is provided by additionally installed emergency make-up water system on each unit, as well as additional emergency make-up water system in case of reactor pond leakage that exceeds the pump flow rate of the filling system.

Reactor ponds at the KNPP units 5 and 6

The racks are manufactured from borated steel and they ensure subcriticality in the pond not lower than 5% in case of design initiating events, including the drop of a heavy object. The absorbing capacity of the rack cells is preserved over the entire operational period. The reactor pond is filled with boric acid solution with a strength of 16 g/kg.

The cooling system consists of three channels, three pond cooling pumps, three heat exchangers at the suction part of each pump. pipes and valves. The channels are joined by means of connection of the suction and the discharge pipes, which permit switching from one channel to the other in the event of failure of any of the channels. Three fast acting localizing valves are installed at both the discharge and the suction pipes, one of the valves being placed in the containment. The heat exchangers are cooled by the service water system for significant users, and each channel is separately cooled.

The performance capacity of each of the three channels is such that each of them can ensure heat removal from the reactor pond under any of the system operating modes.

RAW minimization

The regulations providing for the safety of the spent fuel, generated by nuclear power plants and research reactors, require such a design that limits the liquid RAW volume and activity to as low as reasonably achievable levels through efficient cleaning systems and multiple use of the radioactive fluids, prevention of leakages from systems containing radioactive fluids and reducing the frequency of occurrence of events that require significant decontamination efforts.

Section H of this report, the text on article 11 of the Convention, contains information on the RAW from the SF management in the SFSF , and the respective trends. The same section provides data on the generation of RAW and the trends in this field as regards KNPP units 1-4, and summarised data on the RAW generated on units 5 & 6 (it is not possible to specify what part of the RAW is generated from the SF storage and what the share of the units operational waste is).

Taking into consideration the interdependence of the different SF management stages

The National Strategy for SF and RAW Management considers the separate stages of SF management and offers a detailed analysis of the various storage and processing options. The analysis has due regard to a number of factors related to safety, environmental protection, funding, disposal of the processed RAW, etc.

The safety regulations define requirements to the nuclear facility design to ensure the possibility for spent fuel retrieval for transportation, processing or disposal at any time of the facility operation. The nuclear power plant operator and nuclear research installation operator are obliged to maintain an adequate storage mode of the spent fuel in the reactor pond, in order to ensure the opportunity for delivering the fuel for processing or storage.

Protection of the individuals, public, environment and future generations

More detail on the practical implementation of the principles for protecting the personnel and the public is presented in Section F of this report (article 24 of the Convention). The submitted Safety Assessment Reports on the existing SF management facilities show no exceeding of the regulated limits for radiological consequences on the public and environment even with the most conservatively formulated scenarios.

The dose limits due to SF management for the future generations assumed in the national legislation are not higher than the currently effective ones. Their actual values and the mechanisms to achieve this level of protection are dealt with in the Second National Report.

The Bulgarian legislation is based on the principle of avoiding to impose undue burden to future generations. The ASUNE envisages the issuance of a nuclear facility operational licence only to an entity that disposes of sufficient financial, technical and material resources, and organizational structure including for the decommissioning of the facility. The ASUNE states that it is the main responsibility of the operator to ensure sufficient funds for the safe termination of the activity of the facility. The resources required for decommissioning are provided through the Nuclear Facilities Decommissioning Fund.

Pursuant to the *Regulation for providing the safety of spent nuclear fuel management*, the nuclear operator plans and carries out periodic systematic assessment of the safety of the facilities, evaluation of the radiation impact on the environment, at reasonable time periods over the facilities design life, and ensures safe operation at a safety level consistent with the normative requirements in force. The assessment frequency period may not be longer than 10 years. .

Biological, chemical and other risks

In general the SF management does not pose any substantial biological, chemical or other conventional risk. The assessment of these kinds of risk is subject to the EIA, which is applied in these cases as in any other industrial activity.

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."

Brief review of the information presented within the framework of the First and the Second National Reports

An Annex provides a description of the SF management facilities available by the time of entering in force of the Convention. Data is provided on the performed and the planned safety analyses of the SFSF and the reactor ponds at KNPP. The temporary enactments of the *Regulation for providing the safety of spent nuclear fuel management* are presented regarding modifications resulting in changes in structures, systems and components important to safety and located on the welded facilities for SF management, that had been commissioned before the Regulation coming in force. It is stated that the enactments of the regulation apply in maximum force to welded SF management facilities.

Information is provided on the safety reviews and safety enhancements of the existing facilities. It is noted that on the ground of the submitted safety analysis and safety assessment reports, an operational licence valid to 2014 has been issued to the SFSF . The licence conditions related to the SFSF safety reviews and safety enhancements are discussed.

Safety reviews and safety enhancements carried out on the existing facilities

SFSF

In order to provide arguments in support of the potential long term for safe storage under water of the spent fuel assemblies, in 2006 "accelerated corrosion tests" were performed again, using a specially developed methodology that allows to model the impact of an aggressive (aqueous) medium. The tests confirmed the satisfactory condition of the cladding after 50 years of storage.

An evaluation has been made on the status of the construction materials of the ponds lining and the transport storage baskets. Their integrity has been preserved. Their corrosion resistance has been proved for a 50-year operational period.

In 2007 an analysis was made to determine the lifetime of the SFSF building and equipment.

All the measures of the SFSF modernisation programme have been complete by 2008.

Section K of this Report contains information on the measures implemented for safety enhancement of the SFSF .

Reactor ponds 5 and 6

A safety review of reactor ponds 5&6 was conducted within the framework of SAR updating after the modernisation of the respective units. The reactor pond safety was evaluated both under normal conditions and with postulated failures.

Under normal operation conditions

The cooling system proved functional under any operational modes of the unit, thus ensuring the cooling of the fuel in the reactor ponds. The pond is constantly filled with boric acid solution at nominal level and temperature.

In the long-term fuel storage mode it is sufficient to have only one pump working to cool the pond and ensure the normal water temperature (operational range of +20 - +50°C). The availability of three pond cooling channels provides for sufficient redundancy of the system and permits maintenance to be effected under any operational mode. In case of a failure of the channel in operation caused by a pump failure, the switch over to another channel is performed remotely by an operator in the main control room. No automated action is required as even in the case of discontinued supply of cooling water, the temperature will increase very slowly, which gives the operator opportunities to take appropriate action.

In case of emergency fuel unload it is recommended to work with two channels of the cooling system. The second channel is remotely switched on by an operator in the main control room. The boron concentration in the pond is monitored by sampling at the pond cooling circuit. In case of deviations from the normal parameters of the water in the ponds, filtering through the water cleaning system is envisaged.

Under conditions of postulated failures

The SFSF will remain functional under safe shutdown earthquake conditions.

On the outside of the building, the walls and the covering plates have been calculated to resists thermal, chemical and mechanical loads that may occur at an instant Dy850 mm pipeline rupture and simultaneous impact of an earthquake with a magnitude up to a design basis earthquake including.

Failure of one channel of the spent fuel pond

In the fuel storage mode there is sufficient safety margin permitting in case of failure of one channel to ensure reliable residual heat removal of the fuel. The stand-by channel is switched on remotely by an operator. From the time of suspending the cooling water feed to the moment when assemblies start drying a period of 8 to 24 hours will elapse, depending on the type of fuel that is stored. This allows the operator to take appropriate action.

In total fuel unload mode if two operating channels are needed, the third has to be tested in advance and be in a stand-by mode until the primary circuit revision and the core re-fuelling operations are complete.

Failure of all the channels of the spent fuel pond cooling system

In this mode, the heat removal of the stored fuel is performed by evaporation of the water in the pond. To prevent level drop in the fuel areas and drying of assemblies, sprinkler system from the EBT is used, the switching of which is again made remotely by the operator. The time available to take this action is again long enough (of the order of hours). Due to the availability of sufficient time, any operator's error is excluded and the fuel storage criteria are met.

Pipe rupture in the cooling system of the spent fuel pond

During the underwater storage of fuel, the level is maintained at +28.8 m. The axis of the suction pipes is at elevation 28.1 m, while the assemblies' tops are at +25.9 m. The discharge pipes practically reach the floor of the fuel areas and they are equipped with devices for passive breakdown of the syphon at the overflow elevation. A pipe rupture in the cooling system of the spent fuel pond may result in a partial decrease of the water level of the pond (down to 0.9 m below the nominal level) and this will not lead to drying of the fuel assemblies.

A pipe rupture may lead to loss of the channel functionality. On getting a signal for level drop or temperature increase, the operator should switch over to the reserve channel of the cooling system.

A pipe rupture may occur also during the transfer of fuel from the core to the SFP or during the handling of fuel to place it in a transport container. In this mode the water level is maintained at +35.7 m. In this case there is a danger of drying for the transported assembly. Analysis has shown that it takes about 20 minutes for the water level to drop from +35.7 m to +28.1m (the suction pipe elevation). Depending on the phase of the handling operation, the assembly is either returned to the fuel pond or placed in the container. The duration of the operation of submerging the assembly below the water surface is ca 10 minutes.

Decrease of the boric acid concentration

Concentration may decrease due to the following causes: operator's error, tube leak at the heat exchanger of the SFP. The design calculations provide a nuclear safety analysis under this emergency mode.

Draining of the SFP

The draining SFP mode may be caused by the following:

- loss of power supply from all AC sources at KNPP, including the reliable power supply sources (diesel generators), which will lead to continued failure of the SFP cooling system and its make-up (including emergency make-up);
- wrong decision of the operator related to failure to switch the emergency make-up with accidents including the SFP cooling system (isolation of the containment).

Under such circumstances the residual heat removal of the spent fuel is performed by evaporation of the water available in the pond. The water level in the pond may drop to a level when assemblies are left in the dry for a period from 8 to 12 hours. In the course of this available period the operators have to resume the operation of the systems for normal or emergency cooling.

Design assessment

The analysis conducted allows for drawing the conclusion that the SFP was designed in compliance with the effective regulatory and technical documents and meets the set objectives.

The strength of the reinforcement structure is assured against impacts in design modes including maximum design basis accident and safe shutdown earthquake. The required strength and compactness of the leaktight metal lining is ensured.

The SFP subcriticality is guaranteed in all normal operation and design basis accident modes through suitable design solutions and administrative measures.

The design solutions regarding the SFP cooling system ensure implementation of the safety functions in normal operation and design basis accident modes as well as defence in depth.

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."

<u>Brief review of the information presented within the framework of the First and the Second National Reports</u>

The reports describe the requirements set out in the *Regulation for providing the safety of spent nuclear fuel management* and the *Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy* regarding the site selection for SF management facilities. It is highlighted that in the process of the site selection for SF management facilities it is necessary to study and assess the site features that may affect the safety of the facilities, and the effect of the SF management facilities on the public (present and future) and the environment. A list of documents is provided that the applicant has to submit together with the application for issuance of a site approval order. The data is identified that needs to be included in the preliminary safety analysis report that should be part of the document package of the application for issuance of a site approval order. It is also stated that whenever the nuclear facility is envisaged to be located on-site of another already constructed and commissioned nuclear facility, the preliminary safety analysis report shall consider the possible impact on the safety of the proposed new facility and the other nuclear facilites built on the same site.

The reports describe the requirements of the EPA for organizing of a public hearing of the EIA results together with the municipality authorities and the competent body that issues the decision on the EIA. The sequence of EIA implementation is provided, as regulated in the *Regulation about the environmental impact assessment of investment proposals for construction, activities and technologies*. The competent body on making a decision on the EIA is the Minister of the Environment and Waters. The decision on the EIA is made on the ground of the prepared environmental impact assessment, the results from the conducted consultations and public hearing in compliance with the legislation in force. If necessary, the decision should contain measures for mitigation or averting of negative impacts on the environment drafted as a Plan and being obligatory for implementation by the investor / operator during the designing, construction, operation and eventual shutdown of the installation/facility.

A list is provided of the responsibilities of the Minister of Environment and Water in connection with notifying other states about investment proposals for construction, activities and technologies on the territory of the Republic of Bulgaria regarding which a considerable environmental impact on their territory can be assumed.

The reports also note that the Republic of Bulgaria is a party to the Convention for Evaluation of the Environmental Impact Assessment in transboundary context. There is a list of the agreements for operational notifying in case of nuclear accident and information exchange on nuclear facilities with the neighbouring countries.

Information is also provided about the issued site selection permit and an order of approval of the DSFSF site selected. .

Issued permits for site selection for SF management facilities

On 21.12.2006 the BNRA Chairman approved by an order the site selected for construction of the Belene KNPP. The order points out as follows:

- the conditions set out in the site selection permit issued in 2004 have been met;
- no conditions or factors have been found that prevent the siting of a nuclear power plant on the selected site;
- it is envisaged that at the designing stage consideration will be given to the site features that require taking additional steps in order to ensure consistent implementation of the defence-in-depth concept;
- the preliminary safety analysis report substantiates the possibility for construction and subsequent operation of a nuclear power plant on the selected site.

This order obliges the National Electricity Company Plc to:

- consider in the design basis the external impacts that are typical of the selected site, including the maximum parameters of these impacts, taking into account the behaviour of the structures, systems and components, using deterministic methods, and based on the requirements in the regulatory legislation, the IAEA standards and the current nuclear power plant designing expertise;
- continue to monitor the parameters of processes and phenomena of natural origin and periodically control the parameters of msn-made factors included in the design basis and, if needed, provide for additional monitoring technical instruments, as well as maintain a data base of the Belene NPP location conditions and the most important information about them;
- submit to the BNRA, on demand, data from the data base mentioned above, together with information on the steps taken in connection with changes of the initial location conditions that might affect safety;
- envisage in the design a set of actions and tools to avoid and mitigate the negative impact of the safety significant hydro-meteorological, geological and engineering-geologic processes, phenomena and factors on-site, taking into consideration possible scenarios for their development, their interrelation and correlation and, if needed, protection of the personnel directly involved in the management of the nuclear power plant.

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 is supported by experience, testing or analysis.”

Brief review of the information submitted in the frames of the First and Second National Reports

A description of the requirements of the *Regulation for providing safety of spent nuclear fuel management* and *Regulation for safety of the decommissioning of nuclear facilities* concerning design and construction of the SF management facilities is provided. It is pointed out that safety of the spent fuel management facility is provided through:

- conservative approach in establishing the barriers and the protection levels;
- high quality of design, construction and equipment;
- implementation of technologies proved in the practice;

It is pointed out that the design of the spent fuel management facilities should contain a preliminary SAR for spent fuel storage, transport and handling for normal operation and design-basis and beyond design-basis accidents. After the facility construction, the SAR is updated according to its current state.

The obligation of the Holder of the permission for design or construction to develop preliminary and interim concepts and plans for decommissioning of the nuclear facility has been discussed.The requirements to the content of the Concept including the requirement for completion of the preliminary analysis and assessment of the impact of the decommissioning of the nuclear facility on the population and the environment were given.

Designed and constructed facilities

Dry Spent Fuel Storage Facility at the site of Kozloduy NPP

The storage technology for the Dry Spent Fuel Storage Facility includes a system for storage of containers with natural convection of air cooling. The reinforced concrete CONSTOR®440/84 type containers have the storage capacity of 84 spent fuel assemblies of the WWER -440 type reactors per container

The container consists of an enclosure with a basket, a closing system of the container with the first cover, sealing plate and footstep bearings. The enclosure of the CONSTOR® 440/84 type container is used as a chamber for incorporating the basket and the fuel assemblies. The container enclosure is a “sandwich” type with external and internal shell of fine grained steel. There is an intermediate layer of CONSTORIT (granulated material with a cement solution) between the external and internal shells, as well as tensioning studs. The protective gamma irradiation shielding is provided by the external shell, the CONSTORIT layer and the cement solution, and the neutron irradiation is mitigated mainly through water in the cement solution. 124 steel coiling plates in total are welded to the surface of the external shell. The first cover closes the interior of the containers at its upper end. The sealing plate, which is the fist independent sealed barrier, is located between the first and second cover. After placing the sealing plate in the socket of the main sealing ring, the plate is welded to the container enclosure. The second cover is the second independent sealing barrier. It is located above the sealing plate and above the intermediate steel plate and closes the container at its upper end at the main ring. It is made from the welding fine grained steel and provides additional shielding. The second cover is hermetically welded in the socket of the main ring with the container enclosure. The system provides hermetic shells of the spent fuel in the conditions of normal operation and accidents.

The qualified large welds and the welding procedure for the welding the sealed plate and the first cover ensure the same quality of the welds as the factory welds of the container enclosure, and have a standard for pressurized vessels.

The container internals where the spent fuel is located is dried out through a qualified process of container vacuum evaporation and the container is filled with helium. The inert atmosphere of the container internals does not allow the fuel rods to corrode for a long term storage.

The passive system of the Dry Spent Fuel Storage Facility for natural cooling through the air convection and the design of the containers for optimal heat exchange (from the enclosure of the fuel rod to the external shell of the container) prevents from exceeding the temperature limits of the enclosure of the fuel rods and aging process of the structure of the fuel assemblies and the container.

On the 2nd April, 2008 the chairman of the Bulgarian Nuclear Regulatory Agency approved the technical design for the Dry Spent Fuel Storage Facility. The approval contains the following conditions:

- Review the possibilities for usage of the refuelling machine in the wet spent fuel storage facility (SFSF) when loading spent fuel storage in the CONSTOR containers;
- The structure and the content of the Final Safety Assessment Report (Final SAR) should comply with the *Manual "Contents of the Safety Analysis Report of a Dry Spent Fuel Storage Facility", Forum of the state nuclear regulatory authorities of the countries operating WWER type reactors* prescribed by the Bulgarian Nuclear Regulatory Agency ;
- The Final SAR should be complemented with:
  - Identification and predicted amount of radioactive waste generated from decommissioning;
  - Safety analysis during the operation of the first stage of the Dry Spent Fuel Storage Facility for the time of construction of the second stage;
  - Re-evaluation of the combination of loads on buildings from snow, wind and temperature in compliance with the IAEA recommendations, IAEA-TECDOC-1347, 2003;

On the 17th June, 2008 the chairman of the Bulgarian Nuclear Regulatory Agency issued a permission for construction of the Dry Spent Fuel Storage Facility for storage of 2800 spent fuel assemblies from WWER -440 type reactors. Most important conditions of the issued permission are as follows:

- The Holder of the permission shall be obliged to perform quality control when performing the activities for detailed design, as well as control of the incorporated materials, structure and components, control of manufacturing, construction and installation of the equipment of the Dry Spent Fuel Storage Facility so that they shall be done in full compliance with the approved technical design and current Bulgarian regulations;
- The imported equipment shall be designed and manufactured in compliance with the national standards of the counties, where the equipment is manufactured;
- The Holder of the permission shall be obliged to request for the modification of the permission for all changes required in the process of civil construction works, resulting in deviations from the approved technical design related to the nuclear safety and radiation protection;

- The Holder of the permission shall be obliged to analyze and store the results from the performed receiving inspection of the materials, the results from single tests of components, as well as the documents establishing the compliance of the performance of the construction and installation works with the design;
- The safety culture should be a leading principle for performance of the civil construction works. The Holder of the permission shall be obliged to provide priority of safety and quality to the other aspects of the activity, including the costs and planned terms for implementation;
- The Holder of the permission shall be obliged while performing the activity as much as possible to provide unimpeded functioning of the already constructed structures, systems and components of the other on-site located facilities, to which the storage facility shall be technologically connected;
- The Holder of the permission shall be obliged to perform construction and installation works so that the probability for or consequences from accident or failure of the on- site located structure, systems and components shall not be increased, as well as the level of safety of any of the facilities shall not be decreased;
- In order to provide technical assistance for performance of the project, the Holder of the permission shall provide field supervision of the facility design, which shall last also during facility commissioning;
- The Holder of the permission shall be obliged to submit to the Bulgarian Nuclear Regulatory Agency quarterly reports for performance of the civil construction works and schedules for the planned activities for the next three month period;
- The Holder of the permission shall be obliged to maintain a high level of quality for performance of the activities related to the persimmon in compliance with the requirements of the Quality Assurance System implemented currently at Kozloduy NPP;
- The Holder of the permission shall be obliged before starting the activities to approved the Quality Assurance Programme of the Contractor and its subcontractors, as well as their quality assurance plans. The programmes shall be in compliance with the Quality Assurance Programmes of the Holder of the permission;
- The Holder of the permission shall be obliged to exercise effective control of performance of the requirements of the Quality Assurance Programme through establishing a proper organization structure provided with a qualified personnel.

Belene NPP

Permissions for design of the Unit 1 and 2 of Belene NPP with the validity of 2013 and 2015 correspondingly were issued in 2007. The conditions of the permissions related to the spent fuel management are:

- The Holder of the permission shall develop a long-term plan for spent fuel management of the Units and a programme with measures for its implementation, including activities until the disposal of spent fuel or radioactive waste from its treatment. The capacity of the spent fuel storage facilities should be justified in the design.
- The Holder of the permission shall be obliged to ensure in the design solutions for providing safety during unit decommissioning, including, if necessary, allocation of the site for possible installation of facilities for handling, treatment and storage of radioactive waste generated from the decommissioning of the units, as well as creation of data bases required for planning of the bit decommissioning activities.

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).

Brief review of the information presented in the frames of the First and Second National Reports under this article

Description of the requirements of the *Regulation for providing the safety of spent nuclear fuel management* and *Regulation for safety of the decommissioning of nuclear facilities* concerning design and construction of SF management facilities is provided. It is pointed out that the performance of the safety assessment is main responsibility of the licensees and the design of the spent fuel management facilities should contain the preliminary safety assessment reports. Information is presented concerning the environmental impact assessment.

It is pointed out that the design of the spent fuel management facilities should contain a preliminary SAR which is updated in compliance with the current status of the facility after its construction. The SAR shall contain technical and organizational measures, safety analysis and assessment, justification of the performance of main safety functions, the identification of risk of initiating events considered in the design, the demonstration of the achieving of the objectives and safety criteria. The Safety Assessment Report reflects the physical condition of the facilities throughout their entire operational life time and in the period of decommissioning.

Most important requirements to the content of the preliminary SAR, which is submitted with the request for issuing the permission for approval of the selected site for the nuclear facility are reviewed. It is pointed out that it is obligatory to attach the decision on the Environmental Impact Assessment Report (according to chapter 6 of the Environmental Protection Act) to the request for approval of the selected site for nuclear facility.

It is pointed out that to the request for issuing the approval of the developed technical design of the nuclear facility, the Applicant shall also attach an Interim SAR elaborated on the basis of the preliminary SAR and the technical design of the facility. The Final SAR elaborated on the basis of the interim report containing the results from the commissioning of the nuclear facility shall be attached to the application for issuing a license for the operation of nuclear facility.

Legislation changes, related to safety assessment of the facilities

Changes to the legislation and regulations have not been performed after the First and Second National Repost were issued.

Review and assessment of the safety report.

The process of review and assessment of the safety reports may be summarized in the following main stages:

- Selection an expert or a team of experts participating in the process of review and assessment of the documentation, a coordinator of the task and the distribution of work and responsibilities between experts in the team, including methodological instructions for the task implementation for separate cases;
- Perform review and assessment of the application and the attached documentation for compliance with the current regulations, and if applicable, the applicable documents from the

IAEA and other regulatory authorities. If required, the Applicant shall be required to submit additional information for assessment performance;

- Documentation of the results from the assessment in the expert statement of the separate departments at the Bulgarian Nuclear Regulatory Agency, including a proposal for issuing a license or justified refusal;

If in the process of the assessment, a discrepancy of the submitted information with the safety requirements is found, the Applicant shall be sent comments requiring their correction and meetings with the representatives of the Applicant for discussing and clarifying the comment made shall be performed.

In cases when the submitted documents contain information for assessment which requires a special knowledge, the chairman of the Bulgarian NRA may assign the review and assessment of these documents to external consultants according to the proposal of the corresponding Director. The experts from the involved departments shall elaborate Terms of Reference for performance of the expertise and shall take part into the procedure for acceptance of the performed activity.

When performing the programme for review and assessment of the document for approval of the technical design for Dry Spent Fuel Storage Facility, an external expertise was performed by the Interim SAR from RISKAUDIT (a consortium between the French IRSN and German GRS). The RISKAUDIT report which contains the assessment of the report with the ranked safety comments was sent to Kozloduy NPP with the NRA comments.

In the frames of the procedure for approval of the technical design for Dry Spent Fuel Storage Facility, the Applicant shall perform gradual correction of the comments of the NRA and the external auditors, and finally the fifth version of the Interim SAR was approved. Due to significant problems for justification of the subcriticality of the CONSTOR® 1000/19 type container, the NRA refused to issue the approval of the design regarding the part for storage of spent fuel from WWER-1000 type reactors.

