NATIONAL REPORT

ON FULFILLMENT OF THE OBLIGATIONS

OF THE REPUBLIC OF BULGARIA

ON

THE JOINT CONVENTION ON

THE SAFETY OF SPENT FUEL MANAGEMENT AND ON

THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Sofia, April 2003

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Section A. Introduction

In Vienna on September 22, 1998 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 Joint Convention).

The Joint Convention is ratified by a Law (promulgated in State Gazette No. 42/2000) and is in force in the Republic of Bulgaria as of June 18, 2001.

This report presents the state of compliance with the requirements, the achieved and the planned measures of the Government of the Republic of Bulgaria, its institutions and holders of the permits for implementation of the obligations ensuing from the Joint Convention.

The evaluation of the level of compliance with the obligations is based first of all on the legislation of the country, as well as on the measures undertaken for review and assessment of safety in the management of spent fuel and in the radioactive waste management.

The safety of spent fuel management and radioactive waste management is regulated by the Act on Safe Use of Nuclear Energy (ASUNE) and the legislation for its implementation adopted by the Council of Ministers. A modern legislative basis for the Safety of Spent Fuel Management and Safety of Radioactive Waste Management is in the process of creation. The legislative acts for implementation of the revoked in 2002 Law on the Safe Use of Atomic Energy for Peaceful Purposes are temporarily in force until adoption of the respective legislation stipulated in ASUNE. One of the main principles, defined in ASUNE, is to ensure human life protection, health and life conditions of the present and future generations, the environment and property from the harmful influence of ionising radiation during any activities involving the use of nuclear energy and ionising radiation.

The Republic of Bulgaria has two nuclear facilities, which, during operation, generate spent fuel (SF) and radioactive waste (RAW): Kozloduy NPP and the research nuclear reactor (RNR) of the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences (BAS).

RAW is generated also from the use of radioactive materials in some other fields: medicine, agriculture and scientific research as well as from the uranium mining and processing. Uranium mining was terminated in 1994 after the decision of the Government of the Republic of Bulgaria.

There are no local plants for conversion, enrichment and production of nuclear fuel as well as for reprocessing of SF.

There are no nuclear facilities that are in the process of decommissioning. Units 1 and 2 of Kozloduy NPP are switched off from the power grid, but preparations for their decommissioning have not started. The RNR of BAS was shut down by a prescript of the regulatory body on nuclear safety in 1989 subject to its modernisation in order to comply with contemporary requirements for nuclear safety and radiation protection. By a Council of Ministers decision in 1999 the operation of this reactor on power was finally terminated. The Council of Ministers adopted a decision in 2001 for reconstruction of this reactor into a low power reactor – 200 kW.

The SF of Kozloduy NPP is stored in pool type storage facility at each NPP unit and common "wet" storage facility on the site of the NPP, where after additional temporary storage, part of it is returned to the Russian Federation. According to the agreement between the Republic of Bulgaria and the Russian Federation for co-operation in the field of atomic energy, the Bulgarian party is responsible for accepting the High Level vitrified RAW from reprocessing of the SF of the Kozloduy NPP according to the programmes and time periods co-ordinated between the contracting parties. It is planned to construct a "dry" storage facility on the site of the NPP for long term storage of SF. The SF from the RNR is stored in storage pool in the reactor building. No decision for SF disposal is made in Republic of Bulgaria.

The facilities for management of RAW, including those for temporary storage, are placed on the Kozloduy NPP site. With regard to disposal of RAW, Kozloduy NPP is in a process of implementation of a programme for choice of a suitable site, where a facility for disposal of Low and Intermediate RAW may be constructed. For this purpose several sites around Kozloduy NPP are being studied and examined. The RAW generated from medical and industrial applications of radioactive materials are stored in the Permanent Repository for RAW – Novi Han.

The Low Activity RAW obtained from the uranium industry are disposed in tailing ponds, while the metal RAW in trenches near the villages Eleshnica and Buhovo.

Projects for technical liquidation, technical and biological remediation are being carried out. The National Strategy for Safe Management of Spent Fuel and Radioactive Waste, adopted by the Council of Ministers in 1999, envisages the process of creation of the complete infrastructure for RAW management to be completed by the end of 2003 and from January 1, 2004, in accordance with the requirements of ASUNE, the State Enterprise “RAW” also to start operation. In this way, RAW management outside of the premises where they are generated, from the beginning of 2004 will be carried out by the State Enterprise “RAW”.

The financing of the activities linked with RAW management will be carried out by entities which generate these RAW including through payments to the Fund “RAW” while the activities for decommissioning will be carried out by the operators of Nuclear Facilities including through payments to the Fund “Decommissioning of Nuclear Facilities”.

International co-operation is especially important to the enhancement of safety in management of SF and RAW. In this connection the role of the IAEA and the European Commission is of great importance. Of special significance is the continuation of the efforts for harmonisation of both safety standards and also on approaches for their implementation, which will further facilitate the consolidating of international efforts for nuclear safety and public trust. Possibilities for creation of regional storage facilities with international financing should also be considered.

In sections B – J of this report along with the description of the reviewed questions a declaration on implementation of each article of the Joint Convention is given.

The main activities planned for the enhancement of safety are given in Section K, while in Section L information pertinent to the questions under discussion is enclosed.

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.

1. Policy

The policy of the Republic of Bulgaria in the field of spent fuel and radioactive waste management is carried out on the basis of the following fundamental normative acts:

- Act on the Safe Use of Nuclear Energy;
- Act on Environmental Protection.

The policy is directed towards spent fuel and radioactive waste management in an environment and population safe, economy efficient, comprehensive and overall approach, where the historical aspect and the contemporary trends, the country's scientific, engineering and financial resources are considered, and the responsibilities of the state and the nuclear facilities operators are clearly defined.

The main responsibility for ensuring the safety in Spent Fuel and Radioactive Waste management lies with the state. The policy and practices in the field of Spent Fuel and Radioactive Waste management in the Republic of Bulgaria are based on the following principles:

1. The effective protection of the health of individuals and the society from the impact of ionising radiation and the potential hazards, and protection of the environment through safe Spent Fuel and Radioactive Waste management at all stages at present and in the future have the highest priority;
2. Striving for the role of safety in the Spent Fuel and Radioactive Waste management through the national legislation and the international agreements;
3. Strengthening the independence and capabilities of the regulatory authority;
4. Application of effective methods for protection, approved by the regulatory authority in the framework of the national legislation with due regard to the internationally endorsed criteria, standards and good practices;
5. Prevention of imposing undue burden upon future generations;
6. Prevention of actions which impose reasonably predictable impacts on future generations, greater than those permitted for the current generation;
7. Maintaining high standards of safety and application of proven technologies in Spent Fuel and Radioactive Waste management;
8. Encouragement of the development and keeping of an effective safety culture at all stages in Spent Fuel and Radioactive Waste management;
9. Recognition of the importance of providing information related to the safety in Spent Fuel and Radioactive Waste management to the society in a timely and transparent way;
10. Taking into account the public opinion in formulation the policy for safe management of Spent Fuel and Radioactive Waste;
11. Strengthening and development of the international co-operation;
12. Assistance to the safe and effective Spent Fuel and Radioactive Waste management through bilateral and multilateral agreements;
13. Deferred decision and partial transportation of the spent fuel for reprocessing on the basis of bilateral and multilateral agreements;
14. Ensuring financially the effective Spent Fuel and Radioactive Waste management through the national legislation.

The tasks, measures and their priorities for achieving the objectives of the Act regarding safe management of spent fuel and radioactive waste are formulated in the National Strategy on Spent Fuel and Radioactive Waste Management, adopted by the Council of Ministers in 1999. The strategy is directed towards the establishment of a joint national system for Spent Fuel and Radioactive Waste management in accordance with IAEA recommendations, Joint Convention provisions and with the *Acquis Communautaire*. A strategy updating is being prepared which takes into account the implemented measures and outlines new ones in compliance with the national policy and the process of European Integration.

Spent Fuel and Radioactive Waste management in the Republic of Bulgaria is subject to a authorisation regime and is conducted solely after obtaining permits and licenses and in compliance with the conditions there for the safe implementation of the relevant activities.

Radiation protection of the personnel and the population from ionising radiation in conducting activities with Spent Fuel and Radioactive Waste is performed according to the requirements of the Regulation for Basic Standards for Radiation Protection (BSRP-2000).

The means for attaining the objectives of the Act on Environmental Protection (AEP) is the National Environmental Strategy, which is developed by the Minister of Environment and Water.

Institutional framework

Council of Ministers:

1. Adopts normative acts for applying ASUNE and AEP.
2. Adopts the national strategy on Spent Fuel and Radioactive Waste management, approves and submits the National Environmental Strategy for adoption by the National Assembly.

The NRA Chairman (a legal successor of the Committee on the Use of Atomic Energy for Peaceful Purposes) is an independent specialised authority of the executive branch, which carries out the state regulation of the safe management of spent fuel and radioactive waste.

The Minister of energy and energy resources conducts the national policy for safe management of spent fuel and radioactive waste and develops and submits for adoption by the Council of Ministers the strategy for safe management of spent fuel and radioactive waste.

The Minister of Environment and Water develops the policy and strategy for environmental protection and implements the state policy in this field, which is integrated into the branching policies– transport, power engineering, construction, agriculture, industry, education etc.; exercises control upon environmental components and the factors which have an impact upon them at a national level.

The ministers of health, of interior, of defence, of agriculture and forestry, of transport and communications, of education and science perform specialised control according to their legal authorisations.

The permanent commission on protection of the population in case of disasters, accidents and calamities within the Council of Ministers realises the organisation, management and control of activity of prevention, reduction and mitigation of consequences in times of disasters, accidents and calamities off the nuclear facilities sites.

Nuclear facilities operators are responsible for the safe handling and storage of generated SF at the facility site, where it has been used. They provide financial resources for the decommissioning of the facilities.

RAW generators bear the responsibility for the safe management of waste generated by them till they deposit it to the state. In compliance with the principle “the polluter pays”, they cover the expenses for the management of their waste from its generation till its disposal, including monitoring of storage facilities after their closure.

2.Practices

2.1. Spent fuel management

The spent fuel is not designated for disposal.

INRNE

Activities on the spent nuclear fuel management in the country begin with the commissioning of the research reactor IRT-2000 (Russian design) in 1961 г. at the Institute of Physics with Atomic Research Centre (IP with ARC) of the Bulgarian Academy of Sciences (BAS) Sofia, at present – Nuclear Research Centre (NRC) within the Institute for Nuclear Research and Nuclear Energy (INRNE) of BAS. The reactor is intended for carrying out scientific research and for production of radioactive isotopes. Irradiated fuel is stored in the at- reactor shaft storage pool-type facility, constructed within the boundaries of the biological shield of the reactor. The research reactor was shut down in 1989.

Kozloduy NPP

Questions concerning spent fuel management from Kozloduy NPP are subject to the units design and the agreements between Bulgaria and the former USSR for their construction. According to the initial design spent fuel (SF) is stored for 3 years in spent fuel pools (SFP) at the reactors and then it is sent back to the former USSR for processing.

In 1985 the minimal term for SF storage before its sending back for reprocessing was changed from 3 to 5 years. This requirement, as well as the necessity in providing an additional capacity for spent fuel temporary storage in cases of delayed sending back to Russia, made necessary the construction of a separate facility (storage) for temporary spent fuel storage (SFSF) at the site of Kozloduy NPP. Initially the SFSF was intended for storage of SF from WWER-440 and was commissioned in1989. In 2000 the SFSF reconstruction for SF from WWER-1000 was finalised.

At present, the spent fuel from reactors WWER-440 and WWER-1000 is stored for a minimal term of 3 and 5 years respectively in the reactor spent fuel pools after which it is transferred for temporary storage to the SFSF with the assistance of internal transport container and a specialised autotrailer. In SFSF the spent fuel assemblies are stored in wet storage, placed in transport baskets. The time period, foreseen for temporary wet storage is 30 years.

In the period 1979-1988 the SF from WWER-440 type reactors was returned to the former USSR without ensuing obligations for Bulgaria to receive back radioactive waste from the fuel reprocessing. According to the Agreement from 1995 between The Republic of Bulgaria and the Russian Federation, the reception of spent fuel from Kozloduy NPP is bound with sending of High Level Waste (HLW) from the reprocessed fuel back to Bulgaria. Since 1998 till now WWER-440 and WWER-1000 spent fuel has been sent back to Russia upon contractual basis.

The plan for safe management of the nuclear fuel cycle at the Kozloduy NPP approved in 2002 by the Minister of Energy and Energy Resources determines specific measures for management of spent fuel, namely:

- To continue sending back spent fuel to the Russian federation at a short term basis;
- Increasing the capacity of the existing SF wet storage facility on the site;
- Construction of a new SF dry storage facility (at present there is a tender procedure under way, the first stage if the storage is expected to be commissioned in 2006).

2.2. RAW Management

RAW, generated at Kozloduy NPP

The prevailing part of RAW generated at Kozloduy NPP, are Low and Intermediate Short-Lived (LILW-SL) according to IAEA terminology.

The first four units of the plant are designed in accordance with the concept for collection and storage of RAW on site till the decommissioning stage.

In mid 1990-ies, at Kozloduy NPP site started the construction of a Plant for treatment, conditioning and storage of RAW on the NPP site, which includes a solid RAW treatment line, liquid RAW treatment line, RAW conditioning, and storage facility for temporary storage of conditioned RAW.

At present, RAW management activities from Kozloduy NPP include preliminary treatment, processing and storage of liquid and solid RAW and are carried out at the plant site. Gaseous radioactive substances, which are generated in the process of operation of nuclear facilities at the plant site, are released into the environment after preliminary purification, as emissions, permitted by the regulatory authority.

Liquid RAW, generated at Kozloduy NPP, are mainly aqueous waste and comparatively small volume of organic waste. Technological radioactive by contaminated waste water is collected via special systems and reprocessed. Distillate and concentrate are obtained as a result. The distillate passes through ion-exchange filters and is controlled according to chemical and radiochemical indicators. If compliance is recognised with the requirements of the technological specifications in terms of specific and total activity, the so-called discharge water is released into the environment, as effluents, permitted by the regulatory authority. The concentrate is stored in stainless steel tanks, situated in the Auxiliary buildings (AB) of Kozloduy NPP units. The liquid RAW storage facilities are constructed along with the relevant units. The liquid RAW treatment and RAW conditioning line is in a process of testing and commissioning.

The organic liquid RAW (spent sorbents) are collected and stored separately in auxiliary buildings at Kozloduy NPP units.

The solid RAW are sorted at the place of their generation according to their radiometric characteristics and by the type of their material. At this stage the separation of radioactive waste from the Very Low Level Waste (VLLW), as well as the separate collection of RAW by categories and types, is carried out.

The solid RAW, which represents contaminated materials with high activity are stored in special protective facilities “shaft storage facilities”, situated in the central reactor halls of Units 1-4 in the specialised building of Units 5-6.

Compactible solid RAW is treated in order to reduce the volume and ensure structural stability. Processing is carried out in the RAW treatment, conditioning and storage plant, via Solid RAW treatment line. The Waste is compacted in 200-l drums at two stages– precompaction of RAW in drums by a 50 ton precompactor, supercompaction of drums by a 910 ton supercompactor. Solid noncompactible waste is of relatively small volume and is collected in 200 l drums without any further processing.

RAW transportation at the plant site is carried out in transport containers, by container-trucks, a special transport trailer and a tank truck.

RAW from nuclear applications

All RAW generated as a result of use of sources of ionising radiation in medicine, industry, research and education (nuclear applications) are low- and intermediate level (LILW-SL, LILW-LL) according to IAEA terminology.

RAW safe management activities at the places of their generation, till their transfer to the state, is regulated and controlled as a part of the activities concerning the use of Sources of Ionising Radiation according to the Act on the Safe Use of Nuclear Energy. The scope of these activities is different for separate fields.

Management of RAW, transferred to the state for long-term storage, is carried out by the Institute for Nuclear Research and Nuclear Energy (INRNE) at BAS via the Permanent Repository for Radioactive Waste situated near village of Novi Han (PRRAW-Novi Han).

PRRAW-Novi Han was commissioned in 1964. The repository was built according to a Russian typical (standardised) design and was intended for disposal of low- and intermediate level waste from nuclear applications in the country. It is entrusted for operation, maintenance and scientific service to the Institute of Physics with Atomic Research Centre (IP with ARC) of the Bulgarian Academy of Sciences (BAS) and since 1972 - to the successor of part of the activities of this institution - the Institute for Nuclear Research and Nuclear Energy (INRNE) at BAS. At that time the IP with ARC, as operator of the research reactor IRT-2000, was the main RAW generator and the place, where specialists in the field of RAW work. At PRRAW-Novi Han site facilities are placed for storage of disused sealed sources, solid untreated waste and conditioned biological waste, where RAW is placed since the storage facility commissioning in 1964 to 1994.

In 1994 PRRAW-Novi Han operation was stopped by the regulatory authority in order to undertake maintenance measures and modernisation of facilities and infrastructure. The new-coming RAW was stored in a temporary Central Isotope storage at the site of INRNE in Sofia. As a result of the carried out maintenance and restoration works between 1988 – 2000 PRRAW-Novi Han received permit for RAW storage in surface facilities for temporary storage. At the end of 2000 all radioactive waste from Central Isotope Storage was transported to the PRRAW-Novi Han site and placed in the aboveground facilities for temporary storage. At present the operator of the storage facility performs transport activities, pre-treatment, and RAW storage.

In PRRAW-Novi Han the received waste is placed for temporary storage in special receivers. The Solid RAW and spent low-level sources, which do not require additional protection against radiation, are stored in standard railroad containers. Used sources in transport packages, including High-level, requiring additional protection against radiation, are stored in waterproof reinforced-concrete receivers. If necessary, the waste is sorted and repacked.

RAW from uranium raw material extraction and processing

Within the framework of the uranium industry were operated more than 40 extraction sites and 2 hydrometallurgy plants in the Republic of Bulgaria. More than 20 million tons of waste were generated, accumulated in 3 tailing ponds and about 300 waste banks. Uranium extraction was ceased by a decision of the Government of the Republic of Bulgaria in 1994.

The regions assessed as being the most hazardous for the population in terms of radiology are characterized with a large amount of mining done in the past and with carrying out hydrometallurgy processing of uranium raw material.

The measures in the field of the uranium industry are directed towards mitigation of consequences from the extraction and processing of uranium ore within the framework of the environment management. The main objective is environment recovery in regions with closed sites for uranium ore extraction and elimination of health hazards for the population of these regions. The safe management of radioactive waste from the extraction and processing of uranium raw material which are beyond the scope of the Convention (see Chapter C from the report), are subject to the National environment strategy and the National programme for waste management.

In accordance with the National environment strategy and the National programme for waste management, adopted by the Council of Ministers in 1999, the priorities for the safe management of radioactive waste from the extraction and processing of uranium raw material are:

- Finalisation of technical liquidation of uranium-extracting and uranium –processing sites;
- Carrying out of a proper qualitaty technical and biological re-cultivation with regard to the future use of agricultural land and forestry;
- Conducting of complex and systematic monitoring of affected regions;
- Complex purification of contaminated water, discharging from the regions of the former uranium extraction sites;
- Detailed evaluation and application of the necessary rehabilitation measures in the regions of extracting, experimental and research uranium mines and areas which were not included into the programme for mitigation of consequences from the extraction and reprocessing of uranium ore.

Radioactive waste from uranium industry, regarding its specifics, is managed according to Order № 1 dated 15.11.1999 for standards for the objectives of radiation protection and safety in mitigation of consequences from the uranium industry in the Republic of Bulgaria and Instruction № 1 of CUAEPP for the order and way of treating radioactively contaminated materials, facilities and waste from mitigation of uranium-extracting sites such as:

- Disused radioactive sources – standard ones and for technological control are managed as those from the other nuclear applications:

- Other radioactive waste materials are stored safely in-site and/or are deposited in trenches, at waste banks or tailing ponds. It is allowed to use mine shafts of uranium-extracting sites. The technologies and places for deposition are specified by the technical liquidation and re-cultivation projects.

3. Criteria for radioactive waste definition and categorisation

Pursuant to the Act on the Safe Use of Nuclear Energy:

“Radioactive waste means a radioactive substance in a gaseous, liquid or solid form, for which no further use is foreseen by the licensee or the permit holder, and which is controlled by the Nuclear Regulatory Agency as radioactive waste according to this Act, including radioactive source, for which the safe operating lifetime has expired according to the design documentation.”

The waste, containing radioactive substances and is controlled as RAW, is specified in Order No 7 of CUAEPP, for RAW collecting, storage, reprocessing, storing, shipment and disposal within the territory of the Republic of Bulgaria following the criteria “radiological characteristics” of types of waste. Waste from reprocessing of spent fuel is beyond the scope of this regulation. The types of waste are specified by the criterion “physical status” as liquid and solid, and by the criterion “origin”, as from nuclear plants and from nuclear applications (from utilities without NPP).

The RAW categories are specified in Order № 7 of CUAEPP by the criterion “radiological characteristics” of types of waste

- Liquid RAW is divided in three categories depending on the specific activity, as follows:

Category	**Specific activity, [Bq/l]**
Low-level	to 3.7×10^{5}
Intermediate level	3.7×10^{5} to 3.7×10^{10}
High level	above 3.7×10^{10}

- Solid RAW is divided in three categories depending on the specific activity of the alpha- and beta- emitting radionuclides and on the equivalent dose-rate of gamma radiation at 0.1 m from their surface, as follows:

Category	Equivalent dose-rate of gamma radiation at 0.1m from their surface, [mSv/h]	Specific activity of beta-emitting radionuclides, [Bq/kg]	Specific activity of alpha-emitting radionuclides, [Bq/kg]
I	$1\times10^{-3} - 3\times10^{-1}$	7×10^{4} - 3.7×10^{6}	7×10^{3} - 3.7×10^{5}
II	3×10^{-1} - 10	3.7×10^{6} - 3.7×10^{9}	3.7×10^{5} - 3.7×10^{8}
III	above 10	above 3.7×10^{9}	above 3.7×10^{8}

Section C. Scope of Application

ARTICLE 3. SCOPE OF APPLICATION

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

Spent fuel is generated only as a result of civilian nuclear reactors operation. There are not spent fuel reprocessing facilities in the Republic of Bulgaria.

The Republic of Bulgaria does not specify radioactive waste, generated as a result of the technological increase of concentration of radioactive substances occurring in nature as RAW for the purposes of the Joint Convention.

Radioactive waste, which contains radioactive substances, with the exception of sealed radioactive sources, is not declared as RAW for the purposes of the Joint Convention.

According to the Act on the Safe Use of Nuclear Energy, nuclear energy in the Republic of Bulgaria is used only for peaceful purposes in compliance with the Act and the international treaties ratified pursuant to the constitutional order and promulgated and entered into force in the country. RAW, received as a result from nuclear applications at the Ministry of defence sites, is managed as RAW from the civilian programmes for nuclear applications.

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.

List of SF management facilities, subject to the Joint Convention, with information concerning their location, function and main characteristics is given in Annex L-1.

Inventory of spent fuel, stored in SF management facilities is given in Annex L-2

List of RAW management facilities, subject to the Joint Convention, with information concerning their location, function and main characteristics is given in Annex L-3

Inventory of RAW, stored and disposed in RAW management facilities is given in Annex L-4.

Section E. Legislative and Regulatory System

ARTICLE 18. IMPLEMENTING MEASURES

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

ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK

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 licence;

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

(v) the enforcement of applicable regulations and of the terms of the licences;

(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

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

The Law on the Use of Atomic Energy for Peaceful Purposes (LUAEPP) of 1985 (last amended in 1995) is the first law in the Republic of Bulgaria covering the use of nuclear energy and ionising radiation. Following this law a set of CUAEPP regulations have been developed. Before 1985 the issues in this area have been covered by the documents of the Council of State, Council of Ministers and Minister of Health.

In 2002 a new law entered into force- the Act on the Safe Use of Nuclear Energy (ASUNE).

To enforce the law it is envisaged to adopt 21 regulations by the Council of Ministers within two-year period.

Until their adoption the regulations issued for the application of the LUAEPP shall be applied.

Other laws also providing for regulation of issues in this area are the Act on Environmental Protection and the Act on Public Health. The existing legislation applicable to radioactive waste management and spent fuel management is listed and described in Annex L-5.

Chapter Three of the ASUNE covers the authorisation system. According to Art. 14 radioactive waste management and spent fuel management shall be performed by legal entities only after obtaining a license or a permit for the safe conduction of the relevant activity in the cases specified in ASUNE. Licenses and permits shall be issued, amended, suspended, and revoked by the NRA Chairman under conditions of legal equality and transparency.

According to Art. 75 of ASUNE, spent fuel management shall be conducted by a licensee possessing a nuclear facility operating license. The authorisation regime established for nuclear facilities is applicable to radioactive waste management facilities and spent fuel management facilities.

The NRA Chairman shall issue permits for:
1. siting of a nuclear facility;
2. design of a nuclear facility;
3. construction of a nuclear facility;
4. commissioning of a nuclear facility.

The permits listed above are issued prior to the issuing of an operating licence for a nuclear facility, to a legal entity registered in the Republic of Bulgaria which:

1. possesses a permit for the construction of a new facility for generation of electrical or thermal power according to the procedure established by the Energy and Energy Efficiency Act, if the nuclear facility is a nuclear power plant;
2. is an investor in the construction of another nuclear facility.

A licence for operation of a nuclear facility is issued following the completion of all conditions of the permit for commissioning of a nuclear facility.

A licence for operation of a nuclear facility shall be issued for a term not exceeding ten years.

A licence for operation of a nuclear facility shall include the right of the licensee to use a nuclear facility and to perform all activities, including decommissioning and temporary storage of spent nuclear fuel and radioactive waste, for attainment of the assigned purpose of the facility. Such a license shall be issued if the facility meets all technical aspects of nuclear safety and radiation protection standards and if during all activities the licensee ensures nuclear safety and radiation protection.

Permits shall be issued to the licensee for:

1. carrying out activities leading to modification of:
   (a) nuclear safety and radiation protection related structures, systems and equipment;
   (b) limits and conditions for safe operation, on the basis of which the operating licence has been issued;
   (c) internal rules for conducting licensee activities, including instructions, programmes, technical specifications and similar matters, attached to the licence;
2. decommissioning of a nuclear facility;
3. import and export of nuclear material;
4. transport of nuclear material.

Commercial transactions of nuclear facilities and of nuclear material may be conducted after obtaining a permit from the NRA Chairman, subject to the condition that nuclear safety and radiation protection requirements, rules and standards are not violated. The NRA Chairman shall issue a permit for commercial transactions involving a nuclear facility only when the transferee under the transaction holds a licence for the relevant activity or fulfils the conditions for the issuing of such a licence.

The Act on the Safe Use of Nuclear Energy authorises the NRA Chairman to exercise regulatory control over nuclear safety and radiation protection involving the use of nuclear energy and ionising radiation and concerning radioactive waste management and spent fuel management.

The regulatory control is as follows:

1. preventive regulatory control carried out through issuance of licenses and permits for activities and individual employment licenses;

2. current regulatory control over implementation of the conditions of the licenses and permits issued for activities and individual employment licenses;

3. follow-up regulatory control to verify compliance with the recommendations or prescriptions of the control bodies.

In executing of the authorities the NRA Chairman shall:

1. conduct regular and extraordinary inspections through the authorised officials;

2. notify other responsible bodies with a view of undertaking actions within their competencies;

3. notify the prosecuting authorities if there is reason to believe that a criminal offence has been committed;

4. amend or revoke the permit or license or individual employment license;

5. impose administrative enforcement measures and administrative penalties, as provided under this Act.