The information for the permissions for design and construction of the facilities, issued by the NRA was presented in this chapter in the text of the previous article of the Convention.

ARTICLE 9. OPERATION OF FACILITIES

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

(i) the license 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 program demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operation 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) programs to collect and analyze 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.

Brief review of the information on this article presented within the framework of the First and the Second National Reports

The reports present information on the requirements of the ASUNE regarding issuance of an operational licence for nuclear facilities. They describe the requirements set out in the *Regulation for providing the safety of spent nuclear fuel management, Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy* and the *Regulation for safety of the decommissioning of nuclear facilities* regarding the commissioning and operation of the SF management facilities.

The requirements to the Programme for commissioning of a nuclear facility are identified. This Programme is attached to the application for issuance of a commissioning permit for a NF. The reports note that an operational licence is issued to a nuclear facility only after the conditions of the nuclear facility commissioning permit have been fulfilled, which has to be confirmed by a committee of inspectors from the BNRA, appointed with an order of the Chairman of the BNRA. This committee shall review the document submissions and conduct an on-site inspection. There is a list of the key documents required to be submitted together with the application for issuance of an operational licence for a nuclear facility.

It is stressed that the Technical Specification for Operation that contains the operating limits and conditions shall be compiled on the design of the facilities and the preliminary SAR, and is later adjusted and corrected following the commissioning stage, the introducing of design changes and updating of the SAR.

The operators responsibilities are reviewed as regards developing and applying of parameters and evaluation methodology of the safety level during operation, including a programme for safety self-evaluation that contains an assessment of the safety level achieved, comparison with the planned safety level and specific steps to improve safety.

It is stated that the operator must develop and apply a system for storing, processing and analysis of the information related to the operation of the facilities, the status and failures of the systems and components and the errors made by the personnel. The results from the analyses are reported on a systematic basis and are applied to improve the operating practice, personnel qualification and to optimise the maintenance process.

Operation of the SF management facilities

In the period following the issuance of the Second National Report, no new licences have been issued to SF management facilities.

In 2006 the operational licences of KNPP units 1-4 were changed to prepare for their final shutdown and future decommissioning. In view of the planned long-term operational mode of SF storage, a thorough revision was made of the operating procedures, the supervision and maintenance procedures, and specific rules were drafted to consider the characteristics of the operational mode envisaged. Additional technical solutions were also implemented for process control and monitoring of the parameters that characterize the fuel storage safety. The operator's computer support systems were modernised to automatically register and visually display these parameters. Alternative schemes were provided for spent fuel cooling in case of failure of the regular ones, while additionally on units 3 and 4 extra seismic support was implemented on the delivery and discharge pipes to the spent fuel ponds, as well as a system for emergency cooling of spent fuel was set up. These technical modifications enabled the downsizing of the operational personnel in the main control room.

Reporting of events, analysis of the operational experience

Kozloduy NPP, units 1-6 and the SFSF

The management and responsibilities, the evaluation and analysis methods used and the manner of making decisions for corrective measures and assessment of their effectiveness as regards the feedback of operational expertise have been defined in a system of procedures that are part of the documentation submitted to the regulator body in order to obtain an operational licence for the facilities. The licences define the responsibilities and the range of reporting of operational events, as well as the obligation of the licence holder to ensure their adequate level of analysis detail.

The system covers both own and international operational experience, analysis of deviations, trends, near misses and operational parameters. In order to improve the root cause analysis process and identify the role of the human factor, a *Methodology for Analysis of Events Caused by Human Factor* was developed on the basis of the US methods HPES and INPO.

With the objective of lowering the threshold for selection of events for the root cause analysis, the root causes are analysed not only for events, but also for deviations from the procedures, programmes and errors of personnel, which obviously are below the reporting criteria. An electronic data base has been established to analyse and store all the events occurring on-site of KNPP.

As regards international operational experience, KNPP has made large use of its contacts with other power plants with WWER reactors. Sharing of experience on technical problems takes place via e-mail, workshops of the IAEA and WANO - Moscow Centre.

The Republic of Bulgaria participates through the NRA in the IAEA Information System INES. Kozloduy NPP takes part in the IAEA Information System for reporting of accidents on NPPs (IAEA-IRS). Kozloduy NPP is a direct participant in the WANO information system for reporting of events on NPPs.

In the period since the issuance of the Second National Report, one operational event has been reported in relation to the SF management, and it was assigned "0" level according to the INES scale.

On 30.03.2006 during fuel handling at unit 4, the readings disappeared on the left monitor of the refuelling machine and later the fuel assembly top gripper got stuck. Unsuccessful attempts were made to split the assembly top gripper, following which implementation of the SF transfer programme was suspended. Using a manual gripper, the stuck gripper was separated from the assembly top. The event was assigned level "0" according to the INES scale, as required in item V-1.7.2. of the IAEA Evaluation Guideline, 2001. The event occurred during fuel handling and did not have any significant effect on the operations with irradiated nuclear fuel (there was no leak of radioactivity). There was no breach of the operational safety conditions or the operational limits and conditions of the Technical Specification. The following initial causes of the event were found:

- The probable cause for the disappeared readings in the left monitor of the refuelling machine - 2 (RM-2) must have been unstable power supply of the computer part of the machine. In order to continue the automatic operational mode of RM-2 it had to be switched to "unblock" mode in order to raise the handling pole in transport position, then place the machine in the middle of the SFP and mark the change tool. The operator had moved the machine trolley to the central part of SFP-4 before having raised the work pole (gripper) in transport position.
- The reason for the gripper getting stuck in the assembly head had been the moving of the trolley with the gripper locked to the assembly, and thus the gripper changed its vertical position against the assembly. Due to the tight adhering of the gripper plug to the assembly head, the two parts got stuck together.
- Document *Operational Instruction for RM-2 on units 3 and 4*, does not provide clear instruction on how the RM-2 operator should act in case of a software error and subsequent restart of the computer. Such instructions are described in the technical documentation related to the RM-2 modernisation.

The following corrective measures were implemented:

- A special tool-box talk was held for the personnel on actions to be taken in case of software failure of the machine;
- A UPS was installed to supply power to the refuelling machine computer system;
- Updating was made of the, *Operational Instruction for RM-2 on units 3 and 4*, with directions for action of the personnel in case of failures or defects of the equipment, including the machine software;
- Evaluation of the assembly condition was made.

Decommissioning plans

Preparation of decommissioning plans for the SF management facilities is discussed in Section F of the report, in texts on article 26 of the Convention.

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 ASUNE, the Council of Ministers may declare the spent fuel to be radioactive waste under conditions specified in the Act.

The SF and RAW Management Strategy does not envisage SF disposal.

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."

Brief review of the information presented within the framework of the First and the Second National Reports

The First and the Second National Reports present the basic regulatory acts that regulate the requirements in article 11 of the Convention, namely the ASUNE, EPA, and BNRP -2004. Discussions are offered on the provisions of the ASUNE for ensuring the subcriticality of RAW management, keeping to the minimum the RAW generation and accounting for the interdependence of the different stages of RAW management. Presentaion is made of the *Regulation for safety of RAW management, Regulation for radiation protection during activities with sources of ionizing radiation* and the *Regulation for ensuring the safety of nuclear power plants.*

Special attention is paid on the processes for ensuring of subcriticality and decay heat removal, and the technological solutions implemented to minimize the RAW. The need to put more efforts for exemption of materials from regulatory control is highlighted.

Ensuring of subcriticality and decay heat removal

As recorded in the first two national reports, the *Regulation for safety in RAW management* requires, when needed, the ensurance of subcriticality and the decay heat removal to be considered in the safety cases and taken into account during the designing of the facilities.

The prevailing part of the RAW in our country are category 1 and 2, and do not require any special practical measures for assurance of these aspects of their safe management. In the cases of receiving for storage of category 3 RAW (spent high level sources) the SE RAW – Novi Han SD submits to the BNRA programmes for their safe management on-site, taking into consideration the decay heat removal process.

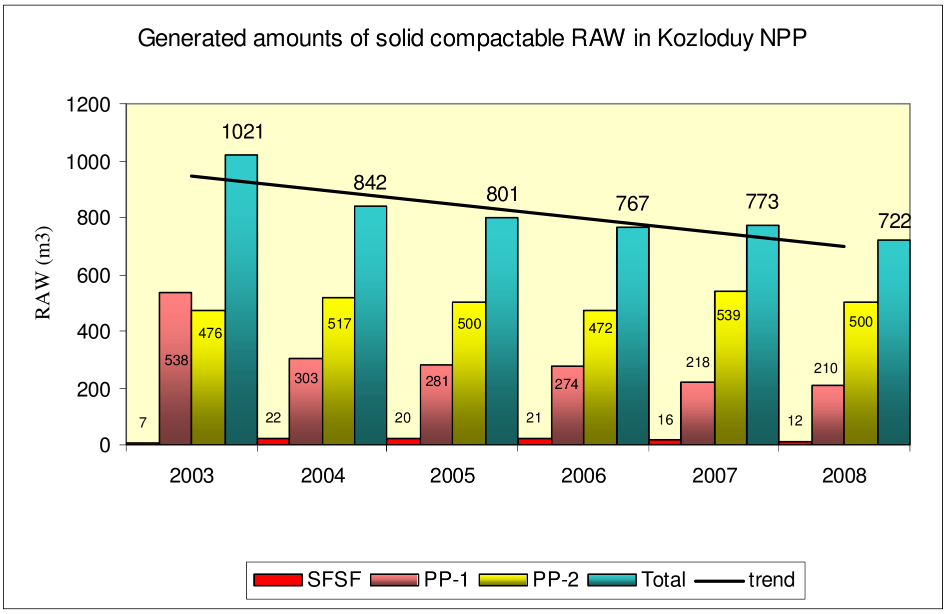
Minimisation of the RAW

The approach adopted since 2005 for RAW management at Kozloduy NPP is oriented to transfer for further processing at the SE RAW - Kozloduy SD of all currently generated category 2a RAW and staged release of all historical waste backlog.

The data presented in the tables and diagrams below define clear trends for decrease of the operational radwaste at KNPP.

Solid compactable category 2a RAW [m^3]

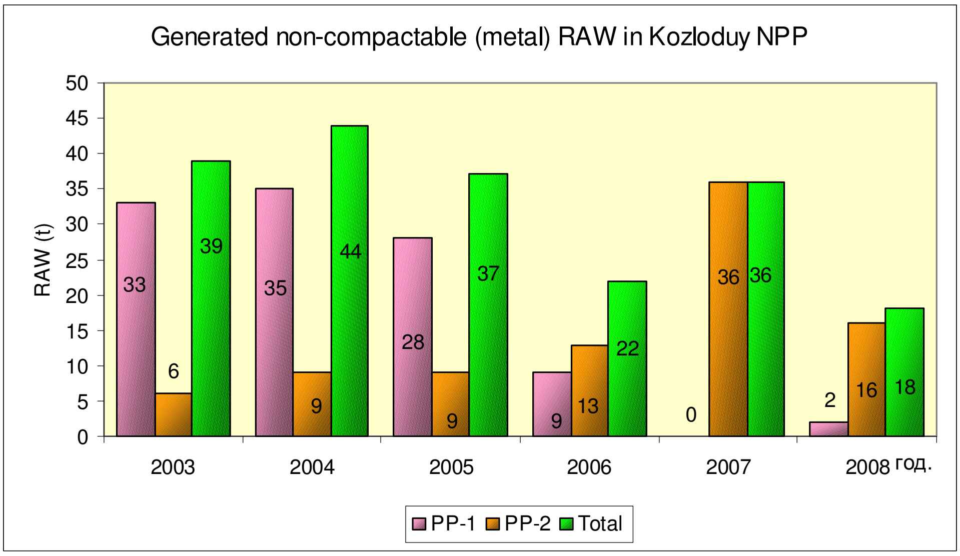
Site	2003	2004	2005	2006	2007	2008*
PP-1	538	303	281	274	218	210
PP-2	476	517	500	472	539	500
SFSF	7	22	20	21	16	12
TOTAL	1021	842	801	767	773	722



*Note:*The 2008 data are forecasts. By 30.06.2008 the actually generated compactable solid RAW are as follows: PP-1 - 59m3, PP-2 - 214 m3, SFSF - 9m3 and total for KNPP - 282m3.*

Solid (metal), non-compactable, category 2 RAW [t]:

Site	2003	2004	2005	2006	2007	2008*
PP-1	33	35	28	9	0	2
PP-2	6	9	9	13	36	16
TOTAL	39	44	37	22	36	18

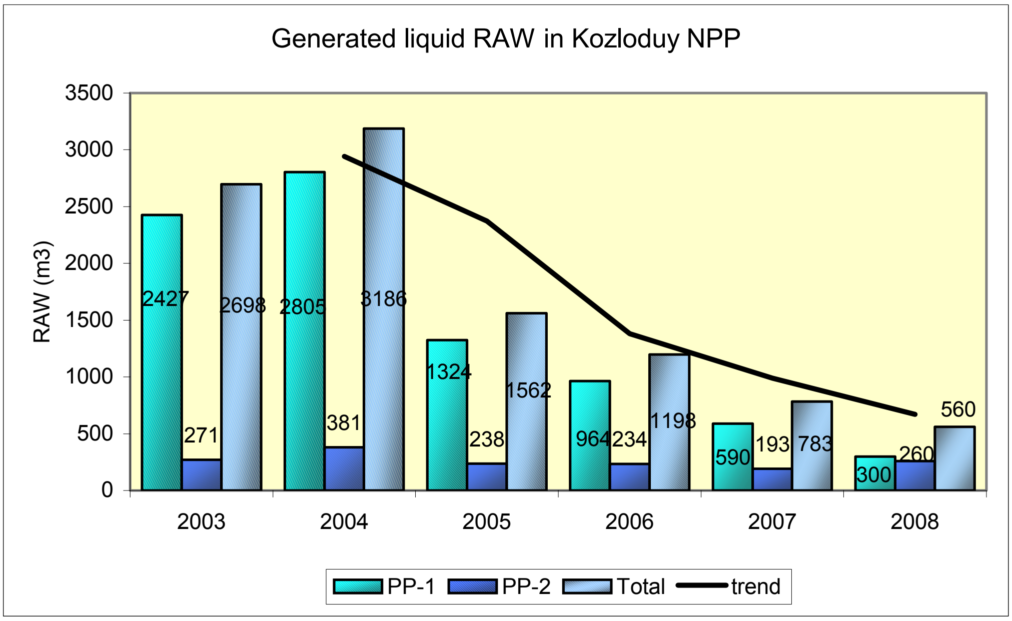


*Note:*The 2008 data are forecasts. By 30.06.2008 the actually generated non-compactible solid RAW are as follows: PP-1 - 1.7 t, PP-2 - 9.0 t, and total for KNPP - 11.0 t.*

The metal RAW delivered from PP-1 in 2007-2008 were generated as a result from equipment arrangement in CR-1. With the completion of the modernisation projects on units 5 and 6 the quantity of non-compactable (metal) solid RAW, category 2a, decreases as regards PP-2.

Liquid RAW generated [m^3] :

Site	2003	2004	2005	2006	2007	2008*
EP-1	2427	2805	1324	964	590	300
EP-2	271	381	238	234	193	260
TOTAL	2698	3186	1562	1198	783	560

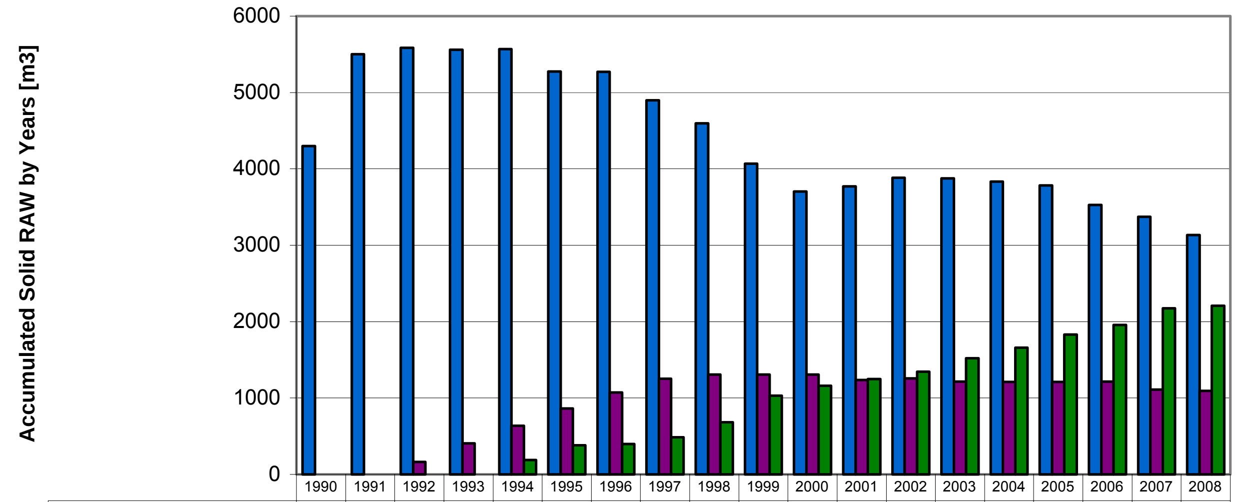


*Note:*The 2008 data are forecasts. By 30.06.2008 the actually generated solid RAW are as follows: EP-1 - 112 m3, EP-2 - 101 m3, and total for KNPP - 213 m3.*

The liquid RAW generation has decreased since the closure of units 1÷4. The rehabilitation conducted on SVO-3 at AB 1÷3, the improved monitoring of the individual processes, the optimisation of the decontamination performed on equipment and rooms and the rest of the measures aimed at minimization of the RAW generation have resulted in a general drop in the liquid RAW generation on-site of KNPP. In order to minimise the RAW generated during the decommissioning process, a project has been implemented for the supply of equipment for measuring of the whole gamma activity of materials of varying shape and size. The equipment and the measurements will aid a more detailed characterization of RAW and correct planning of the further steps for sorting and temporary storage. The effective sorting and identification of any available contamination provides opportunities for segregation of the clean materials and thus reducing the total volume of the generated radwaste.

In the SE RAW – Novi Han SD equipment for inspection on receipt has been introduced with the aim of waste identification and sorting in accordance with their radionuclide composition. The discharging of fire detection ionizing sensors their volume is significantly reduced (down to 80%). The commissioning of the system for cleaning of low level secondary liquid RAW provides opportunities for development of a method statement for free release, which will bring to a minimum the volume of liquid RAW stored on-site.

At the Kozloduy - RAW SU, volume minimisation practices are applied to RAW subject to disposal, by compacting at two stages and further grouting.



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Untreated SRAW	4300	5500	5585	5561	5568	5276	5269	4900	4598	4067	3705	3769	3883	3877	3835	3782	3529	3373	3132
Drums containing SRAW	0	0	165	407	636	862	1073	1253	1308	1308	1308	1236	1255	1215	1212	1212	1213	1109	1094
SRAW in supercompacted drums	0	0	0	0	187	383	397	487	684	1032	1160	1250	1345	1522	1658	1833	1955	2176	2209

The data in the diagram above confirm the decreasing trend of volume reduction of untreated solid RAW historical RAW, stored in the trench of the lime producing facility, by retrieving them and compacting in drums.

In order to reduce to a minimum the final RAW volumes, by the end of 2008 approval is expected of a detailed manual on the application of the free release procedures. The manual has been pulled together within a PHARE project, but for the time being only unconditional clearance is envisaged of fully proven clean materials.

Accounting for the interdependance at the different stages of RAW management

Taking into account the interrelations among the RAW management is one of the main responsibilities of the entities that generate and manage RAW, as defined in the *Regulation for safety in RAW management*. The Regulation requires the RAW management at each stage to facilitate the further stages of management and the RAW treatment methods applied will guarantee consistency of the RAW obtained with the acceptance criteria in the storage and/ disposal facilities. The Regulation puts the obligation before the entities generating radwaste to prepare RAW management programmes that coverall the RAW generated and all of their management stages . When RAW is management by more than one entity, the programmes is agreed among the participants, but the responsibility alwasys remains with the generating entity. Such a programme agreed with the SE RAW has been developed by KNPP and further it needs to be sanctioned by the BNRA.

With due regard to the *Regulation on the terms and conditions for transfer of RAW to the RAW State Enterprise* an effective mechanism has been established to account for the interrelations in RAW management among the different organizations taking part in the separate stages of radwaste management. Each waste generator shall develop a programme with technical specification of the generated RAW, schedule for delivery to the state enterprise, description of the measures for ensuring of effective RAW management and control from the point of their generation to the point of transfer, etc. The RAW SE on its part shall conduct a verification on the RAW compatibility and qualification for acceptance, in order to confirm that at all the stages of RAW management, appropriate technical and administrative measures are applied to ensure correspondence with the acceptance criteria.

Insofar as Bulgaria does not currently have a RAW disposal facility, in RAW management due consideration is given to the requirements of the national legislation and the requirements related to the long-term storage of the packages. In the process of selection of a site and technology for disposal of this waste, the characteristics will be taken into account of the packages obtained using the existing technology and conditioning methods for which the BNRA has approved the technical specifications, recipes and procedures.

Protection of the individuals, public, environment and future generations

Detailed information on the practical implementation of the principles for protecting of the personnel and the public is provided in Section F of this Report (article 24 of the Convention). The Bulgarian legislation is underlain by the principle of avoiding to impose undue burden to future generations. The *Regulation for providing the safety of spent nuclear fuel management* has further developed this principle in terms of the timely processing of RAW until it has been conditioned into a safe long-term form, as well as the timely disposal of the processed waste. The regulation also contains requirements for control following the shutdown of the facilities and monitoring in compliance with the results from the assessment made. The Strategy for SF and RAW management envisages the construction of a national repository for disposal of low and intermediate level radwaste and selection of a disposal option for high level and long-lived RAW, and this is a step in the implementation of the principle for protection and not imposing undue burden on future generations.

More detailed information on the activities planned for site selection of the national repository for LL and IL RAW is presented in the report section on article 13 of the Convention, and as regards the rest of the measures planned - see Section K of the report.

Biological, cemical and other risks

Considering the nature of radioactive waste subject to management in our country, they do not present greater biological, chemical or any other conventional risk as compared to other industrial branches. In the instances when such RAW is generated (for example in medicine and research applications), this is taken into account by the procedures for radwaste management, while observing the requirements of the applicable norms.

The assessment of this type of risks is subject to EIA, which is applied in these cases in the same way as for any other industrial activity.

The decommissioning plans for KNPP units 1-4 include dismantling programmes for asbestos materials (carcinogenic risk), as well as training and qualification programmes for the personnel working with hazardous materials.

The SE RAW – Novi Han SD has introduced additional criteria for acceptance of biological RAW from medical institutes and hospitals. The criteria require preliminary treatment with formaldehyde and gypsum prior to their submission for storage.

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.”

Brief review of the information presented within the framework of the First and the Second National Reports

The reports point out that the safety assessment of the operating facilities has been regulated by the Bulgarian legislation as a basic requirement for extension of the operational licence, the validity of which may not exceed 10 years. The safety review of the RAW management facilities at the KNPP units forms part of the periodic safety assessments carried out for the purpose of licensing the units. It has been noted that the results from the safety assessment of the RAW processing workshop at Kozloduy NPP (currently a part of the Kozloduy - RAW SU) demonstrate the protection of the personnel and the public under normal and emergency conditions, while the share of this facility in the general exposure of the public forms only a small part of the share of the entire plant site.

The reports present the safety enhancement activities in RAW management at the facilities in SE RAW - Kozloduy SD and the SE RAW – Novi Han SD.

Also, more detail is available on past practices regarding radwaste from the shutdown uranium mining and processing industries and the storage of the spent sealed sources in the closed bancrupt enterprises.

Existing facilities

The latest safety assessment (SAR) of the Kozloduy - RAW SU dates from 2007, and it has been reviewed by the BNRA within the framework of the regulatory review for renewal of the operational licence. The results are shown of the failure analyses under normal operating conditions and the consequences from emergency events such as fire, flooding, accident with a vehicle transporting a RAW package, spillage of radioactive cement grouting from a cemented package, etc. The data from the assessment show that the estimated exposure of the personnel and the public is several orders lower than the limits stated in the legislation. As a result from the regulatory review, the transitional conditions of the operational licence have been formulated containing a set of mandatory organizational and technical measures with appropriate delivery dates. Some of the transitional conditions include the completion of the Reconstruction Programme of the Lime plant, the radiological characterisation of RAW, actions for improvement of the radiation protection of the personnel, improvements of the cementation recipes and the package design.

In the period following the issuance of the First and the Second National Reports, the following activities were implemented for improving the RAW management safety in the SE RAW facilities.

Kozloduy - RAW SU

1. The measures listed in the Schedule for Implementation of Units, Components and New Facilities have been complete. They included a set of modifications of the systems aimed at improving their efficiency and safety.
2. In connection with the task for characterization of liquid RAW from KNPP as regards their nuclide composition important for the long-term safety, during their storage RAW sampling was carried out in AB-1,2 and AB-3. Identification was made of the radionuclides that are significant for the RAW disposal and subject to measurement (including the hard to detect nuclides, HDN). Analysis method statements were developed and measurements performed. The results from these activities are used in the implementation of the *Programme for Identification of HDN important to long-term safety during RAW Management,* including the characterisation of packages containing conditioner RAW (incl. alpha and beta emitters) subject to disposal in the national repository.
3. The activities in the *Raw Management Programme for the Lime plant* are being implemented in due sequence the main goal being to speed up the treatment of the historical unprocessed waste backlog.

SE RAW – Novi Han SD

In the period following the issuance of the First and the Second National Reports, the following measures were implemented for safety improvement:

1. Furnishing of compartments with measurement and signalling equipment for the retrieval of the sources from the fire detection sensors (containing Kr and Am);
2. Fireproof packages were implemented to store the sources from the fire detection sensors. During the operational period different types of shielding layers have been designed in them in order to decrease the dose rate on the surface;
3. A receiving inspection system has been implemented on the site of the SE RAW – Novi Han SD after refurbishment of the receipt-and-preparation complex and installation of modern apparatuses for RAW monitoring and characterisation;
4. A monitoring system for low level liquid RAW has been introduced;
5. Supply and implementation was effected of a measurement instrumentation for total alpha and beta activity, in view of improving the RAW characterisation and for the purposes of radiation monitoring;
6. The automated radiation monitoring on-site (observing the RAW movement all the way from entering the facility to its final placement for storage) was rehabilitated with supplementary detectors and construction of a control centre;
7. The personnel dose monitoring system was upgraded with the supply of up-to-date equipment including devices for dose monitoring on receipt of neutron sources, furnishing and refurbishment of the change room, etc.;
8. Additional improvement of the security and defence on-site by construction of supplementary local safety systems;
9. Design and implementation of additional specialised shielding decreasing the dose of the personnel during the RAW transport.

Past practice

In order to fullful the provisions of the *Regulation on the terms and conditions for transfer of RAW to the RAW State Enterprise,* the specialised unit prepared a *Special programme for receipt of RAW from past practices.* The Programme is in the process of implementation and includes the historical waste backlog, mainly spent sealed sources that currently have now owner and originate from bankrupt or privatised companies.

More detail on the Programme performance is provided in Section J.

RAW from the shutdown uranium mining

Remedying the consequences from the extracting and processing of uranium raw material on the territory of the Republic of Bulgaria is realized pursuant to the Council of Ministers Decree Nr 74 of 27.03.1998. In 2007 this Decree underwent changes and amendments in order to include measures for restricting of the environmental impact in new sites of the former geological prospecting activity of the state company “Rare Metals”. As per the programme drafted by the MEW, the activities include closure and remedying works and monitoring. Pursuant to the Decree, in 2007 radiological maps were prepared of the regions formerly connected with the uranium mining. The maps show the level and spread of contamination on-site of the former uranium mining sites, prior to the start of the activities for remedying the consequences and reducing the contamination following the reclamation performed.

In 2007 – 2008 risk assessments were performed of the separate sites.

The sites that were part of the previous Decree were 100% closed down and, with the exception of three more sites, 100% remedied. Of the currently existing three tailing ponds, the one in the village in Eleshnitsa has undergone such reclamation that eliminates the hazards for the environment in the area.

Feasibility Studies have been prepared and the conceptual stage reached for preparatory activities for the designing of reclamation of the tailing pond in the former Metallurg plant in the town of Buhovo near Sofia, and also for the so-called Yana overflow in the same area. Resolving of the contamination problem of the Yana overflow is of major significance as in its vicinity there are municipality and private agricultural lands where agricultural crops are grown. Another outstanding problem is the draining of the tailing pond at Buhovo. Therefore, these two problems are among the priority tasks of the Council of Ministers Decree 74/27.03.1998, to be acted upon in the coming year.

A water treatment station is planned to be built at stulm - 93 above the village of Kremikovtsi, to treat the mining water contaminated with manganese and uranium. In view of the prepared risk assessments, the statements of the responsible institutions, the decision made by the Advisory Council at the Ministry of Economy and Energy and the government budget resources at this stage construction is not planned of any water purification facilities on other sites.

The problem at the so-called "resort area" near the town of Sliven is well known, where houses have been built on contaminated areas. The land reclamation project in the area has been unable to launch due to lack of clarity regarding the ownership resulting from re-sale of privatised contaminated land. This is why a risk assessment for the public in the region will be prepared in 2008 as per the annual programme of EcoEngineering RM Ltd. in view of fulfilling the Council of Ministers Decree 74/27.03.1998.

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.”

Brief review of the information presented within the framework of the First and the Second National Reports

The First and the Second National Reports present the requirements of the ASUNE regarding the way of permit issuance for site selection for new facilities, and the provisions of the EPA for carrying out an EIA of such facilities. The reports contain information on the legal requirements for arrangements of public hearings and of consultations with potentially interested neighbouring countries. A statement has been made of the intent of the Republic of Bulgaria to set up a modern regulatory basis for RAW management that provides the requirements to RAW management sites and the site selection process. The documentation that is required to be submitted to the regulator has been identified. The key role has been highlighted of the quality implementation of the preliminary safety analysis during the approval of the site selected for construction of the repository. Special attention has been paid on the requirements to sites for RAW disposal facilities as regulated in the Regulation for providing the safety during RAW management. The four main phases of site selection have been pointed out, as defined in the same regulation, and the document submissions required by the regulator.

Evaluation of the site selected for the RAW management facility

The RAW State Enterprise is currently in the process of selecting a site for construction of a National Repository for Low Level and Intermediate Level Radioactive Waste. The permit issuance procedure for site selection for a RAW management facility is the same as for any other nuclear facility as discussed in article 7. Important submissions of the necessary documentation for site approval by the BNRA are the preliminary safety analysis report and a decision on the EIA. Consistent with the requirements of the *Regulation for providing the safety during RAW management* the following documents have been submitted to the BNRA for review: radwaste disposal concept and plan for site characterisation.

The NRRAW is intended for the disposal of conditioned short-lived low and intermediate level RAW (category 2a as per the classification in the Regulation for providing the safety during RAW management) generated in our country by nuclear facilities and nuclear applications. The repository is envisaged to be a surface type, multi-barrier engineering facility, modular type which will permit sequential construction of the elements and gradual increase of the capacity. The capacity planned for the first stage of construction is 50,000 m^3.

A Permit No HX-3211/05.05.2006 was issued for RAWNR site selection with a four-year term of validity. The *Regulation for providing the safety during RAW management* provides for four phases of site selection, namely "development of a disposal concept and planning for the site selection", "data collection and analysis of the areas", "site characterisation", and "site confirmation". The activities during each phase are planned and justified in a plan that has to be approved by the Chairman of the BNRA. At the end of each phase a report is prepared with the results from the phase implementation.

At present, the BNRA has approved a *Report on data collection and analysis of the areas*, in which using the centralised approach principle, 12 potential sites on the territory of our country for the NRRAW have been compared. By applying an analysis based on a system of 23 comparison factors (criteria), the 12 potential sites have been assessed and classified. Thus, five prospective candidate - sites have been selected and on part of them detailed studies and surveys will be conducted during the nest phase, "site characterisation". These sites are as follows: Marichin Valog, the Kozloduy NPP site, Vurbitsa, Belene NPP site and Brestova Padina.

Following the procedure of environmental impact assessment, the Minister of Environment and Water issued a decision on the EIA, No 18-8/2004, for the approval of the realization of the investment proposal for the construction of Belene NPP on the Belene site. The application for approval of the selected site was submitted by the National Electricity Company to the BNRA on 12.08.2005. In 2006 the Chairman of the BNRA issued an order for the approval of the selected site. Detailed information on the parameters of the selected site was presented in the Fourth National Report on the Fulfilment of the Obligations of the Republic of Bulgaria to the Nuclear Safety Convention - 2007.

Access to information related to safety

The access to information on the safety of proposed RAW management facilities is mainly ensured by the implementation of the law provisions regarding the carrying out of the mandatory procedure on EIA of such a facility.

The preparation of an EIA of the RAWNR will be done before its final approval by order issued by the Chairman of the BNRA. This EIA will be subject to public hearing. As two of the prospective sites are located on the territory of Kozloduy municipality, a referendum was conducted in the municipality; 20% of the voting public participated and 90% of the votes were dissenting ones.

In connection with the envisaged modernisation and refurbishment of the SE RAW – Novi Han SD (building of a RAW processing workshop, conditioned RAW storage facility and a hot chamber for handling of high level sources) an EIA was prepared and put for public hearing. The result from this public hearing was a negative one.

Approval of the site for Belene NPP

On 21.12.2006 the Chairman of the BNRA issued an order of approval for the site selected for the construction of Belene NPP.

More detail on this order is provided in Section G of the report, related to article 6 of the Convention.

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."

Brief review of the information presented within the framework of the First and the Second National Reports

The First and the Second National Reports present the requirements of the ASUNE regarding the designing of nuclear facilities. A conclusion is drawn that the existing regulatory basis after the First National Report as regards designing criteria for RAW management facilities is insufficient. In the period between the First and the Second National Reports the *Regulation on the safety during RAW management* came into force and it defines the assurance of radiation protection as a basic requirement to the design of a RAW management facility. The regulation contains detailed requirements to the designs including the application of the defence-in-depth concept, definition of design limits, operational modes, classification of systems, structures and components and procedures for this classification, also specific requirements to the design of different types of facilities for RAW management, namely for treatment, storage, or disposal.

A note is made of article 47 of this regulation dealing with the requirements for planning and implementation of decommissioning measures for the RAW treatment and processing facilities.

A stress is put on article 29 para 3 that provide requirements to the design technical solutions, technologies and procedures that need to be defined and justified in compliance with the scientific and technical achievements and the internationally approved operational expertise.

Facilities - designed and under construction

In 2007 design permits were issued for units 1 and 2 of Belene NPP, with due dates to 2013 and 2015, respectively. The permit conditions regarding RAW management are as follows:

- The permit holder shall ensure the implementation of appropriate design measures to keep to the minimum practicable the generation of radioactive waste in terms of volume and activity. The design shall ensure the possibility of radwaste retrieval from the storage facilities at the unit and on-site of Belene NPP without the need to resort to designing of additional facilities.
- The permit holder shall ensure the implementation of appropriate design measures to process the radwaste arisings from the unit operation until they are in condition that guarantees the RAW safe further storage, transport and disposal.
- The permit holder shall provide solutions in the design for safety assurance during the decommissioning of the unit, including, if needed, identifying of on-site areas for potential installation of facilities for handling, treatment and storage of RAW generated during the unit decommissioning, as well as establishing of a data base required for planning of the decommissioning activities on the unit.
- The permit holder shall provide proof that there is an extremely low likelihood of exceeding the discharge limits of radioactive substances to the environment used for determining the external border of the emergency protection action area.

ARTICLE 15. ASSESSMENT OF 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).

Brief review of the information presented within the framework of the First and the Second National Reports

The First and the Second National Reports present the requirements of the ASUNE regarding the safety assessment, and of the EPA for implementation of EIA. The necessity of development of an additional normative and regulatory framework is considered in the second report.

It is stated that during the safety analysis of the RAW management facilities it is required to follow the provisions of article 15 of the Joint Convention.

The second report presents the effective Regulation on the safety during RAW management including RAW final disposal. It identifies requirements to the safety criteria for this type of facilities, provides a sample content of the safety assessment and lists types of safety assessments required at different stages of the lifetime of the facility.

The requirements provided in the *Regulation on the safety during RAW management* are in force for the safety assessments of RAW management facilities, while the EPA provides the requirements applicable to the EIA. The safety criteria identified in this regulation also apply.

The *Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy* defines the stages at which the safety assessment shall be made and updated, and these fully match the provisions of the Convention.

The BNRA drafts additional guides in order to state more accurately the safety criteria and the safety assessment consistence, the implementation of the sensitivity analyses for the parameters and uncertainties during the assessment.

A post-operational safety evaluation has been prepared for the SE RAW – Novi Han SD. The evaluation has been made with a sufficiently conservative approach and dose estimation for an individual from the critical group of the public under conditions of normally evolving scenario for each repository unit. All the exposure ways have been considered such as external exposure, intake and inhalation. The results for the radionuclide concentrations estimated in the discharge point of the water horizon, taken as a sum for all repository units, have lower values than the drinking water norms regulated in the BRPN - 2004. The applied dosimetry models have sufficient detail and use valid data for the public consumption of various food stuffs, in accordance with data of the National Institute of Statistics, as well as researches on the transfer factors, such as contaminated soil - plant. The maximum dose estimate for an individual from the critical group of the public, incurred from all the exposure pathways amounts to $0.34 x 10^{-6}$ mSv, which is by several orders lower than the normatively regulated value 0.3 mSv applicable to new build repositories. The results from the modelled concepts, such as sinking of the top layer, a system of cracks and animal intrusion, also showed values lower than the regulatory criterion. The evaluation also proposes a few alternative evolution scenarios - geological changes, climate changes and intrusion on-site (road and building construction, settlement). The conservative approach used in scenario modelling is a precondition for obtaining higher values than the regulatory criterion. With due regard to the recommendations of ISRP 81, which provide arguments in favour of the need to expand the admissible dose intake range, it is necessary to consider officially regulating a different criterion for intrusion scenarios.

The evaluation document also determines the duration of the institutional period of 300 years following the closure of the repository.

ARTICLE 16. OPERATION OF FACILITIES

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

(i) the license 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) programs to collect and analyze 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.”

Brief review of the information presented within the framework of the First and the Second National Reports

The First and the Second National Reports present the requirements of the ASUNE and of the *Regulation on the safety during RAW management* regarding the provisions of article 16 of the Convention.

Commissioning permit for the RAW management facilities

The RAW management facilities are subject to the same licensing procedures and operational licence issuance as areapplicable to all othe nuclear facilities. The issuance of an operational permit and the conditions needed for it have already been discussed in the Second National Report, article 9.

Pursuant to the ASUNE, dated 2002, in 2006 an operational licence was issued to the SE RAW – Novi Han SD, and in 2008 the operational licence of SE RAW - Kozloduy SD was renewed. The licences are based on a set of licensing documentation, among which updated safety analysis reports of 2005 for SE RAW – Novi Han SD, and of 2007 for SE RAW - Kozloduy SD, also information on the implementation of the commissioning programmes together with operational documentation related to the systems, structures and components important to safety.

Operational limits and conditions

In accordance with the *Regulation on the safety during RAW management,* internal rules, regulations, procedures and instructions have been drafted and they contain operational limits and conditions for the RAW management facilities. The operational limits and conditions for the systems, structures and components important to safety are provided in a document subject to the regulator's approval, and their change will require the permit of the BNRA. In the case with the RAW management facilities in Kozloduy and Novi Han, the limits and conditions and the actions necessitated by their breaching are determined in the Technical Specification. The Technical Specification is updated as a result from the experience accrued during the implementation of the commissioning programme and following the submission to and approval by the BNRA. Schedules for control and inspection of the systems, structures and components are developed and followed on the basis of the limits and conditions identified in the Technical Specification. All these documents form part of the application for licence issuance and their modification is subject of permits.

Procedures, engineering and technical support

The regulatory basis requires the availability of procedures for operation, maintenance, monitoring, etc., pulled together in the QA system. The consistency with this requirement is checked within the licensing process and during inspections. The engineering support and maintenance are subject to special (thematic) inspections by the regulatory authorities.

The Act on the Safe Use of Nuclear Energy requires that appropriate engineering support and maintenance should be available in all safety-related areas over the entire operational life of the facility. The licence is issued to a legal entity that owns technical resources and staff with adequate qualification and capacity for the entire operational life of the facility.

The specialised units of the SE RAW have developed their internal rules for engineering support and maintenance that match the Technical Specification and the schedules for inspection and radiation monitoring.

The maintenance of the specialised instrumentation is outsourced to licensed contractors.

Reporting of events. Analysis of the operational expertise

The ASUNE, article 19, provides that the operational licence should define the requirements for safety-related incidents. The reporting terms and conditions are established in the *Regulation of the* *conditions and procedure for notification of the NRA about events in nuclear facilities and sites with sources of ionizing radiation*.

The licensees develop and apply procedures for analysis of their own operational experience as per the requirements of Article 16 of ASUNE.

Eight deviations from normal operation, classified level "0" by the INES scale, have been reported by the Kozloduy - RAW SU over the period 2006-2008, in view of implementing the reporting and experience analysis procedures. Consistent with the procedure the events have been analyzed and 28 corrective measures defined and implemented within the time limits set.

No events or incidents have been reported by the SE RAW – Novi Han SD.

Waste characterisation and sorting

One of the most important requirements to the safety of RAW management is the radwaste proper characterisation and sorting. The requirements are regulated in the *Regulation on the safety during RAW management.*

The licensees have developed and applied procedures for characterisation and sorting of the RAW they manage with due consideration to the specificities of the technological process and the interrelations among the various stages of RAW generation and management.

The RAW characterisation procedures at KNPP are basically oriented, on the one hand, to a precise radionuclide inventorization required in the determination of a suitable conditioning method, package, storage place and any protection measures, and on the other, to the objectives of the radiation protection of the personnel engaged in RAW handling. Certain difficulties have been encountered during the characterisation of some radionuclide-containing RAW - alpha and beta emitters, important to the RAW long-term management, especially the content of long-lived nuclides that affect the safety assessment for disposal. In order to resolve these issues, additional RAW characterisation steps have been taken, as described in Section K of the Report, and also the staff has been equipped with the necessary measuring instrumentation and methods.

Post-operational safety assessment and facilities decommissioning/shutdown plan

The *Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy* requires updating of all safety assessments (operational and post-operational). Special attention is drawn to the need of reporting the results from operations and radiation monitoring. These requirements are set in connection with the extension of the operational licence. The maximum validity term for an operational licence of a nuclear facility is 10 years.

The same Regulation states that to obtain an operational licence each nuclear facility shall submit to the BNRA also a decommissioning plan of the facility, and in the event of a RAW repository - a shutdown plan is also required. The updated safety assessment reports shall present details of the circumstances that have occurred and preconditioned the revising of the shutdown plan, and point to the need thereof for extending the operational licence.

The information in article 26 of the Report describes the level of development of the decommissioning plans of the nuclear facilities in our country.

At present, the SE RAW – Novi Han SD has not prepared a plan for its closure. The drafting of such a plan is scheduled within the framework of the preparation of the documentation for the operational licence renewal. In the renewed operational licence of Kozloduy - RAW SU a condition has been identified regarding the development and submission to the BNRA of such a plan.

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."

Brief review of the information presented within the framework of the First and the Second National Reports

The First Report concludes that the active regulatory basis does not contain requirements for institutional measures following the closure of RAW repository facilities. In the ensuing period the *Regulation on the safety during RAW management* was introduced and it is thus presented in the Second National Report.

The Second National Report lists the requirements regarding the duration of institutional control following the facility closure, as defined in the *Regulation on the safety during RAW management.* It is stressed that the Regulation envisages two types of control measures - active and passive, and the maximum term of their application is specified. Special attention is paid on the requirements to the defining of the decommissioning plan, the organizational measures needed to exercise control and store information.

It has been explicitly said that the *Regulation on the safety during RAW management* regulates the intervention in the event of unplanned releases in the post-operational period and closure of the RAW repository facility while observing the intervention levels regulated in the *Regulation on emergency planning and emergency preparedness in case of nuclear or radiation accident.*

In the period following the issuance of the Second National Report there are no facilities that have been closed or suspended from operation.

SECTION I. 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 instruments.

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."

Brief review of the information presented within the framework of the First and the Second National Reports

It has been pointed out that export and transport of nuclear material, and SF in particular, are subject to permit issuance; the requirements for issuance of a permit for export and transport of SF are defined by the ASUNE

It is noted that the Republic of Bulgaria has experience only as a State of origin of spent nuclear fuel. Presentation is made of the international agreements related to receiving of SF for processing on behalf of the Russian Federation, and its transit through the territory of the Ukraine.

A description is provided of the scheme for spent fuel transport via railway and water.

The requirements in the *Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy* as regards the implementation of the obligations in this article of the Convention are presented. It has been pointed out that the following documents must also be attached to the application for issuance of a permit for transport of nuclear material:

- transport permits or their respective authorisations issued by the competent authorities of the State of destination and the states through which transit movement will be made - in case of nuclear material export;
- documents that regulate the relations between the consignor and the consignee, and between the applicant and the subcontractors related to the transport performed on the territory of the state;
- authorisations issued by the respective competent authorities for approval of the overpacks in compliance with the *Regulation on the conditions and procedure of transport of radioactive material* ;
- documents certifying that in case a transport cannot be performed or the transport conditions cannot be fulfilled, the consignee will return the consignment to the point of departure while the consignor will receive the consignment.

It has been stated that the requirements for safety during transport of SF are defined in the *Regulation on the conditions and procedure of transport of radioactive material,* that has been developed in consistency with the provisions of the IAEA document *Regulations for the Safe Transport of Radioactive Material, TS-R-1*, as well as the requirements of the respective international rules for 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 rules are annexes to the Convention concerning International Carriage by Rail (COTIF);
- European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR);
- Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Technical Instructions);
- International Maritime Dangerous Goods Code (IMDG Code by IMO).

Changes in the regulatory basis related to transboundary movement of SF

In connection with the accession of the Republic of Bulgaria to the EU, legislative changes are under preparation in order to implement the provisions of Directive 2006/117/EURATOM.

SF transboundary movement practice

Throughout the period after the issuance of the Second National Report permits have been issued and transboundary movement of SF has been made as follows:

- 2006 – from reactors WWER-1000 – 1 shipment, from reactors WWER-440 – 1 shipment
- 2007 - from reactors WWER-1000 – 1 shipment, from reactors WWER-440 –1 shipment
- 2008 (by 30.07.2008) - from reactors WWER-1000 – 1 shipment, from reactors WWER-440 – 2 shipments, from IRT-2000 – 1 shipment.

SECTION J: 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."

Brief review of the information presented within the framework of the First and the Second National Reports

The reports state that implementation of activities with sources of ionizing radiation (SIR) is subject to permit issuance as provided for in the ASUNE and the *Regulation on the procedure for issuance of licences and permits for the safe use of nuclear energy.* While implementing such activities the Regulation on the BNRP-2004 shall be adhered to as well as the specific requirements in the *Regulation on radiation protection during activities with SIR*. When a source is no longer in use it is treated as radioactive waste and pursuant to the ASUNE it has to be transferred to an organization licensed to manage RAW. The disused sealed sources are handed over to the SE RAW – Novi Han SD for centralized storage, and the BNRA shall be notified on each source transfer. The provisions of the ASUNE as regards sealed sources of unknown owner are presented. In such cases the source becomes state property and the Chairman of the BNRA shall issue an order determining the entity to which the source is transferred and the conditions therewith. Following the issuance of the order by the BNRA Chairman, these sources are transferred for storage at the SE RAW – Novi Han SD.

Management of disused sealed sources

The ASUNE provides that the radioactive sources storage activities are subject to permit issuance and may be implemented only after the BNRA has issued the respective licences and permits. The licensees and the permit holders that storage radioactive sources have to carry out the following:

- take inventory and take an account of the SIR;
- appoint authorized individuals to be responsible for the control of the radioactive sources;
- immediately notify the BNRA, Ministry of the Interior and Ministry of Health on detecting the lack or theft of radioactive sources.

The Regulation for radiation protection during activities with SIR defines the requirements, terms and conditions for accounting and control of the radioactive sources.

The NRA maintains a *National Register of Sources ofIonizing Radiation* (NRSIR) consistent with the Code of Conduct on the Safety and Security of Radioactive Sources, issued by the IAEA in 2004.

NRIRS contains data on the activity, radionuclide composition, type, technical characteristics and location of all radioactive sources category 1 to 5, registered in the country, including data on the licensees and the permit holders that use and store radioactive sources.