The NRA Chairman has the right to require information or documentation from persons, relevant to their activity and, if necessary, to request assistance from the specialised control bodies.

The NRA Chairman shall authorise designated officials of the Agency's administration (inspectors) to exercise regulatory control under this Act in accordance with their authorities.

The inspectors shall have the right to:

1. free access at any time to the regulated persons and sites for inspection of nuclear safety and radiation protection and the technical condition of the nuclear facilities and sources of ionising radiation;
2. require from the responsible staff any data, reports, explanations, operating and other information, including measurements and tests, as shall be necessary to clarify the technical status and the operating conditions of the facility, including personnel competence, as well as disclosure of any other nuclear safety and radiation protection related information;
3. issue written administrative penalty acts under the Act;
4. propose amendment, suspension, termination and revocation of permits or licences, including individual employment licenses;
5. issue mandatory written prescriptions for ensuring nuclear safety and radiation protection.

The inspectors prescriptions, issued under their powers pursuant to this Act, shall be mandatory.

The inspectors shall issue a protocol of findings on the results of the inspections, attaching the evidence collected and explanations, measurements or test results.

A joint procedure for exercising the inspection by inspectors, procedures for elaborating and evaluating of the annual NRA plan on regulatory control activities as well as for elaborating documentation on the inspection activities and analyses of the inspections are specified by an Instruction on Inspection Activities.

In accordance to Section II of the above-mentioned instruction, NRA elaborates annual plan on inspections, taking into account the proposals of the specialised responsible bodies. After the approval of the plan by the NRA Chairman it becomes an obligatory document.

The Instruction on Inspection Activities specifies in details the procedures, terms and duties of the different NRA units in preparing the inspection plan, as well as the areas where the inspections of nuclear facilities (including radioactive waste management facilities and spent fuel management facilities) and other sites with sources of ionising radiation are to be carried out.

The instruction determine the following types of inspections:

- routine inspections;
- topical inspections;
- general inspections;
- extraordinary inspections.

The Instruction on Inspection Activities requires evaluation of the results from the inspection and analysing of each inspection activity. The general purpose is improvement of regulatory control and increasing the level of nuclear safety and radiation protection at inspected sites.

According to the established practice, representatives of the specialised responsible bodies take part in the inspections when the subject and the range of the inspections require it.

The specialised responsible bodies also carry out inspections of the nuclear facilities independently.

The results from inspections and regulatory control exercised by NRA and specialised responsible bodies are presented in NRA Annual Report which is submitted to the Council of Ministers, other State authorities, non-governmental organisations and the general public.

The implementation of the normative acts in nuclear safety and radiation protection area and conditions of the permits issued by the NRA Chairman is ensured by administrative sanctions (pecuniary penalty and fines) and administrative enforcement measures.

Written statements for ascertainment of violation of the legislation and penalty decrees shall be issued under the Act on Administrative Prosecution. The written statements shall be issued by the inspectors in accordance to the Act on Administrative Violations and Sanctions.

The penalty decrees shall be issued by the NRA Chairman or by an authorised official. The administrative sanctions (pecuniary penalty and fines) specified by the ASUNE shall be imposed by the penalty decrees. Chapter eleven of the ASUNE specifies various administrative sanctions depending on the type of violation and the violator.

The ascertainment of violations, the issuing, appeal against and execution of penalty decrees shall follow the terms and the procedure established by the Act on Administrative Violations and Sanctions.

The NRA Chairman shall impose administrative enforcement measures to prevent and cease administrative violations and to prevent and eliminate the consequences of such violations.

Administrative enforcement measures shall be imposed for violation of requirements for nuclear safety and radiation protection, physical protection and emergency preparedness, which create an imminent threat of causing an accident.

The administrative enforcement measures which are imposed in these cases are:

1. termination or limitation of the permitted or licensed activity;
2. temporary suspension of the individual employment license;
3. order for carrying out of the following activities:

(a) expert evaluations, inspections, tests of the installation, facility, products, parts, systems or components thereof;

(b) alteration of established operating limits and conditions;

(c) modifications of design and structures relevant to nuclear safety, radiation protection, physical protection and emergency preparedness;

(d) supplementation or alteration of the curricula and training courses and delivery of additional training, including examination of knowledge and skills.

The administrative enforcement measures shall be imposed by an order of the NRA Chairman based on a protocol of findings issued by the inspectors of the Agency.

The order for application of enforcement measures shall establish an appropriate time limit for the execution.

Any order for application of administrative enforcement measures shall be subject to appeal before the Supreme Administrative Court according to the procedure established by the Supreme Administrative Court Act. Any appeal shall not suspend the execution, unless otherwise ruled by the court.

Any person violating the conditions of a permit or a license shall be administratively liable to a pecuniary penalty or fine to the amount specified by ASUNE. Any failure to comply with or violation of the conditions of a permit or a license may be a sufficient reason for revocation of the permit or the license. The revocation of the license or permit shall be done by a decision of NRA Chairman which specifies a time period during which the person shall be barred from applying for a new licence for the same activity.

Following the Act on Safe Use of Nuclear Energy the persons generating radioactive waste shall be obliged to meet all expenses incurred in connection with the management of radioactive waste from its generation to its disposal, including monitoring of repositories after closure and the necessary tests and improvements through the necessary expenditure for safe storage of the radioactive waste from its generation to its turning over to a legal entity possessing a license to operate radioactive waste management facility, and through contribution to Radioactive Waste Fund.

Chapter four of ASUNE specifies the main participants in the radioactive waste and spent fuel management at national level and regulates their relationship:

- The Council of Ministers shall adopt a strategy for spent fuel management and for radioactive waste management on a motion by the Minister of Energy and Energy Resources.
- The Council of Ministers shall take a decision on construction of a national repository for storage or disposal of radioactive waste;
- Spent fuel management shall be conducted by a person possessing a nuclear facility operating license;
- The Council of Ministers may declare the spent fuel to be radioactive waste;
- Radioactive waste outside the place of generation shall be managed by the State Enterprise Radioactive Waste
- Persons generating radioactive waste shall be obligated to turn over the waste to the State Enterprise Radioactive Waste within the time limits established by an regulation. They shall be responsible for the safe management of radioactive waste from its generation to its delivery to the Enterprise.
- Radioactive waste shall become state property from the moment of its turning over to the State Enterprise Radioactive Waste

Chapter Four, Section II of ASUNE establishes the State Enterprise Radioactive Waste and specifies its responsibilities, management bodies, etc. This section will enter into force in 2004.

Secondary legislation, following ASUNE, which shall establish nuclear safety and radiation protection requirements, standards and rules for radioactive waste management and spent fuel management, including siting, design, construction, commissioning, operation and decommissioning of radioactive waste management facilities and spent fuel management facilities is under development.

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

ARTICLE 20. REGULATORY BODY

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

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

In accordance to ASUNE the state regulation of the safe use of nuclear energy and ionising radiation, the safety of radioactive waste management and the safety of spent fuel management is implemented by the Chairman of the Nuclear Regulatory Agency (NRA). The Chairman is an independent specialised authority of the executive power and is vested with competencies, specified by the legislation.

The NRA Chairman shall be designated by a decision of the Council of Ministers and shall be appointed by the Prime Minister for a period of five years and may be re-appointed for one additional term of office (mandate). Two Deputy-Chairmen shall assist the Chairman in the exercising of his authorities. The two deputies shall be designated by a decision of the Council of Ministers on a motion by the NRA Chairman and shall be appointed by the Prime Minister.

Chapter Two, Section I of ASUNE specifies the authorities of NRA Chairman, the conditions for appointment and dismissal of the chairman, NRA legal statute and establishment of advisory bodies. Pursuant to ASUNE the NRA Chairman implements the international co-operation of the Republic of Bulgaria in the area of safe use of nuclear energy and ionising radiation, and in safety of radioactive waste management and spent fuel management.

By the Act on Ratification of the Joint Convention the NRA Chairman is appointed as a regulatory authority in accordance to Art.20 of the Convention and as a co-ordinator for preparation of the national reports for fulfilment of the obligations of the Republic of Bulgaria, ensuing from the Convention.

In his/her activity, the Chairman shall be assisted by an Administration organised in the form of a Nuclear Regulatory Agency. The Agency shall be a legal entity, financed by the national budget and with its headquarters in Sofia. The Agency's structure, operation and work organisation, as well as the staffing shall be determined by the Statutory Rules adopted by the Council of Ministers on a motion by the NRA Chairman. The transformation of the Committee on the Use of Atomic Energy for Peaceful Purposes into the Nuclear Regulatory Agency as a result from ASUNE (in force since July 2002) is specified by an Act of the Council of Ministers, which also approves the NRA Rules of Procedure. The NRA Statutory Rules, in force since September 2002, specifies the NRA staffing and determines the chairman as a primary administrator of the budgetary resources. The Rules of Procedure also specify the functions of the NRA administrative units.

The Act on Safe Use of Nuclear Energy establishes advisory bodies within the chairman as follows:

1. Advisory Council on Nuclear Safety;
2. Advisory Council on Radiation Protection.

The NRA Chairman shall approve the composition of the Advisory Councils by an order. The Advisory Councils shall include prominent scientists and experts in the field of nuclear energy and ionising radiation, radioactive waste management and spent fuel management. The Advisory Councils shall adopt rules of procedure and the meetings shall be presided over by the NRA Chairman or by a person authorised. The Advisory Councils shall assist the Chairman by giving expert advice on the scientific aspects of nuclear safety and radiation protection.

The NRA organisational structure is presented in Annex L-9.

The NRA structure is developed in accordance with the Act on Administration, which defines joint requirements to the structure of each administration assisting a state authority. The NRA administration is organised in a General Department and four Departments, distributed in General and Specialised Administration. The Executive Secretary exercises the administrative management of the administration.

The operation of NRA shall be financed by the national budget and by revenues from the fees collected under ASUNE.

The priority order for expenditure of Agency's financial resources shall be as follows:

1. financing of studies, analyses and expertise associated with assessment of nuclear safety and radiation protection and the financing of the regulatory activities under ASUNE;
2. development of infrastructure;
3. training and enhancement of the qualification of the staff;
4. financial bonuses to NRA personnel.

Most of the staff members are appointed pursuant to the Act on the Civil Servants, which creates possibilities for paying adequate salaries in accordance to the possessed rank and position occupied.

The financial bonuses to NRA personnel are also specified by the legislation.

The NRA organisational structure and administrative units consist of 102 staff members. The NRA list of positions includes 29 nuclear safety inspectors, 9 of them are inspectors in the area of spent fuel and radioactive waste management and physical protection. There are 19 inspectors in the area of safety assessment of documentation presented by applicants, respectively-by the licensee or holder of permit for issuance of a license or a permit for activities connected with nuclear facilities. 18 inspectors exercise regulatory control of activities with sources of ionising radiation and generated radioactive waste, 6 of them are inspectors in the area of emergency planning and preparedness. Six of the inspectors work full time at the Kozloduy NPP site. 95% of the inspectors have higher education and more than 60% of them have above 15-year experience in the nuclear power industry.

By a Decree of March 2000, the Council of Ministers grants the NRA administration Category A2, which makes it equal in rank to a ministry. This is one of the administrative measures to increase the payment and motivate the personnel and to help the attracting and maintaining of competent and experienced specialists.

The Act on Safe Use of Nuclear Energy guarantees the effective independence of the regulatory functions from other functions, connected to radioactive waste management, specifying that the Minister of Energy and Energy Resources shall implement the state policy in the field of radioactive waste management and shall exercise the authorities relating to the operation of the State Enterprise Radioactive Waste. The Minister of Energy and Energy Resources is included in the management bodies of the enterprise. A strategy for spent fuel management and for radioactive waste management shall be adopted by the Council of Ministers on a motion by the Minister of Energy and Energy Resources.

The Minister of Energy and Energy Resources is also authorised to propose to the Council of Ministers the construction of nuclear power plants, to be the chairman of the "Radioactive Waste" fund and "Decommissioning of Nuclear Facilities" fund and to exercise control over the technical status and operation of nuclear sites.

Being state authorities, the NRA Chairman and the Minister of Energy and Energy Resources co-ordinate their activities for carrying out adequate joint state policy on the radioactive waste and spent fuel management and improvement the safety of facilities.

In conclusion, a regulatory authority in the Republic of Bulgaria is established pursuant to the requirements of Art.20 of the Joint Convention.

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 licence and shall take the appropriate steps to ensure that each such licence holder meets its

responsibility.

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

According to article 14 of ASUNE radioactive waste and spent fuel management shall be performed by legal entities solely after obtaining a permit and/or a licence for the safe implementation of the relevant activity specified in this Act.

According to article 16 of ASUNE, entities performing activities on radioactive waste management and spent fuel management, are required to:

- Comply with nuclear safety and radiation protection requirements, standards and rules while performing the relevant activity;
- Perform monitoring of radiological characteristics of the site and the environment;
- Perform assessment of nuclear safety and radiation protection at the nuclear facilities and sites with sources of ionising radiation and undertake actions and implement measures for the improvement of nuclear safety and radiation protection, taking into account national and international operating experience and scientific achievements in this field;
- Employ only those individuals who meet established statutory requirements for educational level and competence for employment at nuclear facilities or with sources of ionising radiation;
- Employ only those individuals who meet the specific and statutory established health requirements;
- Provide the general public, state bodies and public organisations with objective information regarding nuclear safety and radiation protection;
- Carry out all measures and activities associated with the safe storage of the generated as a result of their activities nuclear material, radioactive substances, spent nuclear fuel, and radioactive waste until their turning over for management to an entity having an operating licence for a radioactive waste management facility;
- Take actions for prevention of incidents and accidents and for mitigation of their consequences;
- ensure sufficient financial resources for safe termination of the relevant activity;
- create such conditions during the activity that the generation of radioactive waste be as low as reasonably achievable in terms of volume and radioactivity;

- measure, record and monitor the parameters characterising nuclear material, radioactive substances and other sources of ionising radiation, and maintain systems for their accounting and control;
- ensure the physical protection of nuclear facilities, nuclear material radioactive substances and other facilities with sources of ionising radiation, which is in co-ordination with the competent authorities of the Ministry of Interior, where so provided in the law;
- provide for personnel training and retraining, as well as for continuous improvement and control of qualification;
- maintain a high level of quality in all activities carried out;
- apply systems and equipment, technologies and procedures in line with the latest development of science and technology and internationally acknowledged operating experience;
- maintain a system to control the discharges of radioactive substances and the radiological parameters at the site, in the radiation protection area and in the monitoring area;
- Maintain insurance or other financial security against nuclear damage for the whole period of nuclear facility operation pursuant to the Vienna Convention on civil liability for nuclear damage amounting to 96 million BGN.

Along with the obligations, established by the Act, the licensee, correspondingly the licence holder has specific obligations, given as conditions of the issued licence/permit for implementing the activity. NRA inspectors conduct inspections to control the licensee/licence holder implementing of obligations and when necessary impose enforcement measures. This inspecting practice and the order of applying enforcement measures are described in article 19 of the present report.

In compliance with article 21, item 2 of the Joint Convention, the Republic of Bulgaria has taken the legislative measures that the responsibility rests with the country in cases when a responsible party for the spent fuel and radioactive waste management can not be found. According to article 73 of ASUNE, any radioactive waste and spent fuel, for which the owner is unknown, shall be state property. The state bears the responsibility for its safe management. The NRA Chairman designates the licensee to which such sources shall be established and the relevant conditions.

In conclusion, The Republic of Bulgaria has taken the appropriate steps with the objective to ensure that the responsibility rests with every licensee/licence holder, in compliance with the requirements of article 21 of the Joint Convention.

ARTICLE 22. HUMAN AND FINANCIAL RESOURCES

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

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

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

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

Article 35 of ASUNE specifies as a condition that a licence for operating is issued when the applicant possesses sufficient number of qualified and competent personnel with the appropriate level of qualification and training for all activities related to the operation of facilities for SF and RAW management. The requirements for the people implementing the relevant activity are stated in the licence for operation of SF and RAW management facilities.

In compliance with the requirements of article 64 of ASUNE safety related activities, at nuclear facilities, are performed solely by professionally qualified and licensed staff. The licence is issued by NRA Chairman on the grounds of successfully passed examination before a qualified examination commission, appointed by NRA Chairman and co-ordinated with the Minister of Health. According to article 98 of ASUNE the NRA Chairman shall exercise preventive regulatory control before the licence issuance and current regulatory control over implementation of the conditions of issued licences.

The criteria and requirements for training, qualification and competence of personnel engaged in the nuclear power field, are given in Regulation № 6/1989 by CUAEPP.

Article 35 of ASUNE specifies as a condition that a licence for operating is issued to the Applicant if he possesses financial, technical and material resources for maintaining a high level of safety for the entire lifetime of the nuclear facility as well as for the safe decommissioning of the facilities for SF and RAW management. These resources must be sufficient for the licensee on the grounds of nuclear safety assessment and radiation protection to take activities and steps for their enhancement considering its own and international experience and scientific achievements. To certify that complies with the requirements under the act, the applicant is obliged to submit the necessary information. The licensee is obliged with the licence conditions to keep enough financial and material resources and on request by NRA Chairman to present information about that.

Information about human and financial resources of operators of nuclear facilities for SF and RAW management is given in Annex L - 10.

The funds “Safe Storage of radioactive waste” and “Decommissioning of nuclear facilities” are established by the Act on the Safe Use of Nuclear Energy, the legal entities and persons conducting activities resulting in the generation of radioactive waste shall make contributions to these funds. The amount of contributions, collecting, spending and control of the funds financial resources and their management were determined by the Council of Ministers in February 1999. As of 01.01.2003 pursuant to the Act on the Safe Use of Nuclear Energy are established the funds “Decommissioning of nuclear facilities” and “Radioactive waste”, which are legal successors, correspondingly to “Decommissioning of nuclear facilities” and “Safe storage of radioactive waste” funds.

The financing for implementation of appropriate institutional control and monitoring for the corresponding period following the closure of facilities for disposal of radioactive waste shall be provided by the fund “Radioactive waste”.

An updating of the regulations determining the amount of contributions, collecting, spending and control of the financial resources of the funds “Decommissioning of nuclear facilities” and “Radioactive waste” is forthcoming aiming to ensure that:

- During the NPP units operation, sufficient financial resources for the decommissioning and for the long-term RAW management (including their disposal) shall be collected in the funds;
- sufficient financial resources are provided by the contributions of organisations whose activities result in the generation of RAW, for long-term management (including their disposal);
- funds are independent, the available resources are managed in a transparent way and in a way, ensuring their profitability, according to the legislation in force.

- there is control on the expenditure, it is made solely for justified objectives and is in compliance with the funds contributions.

In conclusion, The Republic of Bulgaria has taken the appropriate steps to ensure that every licensee/licence holder possesses the necessary financial and human resources, in compliance with the requirements of article 22 of the Joint Convention.

ARTICLE 23. QUALITY ASSURANCE

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

By article 16 of ASUNE persons, performing radioactive waste and spent fuel management activities, are obliged to maintain high level quality of the performed activities. According to article 7a of Regulation No. 5 every written request for permit is accompanied apart from the necessary documents, by a quality assurance program, including verified computer programs and software products for the relevant type of activity. In accordance with this Regulation, quality assurance means systematically planned and performed activities, aiming to perform activities according to the established procedure, and its results shall satisfy all requirements, including nuclear safety and radiation protection Standards and rules.

The organisation, operating SF storage facility, develops and applies quality assurance program for the operation of facilities, according the requirements of Regulation No. 11 of CUAEPP.

NRA controls and inspects the quality assurance program application.

Quality assurance in Kozloduy NPP

A policy for establishment of joint, integrated quality assurance system, which shall combine existing systems in the structural subdivisions, is in force in Kozloduy NPP since 1993.

The Kozloduy NPP Plc has been developing and implementing Quality management system in compliance with EN ISO 9000:2000 since 2000, taking into account the recommendation of IAEA documents 50-C/SG-Q, concerning quality assurance in NPP.

Documents, ensuring the quality of SF and RAW management activities, are:
1. Quality management manual in Kozloduy NPP.
2. Quality assurance program for the operation of Units 1-4 of Kozloduy NPP plc
3. Quality assurance program for the safe operation of Units 5 and 6 of Kozloduy NPP plc
4. Quality assurance program for the commissioning of RAW treatment and storage plant of Kozloduy NPP plc
5. Quality assurance program for the operation of RAW treatment and storage plant of Kozloduy NPP plc
6. Quality assurance programs for the reception and storage of SNF from units 1-6 in SFSF.

Quality assurance program in the Nuclear research centre of the Institute for Nuclear Researches and Nuclear Energy at BAS

In 2000 in INRNE was developed and implemented a quality management system by standard BDS EN ISO 9001:1994, audited and approved by a consulting company in January 2002. Till January, 2003 have been held two internal audits aiming to maintain and improve the system, and in February, 2003 was held a preliminary external audit aiming to inspect the worthiness of the system and to determine the necessary corrective measures to pass to standard EN ISO 9000: 2000.

All these measures are related to the activities in Nuclear Research Centre, including spent fuel management.

The current activities are in compliance with the program for ensuring nuclear and radiation safety for a shut down condition of the nuclear reactor IRT-2000.

Quality assurance in RRAW - Novi han

An integrated quality and environment management system is in the process of establishment since November, 2001 according to the standards EN ISO 9000:2000 and BDS EN ISO 14001:1996, IAEA documents 50-C/SG-Q recommendations. The basic documents for quality assurance of RAW management have been developed.

1. Quality management manual
2. Quality assurance program for RAW transport
3. Quality assurance program for RAW storage
4. Quality assurance program for the radiation protection of PRRAW.
5. Quality assurance program for monitoring of PRRAW

In conclusion, The Republic of Bulgaria takes and plans the appropriate steps for establishment and implementation of quality assurance programs in compliance with the requirements of article 23 of the Joint Convention.

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.

Article 3 of ASUNE requires that exposure to ionising radiation of personnel and population shall always be kept as low as reasonably achievable.

The Regulation for Basic Standards for Radiation Protection (BSRP-2000) is based upon the international safety standards /BSS/, series № 115, IAEA issued in 1996 and Directive 96/29 of the European Union from 13.05.1996.

In BSRP-2000 defines the following dose limits for professional exposure:

- The limits of the effective dose for professional exposure shall be 100 mSv for a period of 5 consequent years or 50 mSv in any single year abiding the dose requirements for 5 consequent years;
- The limits of the annual equivalent dose for professional exposure abiding the requirements for the effective dose, are -150 mSv for eye lens, 500 mSv for the skin (this limit applies to the average dose, received from any area of 1cm^2, regardless of the area of the irradiated surface), 500 mSv for the hands, forearms, feet and ankles
- Additional requirements are introduced regarding the exposure of working women at pregnancy or breast feeding, the embryo or the foetus should be protected in such a way as any individual from the population and there shall be no probability for radioactive contamination of the mother.

In BSRP-2000 are defined the following dose limits for exposure of the population:

- Annual effective dose limit for each individual of the population shall be 1 mSv;
- Annual effective dose of up to 5 mSv can be permitted only in certain circumstances under the condition that the average effective dose for 5 consecutive years shall not exceed 1 mSv;
- Limits of the annual equivalent doses, observing the effective dose limits for an individual of the population, are the following: for the eye lens - 15 mSv, for the skin - 50 mSv (this limit shall apply to the average dose received over any area of 1cm^2, regardless of the area of the irradiated surface).

According to article 16 of ASUNE persons dealing with SF management and RAW management activities are required to comply with nuclear safety requirements, radiation protection standards and rules,. Article 122 of ASUNE specifies the licensees and permit holders obligations in case of an accident:

-take actions for mitigation and remediation of accident consequences;

- control and regulate the exposure of the persons engaged in accident mitigation and elimination;

- ensure continuous monitoring of the radioactive releases into the environment; Operational licence for RAW management and SF management facility is issued to a legal entity that:

- possesses the necessary technical resources and has established the appropriate organisation, so that personnel and population exposure doses are kept as low as reasonably achievable

- has approved emergency plans for response in case of an accident;

- has ensured compliance of the installation and the declared operating activity with the requirements, standards and rules of nuclear safety and radiation protection.

Technical specifications contain the operational limits and conditions, including limits for radioactive substances release into the environment in normal operation. Population exposure limits as a result from radioactive substances release into the environment in case of an accident are contained in the Regulation for emergency planning and preparedness for action in case of a radiation accident.

The Nuclear Regulatory Agency exercises regulatory control to ensure the implementation of the radiation protection requirements and requirements for the operation of SF management and RAW management facility.

Specialised authorities of the state sanitary control are the National Centre of Radiobiology and Radiation Protection and the divisions State radiation control and protection, at the five Hygiene and epidemiology inspections in the country.

All activities with ionising radiation sources are subject to control via control of the protection of the source and working places and radiation parameters of working place and environment. Radiation control at the nuclear power plant is implemented as permanent and periodical. Subject to this control are the radiation parameters of the working environment, personnel exposure dose, employees' health status and compliance with hygiene and radiation-protection standards.

Control on the impact of Kozloduy NPP upon the population in normal operation is aimed at assessment of population exposure dose and defining the radiation risk within the region of location of nuclear power plant (in radius of 100 кm). Population exposure is controlled by measurement of samples from land and water ecosystem and by mathematical model determining of doses on the basis of actual releases of radioactive substances in the ground atmospheric air. The total number of sampling places is 17, the control parameters are 6 (water resources, bottom sediments, atmospheric residues, soil, plants and food). Control is carried out four times a year. It started in 1970 and continues throughout the whole operational period. According to the environment monitoring, the nuclear power plant impact upon the technogenic radioactivity in the plant region is insignificant and does not allow defining the population exposure doses due to the gaseous aerosol discharges. This is the reason to use the mathematical model methods; for output data are used the actual discharges of radioactive substances into the atmospheric air, demographic, soil, meteorological and other regional characteristics. The population exposure dose is assessed as supra position of the separate sources of radioactive substances discharge (ventilation stacks) at a point with specified coordinates. This approach allows assessment of any source contribution.

According to article 148 of the Act on Environment Protection, the Ministry of Environment and Water carries out control on the environment components and factors that affect them.

Preventive control is carried out by an ecological assessment when approving plans and programs and by environment impact assessment (EIA) as the condition for the issuing of a visa for design in the development of an investment process.

Besides preventive control MEW carries out current control by inspections, observations and measurements including access to the site monitoring data, implemented by the operator. Further control is carried out by tracing the results from the performed measures, foreseen in EIA decisions as well as for performance of prescriptions issued to the controlled persons during inspections.

An Executive Environment Agency (EEA) is established within the Ministry of Environment and Water to perform management coordinating and information functions in terms of control and environment protection in the Republic of Bulgaria. The agency is a governing body of the National ecological monitoring system (NEMS) and is a national referent centre within the European environment agency.

The radiological monitoring is performed by a program, which is a part of NEMS and includes a network of observation points, relevant periodicity and a set of observed radiological features. The radioactive contamination of atmospheric air, soil surface and underground water and other sites from the environment is controlled.

The constant observation of the equivalent dose rate level within the territory of the Republic of Bulgaria is carried out by the National automated system for constant control of gamma-background. It consists of 26 local monitoring stations, covering the whole territory of the country, regional monitoring stations – in the regional inspectorate on environment and water (RIEW) Varna and Vratza and central monitoring station – at EEA, where the central data base is maintained. Information is received in real time and is transferred to the Emergency Response Centre at the Nuclear Regulatory Agency and the National response centre at the State Agency on Civil protection.

The automated system for external radiation control "Berthold" of Kozloduy NPP was integrated in it in 2000, and so the Joint national system for radiation monitoring was established. As a result were added and received data on the radiation background from 8 more control stations located in the radiation protection area of Kozloduy NPP.