A *Special Programme for Acceptance of RAW from Past Practices* has been established and updated on annual basis by the SE RAW with the BNRA approval. In compliance with the Programme, in 2007, the SE RAW accepted for long-term storage 15 843 disused radioactive sources (sealed ^{137}Cs, ^{60}Co, ^{90}Sr, neutron sources, industrial gamma radiography, NSE, smoke detectors) from 162 sites within the country (their total activity being about 30 TBq). The handover activitis with radioactive sources declared as RAW are carried out under the supervision of the BNRA and consistent with the *Regulation for the conditions and procedure for transfer of radioactive waste to the state enterprise "Radioactive Waste"*.

Over the past few years, the SE RAW annually receives about 10 000 disused radioactive sources for safe storage and further conditioning and disposal. At this rate of proceeding it is expected that by 2011 there will be a final resolution of the problems related to collection and safe storage of the so called historical RAW (spent radioactivity sources from past activities, including abandoned sources).

Transfer of sealed sources with unknown owner

In 2006-2008 the following 43 sealed sources of unknown owner have been transferred to the SE RAW – Novi Han SD according to an order of the NRA Chairman:

- 14 sources in 2006;
- 25 sources in 2007;
- 4 sources in the first half of 2008.

Measures for detecting sources with unknown owner and preventing their transfer to manufacturing processes where they may cause damage to people and the environment

The Strategy for Prevention of incidents with Radioactive Sources and Materials applied by the competent state authorities in our country includes as follows:

- implementing of strict customs control to detect goods and materials with elevated radioactivity, in order to prevent illegal import/export or traffic of nuclear and radioactive materials;
- developing and introducing of regulatory documents and standard procedures to prevent incidents and respond in case of illegal import/export or traffic of nuclear and radioactive materials; and in instances of detecting radioactive scrap or abandoned sources;
- licensing of companies to perform radioactive monitoring of scrap metal on sites with radioactive sources;
- implementing of preventive control in enterprises working with scrap and inspecting sites containing radioactive sources and scrap metal, providing the necessary instructions and prescriptions;
- ensuring the security of sites holding radioactive sources and conducting inspections in this respect;
- study and implementation of the good practice of EU countries to ensure the safety and security of radioactive sources and preventing the occurrence of incidents with scrap metal.

The growing trend of the number of incidents with detection of radioactive sources and materials in scrap metal is a worldwide issue of concern. In this connection the IAEA and EU recommend appropriate technical and organizational measures to prevent radiation incidents with scrap metal. In connection with these recommendations, in 2007, the BNRA established a Guide for control of metal scrap and response in case of detecting radioactive metal scrap. This Guide has been coordinated with the Ministry of the Interior, Ministry of Health, Ministry of Emergency Situations, Ministry of Economy and Energy, the RAW State Enterprise, the Bulgarian Recycling Association for and the companies that are members of this Association. The largest metallurgical enterprises (Kremikovtsi JSC, Sofia; Steel Industry JSC, Pernik; Non-ferrous Metals Plant, Plovdiv; and Non-ferrous Metals Plant, Sofia) have installed automated systems for radiation monitoring of the scrap received. The companies dealing with scrap metal take steps for preventive radiation control at storage, transport and sale of metal scrap, using their own radiometric devices and/or the services of organizations licensed by the BNRA for such activity. On-site emergency plans have been developed, and areas have been assigned for isolating and handling of radioactively contaminated scrap metal. The companies licensed by the BNRA immediately notify the competent authorities on detection of radioactive sources or radioactively contaminated scrap metal.

Bulgarian legislation does not prohibit re-import of sealed sources manufactured in the country.. However, Bulgaria does not produce sealed sources and therefore such import does not occur.

SECTION К: ACTIVITIES PLANNED TO IMPROVE SAFETY

Implementation of the planned activities in accordance of the First and the Second National Reports

1. Site selection for the National Repository for low and intermediate level radwaste

In August 2005 BNRA has received and application for site selection sent by the SE RAW. The site selection process is presently at phase 3 – characterisation of 5 selected sites for detailed studies and preparation of a preliminary safety analysis report. The regulator is in the process of reviewing the Concept for the Construction of a NR and the Plan for Characterisation of the Selected Prospective Sites.

2. Selecting an option for high level RAW disposal

Pursuant to the *Strategy for Spent Nuclear Fuel and Radioactive Waste Management* in December 2007 The Ministry of Economy and Energy assigned to the RAWSE to commence the activities on studying the possibilities to construct a geological repository for high level long-lived radwaste within a stable geological formation.

The SE RAW developed a Programme for preliminary studies over the 2008 – 2010 period that shall include as follows:

1. Analysis of the experience worldwide in the geological disposal of SF, HL waste from the SF processing and long-lived radwaste in terms of applicability of various concepts to the conditions in Bulgaria.
2. Formulation of scenarios for the generation of radwaste subject to disposal in a geological repository, which will take into account both the return of vitrified HL waste to Russia and the theoretical possibility of declaring SF radioactive waste.
3. Analysis of the possible options for long term management of high level and long-lived waste. The options include long-term storage on-site of the generating organization, long-term storage in a centralized repository, disposal in geological repositories, transmutation, disposal in and international/regional repository, bilateral agreement for disposal in geological repositories abroad, return of SF to the manufacturing state without the obligation for returning the high level waste back to Bulgaria.
4. Preliminary analysis of the conditions in the country in view of clarifying the conditions for selecting a site potentially suitable for the construction of a geological repository.
5. Developing of a conceptual description of a geological repository for various types of geological environment, taking into account the characteristics of high level and long-lived radwaste.

On the basis of these studies, a detailed programme will be prepared for the construction of a geological repository for high level and long-lived radwaste in our country

3. Establishment of BNRA regulatory guides related to the safety of SF and RAW management

Within the framework of various international projects, the BNRA has been developing 13 guides, the greater part of which apply to regulating the content and methods for performing of safety assessment of RAW repositories, packaging criteria for conditioned RAW, decommissioning and radiation protection, in order to facilitate the implementation of the respective Regulations. Part of them are in the process of coordination with the stakeholder institutions and they are expected to get approval by the BNRA Chairman by the middle of 2009.

4. Development of a technology for dissolving of the solid phase in the ECT

The concentrate in the evaporator tanks (evaporator concentrate, EC) of the systems for water treatment (SWT), is stored in a total of 10 tanks (ECT) of auxiliary buildings 1 and 2 (AB 1& 2). Five tanks are located in AB-1 and another five in AB-2. The concentrate occurs as solid and liquid phase. According to the Decommissioning Strategy of Units 1-4 it is required to empty and clean these tanks of the waste they currently hold.

Tender documentation has been prepared and a tender called for the supply of a Facility for retrieval and treatment of the solid phase in the evaporator concentrate tanks (ECT). The technical specification necessitates preliminary studies, designing, engineering, analyses, radiological characterisation of the solid phase within the tanks and of the final product, plus delivery, installation, testing and commissioning of this facility.

A tendering procedure is in place for selection of a Contractor.

5. Ensuring of transport conditions of liquid RAW from ECT at AB-1 to ECT at AB-2

The concentrate in the evaporator tanks (evaporator concentrate, EC) of the systems for water treatment (SWT), is stored in a total of 10 tanks (ECT) of auxiliary buildings 1 and 2 (AB 1& 2). Five tanks are located in AB-1 and another five in AB-2. The concentrate occurs as solid and liquid phase. AB-2 has a functional system for retrieval of the liquid phase from the ECT and transporting it in a specialised tank truck to the Kozloduy - RAW SU. AB-1 does not have such a system.

This project will provide the conditions for retrieval of the liquid phase frm the evaporator concentrate from ECT in AB-1, as well as the conditions for transporting this type of radioactive waste from AB-1 to the Kozloduy - RAW SU.

A feasibility study is in progress to determine the capabilities of implementing this project and specifying the necessary equipment. The project will be implemented by KNPP staff. The equipment required will be procured by the KIDS fund administered by the EBRD.

The project includes retrieval of the solid phase of the evaporator concentrate from ECTs 1-5 at AB-1 and its movement to a special truck tank along the transport corridor - 1 (TC-1). Implementation of the project will take place after the tender for purchasing of the equipment has been held, as per project 9a.

The retrieval activities will be performed in AB-1, and transporting will be realized using the specialised vehicle ECTT (evaporator concentrate truck tank). Prior to and following the unloading of the truck tank at the RAW Processing Workshop, radiation monitoring is performed and gamma mapping of both the room and the truck tank.

6. Supply and installation of a facility for treatment of low level liquid RAW

A project is under way for the supply of a custom built equipment of modular type, for the treatment and conditioning of contaminated water discharged from the specialised laundry, the bathrooms, and floor drain water from units 1 & 2 at KNPP, and further conditioning of the radioactive waste. The supply scope includes equipment design and supply, commissioning, operations and maintenance procedures, training of the operational personnel and appropriate supply of consumables.

A detailed design has been approved. The MEW has issued a construction permit. A Technical Decision has been established for design changes of units 1&2 in order to implement the project for Supply of a Facility for Treatment of Liquid Radioactive Waste. All the documents required for the issuance of a Permit for Design Changes have been submitted to the BNRA and are currently under review by the regulator.

The greater part of the equipment has been manufactured, passed factory acceptance tests at the manufacturer's premises and delivered to the warehouses of KNPP Plc. At present, the Detailed Design is being revised and a Safety Analysis Report is being developed.

7. Supply and installation of equipment for exclusion measurement of materials

This facility measures the total gamma activity of materials of varying shape and size in order to establish if radioactive contamination is available. In case contamination has been detected, its level and location are established on the ground of the measurement.

The project was delivered in May 2006. A facility of UTT, Germany, with subcontractors VF, Czech Republic, and Tita Consult, Bulgaria, was supplied. The facility is currently installed on the site of units 1&2. Pre-commissioning trials have been conducted. An initial metrological check has been made by the Metrology and Techncial Supervision State Agency. The operations and maintenance manual has been drafted.

8. Implementation of a facility of RAW treatment and conditioning with high volume reduction factor

As provided in the approved Technical Specification, the project includes supply of a technology, manufacturing, construction and commissioning of a facility for treatment of solid low level radioactive waste, generated during the operation of units 1-6 at KNPP Plc., and during the initial stages of the decommissioning activities. The facility has to ensure considerable volume reduction of the waste, as well as conditioning of the treated RAW in packages that are suitable for transport and temporary storage at the facilities of Kozloduy NPP Plc.

To achieve these objectives, KNPP Plc. has approved the use of plasma technology. A tender procedure is under way for selecting a Contractor for this project.

9. Supply and installation of a facility for retrieval and conditioning of spent ion exchange resins

This project is for the supply of equipment for the retrieval of spent ion exchange resins (IER) from the tanks located in AB 1 & 2 at Kozloduy NPP, and conditioning them in a form suitable for transport and final disposal. The conditioned waste will be loaded to a transporting system, compatible with the waste transport system existing on-site of KNPP.

The scope of supply includes design, manufacture, tests, analyses, installation, training, commissioning, quality assurance and other related activities required for the safe, complete and functional facility for retrieval and conditioning of spent ion exchange resins.

A Technical Design has been established for the facility. At present, the comments made by Kozloduy NPP Plc. and the RAW State Enterprise are being incorporated in the technical design. The requirements of the RAW State Enterprise for characterisation of the final product of this facility have been specified. In order to meet these requirements it shall be necessary to perform thorough characterisation of the spent ion exchange resins including the determination of long-lived alpha nuclides that are critical for surface disposal. The procedure is under way for assigning the activities needed for the full characterisation of the resins.

10. Supply and implementation of equipment and devices for radiological inventory

The supply consists of three parts: radioactivity measurement equipment (including devices for alpha spectrometry, beta spectrometry, in-situ gamma spectrometry and surface contamination measurements), ancillary chemical equipment for preliminary treatment and specific radiochemical separations and laboratory furniture.

The procurement was completed in 2006 and the equipment has been commissioned.

11. Obtaining an operational licence for the RAW treatment, conditioning and storage at Kozloduy NPP – RAW - Kozloduy SU of the RAW State Enterprise

A licence Series E, No. 01740 of 29.04.2005, has been issued and renewed on 29.04.2008 for a period of 7 years.

12. Implementation of the programme for reconstruction and modernisation of SE RAW – Novi Han SD

The programme has been complete. The required equipment and measuring instrumentation have been delivered and commissioned. An enlarged Radiation Monitoring Programme is under way. The measuring of ^{14}C is still an open issue. The equipment for inspection on receipt and RAW identification has been widely used. The Radiation Monitoring Automated System has been rehabilitated and expanded. The dose monitoring system has been upgraded.

Rehabilitation - waterproof flashing and replacement of ridge tiles has been performed on the repositories holding disposed RAW. A package for temporary storage of RAW is scheduled to me introduced.

Compartments for discharge of smoke detectors have been equipped and furnished.

A system for treatment of low level secondary liquid RAW has been operated.

The RAW State Enterprise received a licence Series E, Nr 02088 of 14.07.2006 for operation of the SE RAW – Novi Han SD with a validity term of 5 years.

13. Implementation of a new recipe for cementation of liquid RAW at Kozloduy - RAW SU

In 2007 and 2008 technical documentation and specifications for the introduction of a new cementation recipe with the supplement of slag cement have been developed and submitted for review by the BNRA. Following the submission of the results from the industrial tests, the BNRA issued a permit for the introduction of the new recipe.

14. Transporting of SF from the IRT-2000 research reactor

In July 2008 the SF has been removed from the reactor and transported to Russia.

More information on this issue is provided in Section B of this Report.

15. Adapting to KNPP practices of new methods and technologies for RAW processing - decontamination, volume reduction, activity decrease and change of composition

Rehabilitation of the system for treatment of floor drain water (SWT-3) was performed at PP-2 in 2006 and 2007. Replacements took place for condenser - deflegmator and the distillation pumps. Presently, ultrasonic level measuring devices are being commissioned at the tanks of the system.

16. Safety enhancement activities in SF management at Kozloduy NPP

The SFSF modernisation programme measures for up to 2008 have been completed. The BNRA has prescribed updating of the programme.

In 2005-2008 the following measures for improvement of the safety of the SFSF have been implemented:

- Providing a refuelling machine for handling of spent nuclear fuel from WWER-1000 and WWER-440 reactors in the receiving and refuelling areas;
- Modernising of the radiation monitoring system (replacement of the devices with modern ones for automatic registering of the parameter readings in a data base);
- Replacement of the interlock and protection system with a digital one (on the principle of programmable logic controller, PC, etc.);
- Preparation of a lifetime analysis of the building and the equipment of the SFSF;
- Expansion of the temperature monitoring range of the compartments;

- an information system has been introduced to display the status of the equipment and technological parameters of the SFSF ;

Pursuant to the National Strategy for SF and RAW Management, the Updated Decommissioning Strategy for KNPP Units 1-4 and the framework Agreement signed with EBRD in 2001, funding is provided for stage 1 of the construction of a dry storage facility for storing spent fuel from units 1-2 for a period of 50 years. The storage capacity of stage 1 of the DSFSF is 2800 WWER-440 assemblies. The deadline for commissioning of the facility is 2009. The stage 1 project includes establishment of a conceptual design for stage 2 with a storage capacity of 5200 WWER-440 spent fuel assemblies and 2500 WWER-1000 ones.

The storage technology is based on a cask system with air cooling through natural convection. Two types of casks shall be used:

- CONSTOR 440/84 casks for storage of SF from WWER-440 reactors, each casks has a holding capacity of 84 assemblies;
- CONSTOR 1000/19 casks for storage of SF from WWER-1000 reactors, each casks has a holding capacity of 19 assemblies.

The casks are loaded with spent fuel and prepared for storage inside the existing SFSF .

The casks will be located in a building that ensures security and protection from natural impacts for the storage process and the supporting equipment. The DSFSF site is located North-North-West of the existing SFSF on an area of 12160 m^2.

At present only construction of Stage 1 has been planned. During this stage 34 casks CONSTOR 440/84 will be supplied for the storage of 2800 WWER-440 assemblies. The handling capacity for preparation of SF assemblies for storage is 420 assemblies per year. This is equivalent to 5 CONSTOR 440/84 casks annually. The Stage 1 building is about 45 m long and 28 m wide.

The Contractor for this project is the German Consortium NUKEM Technologies GmbH - GNB, and the contract was placed in May 2004. Subcontractors to this project are Bulgarian companies such as EQE, Risk Engineering, Besttechnika, Eurobuild, Bauer, etc. The cask manufacturer is Skoda, Czech Republic. The project is managed by the Kozloduy-PMU where the British company VT Nuclear Services is one of the participants.

The commissioning is scheduled for 2009. Completion of the building and delivery of the first 10 casks is expected by August 2009. By June 2010, 34 CONSTOR® 440/84 casks for SF storage will be supplied to Kozloduy NPP.

The Technical Design and the ISAR were approved by KNPP in June 2006

Preparatory work started in November 2007, and they include site clearing, installation of a temporary fence, offices and test piles, etc. The piling foundation of the building started in June 2008. .

On 02.04.2008 the Chairman of the NRA issued an Order of Approval of the Technical Design.

On 17 June 2008 a Construction Permit was obtained from the NRA for the construction of a dry spent fuel storage facility with 2800 assemblies of spent fuel from WWER-440 reactors.

18. Measures for RAW minimisation

Revision 3 of July 2008 of the Complex Programme for RAW Management at Kozloduy NPP Plc. provides operational parameters for RAW management. The parameters have been selected so as to provide quantitative characteristics of the activities and processes related to the management of liquid and solid RAW. A target value has been identified for each parameter for the operator to put efforts to achieve.

Development is under way of practices for free release of materials consistent with the provisions of the Regulation about procedures for work with ionizing radiation sources. A decommissioning project dealt with the supply of a free release measuring facility for clearance of materials using the total gamma activity method. Functional and metrological tests were successfully performed on the facility. On the basis of the results from a radiological inventorization of Units 1&2, radionuclide vectors were developed and will be used by the software of the facility to compare the activity of the materials with free release levels.

A technology for the discharge of fire detection ionizing sensors was introduced at the SE RAW – Novi Han SD thus reducing the volume of the sensors by 80%.

Planned safety improvement activities for the period 2008-2011

The planned safety improvement activities result from the *Strategy for Spent Nuclear Fuel and Radioactive Waste Management* , the conditions laid in the NRA licences, and the plans and programmes of the nuclear regulator and the operators of nuclear facilities.

The main strategic tasks of national importance are as follows:

1. Site selection for the national repository for radioactive waste;
2. Identifying, by 2010, the option for disposal of high level radioactive waste.

The main activities regarding the legislation for the safe management of SF and RAW are as follows:

1. Amending the regulatory basis in order to ensure the resources for long-term management of SF and defining the terms and conditions for transfer to the state of orphan sources of or belonging to an insolvent owner company.
2. Establishment and approval of the NRA regulatory guides for implementation of the regulations on the safety of SF and RAW management.

Activities planned to enhance the safety of RAW management at the SE RAW - Kozloduy SD

1. Activities and measures in the Programme for safety improvement of the RAW management facility at Kozloduy NPP;
2. Activities and measures in the Programme for RAW management on the site of the Lime Plant.

Activities planned to enhance the safety at SE RAW – Novi Han SD:

1. Commissioning of a hot cell for receiving inspection and characterisation of sealed sources;
2. Rehabilitation of a repository unit for the liquid RAW;
3. Construction of two additional drill on-site to serve the objectives of radiation monitoring;
4. Refurbishment of the receipt and preparation laboratory complex and supply of facilities for treatment and storage of conditioned RAW.

SECTION L: ANNEXES

Annex L-1

List of the spent fuel management facilities, their location, main purpose and key characteristics

Annex L-2

Spent fuel report

Annex L-3

List of the radioactive waste management facilities, their location, main purpose and key characteristics

Annex L-4

Radioactive waste report

Annex L-5

List of the international agreements, laws and normative sublegislation applicable to the spent fuel management facilities and the radioactive waste management facilities.

Annex L-6

Human and financial resources

Annex L-7

Brief outline of the projects funded by KIDSF and managed by the PMU on decommissioning of Kozloduy NPP units 1-4

LIST OF SPENT FUEL MANAGEMENT FACILITIES, THEIR LOCATION, BASIC FUNCTION AND MAIN CHARACTERISTICS

I. NPP "Kozloduy

I.1 Spent fuel storage facility

The spent fuel storage facility (SFSF) is a separate building, located at the Kozloduy NPP site, where facilities and systems, providing subcriticality, residual heat removal and biological protection, are situated.

The spent fuel storage facility is designed for storage of spent fuel from reactors WWER-440 and WWER-1000 after at least three years of initial storage in at-reactor SF ponds. The storage is a "wet" type; the spent fuel is stored under water in pool with four compartments. The spent fuel storage fuel assemblies are stored in transport baskets. The project capacity of spent fuel storage facility is 168 baskets.

The subcriticality is ensured by the basket construction (grid step and basket material) and spent fuel baskets' grid step in the pool. This allows the spent fuel pool to be filled in with demineralized water without reagents (boric acid, etc.), which significantly facilitates the operation of SFSF.

The residual heat removal is provided by:

- Heat exchangers, cooled with service water;
- Pool water evaporation;
- Ventilation of the main hall;
- Heat losses through the building structure;

Biological protection is provided by the building structure and the water layer above the spent fuel in the spent fuel storage pool.

SFSF is integrated with the following NPP systems:

- Physical protection system;
- Emergency planning;
- Radiation control;
- Fire protection;
- Accident signalization system;
- Treatment and storage of radioactive and non-radioactive waste;

The technical design of the existing SFSF was developed in compliance with the normative documents in force, during the 70^s of the last century, in the former Soviet Union. The spent fuel storage safety practically is based upon the application of the “in-depth protection” principle. The basic design solutions, applied in the process of SFSF construction are:

- The fuel assemblies are stored under water (chemically treated, at a temperature below 40°C), which protects them from damaging; suppresses the degradation processes of the cladding material of the fuel elements and the construction material of the fuel assemblies; the parameters of the water chemical composition and its activity (the utmost radioactive contamination level is 1.11×10^5 Bq/l) are maintained by the water purification system;
- The cooling system (spent fuel residual heat removal) is designed with high redundancy level - the cooling water is supplied to the pools from above, their drainage, because of the siphon effect is impossible; there is a possibility for rapid water supply from the tanks with rate 10 times higher than the maximum designed controlled leakages from the pool;
- The pool’s double lining provides high density and reliable control of leakages (the lining is supported from porous concrete layer, in case of leakage from the facing, the water is absorbed through the porous concrete layer to special collecting points from all directions of a given compartment and in the bottom center, it is collected by a system of controlled leakages and is directed towards the purification system);
- The massive building structure (reinforced concrete frame and reinforced concrete walls) of SFSF provides biological protection (the reinforced concrete walls and the pool bottom have a thickness of 1,5m);
- The spent fuel assemblies leak tightness during the transportation process and storage in normal and emergency conditions is ensured by the conditions for transport and storage; the untight spent fuel assemblies are stored in tight cans;
- The subcriticality is ensured by the transport baskets’ structure (through geometrically safe configuration of the loading of the fuel) and storing conditions in the pool and does not depend on a permanent or burnable absorber. The assessment of subcriticality does not take into account fuel burn-up;
- The shipment of the fuel assemblies from the at-reactors SF ponds (minimum after 3 years storage of the WWER-440 fuel assemblies and minimum after 5 years storage of the WWER-1000 fuel assemblies) to SFSF is carried out by transport baskets in a fuel transportation cask; in the process of loading and transportation of the cask the personnel acts according to the especially developed instructions; the fuel assemblies are stored vertically, as well as they were situated inside the reactor;
- availability of ventilation systems, fire protection systems and control and management systems;
- availability of 12 control probe wells around the SFSF building for underground water activity control;

For safety substantiation of the SFSF the appropriate analyses were conducted. The constructional and neutron-physical features of the spent fuel assemblies provide their density and integrity conservation in case of completely dried pool, and air-cooling for a period of time, sufficient for the commencing of recovery activities (100 hours in case of the most unfavorable temperature conditions of the environment).

An additional safety assessment of the SFSF was conducted within the PHARE program during 1999. A standard list of accident scenarios is accepted as a basis for the safety analysis, based on IAEA document - Safety Series № 118 “Safety Assessment for Spent Fuel Storage Facilities”.

After seismic analysis of the building structure, including the foundations of the equipment, important for the SFSF safety, and specifying the areas of admissible safety, was implemented an anti-seismic anchorage of the building construction, the equipment significant for the safety, 125t crane and the lighting bar. In the conducted review of the seismic stability of the transport baskets in the SFSF was not detected any necessity of supplementary anchoring of the transport baskets.

In order to justify the potential term of long-term safe enclosure of the assemblies under water, in 2006 “accelerated corrosion tests” were conducted again using a specially developed method statement that allows modelling the impact of a corrosive (aqueous) medium with a storage period of 50 years. The complex non-destructive and destructive examinations of the fuel rods and the other design elements of a type assembly with spent nuclear fuel of WWER-440 and WWER-1000 after a prolonged storage under water; the studies with hydrogen saturation and determining the mechanical characteristics of the fuel rod metal cladding; the accelerated corrosion tests and the analysis of the results from other tests have confirmed the satisfactory condition of the cladding following 50 years of underwater storage, provided that the specified water chemistry is adhered to.

Evaluation has been made of the condition of the structural materials, the pond lining and the transport storage baskets. Their integrity has also been preserved. Their corrosion resistance for a 50-year period of operation of the storage facility has also been confirmed.

In 2004 a Safety Assessment of the SFSF was made, on the basis of which the NRA issued an operational licence of SFSF until 2014.

In 2005 a Technical Specification for operation of the SFSF updated with the new requirements of the regulatory documents was approved. The project for Modernisation of the radiation monitoring system was delivered (replacement of the instrumentation with modern one capable of on-line recording in the data base of the readings.

In 2006 the areas for fuel receiving and refuelling were furnished with a refuelling machine for WWER-440 and WWER-1000 assemblies. The protection and interlocks system was replaced by a digital one (using programmable logic controllers, PC, etc.).

In 2007 analyses were made to determine the lifetime of the SFSF building and equipment.

I.2 Reactor ponds - 1, 2, 3, 4

The reactor ponds are used for short-term storage of the assemblies once they have been taken out of the core, and the objective is to reduce their activity as well as their decay fuel removal prior to being transferred to the SFSF or transported to Russia.

The regulated term for storage in the reactor pond is 3 years if the SF will be transferred to the SFSF and 5 years if it will be transported to Russia.

The nuclear safety of the reactor ponds is ensured by the design, namely by the spacing of the grid, which provides a minimum of 5% subcriticality during the SF storage and at a maximum effective multiplication coefficient (the pond fully taken by fresh fuel, absence of soluble neutron absorbent (H3BO3) from the water, and at 20˚C water temperature)

The cooling system provides mandatory decay heat removal and temperature in the reactor ponds is maintained within the 20÷50˚C range (under no circumstances should it exceed 65˚C), with the pond completely filled with SF, including holding the assemblies after a full "hot" defuelling. Emergency cooling of the reactor pond heat exchangers is provided by additionally installed emergency make-up water system on each unit, as well as additional emergency make-up water system in case of reactor pond leakage that exceeds the pump flow rate of the filling system, at reactor ponds 3 and 4, where storing of SF is still on two rows of racks (this is a new system, adopted in 2008)**.**

The coolant treatment system removes fission or corrosion products from the water, and ensures the required transparency of the reactor ponds.

The design of the reactor pond for WWER-440 assemblies consists of two rows of racks: the upper layer can be dismantled while the bottom one is fixed. Each row has three sections. The total capacity of reactor ponds 1, 2, 3 and 4 is 701, 728, 728 and 726 assemblies, respectively.

When the reactor unit is in on-load operational mode, the SF is stored only on the lower rack of the reactor pond and the upper rack is then used for temporary storage - if re-arrangement is needed and during refuelling (for instance when the core is fully defuelled to the spent fuel pond).

Currently, units 1-4 hold operational licences for operation in E mode - storage of SF in the reactor ponds. The fuel in reactor ponds 1 and 2 has to be placed on one row of racks and in reactor ponds 3 and 4 - two rows of racks by the end of 2009.

The SF from reactor ponds 1÷4 is periodically transported to Russia. The Transport schedule follows the schedule for the rated storage time allowing for the SF to be moved. Due to the SF movement, since 2006 the SF in the reactor ponds 1 & 2 has been stored in a single row of racks, as required by their licences.

The reactor ponds 1÷4 also hold for storage other elements of the core, such as control rod absorbers and dummy fuel assemblies that do not contain nuclear material.

1.3 Reactor ponds – 5 and 6

The fuel storage and refuelling ponds (SFP or reactor ponds) are located in the unit containment area. The spent fuel is stored there in order for the decay heat to be brought down to admissible levels. The ponds also serve for temporary storage of control rod absorbers and dummy fuel assemblies. Each spent fuel pond consists of 4 compartments physically separated by partition walls up to elevation 28.93. Above elevation 28.93 up to 36.2 the pond volume is common. Three compartments are allocated for immediate storage of the spent assemblies, while the fourth compartment is used for transport and handling operations with fresh and spent fuel. The SF overpack, the fresh fuel baskets and the baskets holding hermetic storage tubes are placed in the fourth compartment. The racks and hermetic storage tubes for accommodating and storing of assemblies are inside the fuel storage compartments.

The racks are manufactured from borated steel and they ensure subcriticality in the pond not lower than 0.05 in case of design initiating events, including the drop of a heavy object. The absorbing capacity of the rack cells is preserved over the entire operational period. The reactor pond rack is designed to ensure that:

- the fuel assemblies and the hermetic storage tubes are positioned vertically inside the pond;
- mechanical damage is prevented on the surface of the assemblies while they are being placed or taken out of the rack's guide frames;
- the assemblies and the hermetic storage tubes have been fixed to the rack;

- the decay heat of the spent fuel assemblies is reliably removed;
- the racks shall preserve their functionality at the seismic impact of a design shutdown earthquake;

Each SFP has a load capacity of 612 fuel assemblies and shall assure storage of the spent fuel assemblies not shorter than three years, as provided in GOST.95.7.5-87;

The separation of the SFP into three compartments allows for maintenance works to be carried out in one of them while the spent fuel assemblies have been placed in the other two compartmnents;

The area assigned for loading of the overpack (transport container) is called "universal load location"; it has been separated from the assembly storage area so that in case of a container drop, the fuel elements will not be damaged or, in case an assembly has been taken out, the level of the boron solution ensuring the assemblies are submerged and protected will not diminish.

The fencing structures of the SFP are intended to hold back the cooling boron solution (which may contain radioactive products) and also to decrease the ionizing radiation;

The SFP fencing structures consist of the following elements:

- The double metal lining has a drain for any potential leaks. The space between the two walls with lining is filled with drainage (porous) concrete thus forming an enclosed common hollow space with the floor and the walls, enabling to keep track of potential leaks through the lining. In the floor between the two walls there are drains (one for each SFP and universal load location) that run to a room where it is possible to inspect visually for any leaks.
- Reinforced concrete fencing structures

The design of the structures fencing the SFP has taken into account the following principles:

- Preserve the functional attributes (tightness and strength) under different operational modes, including safe shutdown earthquake;
- Ensure shielding in normal operation modes and 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 pond is filled up to elevation 28.83 in fuel long-term storage mode. In the refuelling mode (when transport handling with the fuel is envisaged) the pond is filled to elevation 35.7. Thus, movement of the fuel underwater is ensured. To prevent pond overfilling, there are two overflow devices in each compartment of the pond - one at the water level for long-term fuel storage (28.8), and the other at water level for refuelling (36.2). If the water level needs to be maintained at 35.7, the operator shall close the isolation valves corresponding to level 28.8. The fuel storage compartments do not have service drains at the bottom part which guarantees they cannot be drained empty and leave the SNF without coolant.

In the operational modes when there is no fuel movement, the top part of the pond is covered by plates. To avoid the plates breaking and falling in the pond, they are designed to withstand an earthquake with a magnitude of 9 on the MSK-6 scale and shock wave impact all over the plate surface with a force of 148 kN (14.8 ts/s) in case of a main circuit pipeline rupture. The plates can withstand shock loads in the event of objects with a mass of 5 kg dropping from 10 m height (i.e. small size tools dropped from the undercrane structures).

In the top part of the pond there is a ventilation, suction-supply system that ensures an air screen preventing the spread of gaseous aerosol products from the SFP surface to the main room. Thus, the service personnel in the containment is protected in refuelling modes or unit maintenance modes.

The cooling system consists of three channels, three pond cooling pumps, three heat exchangers at the suction part of each pump, pipes and valves. The channels are joined by means of a connection of the suction and the discharge pipes, which permits switching from one channel to the other in the event of a failure of any of the channels. Three fast acting localizing valves are installed at both the discharge and the suction pipes, one of the valves being placed in the containment. The heat exchangers are cooled by the service water system for significant users, and each TG channel is cooled by a separate channel.

The performance capacity of each of the three channels is such that each of them can ensure heat removal from the reactor pond under any of the system operating modes.

II. Shaft repository in the nuclear research reactor IRT -2000.

The Nuclear Research Center at the Institute for Nuclear Research and Nuclear Energy /INRNE/ at the Bulgarian Academy of Science has a SFSF in water, constructed in the biological protection of the reactor's pool, called shaft repository. The access to it is from the reactor site.

The shaft repository has rectangular form with measures of the base 1910 mm x 1010 mm.

The shaft repository bottom is located at elevation +2.13, and the lid is thick 400 mm, manufactured from steel, at elevation +7.94. The biological protection is constructed from heavy concrete with thickness: 1755 mm of the west side; 1935 mm of the east side and 850 mm of the north side. South of the shaft repository is located the reactor pool, separated by heavy concrete with thickness 1900 mm. The walls are lined with aluminum sheets, and at the bottom there are distancing bars with pitch 190x170 mm also from aluminum, where clusters are formed for the fuel assemblies. The fuel assemblies are stored in vertical position at two levels. The clusters are 54, which allows the storage of 108 fuel assemblies.

The water in the shaft repository pool is distilled. The residual heat removal is absorbed by the walls of the shaft repository through natural circulation of the distillate. The water in the shaft repository is filtered via a circulation pump and a mechanical filter, located at the reactor site.

The water level in the shaft repository is automatically controlled. In case of its lowering to specified limits a sound and light emergency signalization system is actuated.

Fuel assemblies handling is carried out by special tools and equipment.

SPENT FUEL INVENTORY

I. Kozloduy NPP

The spent fuel at Kozloduy NPP site, stored in the at-reactor SF ponds and in the SFSF, at 31.07.2008 contains 872.3 tones heavy metal /HM/. This amount is distributed into 5736 spent fuel assemblies from WWER – 440 and 540 spent fuel assemblies from WWER – 1000, total of 6276 spent fuel assemblies are stored.

Spent nuclear fuel inventory in SFSF at 31.07.2008

Reactor type	Assembly type	Initial enrichment at ^{235}U [%]	SFSF		**TOTAL**	
			Number of Assemblies	Heavy metal mass [kg]	**Number of Assemblies**	**Heavy metal mass [kg]**
WWER-440	116	1.6	7	826	**4 192**	**482 123**
WWER -440	124	2.4	97	11 299		
WWER -440	136	3.6	3516	406016		
WWER -440	216	1.6	9	1006		
WWER -440	224	2.4	433	48555		
WWER -440	236	3.6	130	14 421		
WWER -1000	A	2.0	12	5138	**24**	**10146**
WWER -1000	Г	3.3	12	5008		
TOTAL					**4 216**	**492 269**

Spent nuclear fuel and havy metal inventory in at-reactor SF ponds – 1-6 at 31.07.2008

Reactor type	Assembly type	Initial enrichment at ^{235}U [%]	SFP-1		SFP -2		SFP -3		SFP -4		**TOTAL**	
			Number of Assemblies	Heavy metal mass [kg]	Number of Assemblies	Heavy metal mass [kg]	Number of Assemblies	Heavy metal mass [kg]	Number of Assemblies	Heavy metal mass [kg]	**Number of Assemblies**	**Heavy metal mass [kg]**
WWER -440	116	1.6	0	0	0	0	2	237	0	0	**2**	**237**
WWER -440	124	2.4	12	1 410	3	354	13	1538	13	1535	**41**	**4837**
WWER -440	136	3.6	252	29211	75	8757	483	56109	510	59216	**1 320**	**153 293**
WWER -440	216	1.6	1	114	0	0	1	114	7	799	**9**	**1027**
WWER -440	224	2.4	40	4 491	3	338	26	2937	25	2796	**94**	**10562**
WWER -440	236	3.6	0	0	0	0	42	4699	36	4019	**78**	**8 718**
TOTAL			**305**	**35 226**	**81**	**9 449**	**567**	**65 634**	**591**	**68 365**	**1 544**	**178 674**

Reactor type	Assembly type	Initial enrichment at ^{235}U [%]	SFP -5		SFP -6		**TOTAL**	
			Number of Assemblies	Heavy metal mass [kg]	Number of Assemblies	Heavy metal mass [kg]	Number of Assemblies	Heavy metal mass [kg]
WWER -1000	B	3.0	1	389	1	390	**2**	**779**
WWER -1000	Г	3.3	1	422	92	38 570	**93**	**38 992**
WWER -1000	ГВ	3.3+3.0	0	0	2	842	**2**	**842**
WWER -1000	ЕД	4.4+3.6	124	47 588	114	43 750	**238**	**91 338**
WWER -1000	Е	4.4	85	32 502	90	34 425	**175**	**66 927**
WWER -1000	N 3536	3,53	6	2 496	0	0	**6**	**2 496**
TOTAL			**217**	**83 397**	**299**	**117 977**	**516**	**201 374**

TOTAL FOR KOZLODUY NPP

Reactor type	Number of Assemblies	Heavy metal mass [kg]	Estimated activity [Bq]
WWER -440	**5 736**	**660 797**	**$1,3.10^{19}$**
WWER -1000	**540**	**211 520**	**$1,7.10^{19}$**
TOTAL	**6 276**	**872 317**	**$3,0.10^{19}$**

Description of spent fuel assemblies construction

1. Fuel assembly for WWER-440 reactor.

1.1 <u>Fuel assembly (FA)</u>

The fuel assembly is a non-dismountable construction and consists of a bundle of 126 fuel rods, fuel assemblies 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 labeled with code 116, 124 and 136.

1.2 <u>Regulating and shim fuel assembly (RSA)</u>

The regulating and shim fuel assembly does not differ from a FA in general. The difference is 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 labeled with code 216, 224 and 236.

2. Fuel assembly for WWER-1000 reactor.

<u>2.1 Assembly of TVS type</u>

The TVS assembly is of 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% to 4.4% and are labeled with code: Н, А, В, Г, ГВ, Д, Е and ЕД respectively.

<u>2.2 Assembly of TVSA type</u>

The TVSA assembly is of non-dismountable construction and consists of 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 assembly consists of approximately 430 kg heavy metal. The fuel assemblies are produced with enrichment of 3.53% to 4.38 and are labeled with code N3536, N3906, N3996, N4306, and N4386 respectively.

II. Shaft repository in IRT-2000

General features of the stored SF

Fuel type	Number of Assemblies	Number of fuel rod	Estimated activity [Bq]	Residual heat release [W]	Mass $^{\Sigma}U$ [g]	Mass ^{235}U [g]	Assemblies' mass [kg]
EK-10	0	0	0	0	0	0	0
S-36	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Description of Fuel assemblies for reactor type IRT- 2000

The reactor IRT-2000 nuclear fuel is classified according to type, the number of fuel rods, the fuel assembly geometry and delivery date.

There are two types of fuel:

- EK–10, with 10 % initial enrichment by ^{235}U, is UO_2 in matrix of Mg;
- C-36 with 36 % initial enrichment by ^{235}U metallic U in matrix of Al;

The assemblies are with square section, which could be with one chamfer (geometry type G), two chamfers (geometry type C), three chamfers (geometry type B), or without chamfers (geometry type A), and number of the fuel rods from 14 to 16.

The cladding of the fuel rod, the fuel assembly framework as well as all supporting elements, is made of aluminum.

The supply of fuel is provided three times:

- As part of the equipment in the process of its construction – 49 type EK-10;
- In 1980 – 9 type EK-10;
- In 1985 – 16 type C-36;

The spent fuel is stored in the shaft repository, placed in the biological shield wall of the reactor vessel.

LIST OF THE FACILITIES FOR RADIOACTIVE WASTE MANAGEMENT, THEIR LOCATION, BASIC FUNCTION AND MAIN CHARACTERISTICS

1. KOZLODUY NPP FACILITIES FOR RAW MANAGEMENT

Auxiliary Building - 1

The storage facilities are designed for temporary storage of solid waste class 2 - low and intermediate level liquid radioactive concentrates, and spent sorbents from the reactors operation.

The storage facilities are situated in a building with reinforced structure, separated part of auxiliary building – 1 (AB-1) serving units 1 and 2.

The storage facilities for solid RAW are vault-type with upper hatch; they are seven, with different volume (from 80 m^3 to 230 m^3) and total net volume of 1010 m^3. The service conditions are room temperature and atmospheric pressure.

The storage facilities for liquid radioactive wastes are stainless steel tanks. Each of them is situated in a separate room provided with metal lining. The tanks are five and each of them has 10m diameter, 7 m height and net volume of 470 m^3. They are provided with a level control system. Operating conditions – temperature up to 100 ^oC, atmospheric pressure. A blow tank provides the radioactive liquid transport. Suction ventilation system of the tanks rooms provides for clean up of the exhaust gases.

The storage facilities for spent high-active sorbents are tanks from stainless steel. Each of them is situated in a separate room provided with metal lining. The tanks are two; each of them has 9.0 m diameter, 6.5 m height and net volume of 350 m^3. They are provided with a level control system. Operating conditions – temperature up to 100 ^oC, atmospheric pressure. The radioactive sorbents transportation is provided by hydro-discharge. The suction ventilation system of the tanks rooms provides for gas clean up.

The storage facilities for spent low-active sorbents are two, provided with a metal lining with dimensions 5,0 x 4,6 x 8,2 m and net volume of 188 m^3 each. Operating conditions – room temperature and atmospheric pressure. They are provided with a leakage control system. The suction ventilation system of the tanks rooms provides for gas clean up.

Auxiliary building - 2

The storage facilities are designed for temporary storage of solid RAW class 2, low and intermediate level liquid radioactive concentrates and spent sorbents from the reactors operation.

The storage facilities are situated in a building with reinforced structure, separated part of auxiliary building – 2 (AB-2), serving units 3 and 4.

Their characteristics are the same as of AB-1.

Auxiliary building - 3

The storage facilities are designed for temporary storage of solid RAW class 2б, low and intermediate level liquid radioactive concentrates, the spent sorbents from the reactors operation.

The storage facilities are situated in a building with reinforced structure, separated part of auxiliary building – 3 (AB-3), serving units 5 and 6.

The storage facilities for solid class RAW 2б are vault-type with upper hatch; they are eighteen, with different volumes (from 78 m^3 to 189 m^3) and total net volume of 2486 m^3. Operating conditions – room temperature, atmospheric pressure. Facilities are provided with fire alarm and fire-extinguish systems.

The storage facilities for solid RAW class 2-III are vault-type with upper cylindrical hatch and monolithic reinforced structure providing the necessary bio-protection. Total net volume of 213 m^3. Operating conditions – room temperature, atmospheric pressure.

The storage facilities for liquid radioactive concentrates are tanks from stainless steel. Each of them is situated in separate room provided with metal lining. The tanks are seven, with total net volume of 3600 m^3. Three of them have 6.4 m diameter, 6.4 m height and net volume of 200 m^3, each and the rest four of them have 10 m diameter, 10 m height and net volume of 750 m^3, each. They are provided with a level control system. Operating conditions – temperature up to 100 ^oC, atmospheric pressure. The transport of radioactive liquids is provided by a vacuum-pressure-operated intermediate tank. The suction ventilation system of the tank rooms provides for exhaust gas clean up.

The storage facilities for spent sorbents are tanks from stainless steel. Each of them is situated in separate room, provided with metal lining. The tanks are two; each of them has 4,5 m diameter, 6,3 m height and net volume of 100 m^3. They are provided with systems for level and temperature control, hydro-transport of the radioactive liquids and fire extinguishing. Operating conditions – temperature up to 40 ^oC, atmospheric pressure. The suction ventilation system of the tank rooms provides for exhaust gas clean up.

Storage facility in reactor hall - 1

It is designed for temporary storage of solid RAW class 2б from the reactors operation; situated in main (reactor) hall (RH-1) of units 1 and 2.

The storage facility is tube-type. 400 concrete steel tubes with upper hatch, each having 0,18 m diameter, 8 m height and total net volume 81,6 m^3 are located in a monolithic reinforced concrete constructio providing the necessary biological protection. Operating conditions – room temperature, atmospheric pressure.

Storage facility in reactor hall - 2

It is designed for temporary storage of solid RAW class 2б from the reactors operation; located in reactor hall (RH-2) of units 3 and 4. The storage facility characteristics are the same as of RH-2.

Storage facility of sources of ionising radiation at "Metrology Service"

The sealed ionising radiation sources are stored in a designated storage room located in the premises of "Ionising radiation measurement" laboratory, Service Building – 1, Electro-production – 1.

The sources are stored according to permission by NRA, which is re-issued annually and is related with an NRA licence for use of ionising radiation sources for the industrial purposes.

Site for temporary storage of sources of ionising radiation in smoke detectors

Sources of ionising radiation used in smoke detectors are storage in the following locations: Laboratory "Radiometry", ОППС V unit, Room 6 DE, room 3005 at elevation 30.00 – turbine hall – east staircase cage VI unit and "Kulata" storehouse.

The sources are stored according to permission by NRA with 5 years term of validity, which is related with an NRA licence for use of ionising radiation sources for the industrial purposes.

2. SE RAW

2.1. SE RAW –Kozloduy SD

Department for treatment of RAW

It is a separate installation designed for pre-treatment, treatment and conditioning of RAW generated from Kozloduy NPP.

The conditioning process includes:

- extraction of the liquid RAW from the tanks for liquid radioactive concentrate;
- transport to the RAWPP;
- concentrating of the liquid radioactive concentrate (when necessary) by evaporation;
- pH correction;
- dosing of the liquid radioactive concentrate, the cement and the supplements;
- mixing, homogenisation and filling of the cement radioactive mixture into reinforced concrete container;
- sealing the package (placing and closing the cover, sealing up the cover's hole)

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

Thereby the conditioned RAW are stored on the site of Kozloduy NPP and are subject of further disposal without additional treatment.

There are two separated processing lines in RAWPP:

Line "Solid RAW"

It is designed for sorting and treatment by compaction of solid RAW in order to reduce the volume and to prepare them for further conditioning. The line includes:

- Centre for receiving and uploading of solid RAW;
- Sorting table;
- Two presses with 50 t force;
- Mechanism for sealing of 210 litres tanks;
- System for measuring of wastes' activity;
- Super-compactor with 910 t force;
- Two depots for tanks;
- Roll conveyors;
- Crane-manipulator;
- 20 tonnes transport carriage;
- Two cranes with load capacity of 40 t.

Line "Liquid RAW"

It is designed for treatment and conditioning of liquid RAW including RAW packaging. The line includes:

- Specialised tank truck for transport of the liquid RAW from the temporary storage facilities;
- Centre for receiving and uploading of liquid RAW;
- Two receiving tanks for liquid RAW with 40 m^3;
- Two-stages evaporator with receiving tanks for distillate and condensate;
- Two tanks for concentrated liquid RAW with 12 m^3;
- Receiving bins for cement and chemical supplements;
- Batcher for the cement and the supplements;
- Mixer;
- Pumps, tanks, etc.

RAWPP is provided with all necessary safety systems and external communications.

Construction of an installation for decontamination of metal RAW is forthcoming.

Storage facility for conditioned RAW

It is designed for temporary storage (prior to disposal) of conditioned RAW from Kozloduy NPP.

It is a surface ferroconcrete facility which provides the necessary engineering barriers between the stored RAW and the personnel and the environment. Its capacity is 1920 reinforced concrete containers with conditioned RAW (960 in each field "A" and "B", in 4 rows one on top of the other). Two bridge cranes of 25 t load capacity each (one for each field) perform all transport operations in the storage facility. They are provided with grip devices for arranging and positioning of the containers with RAW.

"Lime Plant"

A site where the following sub-sites for RAW management are separated:

Storage facility of trench type for storage of solid RAW

It is designed for temporary storage of solid RAW of class 2-I and 2-II and serves all nuclear facilities at the Kozloduy NPP site.

The storage facility is surface ferroconcrete construction facility of vault-type. It is separated on forty cells with upper hatch, each with dimensions 2.7 x 5.9 x 6.0 m and volume 96.5 m^3. Operating conditions – ambient temperature, atmospheric pressure.

Storage facility for temporary storage of processed solid RAW

It is designed for temporary storage of processed solid RAW of class 2a from all nuclear facilities at the Kozloduy NPP site.

The storage facility is of building type, reinforced concrete panel structure with transport aisle. The processed solid RAW are stored in metal pallets, arranged in three rows in height. The working volume of the facility is 1130m3. Operating conditions – ambient temperature, atmospheric pressure

Installation for incineration of solid RAW class 2a is installed in a separate room in the building.