Radio-metrical measurements in real-time conditions, samplings and laboratory analysis are performed by the radiation measurement laboratory at EEA and radiological control laboratories at RIEW in Burgas, Varna, Vratza, Montana, Pleven, Plovdiv and Stara Zagora. Radiological monitoring results are published in the periodical issues of EEA and are prepared in an annual report on the environment status, approved by the Council of Ministers.

Radiation factors control, carried out by operators of RAW management and SF management facility as well as its results are discussed in Annex L-11.

Measures on the completion of radiation monitoring activities have been planned and proposed by a report on the carried out geological, hydro-geological, and engineering geological researches at the site of PRRAW-Novi-han.

Metrological control is carried out for ensuring the accuracy and trustworthiness of the measurements connected with health care, public safety and the environment. Pursuant to art. 23 of ther Act on measurements, all technical means related to health care, public safety and the environment are subject to control according to a regulation. The metrological control is carried out by general department "Measures and measuring devices of the State Agency on Metrology and Technical Control. The control over the measuring devices in the fields regulated by the law includes approving the type of device, initial and subsequent inspection of the same.

In conclusion, The Republic of Bulgaria has taken the appropriate steps to ensure the radiation protection of the personnel and the population, the environment protection during operation of RAW management and SF management facilities, in compliance with article 24 of the Joint Convention.

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.

According to article16 of ASUNE persons, performing radioactive waste and spent fuel management activities are required to take actions for prevention of incidents and accidents and for mitigation of their consequences.

According to article 35 of ASUNE a licence for operating radioactive waste and spent fuel management is issued to a legal entity that has approved emergency plans for response in case of an accident.

In case of an accident, licensees and permit holders shall be obliged according to article 122 of ASUNE to:

1. immediately inform the population and the mayors of municipalities within the emergency planning areas and other competent authorities;
2. take actions for mitigation and remediation of accident consequences;
3. control and regulate the exposure of the persons engaged in accident mitigation and elimination;
4. ensure continuous monitoring of the radioactive releases into the environment;
5. participate in activities included in the National Environment Monitoring System;
6. perform any other obligations as may be established in the emergency plans and by. ASUNE.

According to article 117 of ASUNE emergency planning measures shall be established by the emergency plans in the following ways:

1. for protection of the population (off-site emergency plan), which determines the emergency planning areas and determines the actions to be taken by the competent authorities to protect the population, property and environment in case of an accident;

2. for the nuclear facility (on-site emergency plan), which determines the actions to be taken by the licensee for accident mitigation and remediation of consequences in accordance with the off-site emergency plan.

Organisation of development, maintenance and coordination of the off-site emergency plan performance is carried out by a Permanent commission for population protection in case of disasters, accidents and calamities (Permanent commission) within the Council of Ministers and the State Agency on Civil Protection within the Council of Ministers. Off-site emergency plan is adopted by a decision of the Council of Ministers and on a motion by the State agency on Civil Protection.

The off-site emergency plan development, provision of material, technical and human resources for its implementation, emergency preparedness maintenance and application of measures is financed by the national budget.

The licensee operating a nuclear facility shall submit on-site emergency plan to NRA Chairman, the State agency on Civil Protection and to the Ministry of Environment and Water six months prior to commissioning. The emergency plan shall be tested in practice prior to the nuclear facility commissioning and in the course of operation, the separate parts of the plan shall be periodically tested and evaluated.

The NRA Chairman shall approve the on-site emergency plan prior to commissioning.

Licensees and relevant permit holders shall be obligated to familiarise the personnel with the emergency plans and to conduct special training of the employees, designated to perform functions in implementing the emergency plans.

The terms and procedure for preparation of the emergency plans, the persons applying emergency plans, their obligations, measures for mitigation and remediation of the consequences, the arrangements for informing the population, as well as measures for testing emergency preparedness shall be established by a Regulation for planning and preparedness in case of a radiation accident and the Rule for organisation of activity for avoiding and mitigating the consequences in case of disasters, accidents and calamities.

The following emergency plans at national and institutional level are prepared and approved, which are related to radioactive waste management:

- **Off-site emergency plans:**

  - National basic plan (National emergency plan) for conducting of rescuing and urgent emergency – restoration works in case of disasters, accidents and calamities (in force since 2002);

  - Emergency plans of local administration and self rule, ministries and institutions (latest updating 2000 г. – 2003);

- **On-site emergency plans:**

  - Emergency plan of Kozloduy NPP, revision 3, 2000.;

  - Plan for mitigation of consequences and for population and environment protection in case of radiation accident during spent nuclear fuel transportation by the Danube river from Kozloduy NPP harbor to the harbor in Izmail, Ukraine, 2001.;

  - Emergency plan of the RAW treatment plant at Kozloduy NPP site, (revision 0, July 2001.);

  - Emergency plan of the research nuclear reactor at INRNE - BAS, December 2001.;

  - Emergency plan of PRRAW – Novi-han, January 2003.

The organisation, management, coordination and the control over the activities for avoiding, reducing and mitigation of consequences from disasters, accidents and calamities is carried out by the Council of Ministers through the Permanent commission. Interactions of the Permanent commission, ministries, institutions and local authorities, government and non-government organisations are implemented according to their competence. Issues concerning management of disasters, accidents and calamities are regulated in the Rules for organisation of activity for avoiding and mitigation of the consequences in case of disasters, accidents and calamities.

According to article 14 and article 15 of the Rules, at the ministries, institutions, commercial associations and enterprises are established permanent commissions whose obligations are: to organise and conduct preventive activity for avoiding and reducing the harmful consequences from disasters accidents and calamities to establish and maintain prepared the means for notification , collective and individual means for protection of employees and workers and to take steps for mitigation of emergency situations consequences. In compliance with the rules they are obliged to develop plans for rescuing and emergency – restoration works in case of disasters, accidents and calamities and co-ordinate them with the chairmen of the district and municipal commissions which are then approved by their managers.

Exercises and drills are planned to be conducted in compliance with the National emergency plan. Local authorities and legal entities conduct periodical emergency exercises. The Permanent commission organises and conducts national emergency exercises and drills. The Permanent commission organises:

1. a full scope emergency training every 5 years;
2. annual drills for familiarisation with the elements of the plan.

In the full scope emergency exercise participate the executive authorities, as well as local authorities and the population in the emergency planning areas or outside these areas depending on the permanent commission judgment.

The plan and scenario for conducting the exercise for action in case of a radiation accident is prepared by the State Agency on Civil Protection in cooperation with NRA and other competent organisations.

The exercise plan is approved at national level by the chairman of the Permanent commission. Training objectives, emergency plan elements, which shall be inspected, are described in the plan, as well as the participants (ministries, administrative structures, population, media etc.) and exercise observers and controllers, and the schedule for performance of major issues, subject to this exercise.

Since 1996 the country has participated in 15 national and international exercises, as follows:

- emergency exercise Kozloduy NPP (1999, 2001, 2002);
- full-scope national emergency training at Kozloduy NPP (2002 .)
- bilateral Bulgarian –Turkish exercise for response to illegal traffic of nuclear material (2002);
- international emergency exercise at NPP under the code name “INEX-2”, organised by IAEA. (1996 г. - INEX-II - Switzerland, 1997 г. - INEX-II - Finland, 1998 г. - INEX-II - Hungary, 1999 г. – INEX-II - Canada);
- international exercises of INTEX series (International Technical Exercises), organized jointly by NATO and IAEA. (2000 , 2001 and 2002);
- international emergency exercise “JINEX” (Joint International Emergency Exercise 2001 г.);
- international exercise “Axiopolis 2001” for off-site emergency at Cherna voda NPP, Romania (2001 г.);
- international exercise of IAEA for inspection of emergency notification forms “EMERCOM” for radiation accident in NPP (2001).

The Republic of Bulgaria shall continue to participate in international projects in the field of emergency planning, preparedness and response, as follows :

- IAEA project RER/9/050 on the topic “Emergency planning harmonisation in Central and Eastern Europe”
- PHARE project for installation of RODOS (Real-time on-line decision support) in The Republic of Bulgaria;
- EC programme for accession to the project for early notification and exchange of information for nuclear and radiation accident (ECURIE (European Community Urgent Radiation Information Exchange).

Till the end of 2003 the regulations for emergency planning and preparedness shall be updated aiming to unify the obligations on emergency planning, preparedness and nuclear SF and RAW management facilities, which at present are stated in different normative acts.

In conclusion, The Republic of Bulgaria has taken appropriate steps for ensuring the emergency preparedness for the operation of RAW and SF management facility, in compliance with the requirements of article 25 of the Joint Convention.

ARTICLE 26. DECOMMISSIONING

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

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

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

(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and (iv) records of information important to decommissioning are kept.

The Act on the Safe Use of Nuclear Energy establishes the following:

- A license for operation of nuclear facility is issued to a legal entity , that possesses financial, technical and material resources and the organisational structure to maintain high safety level for the whole term of operation as well as for its decommissioning.
- A nuclear facility can be decommissioned solely after issuance of decommissioning permit;
- A decommissioning permit is issued to the entity possessing, facility operational licence;
- the licensee submits to NRA chairman decommissioning plan of the nuclear plant or of separate units or other nuclear facilities at the plant site at least 3 years prior to the facility decommissioning
- the "Decommissioning of nuclear facilities" fund is established. The expenditure of the fund resources is done solely for specific purposes, including expenses on storage and radioactive waste disposal, obtained from nuclear facilities decommissioning activities. The amount of contributions, paid by the nuclear facilities operators and the order for collecting, spending and control of funds resources are specified by a decision of the Council of Ministers (see Annex L-5);
- operating organisation obligations for maintenance of sufficient number of personnel with the necessary qualification, physical protection and emergency preparedness are specified throughout the facility lifetime, including its decommissioning.

Basic issues of safety, resulting from the specifics of the decommissioning works, are settled by Regulation № 10 on safety during decommissioning of nuclear facilities, issued by CUAEPP.

The regulation defines the decommissioning of a nuclear facility as a set of administrative and technical measures and activities, permitting partial or full exemption from the control of the Regulatory Authority at the same time ensuring the personnel, population and environment safety.

According to the regulation, the basic aim of ensuring safety during decommissioning is non – exceeding the determined limits of internal and external exposure of the personnel and the limits for the content of radioactive substances in the environment as well as the protection of the future generations from the harmful effects of ionising radiation. The regulation determines the radiation protection requirements during decommissioning, including application of the principle As Low As Reasonably Achievable (ALARA).

The regulation requires for siting, designing and construction of nuclear facility to be developed an initial conception and plan, which can consider technical measures and decisions facilitating decommissioning. During the period of operation the licensee is obliged to ensure performance of the following measures:

1. ensuring the possible minimum of radioactive contamination and spreading of radioactive substances in the structures, systems and components of the nuclear facility;

2. prompt treatment, classification, storage, accounting and documentation of the generated RAW during operation (pursuant to the legislation in force);

3. carrying out of periodic analyses and calculations for the available and forecasted amounts and volumes of RAW as a result of normal operation and future decommissioning of the nuclear facilities;

4. updating and optimisation of the organisational and technical measures for RAW management.

The regulation defines limitation requirements on radioactive substances release into the environment during dismantling works and removal of nuclear facility physical barriers.

In a special section of the Regulation is required an emergency preparedness plan for protection of personnel, population and environment in case of radiation accident for all stages of decommissioning.

In compliance with Decision № 848 of the Council of Ministers of the Republic of Bulgaria dated 19 December 2002 units 1 and 2 of Kozloduy NPP were disconnected from the national grid of Bulgaria at the end of 2002.

Implementing the Energy strategy of The Republic of Bulgaria approved by the National Assembly, a decision for decommissioning shall be taken on the grounds of a complex analysis for maintenance and upgrading of safety level and management of units 1 and 2 resources in compliance with the national legislation and obligations resulting from the Convention on nuclear safety.

The undertaken organisational measures, related to decommissioning of units 1 and 2 of Kozloduy NPP are given in Annex L-12.

In conclusion, The Republic of Bulgaria has taken the appropriate steps for decommissioning of nuclear facilities, in compliance with the requirements of article 26 of the Joint Convention.

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.

The principal safety requirements for SF management are defined in the Act on the Safe Use of Nuclear Energy (ASUNE), the Act on Environment Protection (AEP), The regulation on basic standards for radiation protection - 2000 г. (BSRP-2000), Regulation № 3 for ensuring nuclear plants safety during design, construction and operation (Regulation № 3) and Regulation № 11 on safety during spent nuclear fuel storage (Regulation № 11), which defines the requirements to the independent SF management facilities, situated at NPP site.

According to section X of Regulation № 3 the possibility for reaching criticality in the spent fuel storage facility must de physically eliminated by ensuring the relevant features for the facility equipment and in the first place by geometry factors, stipulated in the constructional and design decisions. It is required to foresee reliable systems for decay heat removal and the correspondent chemical composition of the decay heat environment to avoid fuel damage, as a result of which radioactive substances could be released into the environment.

In chapter II of Regulation № 11 is defined the maximal effective factor for neutron multiplication 0,95 in normal operational mode and design accidents, which is ensured mainly by fuel assemblies location at a definite pitch of the grid. It is not allowed to use extractable, heterogeneous, absorbing elements in the constructional elements of the racks and containers. The function for subcriticality maintenance during storage, shipment and handling of SF must be ensured during external impact of natural and technogenic character.

Racks and containers, containing absorbing elements of neutrons in the composition of their constructional elements, must be designed, prepared and controlled in a way to avoid inadmissible reduction of absorbing ability during mechanical, chemical or radiation impact in normal operational conditions and design accidents.

In article 38 of Regulation № 11 is required the internal transport package to ensure at least 5% subcriticality for the postulated initiating events, including dropping from maximal height.

In Section III of Regulation № 11 are defined the requirements for decay heat removal. Technical means and organisational measures are foreseen, excluding the possibility for increasing the temperature of SF rods cladding beyond the design limits during storage and transportation of SF in normal operational conditions and design basis accidents. Redundancy of the forced SF cooling systems is required.

According to article 16 of ASUNE, for SF management the licensee is obliged to ensure such conditions that the generation of RAW must be at the lowest achievable level in terms of volume and activity. Regulation № 11 requires taking of steps to maintain SF tightness (article 45 и article 48), as well as the obligation to ensure technical means for storage, transportation and handling of untight assemblies (article 72, i.7).

With a view to consider all stages of SF management, the licensee is obliged to ensure the possibility for SF removal for transportation, processing and/or disposal at every moment of facility operation for storage of SF – article 72, i.8 of Regulation № 11.

Application of ALARA principle is regulated in article 3 of ASUNE, according to which, during SF management, the exposure of personnel and population is to be kept at the lowest possible level.

Efficient protection of personnel, population and environment is ensured by the application of the principle for in-depth protection by establishing a system of physical barriers on the way of ionising emissions distribution in the environment and of a system of technical and organisational measures for protection of barriers and preserving their efficiency. Article 5 of Regulation № 11 requires the application of this principle and specifies the levels of protection.

According to article 2 of Regulation № 11 during storage, transportation and handling of SF the exposure doses of personnel and population, received as a result of these activities, must not exceed the standards for radiation protection in force. Detailed presentation of the standards in force is given in article 24 of this report.

Chapter 6 of the Act on Environmental Protection regulates the environmental impact assessment (EIA) of investment proposals, related to SF management. For the preparation of EIA, the biological, chemical, and other hazards, which can be related to SF management, are taken into account.

Protection of life, health and living conditions of future generations is a basic principle, presented in article 3 of ASUNE. Licensees are obliged to assess safety and to take steps and measures taking into account the modern scientific achievements, national and international operational experience (article 16 of ASUNE).

Article 6 of Regulation № 11 puts the operating organisation under the obligation to plan and perform periodic and systematic safety assessment of facilities, assessment of radiation impact upon environment at justified periods of time during the design lifetime of facilities and to ensure safe operation in accordance with the operating requirements. The period of this assessment cannot exceed 10 years.

In order to avoid the imposing of too strenuous a burden upon future generations, a number of legislative and regulatory measures have been undertaken. The ASUNE stipulates that a license for operation of nuclear facilities is issued only to a person, who possesses enough financial technical, material resources and organisational structure, including facility decommissioning. The provision of enough financial resources for the safe termination of activity is the most important duty of the licensee according to article 16 of ASUNE. The necessary financial resources for decommissioning are provided by the fund "Decommissioning of nuclear facilities".

In the pursuit of providing reduction of radiation exposure at the site of Kozloduy NPP and in order to avoid the imposing of too strenuous burden upon future generations, The Republic of Bulgaria foresees the following essential measures :

- sending back the SF from Kozloduy NPP for reprocessing;
- searching for possibilities, under the auspices of IAEA, for long term storage of SF from Kozloduy NPP in regional storage facilities;
- pertaining to the enriched SF from the Nuclear Research Reactor, a solution for its sending back to Russia is being sought

In conclusion, The Republic of Bulgaria has taken the relevant steps for protection of people, population and environment, in compliance with the requirements of article 4 of the Joint Convention.

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.

At the time of entering into force of this Convention in 2001, there are existing SF management facilities in the Republic of Bulgaria, given in Annex L - 1.

In 2000 was finished the updated safety assessment, which takes into account the condition of systems and equipment following the performed measures for safety enhancement of the SFSF. In 2002 a safety analysis of SFSF was assigned, that must be completed by the end of 2003. A list of performed analysis carried out projects and planned activities, related to SFSF safety, is given in Annex L-13.

For Spent Fuel Pool-1, 2 safety analyses are in force, which are included in SAR of the relevant power unit, updated in 2000. In 2002 the safety of Spent Fuel Pool-3 and 4 was analysed within the updated SAR for units 3 and 4. For Spent Fuel Pool-5 and 6 safety analyses, included in SAR for the relevant power unit are in force for the relevant power unit, updated in 1992, in connection with the replacement of racks for SF storage of sealed type. Review of safety of Spent Fuel Pool-5 and 6 shall be carried out when the SAR of the relevant units is updated after their modernisation.

The safety assessment of the shaft repository of the nuclear research reactor IRT-2000 is planned in connection with the forthcoming reconstruction of the reactor.

List of reports of international missions and projects, related to safety of spent fuel storage facilities and radioactive waste storage facility is given in Annex L-8.

In conclusion, The Republic of Bulgaria has taken the appropriate measures to review the safety of existing facilities for SF management, in compliance with the requirements of article 5 of the Joint Convention.

ARTICLE 6. SITING OF PROPOSED FACILITIES

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

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

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

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

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

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

The choice of an appropriate site is a major element, ensuring the safety of SF management according to Regulation № 3 and Regulation № 11. The licensing mode for siting is regulated in chapter 3 of ASUNE; the licensing procedure is defined in Regulation № 5 on the issuance of permissions for the use of nuclear energy (Regulation № 5). The Act on Environmental

Protection regulates the assessment of the facility impact upon the environment, including the transboundary aspects of this assessment.

According to article 8 of Regulation № 5, the employer shall present a general description of the nuclear facility and the appropriate sites and shall submit Safety Analysis Report (SAR). In chapter III of Annex № 1 of this regulation, the scope of the necessary assessment is described, geography, demography, human activity, meteorology, hydrology and hydro geology, geology, geotechnics, seismicity.

According to article 9, par. 1 of Regulation № 5, the permit for site selection is issued provided that the assessment of safety conforms to the established requirements and is proved that the characteristics of the site, events and phenomena, which might affect the design, have been determined and in normal operating conditions and during design basis accidents, the personnel and population exposure is at a reasonably achievable low level and the established values are not exceeded.

The Act on Environment Protection (article 81) requires an obligatory environmental impact assessment (EIA) of plans, programs, investment proposals for construction, activities and technologies and their changes, enumerated in Annex № 1 of the same act. SF management facilities are included in the annex. The environmental impact assessment (EIA) is regulated in details in section III of chapter six of AEP, the procedure is described in Regulation № 4 for assessment of the impact upon environment. The existence of a positive conclusion of the assessment, given by the competent authority is a necessary provision in order to receive a visa for designing according to the Act on Territorial Structure.

The Act on Environmental Protection regulates the organising of public discussion of the assessment results together with the municipality authorities and the competent body, who issues the decision of the assessment of the EIA. Representatives of the municipal administration, of state and public organisations, of population, as well as concerned persons or legal entities, participate in this discussion. The competent authority under the AEP shall announce the decision, which is to be send in written form to the applicant and shall be published in the mass media or in another appropriate way. The ASUNE assigns to the NRA chairman to submit to the citizens, legal entities and state bodies, impartial information about the status of nuclear safety and radiation protection.

For investment construction proposals, activities and technologies within the territory of The Republic of Bulgaria, for which is expected to carry out a considerable impact upon the environment of another country/countries territory their notification is required. Article 98 of the AEP obliges the Minister of Environment and Water to:

- Notify the concerned countries at the earliest possible stage of the investment proposal, but not later than the date of notification of the population in Bulgaria;
- If there is a consent to participate in the procedure of the EIA, to submit to the concerned country a description of the investment proposal and possible information about the eventual transboudary impact upon the environment as well as information about the character of the decision, which is expected to be taken

The Republic of Bulgaria is a party to the Convention for assessment of impact upon the environment from transboundary contamination.

The Republic of Bulgaria has signed agreements for operational notification in cases of nuclear accidents and exchange of information about nuclear facilities with Greece (April) 1989 and February 1991), with Romania (May 1997) and with Turkey (July 1997). The agreements envisage information about changes in the lists of nuclear facilities at the territory of the contracting countries annually. The agreement with Romania explicitly envisages notification at the beginning of the construction of a new nuclear facility or implementation of a new nuclear activity (article1, i.3).

In conclusion, The Republic of Bulgaria has taken the appropriate steps for site selection of a SF management facility, in compliance with the requirements of article 6 of the Joint Convention.

ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES

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

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

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

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

The requirements ensuring safety during design and construction of SF management facilities are specified in Regulation № 3 and Regulation № 11. The licensing regime for design and construction is regulated in chapter 3 of ASUNE, and the procedure for licence issuance in Regulation № 5.

According to chapter 2, section I of Regulation № 11 constructions, systems and equipment, important for safety, are designed, manufactured and installed considering the possible mechanical, thermal, chemical or other impacts, radioactive substances release in premises and environment beyond the design-specified values.

In chapter 2, section IV of Regulation № 11 are specified the requirements towards the project in terms of radiation protection. Aimed at the limitation of radionuclides discharge into the environment in compliance with BSRP-2000, is provided the necessary control and filtering of air, discharged through the ventilation stacks of the facilities.

Maintenance of high quality level is the obligation of all entities, performing activities under the ASUNE (article 16). Article 24 of Regulation № 3 stipulates that construction and installation organisations shall work, observing a quality assurance program, which is presented to NRA in order to obtain a construction licence.

According to article 7 of Regulation № 11 the designs of SF management facilities shall possess a chapter on decommissioning. In chapter 2, section I of Regulation № 10 on safety during decommissioning of nuclear facilities are specified the requirements for the initial planning of decommissioning at the stage of design and construction. The permit applicants develop initial conceptions and plans for nuclear facility decommissioning. The initial conception and plan have a model content according to Annex № 1 of the regulation and should consider in detail the technical measures and resolutions facilitating the decommissioning activities.

Entities, carrying out activities on the use of nuclear energy, are obliged to apply systems and equipment, technologies and procedures, corresponding to the achievements of science and technology of internationally acknowledged operational experience (article 16, i.15 of ASUNE). In article 5 of Regulation № 11 is stipulated the application of technologies, proven in practice during design and construction.

In conclusion, The Republic of Bulgaria has taken the appropriate steps for design, and construction of SF management facility in compliance with the requirements of article 7 of the Joint Convention.

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).

Assessment of safety is the fundamental obligation of persons, implementing activities using nuclear energy (article 16 of ASUNE). According to article 6 of Regulation № 11 the design of facilities for SF management shall contain the preliminary safety analysis reports. The prepared technical design is approved by the NRA chairman, if it complies with the requirements for safety and radiation protection, specified in the normative acts (article 33 of ASUNE). According to chapter 2, section III of Regulation № 5, the organisation, applying for construction license on the basis of the technical design, submits a Safety Analysis Report (SAR) In Annex № 1 of the regulation is described the structure and scope of information in SAR.

Section IV, chapter 2 of Regulation № 5 stipulates that the organisation, applying for commissioning licence shall submit an updated SAR on the basis of the construction results, start-up and building works and complex testing.

The Act on Environmental Protection regulates the implementation of assessment of impact upon environment of plans, programs and investment construction proposals, activities and technologies or their amendments. Description of the scope, principles and procedures for EIA is given in article 6 in this section of the report.

In conclusion, The Republic of Bulgaria has taken the appropriate steps for assessment of safety of SF management facilities, in compliance with the requirements of article 8 of the Joint Convention.

ARTICLE 9. OPERATION OF FACILITIES

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

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

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

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

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

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

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

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

According to ASUNE nuclear facilities operation is carried out solely by legal entities, possessing an operational licence. The licence is issued after compliance with the provisions of the commissioning permit. In article 35 of ASUNE are described the conditions, which the licensee should meet. Together with the application for licence issuance, the applicant, shall submit to NRA documents, proving that, the facility, as it is constructed meets the design and safety requirements. In section IV, chapter 2 of Regulation № 5 are enumerated the documents, which should be submitted.

According to Regulation № 3 and Regulation № 11 the basic documents, determining the safe operation of SF management facilities, are the technical specifications, which are part of the documentation for commissioning. They contain the limits and conditions for safe operation and the general order for performance of operations, related to facility safety. The specifications are developed and re-viewed by the licensee, taking into account the national and international operational experience.

Operation, technical maintenance, monitoring, inspecting and testing of SF management facilities is carried out in compliance with the instructions, procedures and schedules, described in Regulation № 3 and Regulation № 11 and submitted to the regulatory authority along with the request for licence issuance.

The Act on the Safe Use of Nuclear Energy requires the availability of the relevant engineering and technical maintenance in all areas, related to safety, during the whole term of facility operation. The licence is issued to a legal entity, which possesses technical resources and sufficient number of qualified and competent personnel for the whole term of operation.

In article 19 of ASUNE is envisaged that the operational licence shall specify the requirements to the licensee for reporting of incidents, related to safety. The order and conditions for reporting are specified in Regulation № 2 on the order and procedure for notification of the Committee on the use of atomic energy for peaceful purposes about operational changes, events and accidents, related to nuclear and radiation safety.

Implementing the requirements of article 16 of ASUNE the licensees develop procedures for analysis of their own operational experience.

According to article 8 of Regulation № 10 during the period of operation, the licensee ensures performance of measures, facilitating the decommissioning activities.

Within the period of operation, the licensee is obliged to develop interim conception and plan for decommissioning of facility. The interim plan and conception shall be updated and submitted for co-ordination to the regulatory authority periodically, whereas the period shall not exceed 10 years. The interim conception and plan shall review, update and present in detail the activities for decommissioning planning of the nuclear facility, taking into account the aspects, described in article 9 of Regulation № 10. A model plan for decommissioning is given in Annex 1 of the Regulation.

Activities on operation of SF management facilities are subject to periodical assessment and regulatory inspections. Enforced measures shall be taken when necessary to achieve compliance with the requirements, standards and rules for nuclear safety and radiation protection.

In conclusion, The Republic of Bulgaria has taken the appropriate steps for ensuring safety during operation of SF management facilities, in compliance with the requirements of article 9 of the Joint 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 Act on the Safe Use of Nuclear Energy the Council of Ministers can declare spent fuel as radioactive waste under conditions, indicated in the act.

The National strategy for SF and RAW management, adopted in 1999, does not envisage spent fuel 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.

The general safety requirements in radioactive waste management are regulated according to the Act on the Safe Use of Nuclear Energy (ASUNE), the Act on Environmental Protection (AEP), Regulation No.7, issued by the Committee on Use of Atomic Energy for Peaceful Purposes (CUAEPP) in 1992, on collecting, storage, processing, keeping, transport and disposal of radioactive waste on the territory of the Republic of Bulgaria, Regulation No.0-35, of the Minister of Public Health and Minister of Interior from 2.08.1974, on work with radioactive substances and other sources of ionising radiation, and the Regulation on Basic Standards of radiation protection (BSRP-2000).

According to Article 16 of ASUNE persons who perform activities on management of radioactive waste are obliged to ensure nuclear safety. This includes criticality safety in the cases when the radioactive waste contains fissile material. Regulation No.7 (Chapter 6) limits the content of long lived alpha emitting radionuclides in the waste, including fissile material. Requirements on removal of decay heat are specified by Article 67 of Regulation No.0-35.

Article 16 of ASUNE requires that persons who perform activities on radioactive waste management are obliged to create such conditions that the generation of radioactive waste is as low as reasonably achievable in terms of volume and radioactivity. The Act on Environmental Protection (AEP) requires that the management of radioactive waste should ensure reducing of radioactive waste generation and the associated risk. The import of radioactive waste in the country is prohibited by the ASUNE, except upon re-import of used sealed sources manufactured in the Republic of Bulgaria and when the radioactive waste is generated as a result of the processing of materials performed as a service in favour of the Republic of Bulgaria or of a Bulgarian legal entity. Nuclear material, radioactive waste and spent fuel are transported through the territory of the country by decision of the government and after obtaining a permit issued by the regulatory body. To the mechanisms for minimisation of radioactive waste generation belongs the requirement of ASUNE for qualified personnel with competence to work at nuclear facilities. The minimisation of radioactive waste generation is financially bounded. The persons that generate radioactive waste cover all expenses for radioactive waste management starting from the generation till the disposal, including monitoring after closure of the repository. The operators of radioactive waste management facilities are implementing specific programs with measures for waste minimisation

The requirements for accounting the interdependencies among the different steps in radioactive waste management are established in Article 16 of ASUNE and chapter 2 of Regulation No.7. In this connection measures are foreseen to improve the accounting of the interdependencies along the different stages in radioactive waste management through the following activities:

1 - improvement of waste pretreatment and particularly waste sorting;

2 - improvement of separate treatment of different types of waste.

The basic standards for protection of the people from the harmful effects of ionising radiation, including operating personnel and population, exposed at normal conditions and in cases of chronic or emergency exposure are defined in BSRP-2000. The ensuring of effective protection of individuals, society and environment is reached through site selection, design and construction of multibarrier facilities, operation of the facilities according to written instructions and procedures, establishment of special-statute areas (radiation protection and surveillance areas), emergency planning and preparedness, physical protection, etc. Some measures need legal regulation in compliance with international accepted criteria and requirements. The implementation of the corresponding measures for protection of the environment is guaranteed on national level by the procedure on environmental impact assessment, established by the AEP, and the corresponding permits, issued by the competent authority according to EPA. The fulfilment of the conditions of the permits is guaranteed by the current and follow up control applied by the Ministry of Environment and Water and its regional departments.

Specific requirements, connected to the management of radioactive waste, that contain biological, chemical and other dangerous substance, are defined by Regulation No.7. The specific measures are implemented by the operators of radioactive waste management facilities in order to meet these requirements – development and implementation of waste acceptance criteria, implementation of methods and technologies for deactivation of biological substances, separation of chemical substances, which may cause undesirable chemical reactions, immobilisation of liquid waste, containing toxic chemical substances.

Protection of human life, health and living conditions of future generations is a basic principle, stipulated in Article 3 of ASUNE. Licensees are obliged to perform safety assessment at each stage of facilities' life cycle and to undertake actions and measures for improvement of nuclear safety and radiation protection, taking into account the scientific developments, national and international operating experience (Article 16 of ASUNE). These requirements need additional legal regulation. The international recommendations and good practices are taken into account in the programs, which are implemented by the operators of radioactive waste management facilities.

The avoiding of imposition of undue burdens on future generations is achieved through the established by ASUNE system for financing of radioactive waste management, through selection of suitable sites, implementation of technologies, based on scientific and technical achievements and internationally accepted operational experience, ensuring safe management of the generated waste, including the accumulated waste, implementation of safety requirements in long term aspect.

In conclusion, Republic of Bulgaria is implementing and has planned relevant measures for protection of individuals, population and environment during radioactive waste management in compliance with Article 11 of the Joint Convention

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.

According to Article 16 of ASUNE the operator of radioactive waste management facilities should perform safety assessment of the facility. Periodical safety review is performed according to the prescriptions of the Nuclear Regulatory Agency (NRA) and within the framework of the existing permits. Review of the safety of the existing facilities in the country and the corresponding measures after signing the Joint Convention is required by Council of Ministers Decision No. 539 from 9.11.1998. Results of the periodical safety review are documented in safety assessment reports.

Annexes L-6 and L-7 provide information on the scope of the safety review and the specific measures (technical and organisational) implemented by the operators of radioactive waste management facilities in order to improve the nuclear safety and radiation protection.

List of reports from international missions and projects, related to the safety of spent fuel storage facilities and radioactive waste management facilities is given in Annex L-8.

In conclusion, the Republic of Bulgaria has performed analyses and undertaken measures in compliance with Article 12 of the Joint Convention.

ARTICLE 13. SITING OF PROPOSED FACILITIES

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

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

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

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

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

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

The licensing regime for site selection is regulated in Chapter 3 of ASUNE. The existing regulation (Regulation No.5), which defines the rules and requirements for issuing license, doesn’t specify in detail the procedure for site selection for new radioactive management facilities. Separate safety requirements related to the sites are established in Regulation No.7 and Regulation No.0-35.

The Act on Environmental Protection Act (AEP) (Article 81) explicitly requires environmental impact assessment (EIA) for plans, programs and investment proposals for construction, activities and technologies or their modification. The EIA is in depth regulated in Section III of Chapter 6 of AEP. The procedure is described in Regulation No.4 on EIA. The existence of a positive conclusion from the EIA by the competent authorities is a necessary condition for obtaining a visa for designing according to the Act on Territorial Structure.

The AEP requires public discussion of the EIA results by the municipality authorities and the competent authority, which issues decision on EIA. In this discussion participate representatives from municipality administration, state and public organisations, society, individuals and legal entities concerned. The competent authority gives its decision in written form to the contractor. Notice of the decision is given through the mass media or in another appropriate manner.

ASUNE obliges the Chairman of NRA to provide individuals, legal entities and state bodies with objective information about nuclear safety and radiation protection.

Other country or countries are informed about investment proposals for construction, other activities and technologies on Bulgarian territory, which might have significant impact on the environment of their territory. Article 98 of AEP obliged the Minister for Environment and Waters with the following:

- to notify the affected countries at possibly the earliest stage of investment proposal but not later than the date of notification of the population of Bulgaria;
- in case of consent for participation in EIA procedure – to provide the affected country with a description of investment proposal and available information about possible transbounary environmental impact, as well as information about the decision, which is presumed to be taken.

According to the provisions of the ASUNE it is envisaged to specify by a regulation by the Council of Ministers, the safety requirements for radioactive waste management, including site selection. The deadline for entry into force of this regulation is two years after the entry into force of the ASUNE.

In conclusion, the Republic of Bulgaria is implementing and has planned relevant measures to ensure proper site selection of radioactive waste management facilities in compliance with Article 13 of the Joint 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.

The Act on the Safe Use of Nuclear Energy requires the application of systems and equipment, technologies and written procedures, corresponding to scientific and technical achievements and to internationally accepted operational experience. Some requirements, connected to designing and construction of radioactive waste management facilities are specified in Regulation No.7 and Regulation No.0-35. Their application could not completely ensure the modern safety level.

According to the provisions of the ASUNE it is envisaged to specify by a regulation by the Council of Ministers the safety requirements for radioactive waste management, including the requirements for designing and construction of radioactive waste management facilities. The deadline for entry into force of this regulation is two years after the entry into force of the ASUNE.

In conclusion, the Republic of Bulgaria has planned relevant measures to ensure proper design and construction of radioactive waste management facilities in compliance with Article 14 of the Joint Convention

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).

According to ASUNE (Article 16, item 3) persons, which perform activities in the field of nuclear energy, are obliged to perform safety assessments. Regulation No.7 doesn't completely specify the issues related to safety assessment of radioactive waste management facilities in compliance with requirements of Article 15 of the Joint Convention.

The Act on Environmental Protection regulates environmental impact assessment (EIA) of plans, programs and investment proposals for construction, other activities and technologies or their modifications. Description of the scope, principles and procedures for EIA is given in Article 6, Section G of this report.

According to the provisions of the ASUNE it is envisaged to specify by a regulation by the Council of Ministers the safety requirements for radioactive waste management, including the requirements on safety assessment. The deadline for entry into force of this regulation is two years after the entry into force of the ASUNE.

In conclusion, the Republic of Bulgaria has planned relevant measures for safety assessment of radioactive waste management facilities in compliance with Article 15 of the Joint Convention.

ARTICLE 16. OPERATION OF FACILITIES

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

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

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

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity

of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

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

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

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

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

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

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

According to ASUNE radioactive waste management facilities are operated solely by legal entities, which posses license for operation. License is issued only if the conditions of the permit for commissioning are fulfilled. Article 35 of ASUNE establishes conditions for license application. The applicant should submit to the NRA documentation that proves that the facility is constructed according to the design and meets the safety requirements.

Limits and conditions for safe operation of radioactive waste management facilities are part of license application together with the application for license. Performance of changes leading to modification of the limits and conditions for operation are subject to a permit.

Operation, technical maintenance, monitoring, inspection and testing of radioactive waste management facilities are performed by the operator of the facility according to written instructions, procedures and schedules, which are submitted to the regulatory body along with the license application.

ASUNE requires existence of adequate engineering and technical maintenance in all safety related issues guaranteed for the entire operational life time of the facility. License is issued to a legal entity, which possesses sufficient technical resources, qualified personnel with competence to work at nuclear facilities guaranteed for the entire operational life time of the facility.

Article 19 of ASUNE envisages that the operational license specifies the requirements for reporting safety related accidents. The order and procedures for notification of the Committee on the Use of Atomic Energy for Peaceful Purposes about operational changes, events and accidents, related to nuclear and radiological safety are settled in Regulation No.2

In compliance with Article 16 of ASUNE the licensees develop procedures for analysis of their own operational experience.

According to ASUNE the licensee is obliged to prepare decommissioning plans for radioactive waste management facility, respectively plans for closure of disposal facility. The plans are updated and co-ordinated by the regulatory body during a period not longer than 10 years.

The legislative measures are in compliance with the Joint Convention. For the application of the ASUNE it is envisaged, within two years after the entry into force of act, to elaborate a regulation, which establishes the safety requirements for radioactive waste management, including the requirements for operation of radioactive waste management facilities.

The operation of radioactive waste management facilities is subject of regular assessments and inspections by the regulator. When necessary enforcement measures are imposed in order to meet the requirements, standards and rules for nuclear safety and radiation protection.

In conclusion, the Republic of Bulgaria is implementing the relevant measures to ensure the safe operation of radioactive waste management facilities in compliance with Article 16 of the Joint Convention.

ARTICLE 17. INSTITUTIONAL MEASURES AFTER CLOSURE

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

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

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

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

The existing Regulation No.7 does not provide requirements for institutional control after closure of radioactive waste disposal facilities.

According to the provisions of the ASUNE it is envisaged to specify by a regulation by the Council of Ministers, the safety requirements for radioactive waste management, including the requirements for post closure institutional control. The deadline for entry into force of this regulation is two years after the entry into force of the ASUNE.

In conclusion, the Republic of Bulgaria has planned relevant measures for establishment of post closure institutional control upon radioactive waste disposal facilities in compliance with Article 17 of the Joint Convention.

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.

The export and shipment of nuclear material and particularly of SF is subject to the licensing regime. The requirements for issuance of permission for export and shipment of SF are defined in article 40 and article 41 of ASUNE, and in article 55 and article 56 of Regulation № 5 of CUAEPP from 1988 on the issue of licences on the use of atomic energy.

The Republic of Bulgaria has solely the practice of consignor of spent fuel.

With the agreement between the Government of the Republic of Bulgaria and the Government of the Russian Federation for cooperation in the field of atomic energy dated 19 May 1995 the Russian Federation assumed the obligation to deliver fuel and to accept the spent fuel from Kozloduy NPP.

The agreement between the Government of the Republic of Moldova, The Government of the the Republic of Bulgaria, the Government of the Russian Federation and the Council of Ministers of Ukraine for cooperation during the shipment of nuclear material between the Republic of Bulgaria and the Russian Federation through the territory of the Republic of Moldova and the territory of Ukraine dated 28 November 1997 settles all fundamental issues, related to transboundary shipment of nuclear materials. The agreement was signed by all contracting parties. The Council of Ministers of the Republic of Moldova adopted a draft act on the ratification of the Agreement. The ratification of the Agreement is forthcoming in the spring-summer session of the Parliament of the Republic of Moldova. The competent authorities on the following issues have been designated:

- the implementation of the Agreement conditions and settling of arguments;
- regulation of nuclear safety and radiation protection surveillance;
- physical protection and shipment.

Spent fuel shipment is carried out via railway and water route through the territory of the Republic of Bulgaria, the Republic of Moldova the Russian Federation and Ukraine. A mandatory provision for carrying out the shipment is the signed contract between the legal entities of the Republic of Bulgaria and the Russian Federation. Moldova and Ukraine provide the transit shipment through their territories. The competent authorities of the countries inform in advance each other in written form about the planned shipment of special loads not later than 20 days from the beginning of the shipment.

For the implementation of spent fuel transboundary shipment, the country of Bulgaria, which is a consignor within the meaning of the Joint Convention, undertakes the following measures:

- a commercial contract is signed between the relevant Bulgarian and Russian legal entities, whereof the requirements and obligations of both parties are agreed as well as: the term for shipment implementation; the quantity of spent fuel, which shall be transported; the international documents, which shall be complied with during the shipment; the consignor and consignee obligations for notification of IAEA about delivery and reception of spent fuel; the countries' securities etc.;
- requires the relevant documents, via which the consignee guarantees that:
  - good working order, completeness and full correspondence of the transport package with the requirements for packages type B(U) for the transportation of fission materials in compliance with IAEA Rules;
  - good working order of the specially equipped railroad transport cars;
- agrees with the competent Romanian authorities the spent fuel shipment along the Danube river.

In the commercial contracts, it is specified that if the transboundary shipment is not or can not be carried out, because of occurrence of force majeure circumstances with the duration of more than 6 months, the consignor and consignee agree on further activities

In conclusion, the practice of the Republic of Bulgaria with relation of transboundary spent fuel shipment complies with the requirements of article 27 of the Joint Convention.

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 reentry 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.

According to ASUNE the sources of ionising radiation (SIR) may be used by physical persons and legal entities only after obtaining a permit and/or licence for carrying out the respective activities. Subject of permit issuing are the following activities with SIR:

- use of SIR for commercial, medical and scientific purposes or for performance of control functions;
- SIR production;
- work with SIR for technical maintenance, assembly, dismantling, measurements etc. and other services for legal entities or physical persons which use or produce SIR;

- temporary storage;
- transit transport;
- import, export.

Licences and permits for activities with SIR are issued only in the case that such activities are substantiated and are in compliance with the Regulation on Basic Standards for Radiation Protection 2000 as well as with the implementation of the principle for optimisation of radiation protection measures. Licences for use of SIR in medicine are issued after official co-ordination with the Minister of Health.

The issued permits or licences for activities with sealed sources contain data for radiological characteristics and identification numbers of the sources.

Upon business transaction with SIR the Licensee is obliged within 7 days from the transaction to notify the Chairman of NRA about the type of the concluded transaction, to specify the SIR and to provide information about the counterpart of the transaction.

As far as recycling may be considered as a process of SIR production, it may be carried out in accordance with the provisions of ASUNE requiring licensing of SIR production.

Sealed sources, the further use of which is not planned and which are controlled by the regulatory body as RAW (including sources with expired period of operation according to their certificates) are a subject of permit issue as RAW.

Article 17, item 4 of the ASUNE does not prohibit the re-import of used sealed SIR which were produced in Republic of Bulgaria.

In conclusion, the Republic of Bulgaria has undertaken the respective measures for implementation of activities with used sealed sources pursuant to the requirements of Article 28 of the Joint Convention.

Section K. Planned Activities to Improve Safety

Following the adoption of ASUNE and its successive entry into force there ensue the following future tasks:

- change in the national infrastructure for RAW management during 2004 as well as establishing the management structure and organisation of the operation of the State Enterprise “RAW”;
- updating the National Strategy for Safe Management of SF and RAW until the end of 2003;
- developing of new legislation which determines the requirements, norms and rules for nuclear safety and radiation protection during performance of activities on management of SF and RAW, including site choice, design, construction, commissioning, operation and decommissioning of facilities for management of SF and RAW until July 2004.

For safety enhancement of SF Storage Facility and ensuring safe storage of SF from Units I and II of Kozloduy NPP after their final decommissioning, the following is planned:

- implementation of a long term program for modernisation of SF Storage Facility;

- construction of intermediate "dry" storage facility for storage of SF on the premises of Kozloduy NPP;

The planned activities related to safe management of RAW ensue from:

- the obligation of the State for RAW management after it is turned over by physical persons or legal entities which have generated it;
- necessity of additional treatment and storage of RAW which will be generated upon decommissioning of Units I and II of Kozloduy NPP;
- lack of facilities for additional treatment of low and intermediate RAW, and high level sealed sources in Permanent Repository for RAW – Novi Han;
- lack of facilities for disposal of conditioned sealed sources that do not conform to the criteria for disposal in near surface repositories.

The following activities are foreseen for solution of these problems:

- choice of a site for National facility for RAW disposal until the end of 2008;
- obtaining a licence for operation of the complex for recycling, conditioning and storage of RAW in Kozloduy NPP until the end of 2003;
- implementation of the program for reconstruction and modernisation of Permanent Repository for RAW – Novi Han until the end of 2007;
- investigation of site Gabra for increasing the capacity of the Permanent Repository for RAW – Novi Han.

In order to ensure a more effective organisation of RAW management in Republic of Bulgaria, the ASUNE stipulates the creation of State Enterprise "RAW". The main functions of SE "RAW" are:

- centralised management of RAW;
- construction, rehabilitation, reconstruction, decommissioning and institutional control of facilities for RAW management;
- transport of the turned over RAW, leaving the site of the respective nuclear facility;
- creation and support of an information system and database for RAW and facilities for RAW management.

Section L. Annexes

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Annex L-2
Spent Fuel Inventory

Annex L-3
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Annex L-1

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

OPERATOR	FACILITY	LOCATION
NPP KOZLODUY	Spent fuel storage facility (SFSF)	3,5 km southeast of the town of Kozloduy, NPP site
	Spent Fuel Assemblies Pool 1 (SFAP-1)	Adjacent to unit 1reactor (WWER-440)
	Spent Fuel Assemblies Pool 2 (SFAP -2)	Adjacent to unit 2 reactor (WWER-440)
	Spent Fuel Assemblies Pool 3 (SFAP -3)	Adjacent to unit 3 reactor (WWER-440)
	Spent Fuel Assemblies Pool 4 (SFAP -4)	Adjacent to unit 4 reactor (WWER-440)
	Spent Fuel Assemblies Pool 5 (SFAP -5)	Adjacent to unit 5 reactor (WWER-440)
	Spent Fuel Assemblies Pool 6 (SFAP -6)	Adjacent to unit 6 reactor (WWER-440)
INRNE	Shaft repository	Sofia, INRNE site, adjacent to IRT-2000

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 sub-criticality, decay 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 storage pools. The storage is a “wet” type; the spent fuel is stored in pools under water. The storage has four pools for spent fuel storing. The spent fuel storage fuel assemblies are stored in transport baskets. The design spent fuel storage capacity is 168 baskets.

The sub-criticality is ensured by the basket construction (spent fuel baskets’ placement pitch and basket material) and spent fuel baskets’ placement step in the pool. This allows the spent fuel pool to be filled in with demineralized water without agents (boric acid, etc.), which significantly facilitates the operation of SFS.

The decay heat removal is provided by:

- Heat exchangers, cooled with service water;
- Pool Water evaporation;
- Ventilation of the above water capacity;
- 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 materials and the construction fuel assemblies' materials; 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 decay 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 pools' 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 pool 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 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 sub-criticality 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 sub-criticality does not take into account fuel burn-up;

- The shipment of the fuel assemblies from the spent fuel pools (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, in the way they have been placed 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 pools, 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.

For the analysis of the possible period for continuous safe storage under water of the spent fuel assemblies have been conducted “accelerated corrosion testing” upon a specifically developed method, allowing modeling of the impact of the aggressive (water) environment for storage period of 30 years. The complex destructive and non-destructive tests of the fuel rods and other construction elements of a typical assembly with spent fuel from WWER-440 after continuous storage under water; tests with artificial hydrogen saturation and the defining of metal mechanical features of the cladding of the fuel rods; the accelerated corrosion tests and the results’ analysis from other tests, confirmed the satisfactory status of the covers after 30 years of storage in water, under the condition, that the established water chemistry regime is complied with.

Assessment of the constructive materials status of the pool covers and the transportation baskets for storage has been conducted. Their integrity is also intact. Their corrosion stability is confirmed for a period of 30 years of SFS operation.

I.2 Spent Fuel Assemblies Pool -1, 2, 3, 4

SFAP -1, 2, 3, 4 are designed for spent fuel storage after it is extracted from the reactor. They are placed adjacent to the corresponding WWER-440 reactor. They provide sub-criticality spent fuel decay heat removal and biological protection.

The spent fuel is stored at racks. The capacity of SFP -1, 2, 3, 4 is relevantly 704, 727, 728 and 726 assemblies. The sub-criticality is provided by the assemblies' location pitch in the shelves, even when SFP is filled with demineralized water.

The spent fuel decay heat removal is ensured by the heat loss and compulsory cooling through heat exchangers with service water.

I.3 Spent Fuel Assemblies Pool -5 and 6

SFAP -5 and 6 are designed for spent fuel storage after it is extracted from the reactor. They are situated adjacent to the corresponding reactor WWER-1000. They ensure sub-criticality, spent fuel decay heat removal and biological protection.

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

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

The spent fuel decay heat removal is provided by the heat loss and compulsory cooling through heat exchangers with service water.

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

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 around it 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 decay 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. If a situation occurs off working hours, a signal is transferred to the post providing physical protection of the site, who informs the emergency response group in order to take the necessary steps.

The fuel assemblies handling is carried out by special tools and equipment.

SPENT FUEL INVENTORY

I. NPP Kozloduy

The stored spent fuel at Kozloduy NPP site, collected in SFP and SFSF, at 01.01.2003 consists of 996.7 tones heavy metal /HM/. This amount is distributed into 5146 spent fuel assemblies from WWER – 440 and 890 spent fuel assemblies from WWER – 1000, or totally 6036 spent fuel assemblies.

Reactor type	Assembly type	Initial enrichment at ^{235}U [%]	SFS		TOTAL	
			Number of Assemblies	Heavy metal mass [kg]	**Number of Assemblies**	**Heavy metal mass [kg]**
WWER-440	116	1.6	2	237	**3764**	**432782**
WWER -440	124	2.4	87	10160		
WWER -440	136	3.6	3139	362383		
WWER -440	216	1.6	7	782		
WWER -440	224	2.4	471	52794		
WWER -440	236	3.6	58	6426		
WWER -1000	А	2.0	85	36203	**168**	**71217**
WWER -1000	В	3.0	33	13940		
WWER -1000	Г	3.3	45	18970		
WWER -1000	ГВ	3.3+3.0	5	2104		
WWER -1000	ЕД	4.4+3.6	0	0		
WWER -1000	Е	4.4	0	0		
TOTAL					**3932**	**503999**

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	1	118	0	0	6	708	0	0	**7**	**826**
WWER - 440	124	2.4	5	583	7	819	5	583	7	811	**24**	**2796**
WWER - 440	136	3.6	278	32173	311	36022	327	37769	276	31907	**1192**	**137871**
WWER - 440	216	1.6	2	226	0	0	0	0	1	112	**3**	**338**
WWER - 440	224	2.4	39	4363	27	3018	2	221	14	1560	**82**	**9126**
WWER - 440	236	3.6	0	0	12	1324	36	4008	26	2871	**74**	**8203**
TOTAL			**325**	**37463**	**357**	**41183**	**376**	**43289**	**324**	**37261**	**1382**	**159196**

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	A	2.0	9	3835	6	2550	**15**	**6385**
WWER -1000	B	3.0	3	1263	10	4216	**13**	**5479**
WWER -1000	Г	3.3	256	107249	275	115655	**531**	**222904**
WWER -1000	ГВ	3.3+3.0	25	10497	24	10093	**49**	**20590**
WWER -1000	ЕД	4.4+3.6	62	23807	3	1176	**65**	**24983**
WWER -1000	Е	4.4	47	18041	2	779	**49**	**18820**
TOTAL			**402**	**164692**	**320**	**134469**	**722**	**299161**

TOTAL FOR KOZLODUY NPP

Reactor type	Number of Assemblies	Heavy metal mass [kg]	Assessed activity [Bq]
WWER -440	**5 146**	**591 978**	**9×10^{18}**
WWER -1000	**890**	**370 378**	**7×10^{18}**
TOTAL	**6 036**	**962 356**	**16×10^{18}**

Description of spent fuel assemblies construction

1. Fuel assembly for WWER-440 reactor.

1.1 Fuel assembly (FA)

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

The head and tail have dimensions 144 mm. The total length of the FA is 3217 mm. The fuel assembly consist of 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 Regulating and shim fuel assembly (АРК)

It does not differ from the FA in general.
The differences are as follows:

- The upper rod is 10 cm shorter, as a result of which the content of the heavy metal is 115 kg ;
- in the head there is a bayonet clutch with a locking mechanism;
- there is a mechanism in the bottom nozzle, which is pulled on the damper in the casing pipe at the bottom of the shaft and softens the shock.

The dimension of the top and bottom nozzle 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.

The fuel assembly is a non-dismountable construction and consists of a bundle of 312 fuel rods, distancing bars, support grid, channel (pipes and nozzle), shock absorber, top and bottom nozzles.

The assembly form is hexagonal with dimension 234 mm. The total length of the FA is 4570 mm. The fuel assembly consists of approximately 430 kg heavy metal.

The fuel assemblies are produced with enrichment of 1.6%, 2.0%, 3.0%, 3.3%, 3.3+3%, 3.6%, 4.4% and 4.4+3.6% and respectively are labeled with code Н, А, В, Г, ГВ, Д, Е and ЕД.

II. Shaft repository in IRT-2000

General features of the stored SF

Fuel type	Number of Assemblies	Number of fuel rod	Evaluated activity [Bq]	Residual heat release [W]	Mass $^{\Sigma}U$ [g]	Mass ^{235}U [g]	Assemblies' mass [kg]
EK-10	58	908	1.126×10^{14}	55.44	69328.70	5445.16	195.330
S-36	16	240	0.136×10^{14}	23.67	6041.95	2099.20	45.753
Total	**74**	**1148**	**1.262×10^{14}**	**79.11**	**75370.65**	**7544.36**	**241.083**

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 conducted 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.