Sites (№1 и №2) for temporary storage of solid RAW in reinforced concrete containers

It is designed for temporary storage of processed solid RAW of class 2a, packed in reinforced concrete containers. It serves all nuclear facilities at the Kozloduy NPP site. The site is with capacity for placing of 2000 reinforced concrete containers.

The reinforced concrete container is licensed for transport and storage of solid RAW class 2a. It is with overall dimensions 1,95 x 1,95 x 1,95 m and net volume of 5 m^3. Its walls ensure bio-protection in a way, that the power of the equivalent dose does not exceed 2 mSv/h in any point its external surface, and 0.1 mSv/h at 1 m distance from the surface. Operating conditions – ambient temperature, atmospheric pressure.

The package is in conformity with Technical Specification RAW TR-02/11.07.01.

Site for temporary storage of solid RAW in heavy weight containers

It is designed for temporary storage of low-active solid RAW class 2-I and 2-II class. It serves all nuclear facilities at the Kozloduy NPP site. The site is with capacity for placing of 14 heavy weight containers.

The heavy weight container with side door is with overall dimensions 5,8 x 2,2 x 2,4 m and net volume of 30 m^3. Operating conditions – ambient temperature, atmospheric pressure.

Storage facility for contaminated earth and soil

This facility is located at **"Lime Plant" Site.** It is designed for storage of soil and earth deposits with low level of contamination. Storage capacity is approximately 8000 m^3. This facility is included in the renewed license for operation of **SE "RAW – Kozloduy SD.** It is not yet commissioned, as its modernization is going on.

2.2 SE RAW –Novi Han SD

Storage facility for non conditioned solid low and intermediate level short-lived RAW (2a class)

The storage facility is with capacity of 237 m^3. It consists of three identical cages, with dimensions 5 x 4.5 x 3.5 m. It is dug into ground reinforced concrete multi barrier facility with 15.7 m length, 5.83 m width, and height of the aboveground part 1.2/1.6 m. It is constructed of reinforced concrete with 300 mm thickness, two-sided hydro-insulated with 20 mm bituminous insulation, with lining of 4 mm stainless steel sheets. The internal walls are additionally strengthened with supporting brick walls with 120 mm thickness. The storage facility is filled up from the surface through 7 hatches with external diameter 100 cm and 120 sm. According to the design, after the fulfilling of the cages, they will be grouted with concrete.

Since 1993 there is no deposed waste in the stored facility.

Storage facility for conditioned put in plaster matrix biological RAW, low and intermediate level short lived wastes (2a class)

The capacity of the storage facility is 80 mm^3. Its construction is analogical to the above described one with smaller dimensions – 8.35 m length, 4.00 m width, 2.5 m depth, and 0.5 m height of the overground part (roof construction). The facility is fulfilled from the surface through 8 hatches with dimensions 80 x 80 cm.

Since 1993 there is no deposed waste in the stored facility.

Storage facility for unconditioned low and intermediate level sealed sources (2a class)

Its capacity is 1 m^3. The reinforced concrete facility, with lining of stainless steel is situated in 5.5 m depth under the ground surface. The sources are received through serpentine of stainless steel with 5 mm diameter. The heavy concrete and 5 lead plates with 10 mm thickness, situated between the storage facility and the surface provide the protection against ionising radiation. The storage facility is additionally protected with heavy roof construction.

Since 1993 there is no deposed waste in the stored facility

Engineering trench for solid RAW for unconditioned solid low and intermediate level short lived solid wastes (2a class)

The storage facility is with capacity of 200 m^3 and dimensions 29 m length and 4.1 m width. It consists of 8 cages built up of ready made reinforced concrete elements with 300 mm thickness, bituminous hydro-insulation and supporting brick wall. It is provided with a drain system. It is fulfilled from the ground surface through hatches with diameter 130 cm. Three of the cages are completely fulfilled, stabilised with cement grout, and covered with temporary protective coating.

Tanks for temporary storage of low-active short lived liquid RAW

Four tanks of stainless steel type 1X18H9T with 4 mm thickness, constructed in reinforced concrete cages with dimensions 5.7 x 7.4 x 4.3 m on concrete supports at 0.5 m above the cage's floor. The cage is completely dug into the ground. The capacity is 48 m^3.

*Site for temporary storage of low-active short and long lived wastes (2a and 2b class) in railway containers***.**

Fire alarm detectors in transport packages, solid RAW and β,γ-disused sources with low specific activity, which do not require additional protection, neutron sources and α-sources in transport packages are stored on the site.

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

Site for temporary storage of medium-active short- and long lived RAW (2a and 2b class) in concrete receivers "PEK" type, reinforced containers "StBKKUB" and reinforced concrete containers "StBKGOU"

On the site are stored misused sources in transport packages in concrete receivers "PEK" type, sealed sources in reinforced concrete containers StBKKUB and not completely discharged gamma-irradiation facilities in reinforced concrete containers StBKGOU. The site capacity is 171 StBKKUB with 248 m^3 total volume, 6 "PEK" with 74 m^3 total volume and 18 StBKGOU.

Site for storage of low-level RAW

RAW are stored in 200-liters tanks and in euro-pallets. The site capacity is 400 tanks and 100 pallets. The occupied volume is 331.1 m^3.

Facility for RAW treatment

It is designed for RAW entry check and identification, sorting out, partial re-packing, RAW preparing for storage, decontamination of equipment and vehicles, treatment of low-active water from the operation of the site. In 2007 four work places were equipped for discharging of sources of ionising radiation in smoke detectors . A workplace was equipped for deactivation of ПИЙД casing parts. Within a PHARE project the following equipment was delivered to facilitate the preliminary check:

- A Gamma-scanning System for the inspection of 200 l metal barrels;
- 2 gamma analyzing tools, equipped with germanium detectors ISOCS;
- A portable system for quick measuring of samples for surface contamination and small samples iSOLO
- Beta and Alpha spectrometers;

In accordance with paragraph 4.3 of *The Strategy Document for Management of Spent Fuel and Radioactive Waste* at SE RAW "NOVI HAN" SD site**,** a hot chamber for inspection and characterization of sealed radioactive sources is under construction since 2006. It has the following characteristics:

- Maximum activity of the sealed radioactive sources, that could be processed in the hot cell at the same time - 500 TBq of ^{60}Co;

- Maximum activity of the sealed radioactive sources, that could be stored in a single operation container in the hot cell - 1000 TBq of ^{60}Co;
- Maximum activity of the sealed radioactive sources, that could be stored in operation containers in the hot cell - 4000 TBq of ^{60}Co.

The 'Hot Cell" is in fact one-storey solid building with dimensions 18 m x 10.5 m , and height 5 m, including a premise for the hot cell itself, a receiving room, separate operation room, premises for the auxiliary systems and activities (incoming ventilation, suction ventilation, electrical installation and bathroom). It is to be commissioned by the end of 2008.

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

Storage tanks for liquid low-active RAW

Two tanks with volume of 150 m^3 each, located at 6 m depth, reinforced concrete structure with stainless steel lining of the outside. They are designed for storage of 'by the reactor' pool water and solutions from radio-chemical laboratories.

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

Tailings pond Buchovo – 1

It is located 1 km east of the town of Buchovo. From 1956 to 1960 has served the activity of the hydrometallurgical plant "Metalurg" – Buchovo. The tailings pond covers 24 hectares. Its volume is 1.3 millions m^3 and is fulfilled, comparatively well compackted and partially re-cultivated.

Tailings pond Buchovo – 2

It is located 1 km east of the town of Buchovo. Until 1992 has served the activity of the hydrometallurgical plant "Metalurg" – Buchovo. The tailings pond covers 14.5 hectares. Its volume is 10 millions m^3. The tailings are about 4.5 millions tons.

The facilities, which have served the tailings pond activity, are not in operation.

The RAW from the decommissioning of "Metalurg" plant are stored in trenches, made in the tailings pond's strip of beach.

There is an automated pomp station for filtering water built during the execution of activities on the tailing pond's wall.

In the beach line of the tailings pond there are radioactive waste obtained after the liquidation of PHP "Metalurg"

*Tailings pond "Eleshnitsa***"**

Tailings pond is located at 3 km south of village of Eleshnitsa. Until 1997 has served the activity of the hydrometallurgical plant "Zvezda", village of Eleshnitsa. It covers area of 231 decares. The stored tailings are over 9.0 millions tons, including solid waste of 7 680 tons. The total activity is tentatively estimated to 1.5 x 10^{15} Bq. At the present time, the activities on preservation and re-cultivation of the tailings pond are about finishing. A decontamination centre is constructed for decontamination of the drain water.

Facility for sorption treatment of contaminated with uranium mine water at the "Chora" sector

It is located near the town of "Buchovo", 18 km north-east of Sofia.

The facility treats contaminated with uranium mine water, produced by:

- water effusion from the outsets of stulms №№ 95;120;127;

- water effusion from drillings in the area of stulms 0127.

The main parameters of the incoming water are:

- capacity from 800 м ^{3} to 2100 м ^{3} for twenty four hour period;
- content of the uranium in the water – up to 1.9 mg/l
- pH 7,3 – 8,4.

The facility consists of the following equipment:

- two pump stations for mine water – under the barrage at adit № 127 and pump station under stulm № 95;
- head reservoir with dimensions 10 x 39 x 2.5 m;
- two sorption towers with net working volume of 25 m^3 each;
- sorbent catcher;
- buffer for water, purified from uranium with volume 35 m^3;
- centrifugal pump;
- hydraulic elevator;
- buffer for poor resin with volume 15 m^3;
- buffer for reach resin with volume 16 m^3.

Facility for sorption treatment of contaminated with uranium mine water at the "Bialata voda" sector

It is located 30 km west of town of Dolna Bania. The facility treats contaminated with uranium mine water, produced by the following effusion points:

- water from the barrage in the gully under the formerly waste heaps;
- water from the outset of stulm №1;
- water from the drilling;
- the average capacity of the gravitational receiving water for treatment is 500 m^3 / 24 hours period.

The facility consists of the following equipment:

- barrage under waste heaps;
- receiving basin (sedimentation tank) at stulm №1;
- sorption tower;
- sorbent catcher;
- buffer for poor resin with volume 15 m^3;
- buffer for reach resin with volume 18 m^3.
- sedimentation tank after sorption;
- buffer for re-circulation solutions with volume 30 m^3;
- two centrifugal pumps
- nearby to the facility is established express-laboratory for determination of the uranium content in solutions and resins.

Facility for sorption treatment of contaminated with uranium mine water at the "Iskra" sector

It is located 10 km north-west of town of Novi Iskar. The receiving water to be treated is self-effusion water from the outset of stulm № 5, which at the present is with capacity of about 20 m^3 per 24 hour period, pH – 3,0 and content of uranium 1.0 mg/l.

On the site are situated the following equipment, which are remained from the uranium mining. They have served the activities on water treatment up to year 2000:

- receiving buffer for reach solutions – 35 m^3;
- five centrifugal acid-resisting pumps;
- two sorption towers with net working volume 25 m^3;
- sorbent catcher with net 0.4 mm;
- a sorption tower with capacity 8.0 m^3;
- sorbent catcher
- receiving buffer for poor solutions – 35 m^3;
- reinforced concrete reservoir for water neutralisation with lime;
- receiving cone for poor resin;
- centrifugal pump
- hydraulic elevator;
- buffer for poor resin 15 m^3;
- buffer for reach resin 15 m^3.

In the future, the listed above equipment will be dismantled.

At the present, due to the decrease of the receiving for treatment water, the facility is reconstructed. With this regard, on the site are placed additionally:

- sorption tower with capacity 2.0 m^3, which will serve independently the processes on water treatment. It is made of propylene – tube with 1000 mm diameter and 15 mm wall thickness;
- vessel for lime treatment of water;
- in the decontamination system is included the existing receiving reservoir.

The three facilities treat the mine water from uranium, by following technology procedure with use of ion-exchange resins. The used sorbent is anion type AMP or Varion AP.

The structure of the facilities allows the mine water treatment in different climatic conditions and provides acceptable process parameters, included in the frame of the legal requirements for environment preservation according the index "Uranium content". The facilities operational mode is continuous.

The electrical power supply for all sites is provided from the national electrical grid with the exception of "Iskra" site, where a diesel-generator is used.

Line for regeneration cleaning of ion-exchange resins.

An integral part of the technology of the mine water sorption treatment from uranium is the line for regeneration cleaning of ion-exchange resins (LROYS). It is situated on the site of the former uranium processing plant “Zvezda”, located 3 km south of village of Eleshnica, Blagoevgrad district.

The facility for regeneration of the anion sorbents type AMP or Varion AP includes:

- washing out from mechanical impurities of the receiving enriched with uranium resin. It is performed with drum-net with wholes of the net 0.63 mm and water consumption 1÷2 m^3/ m^3 sorbent.
- water extraction of the washed out from mechanical impurities resin by spiral classificator;
- entry of the dehydrated (to 20÷30 % moisture) reach resin in a dose vessel, fulfilled with 110-110 g/l H_2SO_4 solution;
- veritable sorbent regeneration, which is performed in counter-flow tower with 110g/l H_2SO_4 solution at up to 10 m^3 sorbent consumption and contact time by sorbent above 30 hours. The regeneration tower should operate with covered by sorbent upper drainage, the reached resin should be fed from above, the regenerating solution – from the bottom upwards, the regenerant pass through the upper drainage and the regenerated (poor) resin is drawn with aero-lift from the lower layers in the towel;
- water extraction from the poor resin, putting back in the transport solution to the buffer for regenerating solution;
- washing out of the regenerated (poor) resin from acid in the counter-flow tower with natural water 1÷2m^3/ m^3 sorbent;
- water extraction of the washed up resin;
- inversion of the regenerated sorbent from H^+ state in OH^- state, by treatment in the counter-flow tower with 0,5÷1 m^3/ m sorbent with 60 g/l $NaCO_3$ solution until alikaline reaction is achieved (pH ≥7 at the tower’s exit)
- water extraction of the inversed resin;
- washing out of the inversed sorbent from Na_2SO_4 with natural water 2m^3 / m^3 sorbent;
- neutralisation of the acid water with whitewash $Ca(OH)_2$ in pneumatic agitators to pH within 6÷8,5;
- storage of the regenerated and inversed resin before foRAWarding to the facilities for sorption mine water treatment from uranium;
- uranium extraction from the regenerated substance in four-cameras counter-flow extractor – 0,15 solution of diethylheksilphosphorus acide and thributilphosphat in light diesel fuel (kerosene);
- re-extraction of the uranium from the organics with NH_4HCO_3 solution;
- separation in three-stages cone buffer;
- water extraction by vacuum-filter of the prepared crystal amonium uranil-three-carbonate (AUTC) $NH_4UO_2(CO_3)_3$;
- packing and storage of AUTC.

Additional to these basic operations are the auxiliary ones:

- correction of the H_2SO_4 and ОРП content (trough Potassium permanganate) in the initial solution for regeneration;
- preparation of whitewash $Ca(OH)_2$ with density 1,12 kg/l, using hydrated lime and natural water (1:5);

- refilling of used quantities of Д-2-ЕХФК, ТБФ and solvent in the buffer;
- enriching the solution in the buffer for the extraction agent with NH_4HCO_3 (dry).

At full power operation, the parameters of the process of LROYS are:

- regeneration time – 30 h;
- maximal resin output – 0,5 m^3 / h;
- consumption of regenerating solution – 10 m^3 / m^3 resin;
- potential of oxygenation - deoxidi-zation – 500–500mV;
- water consumption – 1–1,5 m^3 / m^3 resin.

At the present the LROYS operates at 25% of its capacity.

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RADIOACTIVE WASTES INVENTORY

1. Kozloduy NPP Plc.

AB-1

Solid RAW – class 2a
RAW volume towards 30.06.08 - 534 m^3
Physical components (vol. %) – textile (0%), metal (22%), filings (0%), wood (2%), construction debris (0%), polymers (20%), wadding (0%), rubber (0%), paper (0%), mixed (56%).

Processing

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction		-
Super-compaction		-
Packing		-
Not treated	100	-

Liquid RAW
Liquid radioactive concentrate - class 2a
RAW volume towards 30.06.08 - 2240 m^3

General description - Liquid radioactive concentrates with total salts content 35-48 %, boron acid concentration up to 7 %, pH 8 –9 for the particular tanks. Presence of precipitated solid phase.
Radionuclides inventory: Gamma-spectrometrical analysis: ^{134}Cs, ^{137}Cs, ^{60}Co, ^{54}Mn, ^{58}Co and ^{110m}Ag are detected in the cube residual. In the most of cases the first three of isotopes are detected, and for the rest of them the specific activities are under detectable minimum for the conditions of the measurement. The activity of ^{137}Cs is predominate in the samples from different BKO – about 70 ÷ 90% from total.

Spent sorbents - class **2a**
RAW volume towards 30.06.08 - 347m^3 (HST - 131m^3; LST - 216m^3)
General description – Spent organic and non-organic sorbents. The radioactive levels vary considerably depending of the sorbents proportion in the particular sources. The sorbents are accumulated under water in tanks. They are homogeneously dispersed in the volume and can be easily transported.
The physical and the chemical characteristics are analogous to these of the initial sorbents used in this activity. There is a presence of small amounts of active carbon. Proportion – about 70% vol. sorbent and about 30% vol. water.
Radionuclides inventory: Gamma-spectrometrical analysis: The samples from БНС show a presence basically of ^{134} Cs, ^{137} Cs, and ^{60} Co. The detected activities vary from 2.0E+05 to 2.0E+07 Bq/kg for the separate radionuclides. The activity of ^{137} Cs predominates.
The nuclides ^{134} Cs, ^{137} Cs,^{60} C, ^{110m} Ag and ^{54} Mn are present in the БВС samples. The detected activities vary from 5.0E+04 to 8.0E+07 Bq/kg for the separate radionuclides. The activity of ^{137}Cs predominates as well.

AB-2
Solid RAW - class **2a.**
RAW volume towards 30.06.08 – 219,7 m^3

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

Processing

Processing done - 1313 number of drums (200 l)

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction		-
Super-compaction	54,5	7
Packing		-
Not treated	45,5	-

Liquid RAW

Liquid radioactive concentrate - class 2a.

RAW volume towards 30.06.08 - 1900 m^3

General description - Liquid radioactive concentrates with total salts content 28-35 %, boron acid concentration up to 7 %, pH 8 –9 for the particular tanks. Presence of precipitated solid phase.

Radionuclides inventory: Gamma-spectrometrical analysis: ^{134}Cs, ^{137}Cs, ^{60}Co, ^{54}Mn, ^{58}Co and ^{110m}Ag are detected in the cube residual. In the most of cases the first three of isotopes are detected, and for the rest of them the specific activities are under detectable minimum for the conditions of the measurement. The activity of ^{137}Cs is predominate in the samples from different BKO – about 70 ÷ 90% from total.

Spent sorbents - class **2a.**

RAW volumes towards 30.06.08 - 238 m^3 (БВС – 108 m^3; БНС – 130 m^3)

General description – Spent organic and non-organic sorbents. The radioactive levels vary vastly, depending of the sorbents proportion in the particular sources. The sorbents are accumulated under water in tanks. They are homogeneously dispersed in the volume and easily can be transported.

The physical chemistry characteristics are analogous to these of the initial sorbents, which are used in this activity. There is presence of small amounts of active carbon. Proportion – about 70% vol. sorbent and about 30% vol. water.

Radionuclides inventory: Gamma-spectrometrical analysis: The samples from БНС show a presence basically of ^{134} Cs, ^{137}Cs, and ^{60}Co. The detected activities vary from 4.0E+05 to 2.0E+07 Bq/kg for the separate radionuclides. The activity of ^{137}Cs predominates.

The nuclides ^{134}Cs, ^{137}Cs,^{60}C, ^{110m} Ag and ^{54}Mn are present in the БВС samples. The detected activities vary from 2.0E+05 to 4.0E+07 Bq/kg for the separate radionuclides. The activity of ^{137} Cs predominates as well.

AB-3

Solid RAW – class **2a**

RAW volume towards 30.05.08 – 971.53 m^3

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

Processing

Processing done - 4565 number of drums (200 l)

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction	100	3
Super-compaction		
Packing		
Not treated		

Radionuclides inventory [Bq/kg]:– ^{54}Mn – 3.10^4, ^{110m}Ag – 2.10^4, ^{59}Fe, 2.10^4 ^{134}Cs – 2.10^4, ^{58}Co – 2.10^4, ^{137}Cs – 6.10^4, ^{60}Co – $2.10^{5,}$ ^{95}Nb – 5.10^3

RAW activated carbon, ionic resin, and oil
RAW volume towards 30.06.08
- activated carbon – 10.92 m^3
- ionic resin – 5.25 m^3
- oils – 0.2 m^3

Cage 332/1 in AB-3
Solid RAW – class 2б
RAW volume towards 30.06.2008 – 14. 187m^3
Physical components – Basically metal RAW.
Liquid RAW
Liquid radioactive concentrate - class 2a
RAW volume towards 30.06.08 - 2553 m^3
General description – 1365 m^3 liquid radioactive concentrates with total salts content 80 ÷ 355 g/l, boron acid concentration from – 17 ÷ 63 g/l, pH 8 ÷12. Presence of precipitated 1152 m^3 solid phase.
Radionuclides inventory: ^{134}Cs – $1,5.10^5÷2,5.10^6$ Bq/dm^3, ^{137}Cs – $1,9.10^5÷1,1.10^7$ Bq/dm^3, ^{60}Co – $1,1.10^4÷4,0.10^4$ Bq/dm^3
Spent sorbents - class **2a**
RAW volume towards 30.06.08 - 146 m^3
General description – Spent organic sorbents. The radioactive levels vary considerably, depending of the sorbents sources. The sorbents are accumulated under water in tanks. Their physical chemistry characteristics are analogous to these of the initial sorbents, which are used in this activity. There is presence of small amounts of active carbon. Proportion – about 70% vol. sorbent and about 30% vol. water.
Radionuclides inventory: ^{134}Cs – $1,5.10^4÷1,4.10^7$ Bq/dm^3, ^{137}Cs – $5,9.10^4÷3,7.10^7$ Bq/dm^3
^{60}Co – $1,5.10^6÷2,2.10^6$ Bq/dm^3 , ^{54}Mn– $2,2.10^5÷5,5.10^5$ Bq/dm^3

Storage facility in Main Reactor Hall – 1 (RH-1)
Solid RAW - class – 2б
RAW volume towards 30.06.08 – 51,75 m^3

Storage facility in Main Reactor Hall – 2 (RH-2)
Solid RAW - class – 2б
RAW volume towards 30.06.08 – 31,87 m^3

Storage for Radioactive Sources (SRS)
Towards 30.06.2008,- deposed with protocols-20 out of use radioactive beta –sources of "Blenker" type.
Physical components (vol. %) – steel (60%), copper (20%), bakelite (20%)
Radionuclides inventory:
Generally ^{90}Sr /^{90}Y
Total Activity: ≈ 2.10^6 Bq

Sites for temporary storage of Smoke Detectors with radioactive sources
Towards 30.06.08 there is the following status:

- Laboratory "Radiometry" – non
- OPPC – Unit 5 – non
- Local 6 DE – non
- Local 3005 TH – unit 6 – 815 smoke detectors type MHG-181.
- Storage facility "Kulata" – 85 smoke detectors type MHG-181 and 1 smoke detector type MHG-185 outs of use with radioactive alpha-sources.

Physical components (vol. %) – stainless steel (100% - after the sources discharge)
Radionuclides inventory: ^{241}Am
Total Activity: **7**.10^7Bq

2. SE "RAW",
2.1 SE RAW KOZLODUY SD

Trench Storage for Temporary Store of Solid RAW – "TS"
Solid RAW - class **2a**
RAW volume towards 30.06.08 – 3119 m^3
Physical components (vol. %) – textile (3%), metal (2%), filings (0%), wood (1%), construction debris (1%), polymers (0%), wadding (1%), rubber (0%), paper (0%), mixed (92%).

Processing
Processing done - 7758 number of drums (200 l)

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction		
Super-compaction	77	7
Packing		
Not treated	23	-

Radionuclides inventory, Bq/kg
:

^{54}Mn – 3.10^4	^{110m}Ag – 5.10^4
^{59}Fe – 1.10^3	^{134}Cs – 1.10^4
^{58}Co – 2.10^4	^{137}Cs – 7.10^4
^{60}Co – 2.10^5	^{95}Nb – 9.10^3

Storage Facility for Storage of Treated Solid RAW – "BC"
Solid RAW - class **2a**
RAW volume towards 30.06.08 - 455 m^3
Physical components (vol. %) – textile (23,23%), metal (5,48%), filings (1,2%), wood (1,98%), construction debris (8,23%), polymers (1,32%), wadding (9,37%), rubber (0,5%), paper (0,07%), mixed (48,62%).