Annex L-3

LIST OF FACILITIES FOR MANAGEMENT OF RAW, THEIR LOCATION, BASIC FUNCTION AND MAIN CHARACTERISTICS

1. Facilities for management of radioactive waste at Kozloduy NPP site

1.1. List of facilities

1.1.1. Facilities for temporary storage of radioactive waste in Special Building-1;
1.1.2. Facilities for temporary storage of radioactive waste in Special Building-2;
1.1.3. Facilities for temporary storage of radioactive waste in Special Building-3;
1.1.4. Facility for temporary storage of radioactive waste in Reactor Hall-1;
1.1.5. Facility for temporary storage of radioactive waste in Reactor Hall-2;
1.1.6. Storage facility trench type for temporary storage of solid radioactive waste;
1.1.7. Storage facility for temporary storage of treated solid waste;
1.1.8. Site for temporary storage of solid radioactive waste in reinforced concrete containers;
1.1.9. Site for temporary storage of solid radioactive waste in large containers;
1.1.10. Facility for treatment and conditioning of radioactive waste;
1.1.11. Storage facility for conditioned radioactive waste.

1.2. General Site Description

1.2.1. Location and hydro geological features

The site of Kozloduy NPP is located 3,5 km South-East from Kozloduy and 3 km from the Romanian border – the Danube river.

From the North the site is restricted by the lowlands of Danube River (absolute elevation 20 m altitude), and from the South – by the slope of water shade plateau (absolute elevation 90 m altitude). The site is non-overflow one, with absolute elevation +35 m. The relief within the zone is a hilly plain with 100-200 m altitude. The Danube bank in the Oriahovo region and Western from Kozloduy is higher and reaches 100-110 m, and the lowest place alongside the river is Kozloduy lowland of 25-30 m altitude.

Geologically the site is composed of Pliocene and quartile deposits. The upper layer with 14-15 m thickness is made of loess and loam and the surface layer of about 7 m thickness is a settling loess and at 18-20 m depth start the Pliocene deposits (marl dense clays and sands). In about 35 m depth there are sand layer of about 10 m thickness. The total thickness of the Pliocene deposits is about 100 m.

The underground waters are connected with alluvial gravel sand deposits and Pliocene sands as well. The level of underground waters is at absolute elevation of +29.0 m and their movement is directed to Southwest and Southeast. The underground waters are not aggressive towards the concrete.

1.2.2. Seismic features

The site region is located entirely on the Mizia platform. The determined maximum design basic earthquake is (SL2) of 8 degree and design basic earthquake of (SL1) of 7 degree of MSK-64 scale. When the earthquake is over no residual deformations of the soil and other secondary phenomena are expected.

1.2.3. Meteorological data

The climate is moderate-continental one with cold winter and hot summer and it covers the entire climate region of the Danube plain. The openness of the zone from the North and Northeast favours the inrush of cold air masses especially in the winter. The measured maximum temperature is +43.2^{o}C (August). The measured minimum temperature is –26.6^{o}C (January). The average air temperature is 11.5^{o}C. The strongest winds are monitored during the springtime – up to 25 m/s.

1.2.4 Demographic data

The density of the population is uneven. The most densely populated regions are the ones around Oriahovo (100-120 inhabitant/km^2), Kozloduy (80-100 inhabitant/km^2) and Mizia (20-30 inhabitant/km^2).

1.3. Main purpose and important features of the radioactive management facilities

1.3.1. Facilities for temporary storage of radioactive waste in Special Building-1

The facilities are designed for temporary storage of solid radioactive waste categories I and II, low and intermediate level liquid concentrates, spent sorbents from the operation of nuclear power reactors. They are located in a building of reinforced structure, a detached part of the Special Building -1, servicing power units 1 and 2.

The storage facilities for solid radioactive waste are of vault type with upper hatch, they are seven with different volume (from 80 m^3 up to 230 m^3) and total effective volume of 1010 m^3. Work conditions – room temperature, atmospheric pressure.

The liquid radioactive concentrates are stored in stainless steel tanks and each of them is located in a separate room lined with metal casing. The tanks are five and each of them has 10 m diameter, 7 m height and effective volume of 470 m^3. They are equipped with level control system. Operation conditions – temperature up to 100^{o}C, atmospheric pressure. The transportation of the radioactive liquids is made by blow case. The suction ventilation system of the rooms of the tanks provides gas clean up as well.

The spent high active sorbents are stored in stainless steel tanks and each of them is located in a separate room, lined with metal lining. There are two tanks of 9,0 m diameter and 6,5 m height and effective volume of 350 m^3. They are equipped with level control system. Operation conditions – temperature up to 100^{o}C, atmospheric pressure. The hydro transportation of the radioactive media is made by blow case. The suction ventilation system of the rooms of the tanks provides gas clean up as well.

The storage facilities for low active spent sorbents are two. They are lined with metal lining of 5,0x4,6x8,2 m and effective volume of 188 m^3. Operation conditions – room temperature, atmospheric pressure. They are equipped with leakage control system. The suction ventilation system of the rooms of the tanks provides gas clean up as well.

1.3.2. Facilities for temporary storage of radioactive waste in Special Building-2

The facilities are designed for temporary storage of solid radioactive waste category I and II, low and intermediate level liquid concentrates, spent sorbents from the operation of nuclear reactors. They are located in a building with reinforced structure, detached part of Special Building -2, that services Units 3 and 4.

The features of the storage facilities are the same as in Special Building -1.

1.3.3. Facilities for temporary storage of radioactive waste in Special Building-3

The facilities are designed for temporary storage of solid radioactive waste category I and category II, solid radioactive waste category III, low and level liquid concentrates, spent sorbents from operation of nuclear reactors. They are located in the building with reinforced structure that is a detached part of Special Building -3, that services Units 5 and 6.

The storage facilities for solid waste category I and II are of vault type with upper hatch. There are eighteen of in operation with different volume (from 78 m^3 up to 189 m^3) and total effective volume of 2486 m^3. The operation conditions – room temperature, atmospheric pressure. They are equipped with systems for automatic fire alarm and fire extinguishing.

The storage facilities for solid waste category III are of vault type with upper cylindrical hatch, monolithic reinforced structure that also provides the necessary biological protection. Total effective volume is 213 m^3. Operation conditions – room temperature, atmospheric pressure.

The liquid radioactive concentrates are stored in stainless steel tanks and each of them is located in a separate room lined with metal lining. There are seven tanks with total effective volume of 3600 m^3. Three of them are of 6.4 m diameter, 6.4 m height and effective volume of 200 m^3, the other four – with 10 m diameter, 10 m height and effective volume of 750 m^3. They are equipped with level control system. Operation conditions– temperature up to 100^oC, atmospheric pressure. The suction ventilation system of the premises of the tanks provides gas clean up as well.

The spent sorbents are stored in stainless steel tanks and each of them is located in a separate room lined with metal lining. There are two tanks of 4.5 m diameter, 6.3 m height and effective volume of 100 m^3. They are equipped with level and temperature control systems as well as systems for hydro transportation of radioactive media and fire extinguishing. The operation conditions – temperature up to 40^oC, atmospheric pressure. The suction ventilation system of the premises of the tanks provides gas clean up as well.

1.3.4. Facility for temporary storage of radioactive waste in Reactor Central Hall-1

The facility is designed for temporary storage of solid radioactive waste category III from operation of the nuclear reactors. It is located in the central (reactor) hall in the Units 1 and 2.

The storage facility is a monolithic reinforced structure with 400 steel tubes embedded. The tubes have 0.18 m diameter and 8 m height each and they are covered with upper hatch. The general effective volume is 81.6 m^3. Operation conditions– room temperature, atmospheric pressure.

1.3.5. Facility for temporary storage of radioactive waste in Reactor Central Hall-2

The facility is designed for temporary storage of solid radioactive waste category III from operation of the nuclear reactors. It is located in the central (reactor) hall in Units 3 and 4.

The features of the storage facilities are the same as for Reactor Central Hall-1.

1.3.6. Storage facility trench type for temporary storage of solid radioactive waste

The facility is designed for temporary storage of solid radioactive waste category I and II from all nuclear facilities on the site of Kozloduy NPP.

The storage facility is near-surface reinforced structure vault type. It is split in 40 cages with upper hatch and each of them has dimensions of 2.7x5.9x6.0 m and 96.5 m^3 volume. Operation conditions –ambient temperature, atmospheric pressure.

1.3.7. Storage facility for temporary storage of processed solid waste.

The storage facility is designed for temporary storage of processed solid waste category I and II from all nuclear facilities on the site of Kozloduy NPP and represents a building of reinforced concrete panel structure and acceptance transportation corridor. The treated solid waste are stored in metal pallets arranged in three rows in height. The effective volume of the storage facility is 1130 m^3. Operation conditions – room temperature, atmospheric pressure.

1.3.8. Site for temporary storage of solid radioactive waste in reinforced concrete containers.

On this site are placed for temporary storage processed solid radioactive waste categories I and II packed in reinforced concrete containers. The site serves all nuclear facilities of Kozloduy NPP. The storage capacity is 130 reinforced containers.

The reinforced concrete container is designed for transportation and storage of solid waste category I and II. It has outside dimensions of 1.95x1.95x1.95 m and effective volume of 5 m^3. The walls provide biological shielding - the equivalent dose rate of gamma radiation does not exceed 2 mSv/h at any point of the surface and 0.1 mSv/h at a distance of 1 m.

1.3.9. Site for temporary storage of solid radioactive waste in large tonnage containers.

On this site are placed for temporary storage packed solid low level radioactive waste category I. The site serves all nuclear facilities of Kozloduy NPP. The storage capacity is 14 large containers.

The large container with side door has outside dimensions of 5.8x2.2x2.4 m and effective volume of 30 m^3. Operation conditions – ambient temperature, atmospheric pressure.

1.3.10. Facility for treatment and conditioning of radioactive waste

This is a separate facility for pre-treatment, treatment and conditioning of radioactive waste generated at Kozloduy NPP.

There are two technological lines in facility:

The line “solid radioactive waste” is designed for sorting and compaction of solid radioactive waste in order to reduce the volume and to prepare them for further conditioning. The treatment includes compaction of solid waste in 200 L drums and supercompaction of the drums.

The line “liquid radioactive waste” is designed for treatment and conditioning of liquid waste, including packing in containers. The equipment is designed and supplied by Westinghouse company.

The technology for conditioning of both solid and liquid waste is based on cementation.

Differential approach is applied for conditioning of solid waste categories I and II depending of their radiological characteristics:

- conditioning inside the reinforced concrete container of the supercompacted drums with solid waste together with cemented liquid waste;

- backfilling of the reinforced concrete container with supercompacted drums with solid waste with cement;

- packaging of supercompacted drums with solid waste in reinforced concrete container without backfilling.

The reinforced concrete container is licensed by the Regulatory body as a package for transportation and storage of conditioned waste.

The conditioned waste is temporary stored on the site of Kozloduy NPP and are subject to further disposal without any additional processing.

1.3.11. Storage facility for conditioned radioactive waste.

The storage facility is designed for storage (prior to disposal) of the conditioned waste from Kozloduy NPP. It is a surface concrete facility with adequate engineering barriers to protect the operating personnel and the environment from the ionizing radiation. It has been constructed close to the facility for processing RAW.

The capacity is 1920 reinforced concrete containers with conditioned waste (960 containers in two fields, 4 stacks one over the other). The transportation operations in the storage facility are made by two overhead cranes of 25 t lifting capacity each (one per each field), equipped with holding devices for racking and positioning of the containers.

2. Radioactive waste management facilities at Novi Han Repository site

2.1. List of facilities

2.1.1. Disposal vault for solid waste;
2.1.2. Disposal vault for biological waste;
2.1.3. Disposal vault for disused sealed sources;
2.1.4. Engineering trench for solid waste;
2.1.5. Facility for storage of liquid waste;
2.1.6. Surface temporary storage facilities for RAW;
2.1.7. Facility for waste treatment.

2.2. Description of the site

2.2.1. Location

Novi Han Repository is located 35 km Southeast from Sofia and 6.5 km from Novi Han village in the Lozen mountain that is a part of Ihtimanska Sredna Gora mountain. The facility is located in the middle part about 3 km North-East from its highest peak Popov dial in the area called Chukite.

The site is situated at about 920 m altitude, in the beginning of the Northern slope, below the ridge of the mountain. The declination of the slope is 13-16% to the North-North-East. The relief is formed mainly by the impact of flat denudation and linear erosion alongside the dingles, feeders of Turnovska River. Next to the site there are two dingles with impermanent water flow , which drain the shallow underground and surface waters which flow is alongside the slope located below the site. The drainage maximum is in the springtime and it is resulting from the intensive snow melting and rains. In August-September the waters are sharply reduced (below 0,03 l/s), and even the East ravine is almost dry.

2.2.2. Meteorological conditions

During the entire year the prevailing wind direction is North-Northwest and only in the autumn from September until November the Southeastern and Eastern winds prevail.

The average precipitation value is close to the average for the country and is 650 mm.

The average air temperature is 8 °C.The lowest monthly temperatures are monitored in January and February and the highest ones – in July (average monthly temperatures 3.9 and 18.1 °C, respectively).

The average relative air humidity is 78%. The period with snow cover in the highest parts of Lozen mountain lasts between 120 and 130 days in the year.

The information on the geographic conditions in the region does not show any dangerous climate impacts. The site is not endangered by flooding.

2.2.3. Soils and plants

The maroon and brown forest soils prevail in the region. The vegetation is forest, mesophyte mainly of oak, hornbeam and less of beech tree of 30 - 35 years.

2.2.4. Description of the geological environment

The region of the Lozen Mountain between Novi Han and Gabra where Novi Han Repository is located is well investigated from the geological point of view. It is consists of rocks from old Paleozoic period of diabase-phylide type (formation and suite of the Ordovician phillites), sediments of young Paleozoic period (upper carbon-Stephen and Permian periods), terrigenian deposits of lower Trias, sediments of Neogen, Quaternary sediments and several magma bodies of granitoids, syenites and lamprophyre dykes.

The site of Novi Han Repository is entirely located on homogenous rock massive of Ordovician clay phillites. The upper layer (in depth of 4.5 – 5.5 m from the surface) is a vapid phillite (eluvium) with 3.0 – 4.5 m thickness, that in depth become quarts-sericite phylites. Within the entire area up to 800 m depth the phillites are very cracked and crushed due to the Tectonic processes.

The rock massive has good bearing capacity – over 0.3 MPa.

2.2.5. Hydrogeological features

The rock composition of the geological structures and the deep cutting of the ravine and valley system into the mountain relief determines the paucity of the underground waters in the Eastern part of Lozen Mountain. There are no distributed high penetrating carbonate Mezosoic complexes, which in the Western parts of the mountain feed the largest springs. Almost in all geological formations there are no continuous aquifer and their water carrying ability is negligible. The shallow infiltration underground waters are weakly mineralized and with low hardness and they are only fed by the rainfalls. The waters are drained when crossing the shists, tectonic sections and cracks and erosion forms of river-ravine system (such as dingles on the Northern slope of the mountain)

The surface flow is impermanent one and depends on the rainfalls – it dries up during the dry periods.

In the region of storage facility there are two springs, draining the phillite type area – spring Krustevi kladentsi with impermanent flow rate (the distance to the storage facility is 280 m) and Murata with flow rate of 0.2 l/s that is 680 m away. The latter one is captured for the purposes of PRRAW. The waters are hydrocarbonate-sulphate-sodium-calcium type with total mineralization of 0.08 g/l and acid ones (pH 5.6).

The Ordovician phillites are weak-water carrying with low filtration properties. In the region of the storage facility there is a weak water heavy horizon in depth of 10 up to 24 m under the surface with filtration ratio of 0.017 m/d. The underground flow is oriented to two directions – to the North and South. The watershed coincides with the topographic one and is located in the South from RAWPP site in 100 – 150 m away from the Southern border. The head gradient is relatively high and that is determined by the steep relief and by weak filtration properties of the layer as well. In the North the gradient varies from 0.07 up to 0.15, and in the South – 0.13up to 0.18. The average layer conductivity is 0.3 m^2/d. The drainage of the water-carrying horizon to the North is permanently made in the lower parts of the relief following the slope of the Northern flank of Lozen Mountain. In the south the flow is directed to the Valley of Gabra River.

2.2.6. Seismic and Tectonic activity

The active tectonic and neo-tectonic activities are typical for the region and they continue today too with minimum velocity. This is the reason the rocks in the region to be strongly deformed, broken and cracked. According to the map of modern vertical movements the massive of Lozen Mountain raises up with permanent velocity of 1 - 2 mm/a.

In the area next to Novi Han Repository (radius of 1 km) there are two break systems that are proven to be non-active ones – their development and activity were terminated in the Premiocene period.

From the seismic point of view an intensity of IX degree under MSK-64 scale is typical for the site According to the macro seismic investigation of the region of storage facility, there are no conditions for concentration of tectonic stresses that could provoke heavy earthquakes.

The site is not threatened by geodynamic phenomena such as landslide and erosion in depth that threaten the security of the storage facility.

2.3. Main purpose and important features of Novi Han Repository

The Novi Han Repository is designed for disposal of radioactive waste from industry, medicine, research and education.

The area of the site is about 42 500 m^2. The site is divided in two areas - "area with controlled access" and "protected area", separated by a fence. The protected area consists of the facilities for disposal of radioactive waste, temporary storage facilities, waste treatment facility for identification and characterization of waste, sorting, repacking, preparation of waste for long term storage, decontamination of waste packages and transport vehicles. The area with controlled access consists of the administration building, service workshops, radiation control and monitoring building, access control and physical protection building.

The radiation protection area is of 1 km radius and the monitored zone is of 5 km radius.

Novi Han Repository comprises of near surface disposal facilities and surface temporary storage facilities:

2.3.1. Disposal vault for solid waste.

Commissioning – October 1964.

The facility is designed for disposal of loose solid radioactive waste – low and intermediate level short lived waste (laboratory waste, contaminated equipment, structure materials, etc.).

The total volume of the facility is 237 m^3, 120 m^3 of which is full with waste. The facility consist of three cells each with dimensions of 5x4.5x3.5 m and volume of 79 m^3. It represents multibarrier reinforced concrete disposal facility entirely under the ground level (Figure 1) with length of 15.7 m, width of 5.83 m, height of the surface part (roof structure) 1.2/1.6 m.

The facility is constructed of reinforced concrete with thickness of 300 mm, hydro insulated with 20 mm bitumen, lined inside with 4 mm stainless steel. The outside brick walls of 120 mm provide additional mechanical stability. The filling of the disposal facility is made from the surface through 7 hatches with outside diameter of 100 cm and 120 cm. According to the design the cells are backfilled with concrete after filling up their capacity.

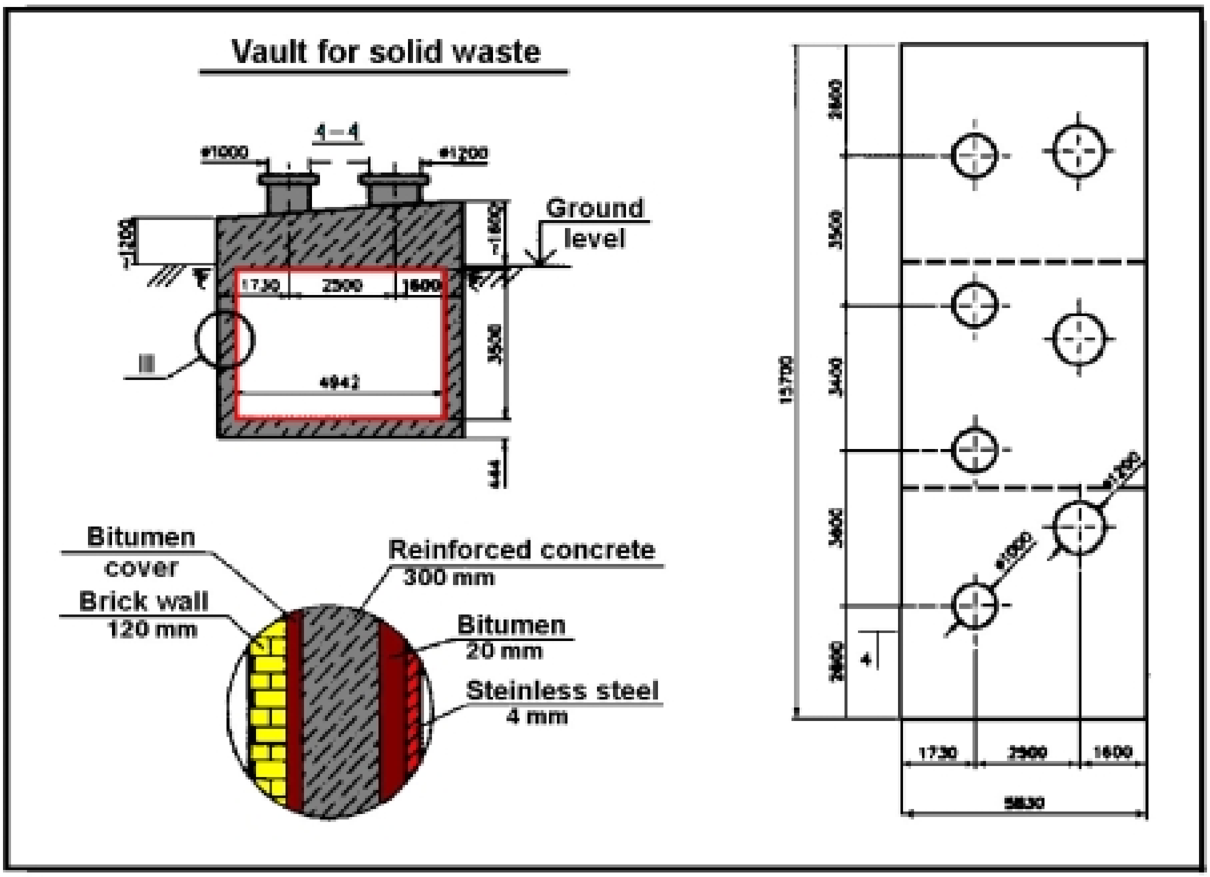


Figure 1. Plan of disposal vault for solid waste.

2.3.2. Disposal vault for biological waste

Commissioning – October 1964.

The facility is designed for disposal of conditioned low and intermediate level short lived biological waste (animal carcasses, biological material treated with 5% solution of lysol or 10% solution of formalin and conditioned in gypsum in plastic packages).

The total volume of the facility is 80 m^3, about 30 m^3 of which is full with conditioned biological waste.

The facility represents a multibarrier reinforced concrete disposal facility (Figure2) with dimensions 8.35 m length, 4.00 m width, 2.5 m depth and height of the surface part (roof structure) 0.5 m.

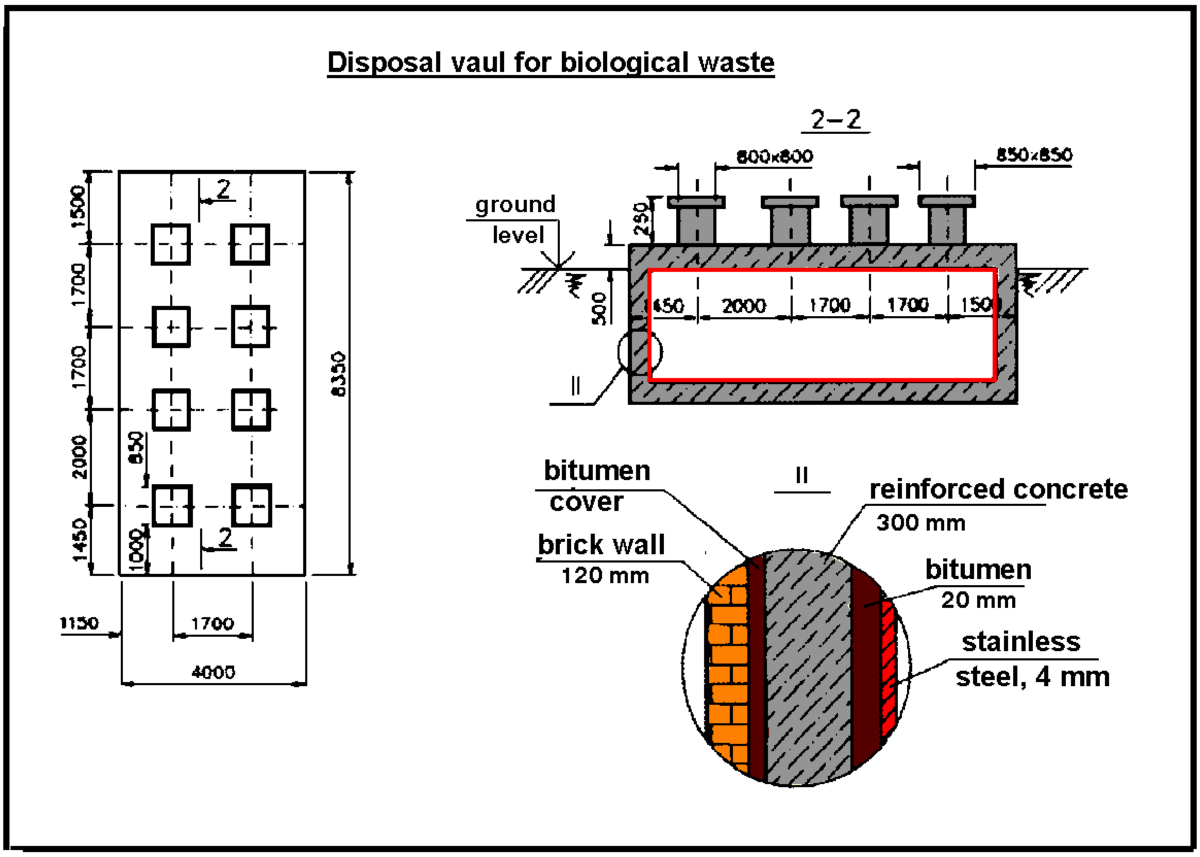


Figure 2. Plan of disposal vault for biological waste

The facility is constructed of reinforced concrete with thickness of 300 mm, hydro insulated with 20 mm bitumen, lined inside with 4 mm stainless steel. The outside brick walls of 120 mm provide additional mechanical stability. The filling of the disposal facility is made from the surface through 8 hatches of 80x80 cm each According to the design the cells are backfilled with concrete after filling up their capacity.

2.3.3. Disposal vault for spent sources

Commissioning – October 1964 г.

The facility is designed for disposal of non-conditioned low and intermediate level spent sources. The total volume of the facility is 1 m^3, about 0.65 m^3 out of which are filled with spent sources.

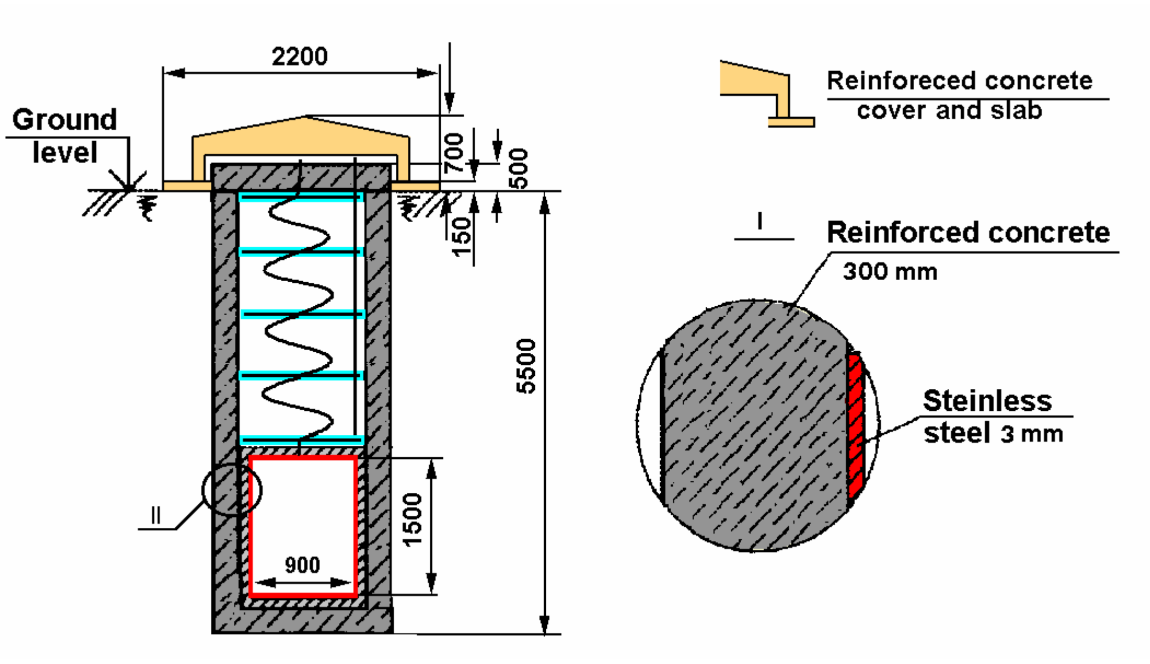


Figure 3. Plan of disposal vault for disused sealed sources

The facility is e entirely under the ground at depth of 5.5 m. It is reinforced concrete facility, lined with stainless steel 1X18H9T of 3 mm thickness. The sources enters via the serpentine of stainless steel ϕ5 mm. The ionizing radiation protection is provided by the heavy concrete and 5 lead plates of 10 mm each, located between the facility and the surface. The facility is additionally protected by heavy mobile roof structure.

2.3.4. Engineering trench for solid waste

Commissioning –1984 г.

The facility is designed for disposal of loose solid low and intermediate level short lived waste (laboratory waste, contaminated equipment, structure materials, etc.).

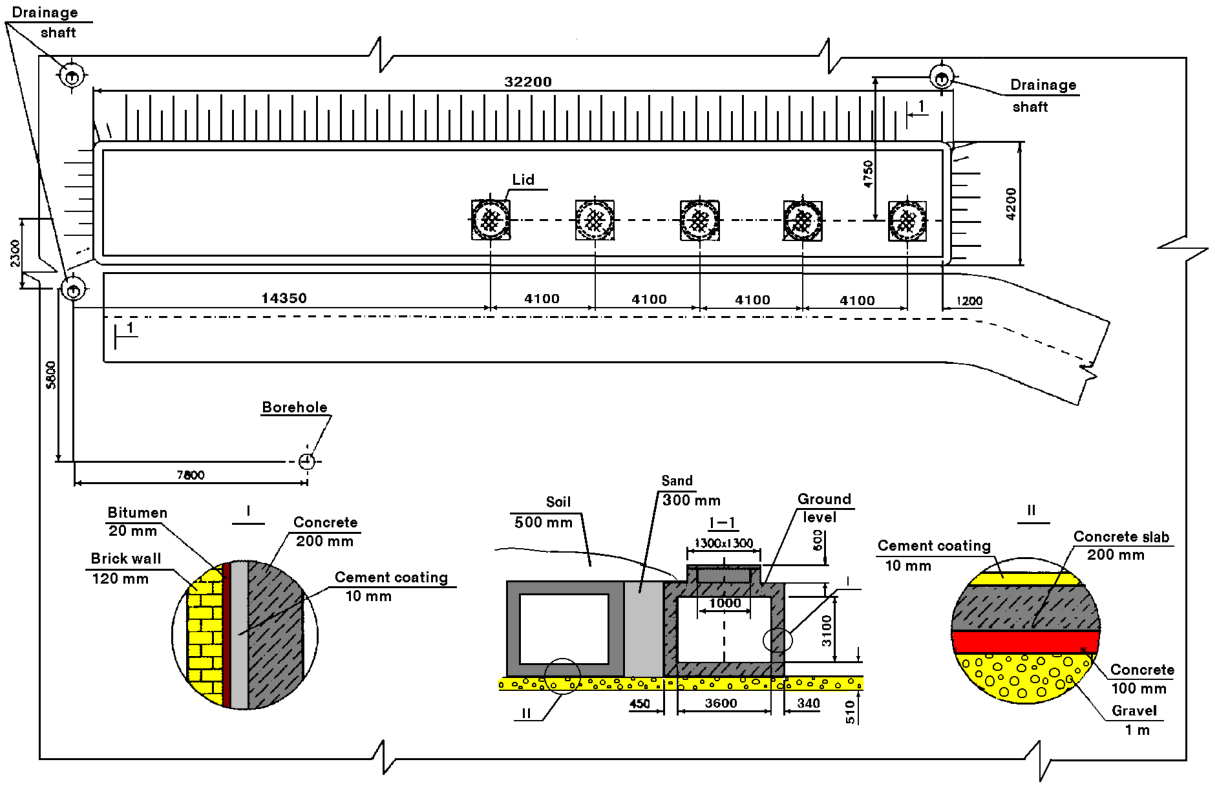


Figure 4. Engineering trench for disposal of solid waste

The total volume of the facility is 200 m^3, about 100 m^3 out of which are full with waste. It consist of 8 separate disposal cells. The trench represents a multibarrier disposal facility entirely under the ground level. It is constructed from prefabricated reinforced concrete elements of 300 mm thickness. The outside brick walls of 120 mm provide additional mechanical stability. The concrete structure is hydroinsulated with bitumen insulation and is equipped with drainage system. The outside dimensions are: 29 m length and 4.1 m width. The filling of the cages is made from the surface. Each cage is equipped with hatch with outside diameter of 130 cm. Three of the cages are entirely filled with radioactive waste, backfilled with concrete and covered with temporary protection cover.

2.3.5. Facility for temporary storage of liquid waste

Commissioning – October1964.

The facility is designed for temporary storage of low level short lived liquid waste, mainly from the operation of Novi Han Repository.

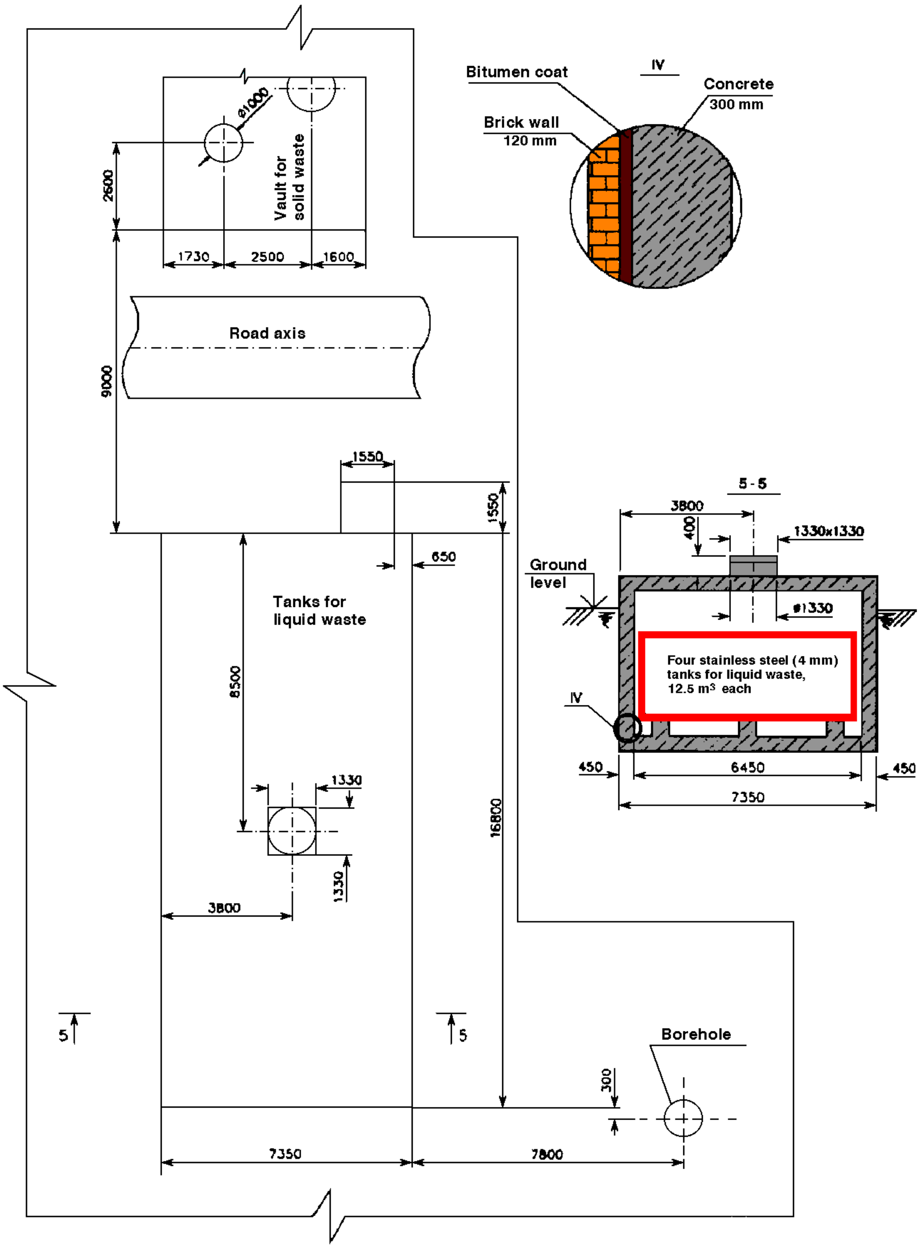


Figure 5. Plan and location of storage facility for liquid waste

The storage facility consists of 4 tanks of stainless steel type 1X18H9T of 4 mm thickness, and only one of them is filled. The tanks are installed in reinforced concrete cage of 5.7x7.4x4.3 m on concrete supports 0.5 m over the cage floor. The facility is totally under the ground.

The water could be discharged into the environment after decay storage or sorption treatment to meet the release limits for discharge into the environment.

2.3.6. Surface temporary storage facilities

Commissioning – October 2000.

Designed for temporary storage of non-conditioned low and intermediate level short and long lived radioactive waste.

The total volume is 469.12 m^3, the filled volume is 349.72 m^3,

The facilities for temporary storage of radioactive waste are:

- 11 standard railway containers with dimensions 6.00x2.35x2.4 m, total volume of 374 m^3. They are designed for temporary storage of smoke detectors in transport packages, solid radioactive waste and spent sources with low specific activity that do not require additional biological shielding;
- 6 hydroinsulated concrete receivers with walls from 20 up to 40 cm and total volume of 74 m^3, designed for temporary storage of spent sources in transportation packages, which require additional shielding from the ionizing radiation;
- 6 hydroinsulated cylinder reinforced concrete containers with dimensions of 1.82x2.20 m, constructed of heavy concrete of 20 cm wall thickness. They are designed for temporary storage of high active sources from gamma irradiators in transport packages.

The railway containers and the reinforced concrete containers are located on concrete plate constructed on a draining sand base.

A temporary site of 80 m^2 is additionally constructed, protected by shelter for storage of very low active waste in 200 l drums.

Designing and commissioning of modular reinforced concrete containers for waste storage, reinforced concrete containers for storage of ^{226}Ra sources and reinforced concrete containers for storage of neutron sources is under implementation.

2.3.7. Facility for waste treatment

Commissioning – 1964, commissioning after repair and reconstruction – 2003.

The facility is a building with the respective production rooms, special sewage system, special ventilation and equipment for identification and characterization of radioactive waste, sorting, re-packing and preparation of waste for storage and disposal, decontamination of equipment and transport vehicles, treatment of low level liquid waste from the operation of Novi Han Repository.

Annex L-4

RADIOACTIVE WASTE INVENTORY

1. Facilities for management of radioactive waste at Kozloduy NPP site

1.1. Facilities for temporary storage of radioactive waste in Special Building-1

1.1.1. Solid radioactive waste – category I and II
Volume by 30.06.2002 - 534 m^3
Physical components (volume %) – metal (22%), wood (2%), polymers (20%),
miscellaneous (56%).

Treatment

	Treated waste (volume %)	Volume reduction factor
Pre-compaction		-
Supercompaction		-
Packaging		-
Not treated	100	-

1.1.2. Liquid radioactive waste – category – intermediate level.
Volume by 30.06.2002 - 1920 m^3
General description – liquid radioactive concentrate, total salt content 32%, boric acid concentration 7%, pH 8.5, precipitated solid phase.
Radionuclide inventory: ^{134}Cs - 1×10^7 Bq/l, ^{137}Cs - 3×10^7 Bq/l
^{60}Co - 2×10^6 Bq/l, ^{54}Mn - 1×10^5 Bq/l

1.1.3. Spent sorbents - category – intermediate level.
Volume by 30.06.2002 - 340 m^3
General description – spent organic and inorganic sorbents. Activity level varies strongly depending on ratio of the sorbents from different applications. Sorbents are stored under water in tanks. They have homogenous distribution in the volume and are easily transportable. Physical and chemical characteristics are the same as the initial sorbents, used in the NPP operation. Small amounts of activated charcoal. About 70% volume sorbents and 30% volume water.
Radionuclide inventory: ^{134}Cs - 3×10^7 Bq/l, ^{137}Cs - 4×10^7 Bq/l
^{60}Co - 7×10^6 Bq/l, ^{54}Mn - 5×10^6 Bq/l

1.2. Facilities for temporary storage of radioactive waste in Special Building-2

1.2.1. Solid radioactive waste – category I and II
Volume by 30.06.2002 – 219.7 m^3
Physical components (volume %) – textile (4%), metal (1%), swarfs (1%), wood (4%),
polymers (42%), wadding (1%), miscellaneous (47%).

Treatment
Number of treated 200 L drums - 1313.

	Treated waste (volume %)	Volume reduction factor
Pre-compaction		-
Supercompaction	54.5	7
Packaging		-
Not treated	45.5	-

1.2.2. Liquid radioactive waste – category – intermediate level.
Volume by 30.06.2002 - 1980 m^3
General description - liquid radioactive concentrate, total salt content 32%, boric acid concentration 7%, pH 8.7, precipitated solid phase.
Radionuclide inventory: ^{134}Cs - 1×10^7 Bq/l, ^{137}Cs - 4×10^7 Bq/l
^{60}Co - 2×10^6 Bq/l, ^{54}Mn - 3×10^5 Bq/l

1.2.3. Spent sorbents - category – intermediate level
Volume by 30.06.2002 - 192 m^3
General description – spent organic and inorganic sorbents. Activity level varies strongly depending on ratio of the sorbents from different applications. Sorbents are stored under water in tanks. They have homogenous distribution in the volume and are easily transportable. Physical and chemical characteristics are the same as the initial sorbents, used in the NPP operation. Small amounts of activated charcoal. About 70% volume sorbents and 30% volume water.
Radionuclide inventoru: ^{134}Cs – 1×10^7 Bq/l, ^{137}Cs – 2×10^7 Bq/l
^{60}Co - 3×10^6 Bq/l, ^{54}Mn – 3×10^6 Bq/l

1.3. Facilities for temporary storage of radioactive waste in Special Building-3

1.3.1 Solid radioactive waste – category I and II
Volume by 30.06.2002 – 1131.2 m^3
Physical components (volume %)– textile (40%), metal (10%), swarfs (1%), wood (3%), construction waste (9%), polymers (4%), wadding (11%), rubber (1%), miscellaneous (21%).

Treatment
Number of 200 L drums with treated waste - 5395.

	Treated waste (volume %)	Volume reduction factor
Pre-compaction	100	3
Supercompaction		
Packaging		
Not treated		

Radionuclide inventory[Bq/kg]:

^{54}Mn – 3×10^4	^{110m}Ag – 2×10^4
^{59}Fe – 1×10^4	^{134}Cs – 2×10^4
^{58}Co – 2×10^4	^{137}Cs – 5×10^4
^{60}Co – 2×10^5	^{95}Nb – 5×10^3

1.3.2. Solid radioactive waste – category III
Volume by 30.06.2002 –10 m^3
Physical components – mainly metal waste.

1.3.3. Liquid radioactive waste – category – intermediate level
Volume by 30.06.2002 - 2699 m^3
General description - liquid radioactive concentrate, total salt content 29%, boric acid concentration 4%, pH 9.5, precipitated solid phase.
Radionuclide inventoru: ^{134}Cs - 1×10^6 Bq/l, ^{137}Cs - 3×10^6 Bq/l
^{60}Co - 1×10^4 Bq/l, ^{54}Mn - 8×10^2 Bq/l

1.3.4. Spent sorbents - category – intermediate level.
Volume by 30.06.2002 - 152 m^3
General description – spent organic and inorganic sorbents. Activity level varies strongly depending on ratio of the sorbents from different applications. Sorbents are stored under water in tanks. They have homogenous distribution in the volume and are easily transportable. Physical and chemical characteristics are the same as the initial sorbents, used in the NPP operation. Small amounts of activated charcoal. About 70% volume sorbents and 30% volume water.

1.4. Facility for temporary storage of radioactive waste in Reactor Central Hall –1
Solid radioactive waste – category III
Volume by 30.06.2002 – 48.41 m^3

1.5. Facility for temporary storage of radioactive waste in Reactor Central Hall-2
Solid radioactive waste – category III
Volume by 30.06.2002 – 19.15 m^3

1.6. Storage facility type trench for temporary storage of solid radioactive waste
Solid radioactive waste – category I and II
Volume by 30.06.2002 – 3589.97 m^3
Physical components (volume %) – textile (3%), metal (2%), wood (1%), construction waste (1%), wadding (1%), miscellaneous (92%).

Treatment
Number of treated 200 l drums - 4188.

	Treated waste (volume %)	Volume reduction factor
Pre-compaction		
Supercompaction	11.84	7
Packaging		
Not treated	88.16	-

Radionuclide inventory [Bq/kg]:

$^{54}Mn – 2\times10^4$	$^{110m}Ag – 2\times10^4$
$^{59}Fe – 3\times10^3$	$^{134}Cs – 2\times10^4$
$^{58}Co – 8\times10^3$	$^{137}Cs – 9\times10^4$
$^{60}Co – 2\times10^5$	$^{95}Nb – 3\times10^3$

1.7. Storage facility for temporary storage of treated solid waste
Solid radioactive waste – category I and II
Volume by 30.06.2002 - 467 m^3
Physical components (volume %) – textile (23.23%), metal (5.48%), swarfs (1.2%), wood (1.98%), construction waste (8.23%), polymers (1.32%), wadding (9.37%), rubber (0.5%), paper (0.07%), miscellaneous (48.62%).

Treatment
Number of treated 200 l drums - 5541.

	Treated waste (volume %)	Volume reduction factor
Pre-compaction		
Supercompaction	100	7
Packaging		
Not treated	-	-

1.8. Site for temporary storage of solid radioactive waste in reinforced concrete containers
Solid radioactive waste – category I and II
Volume by 30.06.2002 - 259.8 m^3
Physical components (volume %) – textile (26%), metal (6%), swarfs стружки (2%), wood (2%), construction waste (12%), polymers (2%), wadding (12%), rubber (1%), miscellaneous (36.44%).

Treatment
Number of treated 200 l drums - 2979, 98 reinforced concrete containers

	Treated waste (volume %)	Volume reduction factor
Pre-compaction		
Supercompaction	100	7
Packaging		
Not treated	-	-

Radionuclide inventory [Bq/kg]:

$^{54}Mn – 3\times10^4$	$^{110m}Ag – 3\times10^4$
$^{59}Fe – 4\times10^3$	$^{134}Cs – 6\times10^4$
$^{58}Co – 1\times10^4$	$^{137}Cs – 6\times10^4$
$^{60}Co – 2\times10^5$	$^{95}Nb – 5\times10^3$

1.9. Site for temporary storage of solid radioactive waste in large containers
Solid radioactive waste – category I
Volume by 30.06.2002 - 268.8 m^3
Physical components (volume %) – textile (1%), metal (38%), wood (9%), construction waste (48%), miscellaneous (4%).
Treatment
Number of 200 L drums with treated waste - 557 .

	Treated waste (volume %)	Volume reduction factor
Pre-compaction	43.1	3
Supercompaction		
Packaging		
Not treated	56.9	-

Radionuclide inventory [Bq/kg]:

$^{54}Mn – 2\times10^3$	$^{110m}Ag – 2\times10^2$
$^{59}Fe – 8\times10^0$	$^{134}Cs – 7\times10^3$
$^{58}Co – 1\times10^2$	$^{137}Cs – 1\times10^4$
$^{60}Co – 2\times10^4$	$^{95}Nb – 8\times10^0$

2. Facilities for management of radioactive waste at Novi Han Repository site

2.1. Disposal vault for solid radioactive waste

Category I and II – short lived low level waste, type of the waste – contaminated equipment, laboratory waste, miscellaneous, volume - 120 m^3.

Radionuclide	Activity, [Bq]	Radionuclide	Activity, [Bq]
^{3}H	2.79×10^{11}	^{106}Ru	3.98×10^{9}
^{14}C	3.70×10^{11}	^{134}Cs	2.30×10^{10}
^{55}Fe	3.42×10^{10}	^{137}Cs	4.54×10^{12}
^{65}Zn	6.98×10^{8}	^{144}Ce	1.44×10^{9}
^{60}Co	1.20×10^{12}	^{204}Tl	1.80×10^{10}
^{90}Sr	8.19×10^{11}	Total	7.28×10^{12}

2.2. Disposal vault for biological radioactive waste

Category I and II – short lived low level waste, type of the waste – solid biological waste conditioned in gypsum, volume - 25 m^3.

Radionuclide	Activity, [Bq]	Radionuclide	Activity, [Bq]
^{3}H	1.17×10^{10}	^{106}Ru	1.00×10^{8}
^{14}C	1.55×10^{10}	^{134}Cs	1.08×10^{9}
^{54}Mn	5.45×10^{7}	^{137}Cs	1.19×10^{11}
^{65}Zn	1.76×10^{7}	^{144}Ce	3.64×10^{7}
^{60}Co	1.15×10^{10}		
^{90}Sr	1.97×10^{10}	Total	11.78×10^{11}

2.3. Disposal vault for disused sealed sources

Category I – III – low and intermediate level, mainly short lived, type of the waste – disused sealed sources, volume - 0.65 m^3.

Radionuclide	Activity, [Bq]	Radionuclide	Activity, [Bq]
^{3}H	1.44×10^{10}	^{137}Cs	5.71×10^{13}
^{22}Na	2.68×10^{8}	^{147}Pm	8.53×10^{7}
^{55}Fe	1.01×10^{9}	^{170}Tm	5.48×10^{5}
^{60}Co	9.85×10^{12}	^{204}Tl	1.48×10^{9}
^{63}Ni	1.56×10^{9}	^{226}Ra	5.97×10^{11}
^{85}Kr	6.32×10^{10}	^{239}Pu	1.82×10^{11}
^{90}Sr	6.98×10^{10}	^{241}Am	2.40×10^{10}
^{133}Ba	4.22×10^{7}	Total	6.79×10^{13}

2.4. Engineered trench for solid waste

Category I and II – short lived low level waste, type of the waste – contaminated equipment, laboratory waste, contaminated soil, miscellaneous, volume - 100 m^3.

Radionuclide	Activity, [Bq]	Radionuclide	Activity, [Bq]
^{137}Cs	7.42×10^{11}	^{239}Pu	6.70×10^{5}
^{60}Co	2.56×10^{11}	Total	1.16×10^{12}
^{90}Sr	1.64×10^{11}		

2.5. Facility for temporary storage of liquid waste
Type of the waste – aqueous solutions of ^{134}Cs, ^{137}Cs, ^{60}Co, ^{90}Sr with activity bellow the regulatory limits for release from radiological control according to BNRP-2000. Volume - 12 m^3.

2.6. Surface temporary storage facilities at the PRRAW-Novi han
Category I - III – low and intermediate level short and long lived waste; type of the waste – spent sealed sources, including smoke detectors, solid waste and limited volume of liquid waste in transport packages, volume - 349.72 m^3.

Radionuclide	Number of sources	Total activity, [Bq]	Description
^{241}Am	34 447	7.87×10^{13}	Smoke detectors, sealed sources
^{239}Pu	70 437	8.93×10^{11}	Smoke detectors, sealed sources, static electricity eliminators
^{238}Pu	1 462	4.00×10^{11}	Smoke detectors, sealed sources
^{226}Ra	219	5.59×10^{9}	Sealed sources
^{3}H	21	3.92×10^{8}	Sealed sources
^{14}C	104	5.00×10^{9}	Sealed sources
^{36}Cl	4	4.63×10^{9}	Sealed sources
^{22}Na	16	6.45×10^{6}	Sealed sources
^{51}Cr	1	4.00×10^{8}	Sealed sources
^{55}Fe	22	2.07×10^{10}	Sealed sources
^{57}Co	12	1.46×10^{6}	Sealed sources
^{60}Co	357	1.67×10^{12}	Sealed sources
^{85}Kr	12 271	4.72×10^{11}	Smoke detectors, sealed sources
^{90}Sr	741	1.56×10^{11}	Sealed sources
^{109}Cd	49	2.55×10^{9}	Sealed sources
^{125}Sb	1	4.00×10^{7}	Sealed sources
^{133}Ba	7	3.72×10^{8}	Sealed sources
^{137}Cs	2 962	3.42×10^{12}	Sealed sources, evidence materials
^{141}Ce	1	4.00×10^{7}	Sealed sources
^{144}Ce	6	8.85×10^{7}	Sealed sources
^{147}Pm	14	5.09×10^{10}	Sealed sources
^{152}Eu	5	1.00×10^{8}	Sealed sources
^{204}Tl	19	2.00×10^{10}	Sealed sources
^{232}Th	14	1.78×10^{8}	Sealed sources
^{252}Cf	4	9.10×10^{7}	Sealed sources
$^{235,238}U$	8	9.84×10^{5}	Sealed sources
$^{239}Pu/Be$	71	1.85×10^{12}	Neutron sources
$^{241}Am/Be$	16	3.74×10^{10}	Neutron sources
$^{226}Ra/Be$	1	2.40×10^{9}	Neutron sources
For identification	1 019	-	Sealed sources
Total	**124 310**	$\mathbf{8.77\times10^{13}}$	
^{60}Co	36	6.27×10^{13}	Gamma-irradiator with 36 sealed sources

Solid RAW			
Radionuclide	**Quantity**	**Specific activity [Bq/kg]**	**Description**
^{137}Cs	0.8 m^3	< 7×10^4	Packages with solid waste
^{137}Cs	30 kg	< 7×10^4	Packages with solid waste
^{90}Sr	0.05 m^3	< 7×10^4	Packages with solid waste
^{60}Co	0.05 m^3	< 7×10^4	Packages with solid waste
^{85}Kr	0.05 m^3	< 7×10^4	Packages with solid waste
^{134}Cs, ^{137}Cs, ^{90}Sr, ^{60}Co, ^{14}C, ^{241}Am, ^{54}Mn, ^{238}U	3.6 m^3	< 7×10^4	Packages with solid waste

Liquid waste			
Radionuclide	**Volume [m^3]**	**Specific activity [Bq/ m^3]**	**Description**
^{134}Cs, ^{137}Cs, ^{90}Sr, ^{60}Co, ^{14}C	0.1	< 3.70×10^8	Liquid waste in plastic packages

Annex L-5

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

I. List of the international treaties, acts and secondary legislation.

I.1. International Treaties and Agreements

I.1.1. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (ratified by the Parliament on 10 May 2000, in force since 18 June 2001);

I.1.2. VIENNA CONVENTION on civil liability for nuclear damage;

I.1.3. CONVENTION on physical protection of nuclear material;

I.1.4. CONVENTION on operational notification in case of nuclear accident;

I.1.5.CONVENTION on assistance in case of nuclear accident or radiological emergency situation;

I.1.6 CONVENTION on the assessment of environmental effects in an international context (in force since 1997), ratified in 1999;

I.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;

I.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;

I.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;

I.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;

I.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;

I.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;

I.1.13 AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation in the domain of atomic energy;

I.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.