Processing
Processing done – 5402 number of drums (200 l)

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction		
Super-compaction	100	7
Packing		
Not treated	-	-

Site № 1 for Temporary Store of Solid RAW reinforced concrete containers – "BC"
Solid RAW - class **2a**
RAW volume towards 30.06.08 - 0 m^3
Site № 2 for Temporary Storage of Solid RAW reinforced concrete containers – "BC"
Solid RAW - class **2a**
RAW volume towards 30.06.08 – 1149 m^3
Physical components (vol. %) – 200-liters tanks with Solid RAW, super-pressed and immobilised in concrete non-radioactive matrix.

Radionuclides inventory of treated RAW [Bq/kg]:

^{54}Mn – 3.10^{8}	^{134}Cs – 1.10^{10}
^{60}Co – 7.10^{10}	^{137}Cs – 3.10^{10}
^{110m}Ag – 7.10^{9}	

Site for Storage of Solid RAW in heavy weight tanks – "BC"
Solid RAW - class **2-I**
RAW volume towards 30.06.08 - 228 m^3
Physical components (vol. %) – textile (1%), metal (38%), filings (0%), wood (9%), construction debris (48%), polymers (0%), wadding (0%), rubber (0%), paper (0%), mixed (4%).

Processing

Processing done – 630 number of drums (200 l)

	Processed Wastes (vol. %)	Volume Reduction Factor
Pre-compaction	56	3
Super-compaction		
Packing		
Not treated	44	-

Radionuclides inventory of treated RAW [Bq/kg]:

^{54}Mn – 1.10^{0}	^{134}Cs – 6.10^{1}
^{58}Co – 2.10^{3}	^{137}Cs – 2.10^{3}

Storage Facility for Storage of Conditioned RAW – SFSC RAW

Package of the Conditioned RAW	***Number of Packages***
StBK-1	**287**
StBK-3-1 and StBK-3-3	**450**
Total	**737**

Radionuclides inventory of treated RAW [Bq/kg]:

СтБК-1		СтБК-3	
^{54}Mn – 1.10^{4}	^{110m}Ag – 2.10^{4}	^{54}Mn – 3.10^{4}	^{110m}Ag – 1.10^{4}
^{59}Fe – 3.10^{3}	^{134}Cs – 3.10^{4}	^{59}Fe – 3.10^{4}	^{134}Cs – 4.10^{6}
^{58}Co – 1.10^{4}	^{137}Cs – 4.10^{4}	^{57}Co – 3.10^{4}	^{137}Cs – 2.10^{7}
^{60}Co – 1.10^{5}	^{95}Nb – 5.10^{3}	^{60}Co – 6.10^{5}	^{95}Nb – 9.10^{3}

2.2 Permanent Storage Facility for SE RAW - Novi Han SD

Storage for Solid RAW

RAW volume: 120 m^3 untreated RAW;

Total buried activity: 6.58 x 10^{12} Bq;

Major radionuclides: ^{137}Cs (4.29 x 10^{12} Bq, 65,20%), ^{60}Co (8.63 x 10^{11} Bq, 13.2%), ^{90}Sr (7.71 x 10^{11} Bq, 11.72%), ^{14}C (3.70 x 10^{11} Bq, 5.62%), ^{3}H (2.42 x 10^{11} Bq, 3.68%) and minimum quantities ^{55}Fe, ^{65}Zn, ^{106}Ru, ^{134}Cs, ^{144}Ce, ^{204}Tl.

Storage for Solid Biological RAW

RAW Volume: 25 m^3 conditioned RAW;

Total buried activity: 1.65 x 10^{11} Bq;

Major radionuclides: ^{137}Cs (1.12 x 10^{11} Bq, 67.88%), ^{90}Sr (1.85 x 10^{10} Bq, 11.21%), ^{14}C (1.55 x 10^{10} Bq, 9.39%), ^{3}H (1.02 x 10^{10} Bq, 6.18%), ^{60}Co (8.28 x 10^{9} Bq, 5.02%) and minimum quantities of ^{65}Zn, ^{54}Mn, ^{106}Ru, ^{134}Cs, ^{144}Ce.

Storage for Sealed Sources

RAW Volume: 0.65 m^3 untreated RAW.

Total buried activity: 6.19 x 10^{13} Bq;

Major radionuclides: ^{137}Cs (5.39 x 10^{13} Bq, 87,08%) and ^{60}Co (7.09 x 10^{12} Bq, 11.45%), minimum quantities of ^{90}Sr (6.57 x 10^{10} Bq, 0.11%), ^{226}Ra (5.97 x 10^{11} Bq, 0.94%), ^{239}Pu (1.82 x 10^{11} Bq, 0.30%), ^{3}H, ^{22}Na, ^{55}Fe, ^{63}Ni, ^{85}Kr, ^{133}Ba, ^{147}Pm, ^{170}Tm, ^{204}Tl, ^{241}Am.

Engineering Trench for Solid RAW

RAW Volume: 100 m^3 untreated RAW;

Total buried activity: 1.04 x 10^{12} Bq;

Major radionuclides: ^{137}Cs (7.00 x 10^{11} Bq, 67.31%), ^{60}Co (1.84 x 10^{11} Bq, 17.69%), ^{90}Sr (1.54 x 10^{11} Bq, 14.81%).

Tanks for Temporary Storage of Liquid RAW

Stored quantity: 12 m^3;

Characteristics: solutions of ^{134}Cs, ^{137}Cs, ^{60}Co, ^{90}Sr with activity under the exempting limits;

Site for Storage of RAW in train containers

RAW Volume: 310,4 m^3 partially processed (dismantling, re-packing) RAW;

Total buried activity: 9.28 x 10^{13} Bq;

Major radionuclides: ^{241}Am (7.84 x 10^{13} Bq, 84.48%), ^{60}Co (1.13 x 10^{13} Bq, 12.18%), $^{239,238}Pu$ (2.18 x 10^{12} Bq, 2.34%), ^{85}Kr (1.03 x 10^{12} Bq, 1.11%) and minimum quantities of ^{3}H, ^{14}C, ^{36}Cl, ^{90}Sr, $^{241}Am/Be$, $^{241}Pu/Be$, $^{226}Ra/Be$;

Site for Storage of RAW in concrete receptacles type of "PEK", reinforced concrete containers StBKKUB and reinforced concrete containers StBKGOU

RAW Volume: 114 m^3 partially processed (dismantling, re-packing) RAW;

Total buried activity: 1.36 x 10^{15} Bq;

Major radionuclides: ^{60}Co (1.05 x 10^{15} Bq) and ^{137}Cs (3.15 x 10^{14} Bq) and minimum quantities ^{241}Am, ^{239}Pu, ^{3}H, ^{14}C, ^{85}Kr, ^{90}Sr, ^{232}Th, ^{252}Cf, $^{241}Am/Be$, $^{241}Pu/Be$.

Site for Storage of low active RAW

RAW Volume: 331,1 m^3 partially processed (dismantling, re-packing).

3. Research reactor IRT – 2000

Storage quantity: 84000 1

Characterization: specific activity 84 Bq/1

4. Uranium mining

Tailings pond "Buchovo – 1"

Quantity of held RAW: 1.3 millions m^3 tailings.

Tailings pond "Buchovo – 2"

Quantity of held RAW: 4.5 millions tons tailings and unknown quantity of solid RAW from the liquidation of "Metalurg" uranium milling plant.

Tailings pond Eleshnitsa

Quantity of held RAW: 9.0 millions tons tailings, 1700 m^3 spent ion-exchange resin and unknown quantity of solid RAW from the liquidation of "Zvezda" uranium milling plant;

Estimated activity: 1.5×10^{15} Bq.

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Annex L-5

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

1. International Treaties and Agreements

1.1. JOINT CONVENTION on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

(ratified by Act of the 38th National Assembly on 10 May 2000 – State Gazette (SG) # 42/2000, published in SG # 63/2001, in force since 18 June 2001);

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 environmental impact assessment in a transboundary context, published in 1999, in force since 1997;

1.7 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Greece on operational notification in case of nuclear accident and exchange of information for nuclear facilities;

1.8 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Romania on operational notification in case of nuclear accident and exchange of information for nuclear facilities;

1.9 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Turkey on operational notification in case of nuclear accident and exchange of information for nuclear facilities;

1.10 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;

1.11 AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Protection of the Environment and Nuclear Safety of the Ukraine in the domain of the state regulation and control on safety in the use of atomic energy for peaceful purposes;

1.12 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation in the domain of peaceful use of atomic energy;

1.13 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation in the domain of atomic energy sector;

1.14 AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes 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.

2. Acts

2.1. Act on the Safe Use of Nuclear Energy (published in SG # 63/28.06.2002, ch.&add. # 120/29.12.2002, # 70/10.08.2004);

2.2. Act on Environmental Protection (published in SG # 91/25.09.2002, ch. SG # 98/18 October 2002, ch. SG # 86/30 September 2003, add. SG # 70/10 August 2004; ch. SG # 74/13 September 2005; ch. SG # 77/27 September 2005; ch. SG # 88/04 November 2005; ch. SG # 95/29 November 2005; ch. SG # 105/29 December 2005; ch. SG # 30/11 April 2006; ch. SG # 65/11 August 2003; ch. SG # 82/10 October 2006; ch. SG # 99/08 December 2006; ch. SG # 102/19 December 2006; ch. SG # 105/22 December 2007; ch. SG # 41/22 May 2007; ch. SG # 89/06 November 2007; ch. SG # 36/04 April 2008; ch. SG # 52/06 June 2008;

2.3. Act on the Public Health (published in SG # 70/10.08.2004; ch. SG # 46/2005; ch.&add. SG # 76/2005 in force since 01.01.2007 # 85; ch. SG # 88 ch. & add. SG #103/2005);

2.4. Act on the Management of Crises (published in SG # 19/01.03.2005);

3. Secondary Legislation

3.1. Regulation for the basic norms for radiation protection (PMS №190/30.07.2004; State Gazette # 73, 2004)

3.2 Regulation for providing the safety of spent nuclear fuel management (PMS №196/02.08.2004State Gazette # 71, 2004)

3.3 Regulation for safety of radioactive waste management (PMS №198/03.08.2004; State Gazette # 72, 2004)

3.4 Regulation for safety of the decommissioning of nuclear facilities (PMS №204/05.08.2004; State Gazette # 73, 2004)

3.5. Regulation for the conditions and procedure for transfer of radioactive waste to the state enterprise “Radioactive Waste” (PMS №164/14.07.2004; State Gazette # 64, 2004)

3.6. Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the Nuclear Facilities Decommissioning Fund. (PMS №300/17.12.2003; State Gazette # 112, 2003; ch. SG # 78/2005; ch. SG # 20/2006; ch. SG # 110/2007)

3.7. Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the Radioactive Waste Fund. (PMS №301/17.12.2003; State Gazette # 112, 2003; ch. SG # 13/2004; ch. SG # 78/2005; ch. SG # 105/2006; ch. SG # 3/2008)

3.8. Regulation for the procedure for issuing licenses and permits for safe use of nuclear energy

(PMS №93/04.05.2004; State Gazette # 41, 2004; ch. SG # 78/30.09.2005)

3.9. Regulation for radiation protection during activities with sources of ionizing radiation (PMS №200/04.08.2004; State Gazette # 74, 2004; ch. SG # 74/08.09.2006; ch. SG # 46/12.06.2007)

3.10. Regulation for providing the safety of nuclear power plants (PMS №172/19.07.2004; State Gazette # 66, 2004; ch. SG # 46/2007; ch. SG # 53/2003)

3.11. Regulation of the conditions and procedure for notification of the NRA about events in nuclear facilities and sites with sources of ionizing radiation (PMS №188/30.07.2004; State Gazette # 71, 2004; ch. SG # 46/12.06.2007)

3.12. Regulation of the conditions and procedure for exempting small amounts of nuclear material from the Vienna convention for civil liability for nuclear damage (PMS №201/04.05.2004; State Gazette # 72, 2004)

3.13. Regulation of the conditions and procedure for acquiring professional qualification and for the procedure for issuing licenses for specialized training and certificates for qualification for use of nuclear energy (PMS №209/06.08.2004; State Gazette # 74, 2004; ch. SG # 46/12.06.2007)

3.14. Regulation for emergency planning and emergency preparedness in case of nuclear and radiological accident (PMS №189/30.07.2004; State Gazette # 71, 2004)

3.15. Regulation for providing of the physical protection of nuclear facilities, nuclear material and radioactive substances (PMS №224/25.08.2004; State Gazette # 77, 2004; ch. SG # 96/30.11.2005; ch. SG # 44/09.05.2008)

3.16. Regulation of the conditions and procedure for establishing of zones with special statute around nuclear facilities and sites with sources of ionizing radiation (PMS №187/28.07.2004; State Gazette # 69, 2004; ch. SG # 46/2007; ch. SG # 53/2008)

3.17. Regulation for the conditions and procedure for gathering and submitting of information and keeping records of the activities subject to guarantees according to the Treaty on the Non-proliferation of Nuclear Weapons (PMS №210/06.0.2004; State Gazette # 74, 2004)

3.18. Regulation on providing the safety of research nuclear installations (PMS №231/02.09.2004; SG # 80/2004);

3.19. Regulation on the conditions and procedure for transportation of radioactive substances (PMS №156/13.07.2005; SG # 60/2005);

3.20. Regulation on Safety and Radiation protection Requirements related to Liquidation the Results from Uranium Ore Industry (SG # 101/1999, ch. SG # 63/2001);

3.21. Regulation on the conditions and procedure for implementation of environmental impact assessment of investment proposals for construction, activities and technologies (SG # 25/18 March 2003; ch. SG # 3/0 January.2006);

3.22. Rules of Procedure of the NRA (PMS №199/29.08.2002; State Gazette # 86/10.09.2002 in force 10.09.2002; ch.& add. SG # 46/03.06. 2005; ch. SG # 78/30.09.2005 in force 01.10.2005; ch. SG # 48/13.06.2006, in force 01.05.2006; ch. SG # 63/03.08.2007, in force 03.08.2007);

3.23. Regulation for the procedure for paying the fees ensuing by the Safe Use of Nuclear Energy Act. (PMS №206/17.09.2003; State Gazette # 85, 2003)

3.24. Tariff for the fees collected by the NRA in accordance with the provisions of the Safe Use of Nuclear Energy Act (PMS №206/17.09.2003; State Gazette # 85, 2003)

3.25. Regulation No 9 for establishment and maintenance of Public Register of the sites of public importance controlled by the Regional Inspectorates for Protection and Control of the Public Health (SG # 28/2005),

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Annex L-6

HUMAN AND FINANCIAL RESOURCES

I. Human Resources

"Kozloduy" NPP

According to the Requirements of the Safe Use of Nuclear Energy Act, the activities that are related to the nuclear facility safety and radioactive sources are performed only by professionally qualified personnel that have qualification certificates.

The criteria and requirements for training, qualification and competence of the personnel, working in the nuclear energy field, are formulated in the Ordinance on the conditions and procedure to acquire professional qualification and on the procedures to issue specialized training licences and certificates authorizing the usage of nuclear energy, 2004 (Ordinance on qualification).

The Bulgarian Nuclear Regulatory Agency carries out a clearly expressed policy of acknowledging the professional qualification of the personnel working in the field of the nuclear energy utilization which requires the following:

- the "Kozloduy" NPP nuclear facility operation licence identifies a list of the positions that require specialized training and acknowledgement of competence by the Qualification Test Committee as per the Safe Use of Nuclear Energy Act;
- approved by the "Kozloduy NPP" Plc Executive Director List of the positions in the "Kozloduy NPP" Plc divisions according to ar.21, para. 1 of the Ordinance on the conditions and procedure to acquire professional qualification and on the procedures to issue specialized training licences and certificates authorizing the usage of nuclear energy, and according to the "Kozloduy NPP" Plc approved salary scale which also includes the personnel that is managing the radioactive waste and the spent nuclear fuel who require specialized training and proving their professional qualification;
- carry out tests of personnel that are subject to acknowledgement of qualification according to the exam synopsis approved by the Chairman of the Nuclear Regulatory Agency;
- the Chairman of the Nuclear Regulatory Agency assigns a test committee which is concurred by the Public Health Minister;
- issues qualification certificates - with a limited period for up to 5 years.

"Kozloduy NPP" Plc management demonstrates its commitment to the human resources in order to ensure:

- the assignment of qualified specialists in compliance with the requirements of the Safe Use of Nuclear Energy Act;
- on-the-job training and maintenance of the personnel's qualification.

The functions related to the selection, professional selection, training and qualification of the personnel are implemented by different structural units in order to ensure independence of assessment and selection and training evaluation.

Preliminary selection is performed by the Administration and Control Division together with the structural units in which the individuals are to work.

A selection system is applied in order to provide qualified and competent personnel. This system ensures the following:

- verifies the compliance of requirements towards applicants with qualification requirements for the positions they are to occupy;
- check of applicants' health status and subsequent assessment to permit work in ionizing radiation media;
- check of psycho-physiological status of the personnel that is to directly perform and control the activities related to the management of nuclear radioactive waste and the spent nuclear fuel and that is subject to qualification certification by the Qualification Examination Commission of the Nuclear Regulatory Agency.

The qualification requirements for each position at "Kozloduy NPP" Plc are described in great detail in the job position descriptions. The job position descriptions cover the description of the safety related functions and the required qualification as well, whenever this is appropriate.

All the activities associated with the radioactive waste and the spent nuclear fuel management is assured with sufficient number of qualified staff. The position salary scale identifies the specific positions, the number of people needed and the minimum educational degree required to occupy that position. The qualification of the personnel that performs the activities related to the assurance and control of nuclear safety and radiation protection in radioactive waste and spent nuclear fuel management is certified by the Bulgarian Nuclear Regulatory Agency.

Training and qualification maintenance of personnel are performed by a separate structural unit – Personnel and Training Center Division. The Training Center (TC) at "Kozloduy" NPP is located on the plant site. The plant has all necessary modern facilities to allow the application of all current forms of training.

The main factor in training and qualification of personnel at "Kozloduy" NPP is the effective training for the performance of specific operational tasks. "Kozloduy NPP" Plc executive director, respective structural unit managers and the Personnel and Training Centre Division are responsible for the personnel training.

In accordance with the requirements of the Safe Use of Nuclear Energy Act and the Qualification Ordinance, on 05.10.2006, "Kozloduy NPP" Plc (the licensee) was issued a Licence (Series: OA, ID No. 02116) for "conducting specialized training on nuclear facility activities that impact safety and include the assurance and/or control of nuclear safety and radiological protection and for conducting specialized training and issuance of qualification certificates for performing activities in ionizing radiation media which is implemented by the Personnel and Training Centre Division.

"Kozloduy NPP" Plc meets the requirements for the personnel as these are regulated in the normative documents by applying the Personnel Training and Qualification System. That system covers the organization, management, implementation and control of the activities associated with the training and qualification of personnel, the structure and responsibilities of the personnel in the NPP structure, levels of authorization and interaction of the system elements throughout implementation of activities.

The training and qualification process is effectively supported by the organizational system of the plant. The managers, the line managers and training coordinators of all organization levels have their identified responsibilities and authorizations related to the qualification requirements specification, identification of training needs, and training requesting and planning.

From qualification requirements, “Kozloduy NPP” Plc personnel that are preoccupied with the management of radioactive waste and spent fuel are divided in four groups, as follows:

Group A: operational personnel and managerial personnel that occupy job positions which functions cover the implementation of activities related to provision and monitoring of nuclear safety and radiation protection (list of positions that require qualification certified by the Qualification Test Committee of the Bulgarian Nuclear Regulatory Agency).

Group B: personnel occupying positions related to the implementation of activities that are nuclear safety and radiation protection related (according to the list, required by ar. 21, para.1 of the Qualification Ordinance).

Group C: personnel of the “Kozloduy NPP” Plc structural units that occupy positions perform regulated functions and have requirements directly associated with NPP equipment and systems operations and maintenance or conduct training for them (excluding the positions under groups A and B).

Group D: personnel of the “Kozloduy NPP” Plc structural units that occupy positions that are not covered by Groups A, B and C.

Training of Personnel is carried out on the basis of developed training programs, and qualification assessment – through developed test synopses. The training programs are developed for job position and position and consider the results of the analysis of the required knowledge and skills of personnel needed for the implementation of their assigned working tasks and the requirements of the respective job position descriptions. Personnel are allowed to work independently upon completion of training and successfully taken exams in safety and job position before the Departmental Test Committees.

For the individuals under Groups A and B, upon completion of their initial or continuous training following individual training programs, sit for exams before the Departmental Test Committee according to ar. 19 of the Qualification Ordinance to prove the successfully conducted training.

All that are qualified for particular job position are subject to re-qualification of different periodicity depending on the job positions and categories of the personnel.

The applied training system, the maintenance and continuous development and enhancement of personnel’s knowledge and skills, the application of up-to-date and modern methods, means and facilities ensure meeting and availability of all conditions needed to provide for qualified personnel that are needed for the implementation of the safety related activities throughout the operational lifetime of the facilities for spent fuel and radioactive waste management.

Information about the education of personnel of the “Kozloduy” NPP structural units that are related to the spent nuclear fuel and radioactive waste management

Structural Unit	Basic Functions	Total Personnel	University Education	Secondary Education	Primary Education
S&C Directorate the personnel who require qualification are licensed by the regulatory authority.	-methodological guide, safety coordination and control; -application of normative requirements and safety culture enhancement; - independent supervision of nuclear safety and radiation protection within the company; -metrological assurance and environmental monitoring.	244	145 59,43%	98 40,16 %	1 0.40 %
"Production" Directorate	- generation of electric and thermal power; - operations of the Storage Facility;				
Maintenance Division	- following the requirements for the Operating limits and Conditions in compliance with the conditions of the regulatory and surveillance authorities;	224	37 16,52%	163 72,76 %	24 10,71 %
Operations Division Including:	- operations of the hydraulic and technological facilities; - Nuclear safety and radiation protection assurance;	3262,5	1098 33.66 %	2059 63,11 %	106 3,24 %
"Electrical Production-1"	-effective resource management – Storage Facility engineering assurance; -planning, coordination and analysis of the production programme implementation;	1126	280 24,87 %	781 69,36 %	65 5,77 %
"Electrical Production-2"	-analysis of the technical and economic indicators;	1837	688 37,45 %	1120 60,96 %	31 1,68 %
	-operations of WWER-440 nuclear reactor facilities;	41	15 39,02 %	26 63,41 %	0 0%
	- operations of WWER-1000 nuclear reactor facilities.	2			
Storage Facility Department	- operations of the Storage Facility.		2 100%		

Structural Unit	Basic Functions	Total Personnel	University Education	Secondary Education	Primary Education
Nuclear Fuel Cycle Section	- develop requests for new nuclear fuel and return of the spent nuclear fuel; - audits the quality systems of fresh nuclear fuel manufacturers; -inspects the status of the nuclear material and the quality of the manufactured nuclear fuel; - supports the process implementing activities related to supplies, recording and return of nuclear materials;	11			
Reactor Physics Calculations… Section	- analyzes neutron - physical, thermo-dynamic, hydro-dynamic and heat transfer processes of WWER; - calculates the neutron-physical processes in WWER reactors.		11 100%		
"P & TC" Division	- organizes and conducts training and simulator training; - qualification control.	58	39 67,24 %	18 31,03 %	1 1.72 %
Test Centre "Diagnostics and control"	- diagnostics and control of the main metal status and welds.	63	30 47,62 %	32 52,38 %	0

State Enterprise "Radioactive Waste"

Related to item 4 of the Licence, issued by the Bulgarian Nuclear Regulatory Agency to the State Enterprise "Radioactive Waste", the Licensee is obliged to employ individuals who meet the professional and health requirements. Attachment 5 of the Licence identifies the job positions that can be occupied only by individuals that possess active licences issued by the BNRA Chairman.

As of 30.06.2008, the State Enterprise "RAW" personnel amount to 270 individuals. They fall in the following structural units and divide in the following groups according to their educational degree:

Structural Unit	Total number	University Education	Secondary Education	Primary Education
Managerial Group of SE "RAW"	22 individuals	20 individuals	2 individuals	-
"RAW - Kozloduy" Department	201 individuals	67 individuals	133 individuals	1 person
Novi Khan RAW Storage Facility	47	29	17	1
Total:	**270 individuals**	**116 individuals**	**152 individuals**	**2 individuals**

Bulgarian Academy of Science – Nuclear Scientific and Experimental Base of the Institute for Nuclear Research and Nuclear Energy

As of the month of June, 2008, the Institute has 43 operational personnel, 29 of whom are with university education, and 3 have scientific degrees. The requirements for qualification are stipulated in the job-position description for each position. The job- position descriptions for the individuals involved in the direct operation of the Spent Fuel and RAW are coordinated with the Bulgarian Nuclear Regulatory Agency.