I.2. Acts

I.2.1. Act on Safe Use of Nuclear Energy;

I.2.2. Act on Environmental Protection;

I.2.3. Act on the Public Health;

I.2.4. Act on Support during Public Disasters;

I.2.5. Act on the Healthy and Safe Conditions of Labour;

I.2.6. Act on the Ministry of Interior;

I.2.7. Act on Territorial Structure;

I.2.8 Act on the Measurements.

I.3. Secondary Legislation

I.3.1. RULES OF PROCEDURE of the Nuclear Regulatory Agency

I.3.2. REGULATION for Basic Standards for Radiation Protection-2000, adopted by the Council of Ministers;

I.3.3. REGULATION on the Order to Define and Apply Sanctions for Damage or for Contamination of the Environment over the Permissible Rates, adopted by the Council of Ministers;

I.3.4. REGULATION on Setting up, Operation and Development of a National Automated System for Permanent control of the Radiological Gamma Background in the Republic of Bulgaria, adopted by the Council of Ministers;

I.3.5. REGULATION on Definition of the amount of Instalments and the Order to Collect, Spend and Control the Resources of the Decommissioning of Nuclear Facilities Fund and its Management of 1999, adopted by the Council of Ministers and amended in 2000;

I.3.6. REGULATION on Definition of the Amount of Instalments and the Order to Collect, Spend and Control the Resources of the Safety and Radioactive Waste Storage Fund and its management of 1999, adopted by the Council of Ministers and amended in 2000;

I.3.7. REGULATION on Emergency Planning and Preparedness for Action in case of Radiation Accident of 1999, adopted by the Council of Ministers;

I.3.8. REGULATION on the Conditions and the Order for Registration and Permission of Foreign Commercial Transactions of 2000, adopted by the Council of Ministers;

I.3.9. REGULATION No. 2 of CUAEPP of 1997 on the Cases and Procedure for Notification of the Committee on the Use of Atomic Energy for Peaceful Purposes for Operational changes, Events and Accidents Related to Nuclear and Radiation Safety;

I.3.10. REGULATION No. 3 of CUAEPP since 1997 for Providing Nuclear Power Plants Safety During Design, Construction and Operation;

I.3.11. REGULATION on Accounting, Storage and Transportation of Nuclear Material and Application of the Safeguards under the Treaty for non-proliferation of Nuclear Weapons;

I.3.12. REGULATION No. 5 of CUAEPP of 1988 on Issuance of Licenses for the Use of Atomic Energy;

I.3.13. REGULATION No. 6 of CUAEPP of 1989 concerning the Criteria and Requirements for Training, Qualification and Certification of Personnel Working in the Area of Atomic Energy;

I.3.14. REGULATION No. 7 of CUAEPP of 1992 on Collecting, Storage, Processing, Keeping, Transport and Disposal of Radioactive Waste on the Territory of the Republic of Bulgaria;

I.3.15. REGULATION No. 8 of CUAEPP and Ministry of Interior of 1988 on Physical Protection of Nuclear Facilities and Nuclear Material;

I.3.16. REGULATION No. 10 of CUAEPP of 30.01.2001 on Safety during Decommissioning of Nuclear Facilities;

I.3.17. REGULATION No. 11 of CUAEPP of 2001 on Safety during Storage of Spent Nuclear Fuel;

I.3.18. REGULATION No. 0-35 of the Minister of Public Health and the Minister of the Interior of 02.08.1974 on Handling of Radioactive Substances and other Sources of Ionising Radiation;

I.3.19. REGULATION No. 46 of the Minister of Public Health and the Chairman of the Committee on the Use of Atomic Energy for Peaceful Purposes of 02.07.1976 on Transportation of Radioactive Substances;

I.3.20. REGULATION No. 4 of the Minister of the Environment and Water on the Assessment of Environmental Effects of 22.07.1998.;

I.3.21. REGULATION No. 1, since 15.11.1999 on Safety and Radiation protection Requirements related to Liquidation the Results from Uranium Ore Industry;

I.3.22. INSTRUCTION No 1 of CUAEPP, since 12.12.1994 on the Procedure for Treatment of Radioactive Contaminated Materials, Facilities and Waste Generated as a Result from Liquidation of Uranium Sites;

I.3.23. REGULATION No 2 on the Fire Protection and Civil Structure Requirements;

I.3.24. REGULATION No I-59 since 1999 on the Activity of the Authorities, Exercising Fire Protection Monitoring

II. Short description of the main legislation

II.1. Acts

II.1.1. Act on Safe Use of Nuclear Energy is the main legislative act in the area of the use of nuclear energy. It entered into force on the 2 July 2002 and replaced the Act on the Use of Atomic Energy for Peaceful Purposes adopted in 1985.

The Act on Safe Use of Nuclear Energy covers the State regulation of the safe use of nuclear energy and ionising radiation and the safety of radioactive waste management and the safety of spent fuel management. It specifies the rights and obligations of licensees implementing those activities, in order to ensure nuclear safety and radiation protection.

Pursuant to ASUNE nuclear energy and ionising radiation shall be used in compliance with nuclear safety and radiation protection requirements and principles. With the aim to ensure the protection of human life, health and living conditions of both present and future generations, the environment and property against the impact of ionising radiation.

According to ASUNE the state regulation of the safe use of nuclear energy and ionising radiation, the safety of radioactive waste management and the safety of spent fuel management is implemented by the Chairman of the Nuclear Regulatory Agency (NRA). The Chairman is an independent specialised authority of the executive power and is vested with competencies, as specified by the law.

Chapter Two of ASUNE "State Regulation" and Statutory Rules of Nuclear Regulatory Agency specifies the NRA statute and its financing.

According to ASUNE radioactive waste management and spent fuel management shall be performed by legal entities only after obtaining a license or a permit following this Act. Chapter Three of this Act specifies the authorisation process for use of nuclear energy and ionising radiation including radioactive waste management and spent fuel management and the main obligations of the licensee and holders of permits. Section Five of the same chapter specifies the financial rules on decommissioning of nuclear facilities and establishes "Decommissioning of nuclear facilities" Fund. The purpose of financing (including for storage and disposal of radioactive waste generated from decommissioning of nuclear facilities) is also specified.

Pursuant to ASUNE the radioactive waste management facilities and spent fuel management facilities are "nuclear facilities" which authorisation requirements are specified by Chapter Three, Section Two "Nuclear Facilities" of ASUNE. Section Seven (Chapter Three) specifies requirements concerning training, qualification and licensing of the staff carrying out activities at nuclear facilities.

A prohibition under ASUNE is established for import of radioactive waste except:

(a) re-import of used sealed sources manufactured in the Republic of Bulgaria;

(b) where the radioactive waste is generated as a result of the processing of materials performed as a service to the Republic of Bulgaria or a Bulgarian legal entity.

Chapter Three also specifies the requirements on financing the decommissioning of nuclear facilities by a special fund established within the Minister of Energy and Energy Resources; requirements to the staff carrying out activities at nuclear facilities and with sources of ionising radiation as well as requirements on accounting and control of nuclear material, radioactive substances and other sources of ionising radiation.

Chapter Four regulates the relationship related to development of joint strategy for radioactive waste management and spent fuel management that shall be adopted by the Council of Ministers on a motion of the Minister of Energy and Energy Resources. The Act requires a public discussion of the draft strategy.

Radioactive waste outside the place of generation shall be managed by the State Owned Enterprise "Radioactive Waste", established by Chapter Four, Section Two of ASUNE.

The main responsibilities of the Enterprise include radioactive waste management, construction, operation, rehabilitation and reconstruction of radioactive waste management facilities, transportation of radioactive waste outside the relevant nuclear facility. The statute of the Enterprise and its management structure are also established. The requirements of this section will enter into force on 1 January 2004. The terms and procedure for radioactive waste delivery to the State Owned Enterprise and the time limits for such delivery, as well as the radioactive waste not subject to delivery, shall be specified by a regulation adopted by the Council of Ministers. Chapter Four, Section Three (in force as of 1 January 2003) specifies the financing of the radioactive waste management by establishing the “Radioactive Waste” Fund within the Minister of Energy and Energy Resources. The procedure for assessing, collection, spending and control of the financial resources, as well as the amount of contributions due, shall be established by a regulation.

Chapter Five of ASUNE specifies the regulatory control over the use of nuclear energy and ionising radiation and concerning RAW and SF management. This chapter also specifies the authorities of the chairman and rights and obligations of the inspectors.

Chapter Six establishes the procedure for establishment of special statutory areas around the nuclear facilities and other facilities with sources of ionising radiation.

Chapter Seven of ASUNE establishes physical protection requirements and Chapter Eight – emergency planning and preparedness requirements. Chapter Nine specifies the requirements concerning Safeguards, Chapter Ten-concerning civil liability for nuclear damage and Chapter Eleven specifies administrative liability requirements.

Additional Provisions include definitions within the meaning of ASUNE, including the definition of radioactive waste management and spent fuel management.

The entering into force of ASUNE creates an obligation of the Council of Ministers for adoption of the secondary legislation within a two-year period. Until the issuing of the secondary legislation provided for under ASUNE, the secondary legislation issued for the application of the Act on the Use of Atomic Energy for Peaceful Purposes shall be applied, insofar as they do not contradict the ASUNE.

II.1.2. ***The Act on Environmental Protection*****,** in force as of September 2002 (replacing the act of 1991). It is the main act, which covers the protection of environment for the present and future generations and the protection of human health; saving the biological diversity in compliance with the natural bio-geographic characteristic of the country; protection and use of the environmental components; control and management of the factors, damaging the environment; exercising of control over the status of environment and the sources of pollution; prevention and restriction of pollution; creating and operation of the National system for monitoring of the environment; strategies, programmes and plans for environmental protection; collecting and access to the information about environment; economic organisation of the activities for environmental protection; rights and the obligations of the state, municipalities, legal entities and individuals for environmental protection.

The Act on Environmental Protection requires conducting an environmental impact assessment (EIA) for construction, activities and technologies related to installations designated: for the production or enrichment of nuclear fuel; for the processing of spent fuel or high-level radioactive waste; for the final disposal of spent fuel; for the final disposal of radioactive waste; for the storage (planned for more than 10 years) spent fuel or radioactive waste in a different site than the production site; for the storage of RAW in a different sites than the production sites; for processing and storage of RAW.

The procedure for conducting the assessment of environmental effects is provided by REGULATION No. 4 on the environmental impact assessment**,** issued by the Minister of Environment and Water, Minister of Regional Development and Public Works, Minister of Health and Minister of Agriculture, Forestry and Agricultural Reform in 1998, last amended 2001.

Pursuant to the Act on Environmental Protection the Ministry of Environment and Water exercises the control over the environmental components and the effects of different factors. Legal entities and physical persons are obligated to provide free access of the MEW control authorities and to co-operate them at each site and territory concerning inspections, measurements or testing of existing or potential sources of contamination or damaging the environment.

II.1.3.*Act on the Public Health* covers the protection of the health of the population. The Ministry of Health is the specialised authority for implementation of the state policy in the area of public health. The Ministry (directly or via its responsible bodies) shall manage, coordinate and control the activity related to the protection and restoration of the health of the population. For ensuring the appropriate living conditions the Ministry of Health and its bodies shall study in advance the influence of the new industries and technological processes on the health and the working capacity of the people and shall propose measures for prevention of the harmful consequences. The Ministry of Health exercises the state sanitary control via its specialised bodies. The officials carrying out the state sanitary control give conclusions on the compliance of all standards, norms and designs for construction and reconstruction, with the hygienic norms and sanitary rules; permit the using of new chemical, radioactive substances; control the radiation characteristics of the working environment and public exposure. They control also the protection of the life and health of the population from the harmful effect of ionising radiation.

The Act for the Public Health requires providing of conclusions for the compliance of all designs for construction, expansion and reconstruction of industrial and other sites and installations, including sites with sources of ionising radiation with the existing hygienic norms and requirements and with the sanitary rules. The using of new chemical, biological and radioactive and other substances shall be implemented after issuance of a permit by the officials carrying out the state sanitary control. In case of violation of the hygienic norms and requirements of the sanitary rules, the construction shall be terminated, commissioning of installations shall be prohibited and the operation of installations shall be terminated.

The officials carrying out the state sanitary control shall participate in the commissioning and acceptance commissions of all sites with sources of ionising radiation and nuclear installations.

I.1.4. Act on the Ministry of Interior defines the main functions of the ministry as follows: protection of national security, respecting the rights and freedoms of the citizens and their life, health and property and providing fire protection and accident safety.

In connection to the safety of SF and RAW management, the ministry of interior exercises control via National office "Fire protection and accident safety". The control includes:

- implementing fire protection requirements during design, construction, reconstruction, modernisation and operation of buildings, technological equipment and installations;
- participation in the state acceptance of the sites and constructions;
- co-ordination of the designs and giving opinion for permitting the use of the constructions;
- certification inspections and issuance of certificates for compliance of the sites with the requirements for fire safety

I.1.5. *Act on the Measurements* covers the field of measurements related to their tracing, precision and reliability. Metrology control shall be exercised for providing precision and reliability of the measurements related to health care, public safety and environment. Pursuant to Art.28 of the act the Council of Ministers shall determine, by a regulation, the requirements for the measuring devices and their use according to their purpose, the order and methods of exercising control.

II.2. Main secondary legislation

II.2.1. REGULATION No. 3 on Providing Nuclear Power Plants Safety During Design, Construction and Operation. (Regulation No. 3 of the CUAEPP). This regulation sets the basic matters of nuclear power plants (NPP) safety as a result of their specificity as a source of ionising radiation and radioactive substances. The regulation contains the organisational and technical requirements whose realisation is a prerequisite for ensuring of NPP safety during their design, construction and operation. The requirements on safety of the systems for storage of the spent fuel and radioactive waste are also specified.

II.2.2. REGULATION No. 5 on the issuance of licenses for the Use of Atomic Energy. (Regulation No. 5 of the CUAEPP). This regulation specifies the necessary documentation, conditions and procedures for the issuance of licences for the use atomic energy.

II.2.3. REGULATION No. 7 on Collecting, Storage, Processing, Keeping, Transport and Disposal of Radioactive Waste on the Territory of the Republic of Bulgaria. (Regulation No. 7 of the CUAEPP). This regulation specifies the terms and procedures for collecting, storage, processing, keeping, transport and disposal of Radioactive Waste (RAW) by the organisations, generating RAW on the territory of the Republic of Bulgaria. This regulation does not cover the spent fuel and waste, resulted from spent fuel treatment.

II.2.4. REGULATION on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund “Decommissioning of Nuclear Facilities” and its management of 1999. The regulation is adopted by the Council of Ministers and amended in 2000. The regulation defines the order for collecting, spending, and control of the resources from the "Decommissioning of Nuclear Facilities" fund under the State Agency on Energy and Energy Resources and the amount of the payments due by the legal entities, using nuclear facilities.

II.2.5. REGULATION on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund “Safety and Storage of Radioactive Waste” *(now “Radioactive Waste” Fund)* **and its management** of 1999. The regulation is adopted by the Council of Ministers and amended in 2000. It defines the order for collecting, spending, and control of the means from the " Safety and Storage of Radioactive Waste " fund and the amount of the payments by the legal entities and physical persons that generate radioactive waste, as a result of their activity.

II.2.6. REGULATION on Emergency Planning and Preparedness for Action in Case of a Radiation Accident of 1999, adopted by the Council of Ministers. The regulation specifies the obligations of the authorities of the executive power, operator of nuclear power plant (NPP) and legal entities, carrying out activities on the territory of the Republic of Bulgaria, for planning actions in case of a radiation accident in the NPP, as well as for maintaining emergency preparedness.

Criteria for decisions making process concerning application of measures for protection of the population in case of a radiation accident are also specified.

II.2.7. REGULATION No. 10 on Safety during Decommissioning of Nuclear Facilities, in force since 2001.

This regulation regulates fundamental safety issues during decommissioning of nuclear facilities, ensuing from the specificity of the decommissioning activities, such as availability of sources of ionising radiation with high mass and level of activity, of radioactive substances and radioactive waste. It contains requirements for radioactive waste management during the decommissioning of nuclear facility.

Pursuant to the regulation, the basic purpose of ensuring safety during decommissioning is non-exceeding the determined limits of internal and external exposure of the personnel and the population and the limits for the content of radioactive substances in the environment, as well as the protection of the future generations from the harmful effects of ionising radiation.

This regulation specifies the main issues concerning management of radioactive waste generated from the operation of nuclear facilities with purpose to make easier the decommissioning activities.

The Regulation contains organisational and technical requirements to the management of radioactive waste, resulting from the decommissioning, including establishment of appropriate organisation, elaboration of radioactive waste management programme, ensuring means for safety management of radioactive waste. The applicability of the main radioactive waste management principles pursuant to IAEA documents are also provided.

The regulation establishes requirements for limitation the discharges resulting from dismantling and liquidation of the physical barriers of nuclear facility. The discharges shall not exceed the rates, specified for permitted discharges during the decommissioning activities.

II.2.8. REGULATION No. 11 on Safety of Spent Nuclear Fuel Storage Facilities, in force since 2001.

The regulation specifies the requirements for ensuring safety during design construction, erection, commissioning and operation of independent facilities for storage, transport and handling of spent nuclear fuel (SNF) from nuclear power plants with WWER type reactors, located on NPP site.
This regulation also regulates specific safety aspects, ensuing from the characteristics of SNF as a special (fissile) nuclear material and a source of ionising radiation.

The regulation provides requirements for ensuring sub-criticality, decay heat removal, radiation protection, transport and technological equipment and construction materials at SNF storage facilities, including specific requirements to wet and dry SNF storage.
II.2.9. REGULATION for Basic Standards for Radiation Protection - 2000, (BSRP-2000) of 2001. The regulation is based on International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources (BSS), safety series No 115, IAEA and Directive 96/29 EURATOM since 13 May 1996. This regulation replaced BSRP-92.

The regulation on BSRP-2000 specifies the purposes of radiation protection, requirements for protection of people from harmful influence of the ionising radiation and safety at work with sources of ionising radiation without being an obstacle to useful activities, related to their use. The regulation also specifies the basic exposure dose limits for the personnel, as well as the intervention levels for protection of the population. It regulates the exceeded exposure of the personnel in the case of emergency.
Basic purposes of the radiation protection, defined by BSRP – 2000 are as follows:

1. Exclusion of the origination of harmful health deterministic effects;

2. Diminution of the probability of the origination of harmful for the health stochastic effects to a level, which is defined as acceptable.

By BSRP – 2000 are created conditions for:

1. exclusion of exceeding of the defined exposure dose limits;

2. exclusion of any exposure, at which the risk of possible harm originated from additional to the natural gamma background exposure is higher than the benefits for the individuals and society;

3. to be kept as low as reasonably achievable, taking into account economic and social factors, the number of exposed individuals, as well as their total individual doses, as a result of exposure from all activities connected to sources of ionizing radiation.

The activities to which BSRP – 2000 shall be applicable are as follows:

- Production, processing, use, handling, possession, storage, transport, import and export of sources of ionizing radiation, management of radioactive waste and all other activities, including education and training, which are connected or can be connected to the exposure of the individual;
- Each activity in the area of the nuclear fuel cycle, including energy production from nuclear installations;
- All activities, which are connected to exposure from natural sources of ionizing radiation during processing of materials because of their radioactivity; their fission qualities to be used as fertilizers etc., and also in cases when this exposure is increased and cannot be neglected in view of radiation protection;
- Operation of any electrical installations and devices emitting ionizing radiation and containing components working at a potential difference above 5 kV;
- All other activities, which are connected or can be connected with exposure, according to the judgement of the responsible authorities.

The exposures for which the BSRP – 2000 shall be applicable are as follows:

- Any professional exposure;
- Any public exposure, resulting from activities or sources of ionizing radiation.

II.2.10. REGULATION No. 4 on the environmental impact assessment (EIA), issued by the Minister of Environment and Water, Minister of Regional Development and Public Works, Minister of Health and Minister of Agriculture, Forestry and Agricultural Reform since 1998, last amended 2001. It defines the procedure for EIA for construction, activities and technologies related to irradiated nuclear fuel processing installations and radioactive waste management installations as specified by the Act on Environmental Protection.

Following the Act on Environmental Protection, in force since September 2002, a new regulation will replace this one. In accordance with the Transitional and Final Provisions of the Act on Environmental Protection, Regulation No. 4 of 1998 will be in force until the issuance of a new one.

Annex L-6

REVIEW OF THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT FACILITIES

I. REVIEW OF THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT FACILITIES AT KOZLODUY NPPSITE

I.1. Facilities for temporary storage of RAW in Special Building-1 and facilities for temporary storage of RAW in Reactor Hall-1:

The facilities are constructed according to the original design of the Units 1 and 2 at Kozloduy NPP. The safety review is part of the safety assessment of Units 1 and 2. From 1991 to 2002 measures are implemented, according to the “Short-term program for reconstruction” and “Comprehensive program for upgrading”, in order to meet the current nuclear safety and radiation protection standards. The improvements and the corresponding assessments are documented in report on operational safety assessment.

Comprehensive safety review is performed according to the IAEA methodology for periodical safety review. The extent to which the deviations from the current safety standards are solved is presented in the “Technical report on the results from the implementation of the comprehensive program for 1- 4 Units upgrading for the period 1998-2002”. Deficiency in the safety of the existing facilities for management of radioactive waste is not observed. A detailed technical project for decommissioning of 1 and 2 Units is developed before 2003 as result of the decision of the Bulgarian government for exclusion of 1 and 2 Units from the national power grid. The accepted decommissioning strategy is in compliance with ASUNE, Regulation №10 of CUAEPP and Belgatom – EWN technical project developed under the PHARE program. Safe storage of the radioactive facilities and installation for period of 35 years is envisaged, followed by a final decontamination and dismantling.

Until now the following assessments are performed as part of "Technical project for decommissioning of Units 1 and 2", developed under PHARE project:

- Operational safety assessment ;
- Environmental impact assessment.

I.2. Facilities for temporary storage of RAW in Special Building-2 and facilities for temporary storage of RAW in Reactor Hall-2:

The facilities are constructed according to the original design of Units 3 and 4 at Kozloduy NPP. The safety review is part of the safety assessment of Units 3 and 4. From 1991 to 2002 measures are implemented, according to the “Short-term program for reconstruction” and “Comprehensive program for upgrading”, in order to meet the current nuclear safety and radiation protection standards. Detailed safety review is performed according to IAEA methodology for periodical safety review.

The results of the assessments are documented in:

- IAEA report from Follow-up SRM, conducted in June 2002, regarding the compliance with IAEA recommendations, both technical and operational aspects, which are defined in OSART report and IAEA- TECDOC-640;
- Report on the compliance of the safety level of Units 3 and 4 with the safety level of Units type B-213 and WENRA and AQG requirements. The assessment is performed by company "ENCONET Consulting";
- “Operational safety assessment of Unit 3" - id.No РД-ТОБ-В, 2002;
- “Operational safety assessment of Unit 4" - id.No РД-ТОБ-Г, 2002;

I.3. Facilities for temporary storage of radioactive waste in Special Building-3:

The facilities are part of the original design of Units 5 and 6 at Kozloduy NPP. Their safety assessment is included in the “Operational safety assessment of the facilities and operation of Units 5 and 6" – October 1993, National Electricity Company, branch Kozloduy NPP.

On request of CUAEPP, IAEA expert mission in July 2000 assessed the technical level of the measures from the "Program for upgrading of Units 5 and 6 ", the status of implementation of IAEA experts recommendations from 1995 mission, the status of solving of the safety related problems according to “Safety issues and their ranking for WWER-1000 model 320 NPPs” (IAEA-EBP-WWER-05). The main conclusion is that there is no safety related area, where the implementation of the measures has not started, some of the safety measures are completely or partly implemented.

I.4. Studies and safety assessments related to all radioactive waste management facilities at Kozloduy NPP site

Numerous studies on the seismic assessment of Kozloduy NPP site are conducted. They are supplemented with specific investigations of the behavior of safety related systems and equipment in case of an earthquake and seismic resistance of the buildings 0.2g (SL2). During the implementation of the above mentioned programmes for reconstruction and modernization, measures are implemented for improvement of the seismic resistance of the equipment, pipelines and basic constructions.

A "Comprehensive program on management of radioactive waste" is developed, which is based on the periodical safety review and NRA prescriptions. The program defines the goals, principles, methods and tools for management of solid and liquid radioactive waste for the overall waste management process: waste generation, treatment, conditioning, safe isolation from the environment. The program is based on the requirements of the existing normative acts in the Republic of Bulgaria and the waste management principles, according to IAEA documents. The implemented and planned activities are described in Annex L-7.

II. REVIEW OF THE SAFETY OF NOVI HAN REPOSITORY

II.1. Safety assessment performed by independent organizations

II.1.1. Project PHARE BG9107-02-04-01

Preliminary post-operational safety assessment is performed in 1997 within a project under PHARE program. The behavior of the repository is evaluated, assuming a post-operational control period of 100 years.

The following migration pathways are considered in the assessment:

- transport with underground water;
- gas generation and migration;
- human intrusion;
- low probability natural phenomena.

The following scenarios are analyzed:

а) current conditions – normal behavior;
б) option for reconstruction - normal behavior;
в) current conditions – human intrusion;
г) earthquake.

Computer codes NAMMU, HARPHRQ, MASCOT, GAMMON и HINDSITE are used in the assessment.

The results show that the total risk is not higher then the acceptable radiological risk of 10^{-6}/a. Higher risk could result from human intrusion. As a consequence institutional control for a period of 250 - 300 years is recommended.

The results can be regarded as preliminary, because of non-conformity to the radionuclide inventory, lack of precise hydrogeological data and the considered bioreceptor.

II.1.2. Safety Substantiation Report, Risk Engineering Ltd., 1997

The following scenarios are considered:

1. spilling of waste on site during unloading and placement of RAW into disposal vaults;
2. spilling of waste as a result of transport accident on the site;
3. fire on the site due to transport accident or other external reasons;
4. release of radionuclides to the environment due to flooding or earthquake.

A probabilistic approach is applied.

The results are as follows:

Scenario 1 – annual risk 7.58×10^{-9}, key radionuclides ^{137}Cs, ^{60}Co, ^{90}Sr.
Scenario 2 – annual risk 2.90×10^{-9}, key radionuclides ^{137}Cs, ^{60}Co, ^{90}Sr.
Scenario 3 – annual risk 3.50×10^{-13}, key radionuclides ^{137}Cs, ^{60}Co, ^{90}Sr.
Scenario 4 – annual risk 5.05×10^{-4}, key radionuclides ^{137}Cs, ^{90}Sr.

Specific measures for increasing safety are proposed, which are implemented by the operator of Novi Han Repository.

II.2. Safety assessment performed by Novi Han Repository

II.2.1.Preliminary safety assessment

The methodology for preliminary safety assessment is developed and implemented by Novi Han Repository in 1997 within the IAEA technical project “Increasing Safety of the Novi Han repository” – BUL/4/005.

Conceptual models are developed, which identity the release of radionuclides from disposal units, as well as during transport, where the presence of radioactive contaminants could result in human

exposure and radiological consequences for the environment. The procedure for construction of the conceptual models is based on simplified approach for identification of features, events and processes (FEPs), which are most important for the safety.
The following two groups of scenarios are analyzed and assessed:

- basic scenario (normal behavior of the disposal units);
- intrusion scenarios – (excavation of disposal units, building of family house on the site and residence with intent for farming and agriculture activities in the area of the repository).