The requirements towards the personnel include the following:

- to have vocational secondary training of the following specialties: mechanics, power generation, electronics, fitter's trade, lathing or other specialties for the technical personnel;
- to have university degrees in nuclear power generation, nuclear physics, power engineering, machine building specialties – for the engineering staff;
- to acquire additional qualification and become qualified for work in ionizing media
- additional training and qualification of personnel for the specific position they occupy.

The Training Program for Personnel Qualification Enhancement is developed on yearly principle and training is conducted both at facility site and outside it. Specialized training covers the following:

- training in nuclear safety and radiation protection;

- training in reactor systems, nuclear fuel handling equipment and the process systems for removing the nuclear fuel from the core into the pre-reactor pools, the systems for collection and storage of effluents, the rules for their maintenance and repair;
- carrying out drills for handling with spent nuclear fuel and RAW;
- drilling of emergency condition activities;
- conducting initial and continuous briefing in occupational safety and radiation protection.

II. Financial Resources

“Kozloduy” NPP

Regarding the financial resources for maintaining safety of the spent fuel facility management and radioactive waste throughout their operational life and for their decommissioning, “Kozloduy” NPP provides resources as follows:

- plant private means;
- other sources (special purposes funds);
- grants.

1. Plant Private Means

The costs for the management of the radioactive wastes and the spent nuclear fuel are covered by the private means of the plant which are a part of the “Kozloduy” NPP” operational expenses that include the following:

- expenses to maintain safety of the facilities for spent fuel management;
- expenses on the return of the spent fuel to Russia for re-processing;
- preparatory activities and measures under nuclear facility decommissioning;
- Installments in the special purposes funds “RAW’ and DNF.

2. Special Purposes Funds

To finance the activities related to the management of the radioactive waste and decommissioning, two funds were established - "Radioactive Wastes" and "Decommissioning of Nuclear Facilities - DNF" to the Minister of Economy and Energy”

The procedure for valuation, collection, spending and control of the means as well as the amount of the due installments are determined by ordinances approved by the Council of Ministers upon the proposal of the Minister of Economy and Energy Resources and the Minister of Finance, namely as follows:

- Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the “Radioactive waste” Fund, PMS No. 301, dated 17.12.2003.
- Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the “Nuclear facilities decommissioning” Fund, PMS No. 300, dated 17.12.2003.

Incomes and cost under the funds are collected, reported and centralized in the system of the unified budget account by using a separate transit account, opened in the name of the Ministry of Economy and Energy at the Bulgarian National Bank and a separate pay code in the system of the electronic bank payments.

These funds are administered in such a way as to ensure the implementation of the activities associated with the radioactive waste management and annual programme fulfillment of the Licensee who is operating the nuclear facility that is decommissioned.

As the licensed operator of the nuclear power plant, “Kozloduy NPP” Plc is liable to a monthly payment in both funds as follows:

- “Radioactive Waste” – the installment is equal to the weight coefficient (forming the amount of the installment in the RAW fund – 0,03, in force since 01.01.2008) multiplied by the price of 1 kWh generated electric power and the amount of the sold electricity for the respective month of the regulated and free market (kWh).
- “Decommissioning of Nuclear Facilities” – the installment is equal to the weight coefficient (forming the amount of the installment in the “Decommissioning of Nuclear Facilities” fund – 0,075, in force since 01.01.2007) multiplied by the price of 1 kWh generated electric power and the amount of the sold electricity for the respective month of the regulated and free market (kWh).

<u>3. Grants</u>

The funds from external sources come from the International Fund “Kozloduy” and from the state fund for “Nuclear Facilities Decommissioning”.

The International Fund “Kozloduy” was established by the European Commission under agreements with Republic of Bulgaria to support the decommissioning of “Kozloduy” NPP Units 1-4. The means of that fund and the grants that are to be submitted by the fund donors are utilized for financing or co-financing through grants (free aid) for preparation or implementation of chosen projects. These projects refer to provision of technical assistance and purchase, installation and commissioning of the equipment needed to support the initial phase of “Kozloduy” NPP Units 1-4 decommissioning and the energy sector measures that originate from the decision made by Republic of Bulgaria to shutdown and decommission Units 1-4 of "Kozloduy" NPP. Money is granted in compliance with the rules of the fund and depends on the available money in the fund and is subject to approval by the fund authorities. The procedure to grant money to respective recipients is stipulated in the Framework Agreement concluded between Republic of Bulgaria and the European Bank for Reconstruction and Development (EBRD) of 15.06.2001. EBRD is the administrator of the grants.

Project engineering support and investment surveillance are executed by the end recipients of the grants who appoint a coordinating team in compliance with the project needs. Financing of these activities is for the recipients’ cost.

The state fund “Nuclear Facilities Decommissioning” provides financing of:

- Preparatory activities and measures for preparation of decommissioning;
- the cost for the return of 720 spent nuclear fuel assemblies from the finally shutdown reactor units WWER-440 for reprocessing within the period 2007 – 2010.

<u>Decommissioning and RAW Management Financing</u>

Management of the spent nuclear fuel and RAW during the operation of facilities is financed by the operator. Decommissioning and RAW management after these are transferred to the State Enterprise “RAW” are financed by the funds “Nuclear Facility Decommissioning" and “RAW”.

The procedure to establish, collect, spend and control the means and the installments due as well, are identified with ordinances approved by the Council of Ministers.

As a licensed operator of the nuclear power plant, "Kozloduy NPP" Plc pays monthly installments in the RAW Fund. The amounts paid by KNPP per year are as follows:

INCOME

Year	Paid money in BG Currency (Levs)				
	NEC-PLC	"Kozloduy" NPP		Others	TOTAL:
		Installments	Interest		
1999	4 230 000	-	-	983 219	5 213 219
2000	18 349 492	9 026 434	-	65 091	27 441 018
2001	12 567 000	13 249 909	-	542 365	26 359 274
2002	10 209 391	23 209 755		1 088 534	33 567 189
2003	-	23 447 914	553 394	1 467 659	25 468 967
2004	-	21 229 964	1 655 827	355 342	23 241 133
2005		16 829 236	4 205	70 892	16 904 333
2006		16 077 314			16 077 314
2007		16 155 802			16 155 802
As of 30.06.2008	-	9 368 519	1 071		9 369 590
Total:					199 797 839

COSTS

Year	Spent amounts in thousands levs				
	BAS-Institute for NR&NE	"Kozloduy" NPP	Others	SE "RAW"	TOTAL:
1999	373 250	1 978 845	29 108	-	2 381 203
2000	1 983 543	4 511 875	83 950	-	6 579 368
2001	3 497 820	7 124 660	126 160	-	10 748 640
2002	3 334 296	7 045 664	55 510	-	9 439 784
2003			67 891	-	4 210 148
2004	170 538	159 514	51 608	6 831 969	7 213 628
2005	-	-	31 891	3 683 142	3 715 033
Total:					44 287 804

Financing of Decommissioning

Financing from the Nuclear Facility Decommissioning Fund

Financing of decommissioning is organized within the framework of the national legislation through the Safe Use of Nuclear Energy Act in which the establishment of the Nuclear Facility Decommissioning Fund is stipulated, this fund is administered by the Minister of Energy and Energy Resources. With the Council of Ministers' decrees No. 300 and 301, dated 17 December, 2003, a new Ordinance was approved on the procedure for the establishment, collection, spending and control of the funds and the amounts of the payments due for the Nuclear Facility Decommissioning Fund - it superseded the 1999 Ordinance that was described in the first national report.

The income of the fund is formed by the installments paid by the entities that operate the nuclear facilities, means from the state budget, etc., while the accumulated funds are spent on special purposes only for financing projects and activities associated with nuclear facility decommissioning.

Information about the movement of Nuclear Facility Decommissioning funds by years:

Year	Paid Amounts in BG Currency (Levs)	Spent Money in BG Currency (Levs)	Available in BG Currency (Levs)
1999	552 200	21 858	530 341,63
2000	66 529 463	75 583	66 984 221
2001	101 972 530	1 797 011	167 159 740
2002	114 915 995	2 234 444	279 841 292
2003	157 292 123	1 997 363	435 136 052
2004	114 979 069	1 167 339	548 947 782
2005	102 719 951	1 329 000	650 338 733
2006	103 823 638	994 993	753 167 378
2007	50 173 786	29 546 000	773 795 164
As of 30.06.2008	25 201 055	-	798 996 219
Total	838 159 810	39 163 591	798 996 219

Grants from the International Fund "Kozloduy"

The International Fund "Kozloduy", established by the European Commission upon agreements with Republic of Bulgaria, is used for financing or c0-financing through grants for the preparation and implementation of chosen projects to support the decommissioning of "Kozloduy" NPP Units 1-4 and other project within the energy sector. Grants are paid in compliance with the rules of the Fund and depend on the availability of the funds paid in the Fund. The procedure for payment of grants to respective recipients is stipulated in the Framework Agreement between Republic of Bulgaria and the European Bank for Reconstruction and Development (EBRD) from 15.06.2001. EBRD is the administrator of the grants.

As of 30 June 2008, financing of projects regarding the preparation for decommissioning of "Kozloduy" NPP Units 1-4 was under the concluded Grant Agreements, and the total amount of the accounted cost under the respective projects carried out in "Kozloduy" NPP is 67 299 thousand levs.

Received amounts from the International Fund "Kozloduy" as per accounting data are as follows:

Years	2003	2004	2005	2006	2007	Total:
Amount(thousand levs)	6 529	6 382	1 513	1 578	51 297	67 299

Intentions:

"Kozloduy NPP" Plc made a proposal to update the Ordinance on the nuclear facility decommissioning in order to:

- revisit the evaluation of the total provisional cost of nuclear facility decommissioning, as well as for the management of the spent fuel, including its re-processing, that remains on site after the final shutdown of the last nuclear reactor unit;
- change the amount of the yearly installments paid by "Kozloduy" NPP which was identified on the basis of the tentative cost for the disposal of RAW generated during the operation of the units/ or the provisional cost for decommissioning/ and the design operational lifetime of the units and the amount of funds accumulated up to now;
- identify the normative period of time in which the funds are to be available to finance the total cost for decommissioning.

Costs for nuclear facility decommissioning and maintenance of RAW equipment management safety are financed by external grants as well.

Under the PHARE Programme – nuclear safety – funds are being granted for development of projects related to decommissioning and RAW management activities.

The IAEA Programme for Technical Support finances the "Project for Decommissioning of "Kozloduy" NPP".

Experimental nuclear reactor

The financial resources for safety management of the experimental reactor spent fuel are provided from the state budget on a yearly basis.

SE RAW

The activities related to the "Kozloduy" NPP radioactive waste management are financed from the "Radioactive Waste" Fund and for that purposes a contract for financing is concluded between the SE RAW and the Fund.

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Annex L-7

Brief Annotation of the Projects funded by the International KIDSF Fund and Controlled by the Project Management Unit for Decommissioning of Units 1-4 at Kozloduy NPP Plc

1. Project 1 – Dry Spent Fuel Storage Facility

The design and construction of the Dry Spent Fuel Storage Facility (DSFSF) is performed by the Consortium NUKEM Technologies GmbH / GNB. The Contract for design and construction of the safe storage facility for 2800 spent fuel assemblies of WWER-440 type reactors was signed on 31 May 2004. The Technical Design and the Interim Safety Analysis Report were accepted by Kozloduy NPP in June 2006.

Since November 2007 the preparatory works, which include clearing of the site, installation of industrial fencing, offices and trial pilot installation have been initiated. On 2nd April 2008 the Bulgarian Nuclear Regulatory Agency issued an order for improvement of the technical design. On 17th June 2008 a permission for construction of the dry spent fuel storage facility for 2800 spent fuel assemblies for WWER-440 type reactors was granted by the Bulgarian Nuclear Regulatory Agency. A permission for construction was given by the Ministry of Regional Development and Welfare. Activities for pilot founding of the building are being performed. The work on the detailed design continues, and some chapters have been submitted to Kozloduy NPP for review.

The deadline for commissioning of the Dry Spent Fuel Storage Facility is August 2009. 34 containers for storage of the spent fuel assemblies of CONSTOR® 440/84 type shall be delivered to Kozloduy NPP by June 2010.

2. Project 2 – Liquid Radioactive Waste Treatment Facility

The project include supply of the liquid low level radioactive waste treatment facility. The facility shall be installed in Auxiliary Building-1, where the water decontamination and conditioning of the secondary radioactive waste shall be performed. The project provides methods to concentrate the radioactive wastes for storage. The Contractor is Atomstroyexport, Russia. The deadline for completion is May 2009. Currently, the detailed design is being re-worked and Safety Analysis Report is being elaborated.

3. Project 3a - Delivery of Security Hardware and Software

After the final closure of Units 1&2, the access regime should be re-organized in order to provide reliable physical separation between Units 1&2 and Units 3&4, which are still in operation. Project 3a covers hardware and software modifications to the existing Access Control Systems, the purchase and installation of new locking and detection systems and access points, computer equipment and electronic security equipment, as well as modifications to the existing communications systems

The project was implemented in the period of May to December 2004.

4. Project 3b - Supply of Physical Barriers and Access Points

Project 3b covers the construction of fencing, metal wall and two check points for the armed guards, which shall allow the physical separation of Units 1&2 from the rest units at the site.

The project was implemented in the period of May to December 2004.

5. Project 4a - Decontamination and Water Treatment Equipment

Under the Project 4a the equipment for the decontamination of spent fuel pond, spent fuel pond racks and reactor refuelling cavity was delivered. The decontamination of the at-reactor ponds, spent fuel storage ponds and other open tanks is part of the preparatory decommissioning activities. This project is to provide efficient cleaning of the surfaces (including those with a complicated geometry) with minimal generation of secondary waste, as well as efficient removal of decontamination products generated in the process of decommissioning.

The activities for equipment supply were completed in 2007. The Supplier of the equipment is Soluziona Consultoria y Technologia SLU & ENSA.

6. Project 4b - Delivery of Equipment for Decontamination and Treatment for Cleaning of Emergency Feed Water Tank (EFWT)

It is planned to purchase the decontamination equipment for the EFWT and other big tank in the frames of Project 4b. Currently a Technical Specification for equipment supply is being prepared.

7. Project 5a – Facility for Retrieval and Stabilization of Spent Ion Exchange Resins

Currently, the spent ion exchange resins from the operation of Units 1-4 are stored in tanks at Auxiliary Building 1 and 2. This project provides the equipment to perform the retrieval and conditioning of these wastes. The Project is at the phase of Technical design.

In addition to the project a Technical Specification for complete characterization of the spent ion exchange resins, including the identification of the critical for surface disposal long-lived alpha nuclides is elaborated.

The Contractor for the project is ENSA/Soluziona S.A. The deadline for completion is July 2009.

8. Project 5b – Facility for conditioning of Solid Radioactive Wastes with a High Volume Reduction Factor

This project is for the provision of design technological solutions, equipment manufacture, construction and commissioning of a facility for the treatment of solid low level radioactive waste generated during the operation and decommissioning activities of units 1-4.

A Tender procedure is being held for selecting the Contractor for the project.

9. Project 5c - Safety Analysis Report for Facility for Treatment and Conditioning of Radioactive Waste with a High Reduction Factor

A preliminary Terms of Reference was elaborated. After the technology and Contractor for Project 5b are selected, it shall be proceeded to a tender procedure for selecting the Project contractor.

10. Project 6a- Facility for Free Release Measurement

The Project is to provide a facility which is capable of measuring the activity low levels in order to free release the waste generated during the decommissioning from control.

The facility was supplied by Umwelt-und Ingenieurtechnic GmbH in 2006.

11. Project 6b –Radiological Inventory Equipment

The equipment at the total cost of 278 00 Euro was delivered in 2006, as follows:

- Measuring devices;

- Supplementary laboratory equipment;

- Laboratory furnishings.

12. Project 6 c- Delivery of Laboratory Equipment and Consumables

In the frames of the Project the following is delivered: consumables, radioactive liquid standards, laboratory equipment, chemical reagents, electrodeposition system.

13. Project 6d-6f –Radiological Inventory Equipment

- Project 6d –Vehicle Exit Monitors;
- Project 6e – Weighbridges for Gate 3 and Gate 6;
- Project 6f – Delivery of additional monitors.

Technical Specifications for Supply were elaborated.

14. Project 7- Mobile Change-room and Decontamination Facility

A change-room facility which can be readily transported to allow workers to carry out a clothing change and personal decontamination/ showering and monitoring is supplied.

15. Project 9a – Equipment for Draining the Liquid Phase from Evaporator Concentrate Tanks

The project includes supply of materials and equipment for installation of the system for draining the liquid phase from the evaporator concentrate tanks in Auxiliary Building -1 before starting to retrieve the solid phase (Project 9b). The scope of supply shall be identified during the detailed design work.

A preliminary study of the feasibility potential of this project and clarification of the required equipment is being performed. The Project shall be implemented by the Plant personnel and its funding shall be only for purchase of materials.

16. Project 9b – Facility for Retrieval and Processing of the Solidified Phase from Evaporator Concentrate Tanks

This project is for the provision of solidified phase characteristics, design, equipment manufacturing, construction and commissioning of a facility for retrieval and processing of the solidified phase from evaporator concentrate tanks.

A Tender procedure is being held for selecting the Contractor.

17. Project 9d – Measuring systems for level of the Evaporator Concentrate Tanks

The project is to provide the level measuring device in Evaporator Concentrate Tank in the Auxiliary Building 1&2. The project is at the phase of Tender procedure.

18. Project 10 – Optimization of the Monitoring System for Liquid and Gaseous Releases

The project is to provide upgrading of the gaseous release monitoring system from the vent stacks of Units 1-4 and liquid releases from Auxiliary Building-1 and Auxiliary Building -2 in compliance with the recommendations of the European Commission 2004/2/EURATOM. The Projects involves equipment delivery and installation, personnel training and elaboration of the corresponding documentation. The Contractor is VF, Czech Republic. A Technical design is being elaborated.

Deadline for completion is May 2009.

19. Project 11

- Project 11a - Delivery of Measuring Equipment and Consumables for Project 11c

A Technical Specification for Supply was elaborated.

- Project 11b – Optimization of the Conditioning and Packaging of the Radioactive Waste

An analysis for delivery of containers required for equipment dismantling activities is being performed.

- Project 11c –Evaluation of the Material Backlog and Radiological Inventory of KNPP Units 1

The project includes the evaluation of the operational material backlog and radiological inventory of the equipment, structures, compartments and radioactive waste. The activities shall be provided in 4 separate lots:

1. Assessment of the induced activity for Units 1-4;
2. Calculation of the radioactive contamination of Units 1 -4, including the steam generator;
3. Radiological assessment of Units 3&4;
4. Radiological inventory of the material backlog at Units 1-4.

A Technical Specification was elaborated. Part of these activities shall be carried out by the Kozloduy NPP Plc personnel.

20. Project 12

- Project 12a - Material Fragmentation and Decontamination Plant

The project includes the design, construction, equipment delivery and installation of the plant for size reduction and decontamination of dismantled materials from Turbine Hall, Auxiliary Buildings at Units 1-4 and Reactor Building.

A Technical Specification was elaborated. A Tender procedure has been initiated.

- Project 12b- Delivery of equipment for Size Reduction Areas in Turbine Hall

The design and supply of equipment for primary and secondary cutting of the large size dismantled equipment, air cleansing equipment for manual cutting and laboratory for monitoring of the surface contamination. A buffer area and two cutting areas equipped with manually controlled machines and remote controlled machines for size reduction shall be arranged in Turbine Hall.

The project is at the phase of Technical specification for delivery though purchasing the standard equipment for furnishing the working places at Turbine Hall and Technical Specification for developing a non-standard equipment. The two Technical Specifications shall be financed after the elaboration of the Technical design for the material fragmentation and decontamination plant.

21. Project 13 – Supply of Dismantling and Decommissioning Tools and Equipment of Technological Equipment for Turbine Hall, Auxiliary Buildings and Reactor Buildings at Kozloduy NPP, Units 1-4

- Project 13a - Dismantling Tools and Equipment for Turbine Hall: manual tools, excavators, mobile platforms, mobile cranes, motorcars, equipment for concrete removal.

The Project is at the phase of Tender procedure.

- Project 13b - Dismantling Tools and Equipment for Reactor Building: manual tools, mobile platforms, motorcars, shielded compartment for dismantling, remote control equipment, Waste Management Facility- for sorting, separation, monitoring, identification and packing, system for decontamination of the fuel storage pond wall - a remote method to remove the surface layer of the pond wall, concrete removal.
- Project 13b - Dismantling Tools and Equipment for Auxiliary Buildings: remote controlled equipment for treatment and size reduction of the active components. Shielding is to be used

for size reduction operations of process equipment in order to ensure that the dose rate of the operators shall comply with the ALARA principle.

- Project 13d - Free Release Facilities to Monitor Waste Measurement Facilities: supplementary facility for precise analyses and recording the radioactive nuclides on waste materials, which shall allow these waste to be free released.
- Project 13f – Supply of Vehicle Mounted Boom for the dismantling activities in Turbine Hall and Reactor Compartment: vehicle mounted boom, special type with more levels of the free travel that the traditional vehicle mounted boom.

The Project is at the phase of Tender procedure.

22. Project 14- Separation of the infrastructure of Units 1-4 from Units 5&6. Supply of equipment for hat, fluid flow and electricity metering

- Project 14a – Supply of equipment for heat, fluid flow and electricity metering. A Technical Specification for Supply was elaborated.
- Project 14b - Design and Supply of necessary equipment and materials for installation of new water pipeline between service water "B" group - units 3, 4 with the service water system of units 1,

The Project is at the phase of Technical design.

- Project 14c – Design and Reconstruction of the Systems for Heating and House Load Steam . Project input data are being collected. A design study is being elaborated.
- Project 14d – Design and implementation of connections between the new hot water boilers (Project 15) and the existing system for hot water and house load steam. The Project shall be started after the completion of Project 15.
- Project 14e - Separation of the security perimeter between Units 1-4 and Units 5&6. Technical specification and tender documentation were elaborated. The project is at the phase of the tender announcing.
- Project 14f – Replacement of artesian waters - Due to obsolescence of the artesian water pipelines (40 years old) their replacement is required. The Project is at the phase of Tender procedure.
- Project 14g – Delivery of replacement equipment for physical protection in relation to the separation of Units 1-4 from those units which are in operation. The Project is at the phase of Tender procedure.

23. Project 15 – Construction of a Heat Generation Plant

A steam and hot water generation plant as a back-up source of steam and central heating water to town of Kozloduy and the consumers of Units 1 to 6 at the site of Kozloduy NPP is required after the closure of Units 1-4.

The project includes design, construction and commissioning of a steam and hot water generation plant as a back-up source of steam and central heating water in case both Units 5&6 are shut down. The plant will use gas as its only source of fuel and shall provide:

- Continuity of supply of central heating water to the town of Kozloduy.
- Continuity of steam supply to Kozloduy NPP to assist with restarting the operational units as quickly as possible.

Technical specification for design, construction and commissioning is at the process of elaboration.

24. Project 16 - Environmental Impact Assessment Report for Decommissioning of Units 1-4 at KNPP

A Terms of Reference for Environmental Impact Assessment is underway. The Ministry of Environment and Waters has requested to consult the Ministry of Environment and Waters, Ministry of Health and Regional Inspectorate of Environment of Vratza for the content of the Terms of Reference, as well as public discussion with the interested populated and non-governmental organizations. A Tender procedure for selection of the Contractor has been initiated.

25. Projects in the process of preparation:

- Project 17 – Safety Assessment Reports for Decommissioning of Units 1-4 at KNPP;
- Project 18 – Assessment of Rest Life Time of Systems, Building Structures and Components at Units 1- 4;
- Project 19 - Design, Construction, Testing and Commissioning of Decay Storage Site for Transitional RAW;
- Project 20 - Information Centre for Decommissioning;
- Project 21 - Site for Conventional Waste for Decommissioning;
- Project 22 - Upgrade of the Decommissioning Management System (DeManS);
- Project 23 – Inventory, Treatment and Conditioning of Contaminated Soil;
- Project 24 - Sampling and In-depth Analysis of the Radioactive Contamination of the Concrete Structures in Reactor Building;
- Project 25 - Equipment for Safe Asbestos Removal and Storage;
- Project 26 - Equipment for Demolishing and Cutting Reinforced Concrete Structures.