Because of the lack of sufficient data for the hydrogeology of the site, simple approach using empirical mathematical models is applied for modeling of:

- radionuclide behavior and transport in the near field and geosphere with water flow (transport and migration through disposal unit, unsaturated and saturated zone);
- biosphere – exposure pathways, conversion factors and dose calculations.

The following results are obtained from the calculation of the basic scenario:

- for radionuclide release rate from disposal units to the geosphere, by varying of the distribution coefficients and defining the retardation factor and transport delay time with corresponding assumptions for the specifics of the adsorption processes:
  - peak values for disposal vault for solid waste – ^{60}Co – 5.88×10^{5} Bq/a, ^{90}Sr – 4.27×10^{3} Bq/a (with adsorption) и 2.47×10^{6} Bq/a (without adsorption), ^{137}Cs – 3.53×10^{7} Bq/a;
  - peak values for disposal vault for biological waste – ^{3}H – 8.47×10^{7} Bq/a, ^{14}C – 7.60×10^{3} Bq/a (with adsorption), ^{60}Co – 1.42×10^{4} Bq/a, ^{90}Sr – 1.02×10^{4} Bq/a (with adsorption) и 5.95×10^{6} Bq/a (without adsorption), ^{137}Cs – 5.09×10^{6} Bq/a;
  - peak values for engineering trench for solid waste – ^{60}Co – 5.88×10^{5} Bq/a, ^{137}Cs – 3.53×10^{7} Bq/a,^{239}Pu – 1.63 Bq/a (with adsorption) и 3.77×10^{1} Bq/a (without adsorption);
  - peak values for disposal vault for spent sealed sources – ^{60}Co – 6.23×10^{9} Bq/a, ^{137}Cs – 1.09×10^{10} Bq/a; ^{239}Pu – $2..79\times10^{2}$ Bq/a (with adsorption);
- concentration of radionuclides in the aquifer – ^{137}Cs – 2.91×10^{6} Bq/m^{3} for disposal vault for solid waste; ^{3}H – 1.45×10^{7} Bq/m^{3} for disposal vault for biological waste; ^{137}Cs – 1.96×10^{6} Bq/m^{3} for engineering trench; ^{137}Cs – 6.06×10^{10} Bq/m^{3} for disposal vault for spent sources;
- annual equivalent doses via from the use of contaminated water for potable purposes – peak value ^{90}Sr – 9.55×10^{-11} mSv/a for solid waste disposal vault.

The main results obtained from calculation of intrusion scenario under extremely conservative assumptions are:

- Construction scenario – peak values for total annual equivalent doses for key radionuclides:
  - disposal vault for biological waste – ^{3}H – 1.9×10^{-15} Sv/a, ^{14}C – 1.1×10^{-6} Sv/a, ^{137}Cs – 0.41×10^{-3} Sv/a;
  - disposal vault for solid waste – ^{90}Sr – 0.17×10^{-3} Sv/a, ^{137}Cs – 2.4×10^{-3} Sv/a;
  - engineering trench – ^{137}Cs – 1.33×10^{-3} Sv/a.
- Residence scenario – ^{14}C – 2.9×10^{-6} Sv/a; ^{239}Pu – 1.9×10^{-3} Sv/a

The carried out safety assessment is a preliminary idea of how to conduct the safety assessment for an existing repository with insufficient input data. Simple approaches and conservative assumptions are applied. A number of key issues are identified, which need clarification for the next iterations of the safety assessment (radionuclide inventory, hydrogeological characteristics of the site and disposal vault for spent sources).

II.2.2. Safety assessment of Novi Han Repository
In this iteration of the safety assessment the methodological approach which was applied previously for the preliminary safety assessment is improved according to the IAEA recommendations and the results of IAEA coordinated program on Improvement of Safety Assessment Methodologies (ISAM). The safety assessment is performed in 1999 within IAEA project "Increasing safety of Novi Han Repository" – BUL/4/005.
Conceptual models are developed that identify the release of radionuclides from disposal units and transport media in which the presence of radioactive contaminants could result in human exposure and radiological consequences for the environment. The procedure for construction of the conceptual models is based on detailed analyses for identification, classification and grouping of the most important features, events and processes (FEPs).
An approach of comprehensive identification of the potentially relevant FEPs is applied for the generation of the set of scenarios, based on IAEA – ISAM preliminary FEPs list. A procedure for identification, classification and screening of the FEPs was developed. Additionally appropriate set of combinations is constructed, which defines the main elements of the radioactive waste, engineering barriers and human behavior in the procedure of scenario generation.
The following scenarios are analyzed:

- Basic scenario (leaching and release of radionuclides)
- Pu capsules scenario;
- Intrusion scenario (on the repository site).

The mathematical models, which are applied in this iteration of the safety assessment, are:

- modeling of the source term and evaluation of the leaching rate and transport in the repository and subsequent transport toward the geosphere;
- modeling of the geosphere through using delay time produced by the unsaturated zone, and through the advection-dispersion equation for the transport in the saturated zone;
- modeling of the biosphere and dose calculation for assessment of the internal and external exposures for a small farm, construction of house and residence on the site.

These mathematical models are implemented in AMBER computer code.
Two iterations are performed in this safety assessment varying the key parameters - distribution factors, hydraulic conductivity and hydraulic gradient. The first iteration is conservative and produces maximum values for the expected radionuclide migration. The second iteration utilizes the existing data from the geological survey of the site.
The results for the peak doses obtained for the basic scenario (conservative set of parameters) are:

Disposal vault for biological waste – total dose (D_{tot}) - ^{14}C – 1.47×10^{-5} Sv/a; dose from external irradiation (D_{ext}) – ^{90}Sr – 2.72×10^{-12} Sv/a; dose from inhalation of dust (D_{dust}) – ^{14}C – 1.9×10^{-12} Sv/a; ingestion dose (D_{ing}) - ^{14}C – 8.31×10^{-5} Sv/a;

Disposal vault for solid waste - D_{tot} – ^{90}Sr – 4.2×10^{-7} Sv/a; D_{ext} – ^{90}Sr – 1.80×10^{-11} Sv/a; D_{dust} – ^{90}Sr – 7.5×10^{-14} Sv/a; D_{ing} – ^{90}Sr – 4.0×10^{-7} Sv/a;

Engineering trench - D_{tot} –^{239}Pu – 6.9×10^{-8} Sv/a; D_{ext} – ^{239}Pu – 1.2×10^{-13} Sv/a; D_{dust} – ^{239}Pu – 1.6×10^{-10} Sv/a; $_{ing}$ – ^{239}Pu – 1.2×10^{-13} Sv/a;

Disposal vault for spent sources - D_{tot} – ^{239}Pu – 5.5×10^{-5} Sv/a; D_{ext} – ^{227}Ac – 3.4×10^{-9} Sv/a; D_{dust} – ^{239}Pu – 3.1×10^{-7} Sv/a; D_{ing} – ^{239}Pu – 5.4×10^{-5} Sv/a;

Whole repository - D_{tot} – ^{239}Pu – 1.6×10^{-4} Sv/a; D_{ext} – ^{239}Pu – 1.4×10^{-9} Sv/a; D_{dust} – ^{239}Pu – 9.6×10^{-7} Sv/a; D_{ing} – ^{239}Pu – 9.6×10^{-7} Sv/a;

Results from calculations of Pu capsules scenarios:

This scenario is generated and applied especially and only for the disposal vault for spent sources because of disposed Pu sources incorporated into ceramic capsules.
The peak doses for both set of parameters are - 5.93×10^{-6} Sv/a и 1.03×10^{-11} Sv/a.
Results obtained for intrusion scenario - excavation and construction show the following:
Disposal vault for biological waste – the peak value of the dose for the worker is 5.0×10^{-2} Sv/a, the key radionuclide is ^{137}Cs and the main contributor pathway is external radiation.
Disposal vault for solid waste – the peak value of the dose for worker is e 1.1×10^{-1} Sv/a, the key radionuclide is ^{137}Cs and the main contributor pathway is external radiation.
Engineering trench – the peak value of the dose for worker is e 1.1×10^{-1} Sv/a, the key radionuclide is ^{137}Cs and the main contributor pathway is external radiation.
Disposal vault for spent sources - the peak value of the dose for worker is 9.5 Sv/a, the key radionuclide is ^{137}Cs and the main contributor pathway is external radiation. In the long-term time scale key radionuclides are ^{239}Pu and ^{226}Ra and the main contributor is the inhalation pathway.
Results from calculations of the intrusion scenario – residence are following:
Disposal vault for biological waste - the peak value of the total individual dose is formed mainly by ^{14}C - 1.2×10^{-3} Sv/a, the key contributor pathway is ingestion.
Disposal vault for solid waste - the peak value of the total individual dose is formed mainly by ^{137}Cs - 2.12×10^{-7} Sv/a, the key contributor pathway is ingestion.
Engineering trench - the peak value of the total individual dose is formed mainly by ^{137}Cs - 2.7×10^{-7} Sv/a, the key contributor pathway is external radiation.
Disposal vault for spent sources - the peak value of the total individual dose is 1.0×10^{-1} Sv/a, formed mainly by ^{226}Ra via ingestion and inhalation and by ^{239}Pu via inhalation.
The main conclusions after the performing of this iteration of the safety assessment of Novi Han repository are:

- more detailed knowledge of the radionuclide inventory is necessary particularly for ^{3}H, ^{226}Ra and ^{14}C;
- additional geological and hydrogeological investigations of Novi Han Repository site are necessary;
- simple generic model of biosphere is used;
- human intrusion is identified as the most dangerous pathway for radiation exposure – the conclusion is not to apply such conservative conditions in the next iteration of the assessment;
- recommendation for institutional control period of 300 years based on the safety assessment;
- the necessity of the regulation on safety assessment is underlined.

II.2.3.Safety assessment – second version
This iteration of the safety assessment is based on the recommended by the IAEA coordinated program ISAM methodological approach for modeling of repository type ”vault”. It is performed 2001 – 2002 within IAAE technical project “Increasing safety of Novi Han Repository” – BUL/4/005.
Conceptual models are developed that identify the release of radionuclides from disposal units and transport media in which the presence of radioactive contaminants could result in human exposure and radiological consequences for the environment. The procedure for construction of the conceptual models is based on detailed analyses for identification, classification and grouping of the most important features, events and processes (FEPs), using the interaction matrix approach.
An approach of comprehensive identification of the potentially relevant FEPs is applied for generation of the set of scenarios, based on IAEA preliminary FEPs list. A procedure for

identification, classification and screening of the FEPs was developed. Additionally appropriate set of combinations is constructed, which defines the main elements of the radioactive waste, engineering barriers and human behavior in the procedure of scenario generation.
The following scenarios are analyzed:

- basic scenario – determination of the expected behavior and evolution of the system, after external FEPs analyses and safety related functions (related to the disposal system and geosphere without any human intrusion events), assuming total institutional control period of 300 years. The calculations are produced for two types of release:
  - liquid release;
  - gas release.

The identification of alternative scenarios is developed on the basis of comparison of each category of external FEPs in the ISAM FEPs list with the defined initial conditions of the basic scenario. The identified scenarios - geological change, climate change and poor design are screened out, with a recommendation for analysis and assessment in the post-operational safety assessment.

- intrusion scenario – after the passive institutional control. This scenario considers excavation activities, construction of house or building and residence. Two different hypothetical groups are considered:
  - excavation and construction worker;
  - resident of the newly build house on the site.

The mathematical models that are applied in this iteration of the safety assessment are related to:

- modeling of the source term at the processes of leaching and percolation with the infiltration water towards the geosphere;
- modeling of the source term for gas release;
- modeling of geosphere through the delay time, which is determined by the presence of unsaturated zone, and through the advection-dispersion equation for the transport process in the saturated zone;
- modeling of the air concentration of concerned radionuclides for gas release;
- modeling of the biosphere, which includes assessment of the internal and external exposures for a small farm, construction of house and residence on the contaminated site and as a result of inhalation of the gas released radioactivity.

The mathematical models are implemented in AMBER computer code.
The results obtained from calculations of the basic scenario – liquid release, show values lower than the accepted radiological criteria of 1 mSv/a.
The maximum value of the total individual dose for disposal vault for biological waste - 2×10^{-7}Sv/a, formed by ^{14}C; for the disposal vault for solid waste - 1×10^{-8} Sv/a, formed by ^{14}C; for the engineering trench - 0.8×10^{-15} Sv/a, formed by ^{235}U, ^{227}Ac and ^{231}Pa and the daughters of ^{239}Pu decay; for disposal vault for spent sources – 0.2×10^{-9} Sv/a, formed by ^{231}Pa and ^{227}Ac. The main pathway is ingestion.
The results from calculations of gas release show values lower than accepted radiological criteria. The key radionuclide, which forms the highest dose is ^{222}Rn – 8×10^{-4} Sv/a, while the dose from ^{14}C is lower than 1×10^{-8} Sv/a, and from ^{3}H is lower than 1×10^{-10} Sv/a.
As a result of intrusion scenario in the repository, doses up 1.0×10^{-2} Sv/a (mainly from ^{137}Cs) may occur for the intruder (excavator worker) over the next 300 years. The dose from ^{239}Pu (6.07×10^{-5} Sv/a) is also high, but lower than the radiological criteria and constant for a long time. The results from the residence scenario after 300 years – show that the individual doses from the whole

repository are lower than the accepted radiological criteria - peak total dose is 1.51×10^{-4} Sv/a as result from ^{226}Ra.
Sensitivity analysis is performed. The key parameter that is analyzed is the distribution factor - three different iterations with minimum, maximum and best value are made.
The analysis of uncertainty is produced as well as validation iterations with experimentally obtained values for the distribution coefficients and soil-plant transfer factors for Co and Cs. All the results are traceable and well documented as part of the confidence building.
This iteration of the safety assessment is generated in accordance with the last recommendations of IAEA using the currently available data for radionuclide inventory after revision of the repository documentation. Detailed analysis and evaluation of the main transport pathway - liquid and gas, are represented. Interaction matrix approach is used for construction of the conceptual models. Recommendations are made for the necessity of additional hydrological investigations of the site.
The results of the Novi Han safety assessment demonstrate that the repository is safe and suitable for disposal of low- and intermediate level waste, but the repository is not suitable for disposal of radioactive waste, that contain long-lived radionuclides.

II.2.4.Post-operational safety assessment

The methodological approach, recommended by IAEA, is improved and applied. The iteration is produced in 2002 within the IAEA project BUL/4/005.
Conceptual models are developed, which identify the release of radionuclides and transport media, where the presence of radioactive contaminants could result in human exposure and radiological consequences for the environment. The procedure for construction of the conceptual models is based on detailed analyses for identification, sorting and grouping of the safety relevant features, events and processes (FEPs), using the interaction matrix approach. The “reference system” is defined based on detailed analyses of the expected evolution of the system.
The approach of comprehensive identification of the potentially relevant factors (FEPs), using IAEA preliminary list of FEPs is used for generation of the set of scenarios. A procedure of identification, classification and screening of the FEPs is developed. Interaction matrix is constructed for each scenario with precise determination of the main diagonal elements and detailed description of the interaction, shown by the off-diagonal elements.
The following scenarios are identified:

- evolution scenarios:
  - scenario geological changes (tectonic processes, seismicity and hydrological response to geological change);
  - scenario climate changes (local and regional);
- scenarios future human actions:
  - human intrusion – digging, mining, operation, construction of road, houses and agriculture activities;

Scenarios, based on low probability events as terrorist attack explosions, are excluded from this iteration.
The identification of alternative scenarios is based of detailed analysis of prospective evolution of the reference system (including near field, geosphere and biosphere). The following alternative scenarios are identified as result of alternative conceptualization of the reference system:

- fracture matrix system;
- cap subsidence

- animal intrusion

The following mathematical models are applied:

- modeling of the source term in the processes of leaching and percolation with the infiltration water towards the geosphere;
- modeling of geosphere through delay time, determined by the presence of unsaturated zone, and through the advection-dispersion equation for the transport process in the saturated zone;
- modeling of the biosphere, including assessment all exposure pathways and assumptions for intrusion scenarios).

The mathematical models are implemented in AMBER computer.

The results obtained from calculations of prospective evolution of the reference system show the following:

- Total Dose - 5.83×10^{-7} Sv/a;
- Main contributor – disposal vault for solid waste;
- Key radionuclide– ^{14}C;
- Main pathway – ingestion.

The results obtained from calculations of alternative conceptualization of the reference system are:

- Fracture Matrix System
  - Total Dose - 1.39×10^{-5} Sv/a;
  - Main contributor - disposal vault for solid waste;
  - Key radionuclide – ^{14}C;
  - Main pathway – ingestion.
- Cap Subsidence
  - Total Dose - 1.18×10^{-6} Sv/a;
  - Main contributor - disposal vault for solid waste;
  - Key radionuclide– ^{14}C;
  - Main pathway – ingestion.

Main pathway – ingestion

- Animal Intrusion
  - Total Dose - 2.025×10^{-5} Sv/a;
  - Основен разпределител - disposal vault for solid waste;
  - Key radionuclide – ^{14}C;
  - Main pathway – ingestion.

The results obtained from calculations of the prospective evolution of alternative scenarios show the following:

- Geological Changes
  - Total Dose - 3.46×10^{-4} Sv/a;
  - Main contributor – disposal vault for disused sealed sources;
  - Key radionuclide– ^{226}Ra; ^{239}Pu; ^{210}Po, ^{210}Pb;
  - Main pathway – ingestion.
- Climate Change
  - Total Dose - 5.38×10^{-6} Sv/a;
  - Main contributor - disposal vault for solid waste;
  - Key radionuclide– ^{14}C;
  - Main pathway – ingestion.

- Human Intrusion
  - Construction of road

D_{tot} max – engineered trench – 3.8×10^{-6} Sv/a;
D_{tot} max - disposal vault for biological waste – 5.33×10^{-7} Sv/a**;**
D_{tot} max - disposal vault for solid waste **-**1.78×10^{-4} Sv/a;
D_{tot} max - disposal vault for disused sealed sources – 2.1×10^{-2} Sv/a;
D_{tot} max - Novi Han repository – 2.28×10^{-2} Sva^{-1}.

- Construction of House

D_{tot} max - engineered trench – 2.378×10^{-5} Sv/a;
D_{tot} max - disposal vault for biological waste – 3.22×10^{-6} Sv/a**;**
D_{tot} max - disposal vault for solid waste – 1.01×10^{-3} Sv/a;
D_{tot} max - disposal vault for disused sealed sources – 2.6×10^{-2} Sv/a;
D_{tot} max - Novi Han repository – 2.72×10^{-2} Sva^{-1}.

- On-site residence

D_{tot} max - engineered trench – 3.7×10^{-8} Sv/a;
D_{tot} max - disposal vault for biological waste – 9.78×10^{-5} Sv/a**;**
D_{tot} max - disposal vault for solid waste – 2.34×10^{-3} Sv/a;
D_{tot} max - disposal vault for disused sealed sources – 1.3×10^{-2} Sv/a;
D_{tot} max - Novi Han repository – 1.53×10^{-2} Sv/a;

Modern, detailed and applicable approach is applied in the Novi Han post–operational safety assessment, capable to identify and assess all potential risks from the disposal of waste in the facility. The conclusion that the facility is not suitable for disposal of radioactive waste, which contains long-lived radionuclides, is confirmed.

Annex L-7

MEASURES FOR INCREASING THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT FACILITIES

The present Annex stipulates the measures for safety improvement of radioactive waste management facilities available at the moment of coming into force of the Joint Convention, undertaken as a result of the performed safety review. The implementation of concrete measures is related to the development by the operators of the facilities of programs, which correspond to the requirements of current regulations in the Republic of Bulgaria and principles of radioactive waste management stipulated in the IAEA safety standards.

1. Measures for increasing the safety of radioactive waste management facilities at Kozloduy NPP site

1.1 Facilities for temporary storage of radioactive waste in Special Building-1 and facilities for temporary storage of radioactive waste in Reactor Hall -1

In order to ensure the safety of Units 1 and 2 during their decommissioning the following assessments are made:

- Preliminary safety assessment (PSA);
- Environmental impact assessment - (EIA).

As a result of the performed assessment the following measures are specified:

- licensing of the processes related to the safety decommissioning of Units 1 and 2;
- decontamination and treatment of the waste;
- rehabilitation of Special Building-1;
- construction of new installations and modification of the existing ones necessary for safety decommissioning of Units 1 and 2 such as:
  - ventilation and heating;
  - electric power supply and lighting;
  - additional systems for radiation control and management;
  - adaptation of fire alarm and fire extinguishing systems;
  - removal of SNF from the units;
  - construction of additional capacity for storage of SNF;
  - treatment, conditioning and storage of radioactive waste;
- keeping of normal working environment in the rooms, provision of protection and protective means;
- performance of medical check ups of the staff.
- purchasing of equipment for assessment of radiological condition and alpha spectrometry of the facilities and production rooms;
- purchasing of equipment for decontamination of the facilities and production premises of Units 1 and 2.

1.2. Other facilities for management of radioactive waste at Kozloduy NPP site

The performed and planed activities for safety improvement of the existing radioactive waste management facilities at Kozloduy NPP site are as follows:

- optimization of the existing practices in radioactive waste management in Kozloduy NPP aiming to improve the safety level;
- conditioning of solid radioactive waste and liquid radioactive concentrates generated during the operation of nuclear power facilities;
- Conditioning of solid and liquid radioactive waste generated during the decommissioning of nuclear facilities;
- long term storage (including disposal) of the conditioned radioactive waste;
- minimization of radioactive waste – both by activity and volume

In order to resolve the main optimization task for radioactive waste management – namely to minimize the activity of generated radioactive waste and the volume of waste for disposal, the following concrete measures are foreseen:

- separation of different radioactive waste flows;
- elimination of any unjustified radioactive contamination of clean materials used in the restricted area;
- adaptation to the practices of the Kozloduy NPP of new methods and technologies for radioactive waste processing – decontamination, volume reduction, reduction of the activity, change of the composition;
- secondary utilization, including recycling of radioactive contaminated materials after suitable processing;
- justification of practices for exemption from regulatory control in compliance with the legislative requirements.

2. Measures for improvement of the safety of Novi Han Repository

The safety improvement measures of Novi Han Repository are stipulated in:

- Program for increasing the safety of Novi Han Repository based on the analysis of IAEA technical project BUL4/005;
- Project for reconstruction and modernization of Novi Han Repository.

During the period following the signing of the present convention the following concrete measures are implemented.

2.1. Organizational measures:

- establishment of Novi Han Repository as independent structural unit of the INRNE;
- improvement of the administrative structure of Novi Han Repository with clear definition of the responsibilities, rights and obligations of the departments and personnel;
- development and implementation of Quality Assurance System.

2.2. Technical measures:

- maintenance of the surface parts of the radioactive disposal facilities (disposal facility for disused sources, disposal facility for solid waste, disposal facility for biological waste, engineering trench for solid waste), including construction of heavy protection cover of the disposal facility for disused sources;
- maintenance and refurbishment of the buildings, including construction of service building, maintenance and reconstruction of special sewage system and special ventilation, system for preparation of decontamination solutions, construction of lightning protection, reconstruction of access control room;

- maintenance and reconstruction of the site infrastructure including water supply, electric power supply (including provision of back up electric power supply);
- construction of fire protection system, including water pool with a volume of 180 m^3 for provision of emergency water reserve;
- improvement of the physical protection and safety of the site including construction of additional fences, technical devices for physical protection on the perimeter of the site, system for early notification, 24-hour control system of the guarding and monitoring alarm facilities, including continuous video control of the disposal and storage facilities, anti terrorist access complex with mechanical entrances and lock organization;
- provision of technical means for prevention illicit import/export of radioactive materials;
- provision of specialized transport vehicles, technical means for automation of loading and unloading works, provision of measuring equipment for radiation control and monitoring, characterization of waste, technological control of the facilities;
- construction of temporary storage facilities for low level waste;
- construction of temporary storage facilities for intermediate level waste;
- construction of temporary storage facilities for powerful sources from irradiators considered as waste;
- improvement of radiation control and environmental monitoring.

An investment program will be implemented for construction of processing facility for low and intermediate level waste and processing facility for high active disused sources.

Powerful disused gamma sources and sources containing long lived radionuclides are stored and will be accepted for storage at Novi Han Repository. This type of radioactive waste doesn’t meet the waste acceptance criteria for near-surface disposal facilities. In order to solve the problem with their safe disposal INRNE has developed a program for feasibility study of deep shaft Gabra (240 m depth) and the site for construction of disposal facility supported by IAEA technical project BUL4/005. Different options for additional safety upgrading of the existing facilities at Novi Han Repository (construction of additional intrusion barriers, retrieval of spent sources) are analyzed.

LIST OF REPORTS FROM INTERNATIONAL MISSIONS AND PROJECTS RELATED TO SAFETY OF SPENT FUEL STORAGE FACILITIES AND RADIOACTIVE WASTE MANAGEMENT FACILITIES

1. Assessment and upgrading of the Novi Han Monitoring system, 2002, Contract ENV.C.2/SER/2000/0006
2. Support for the establishment of a State Body for RAW and to the activities of the RWM Fund, Final report, Dec.2001, PHARE contract BG9809-02-01
3. Radioactive Waste Management in Bulgaria, Final report, Feb.1997, PHARE contract BG9107-02-04-01
4. Report on a PHARE mission to Bulgaria during April 1993, CCE-DG1 PHARE/TACIS Contract No. ZZ.93.01/01.01/B022
5. Provision of assistance in the preparation of draft ToRs in respect of projects for Novi Han Repository, BUL4/005-02-5, 2002, J.Mathieson
6. Technical control for closure of sealed sources disposal facility at Novi Han Repository, BUL4/005-02-4, 2002, A.E.Arustamov
7. Assistance in evaluation of possible backfilling options for spent sealed sources disposal vault at Novi Han Repository, BUL4/005-02-3, 2002, P.Ormai
8. Technical control for closure of sealed sources disposal facility at Novi Han Repository, BUL4/005-02-2, 2001, M.I.Ojovan, A.E.Arustamov
9. Technical control for closure of sealed sources disposal facility at Novi Han Repository, BUL4/005-02-1, 2001, M.I.Ojovan
10. Establishment of a QA system for Novi Han Repository, BUL4/005-07, 1998, F.Gómez López
11. Preparation of report for improvement of Novi Han Repository, BUL4/005-06, 1998, A.S. Barinov
12. Evaluation of radiological monitoring and control practice, BUL4/005-05, 1998, T.Ortiz Ramis
13. Feasibility study for construction of above ground facility, BUL4/005-04, 1998, D.A.Wells
14. Preliminary safety assessment of Novi Han Repository, BUL4/005-03, 1997, M.W.Kozak
15. Evaluation of the monitoring Novi Han Repository, BUL4/005-02, 1997, S.A.Richet
16. Assessment of the available options for improving the safety of Novi Han Repository, End of mission report, BUL4/005-01, 1997, A.S. Barinov
17. Status of the national repository Novi Han – workplan for siting and designing of a near surface repository, BUL/9/016, Y.Marque, D.Subasic, 1995
18. Safety assessment for the screening and site selection investigations of near-surface radioactive waste disposal facilities, BUL/9/016, J.Tamborini, M.J.Akins, 1994
19. Radioactive waste management – Bulgaria, Radioactive waste management advisory programme (WAMAP), IAEA-TA-2420, 1988

MISSIONS AT KOZLODUY NPP

1. OSART MISSIONS

1.	OSART	V Unit	1991
2.	SRM	I-IV Unit	June 1991
3.	SRM (Follow-up) mission	I-IV Unit	April 1993
4.	SRM (Follow-up) mission	I-IV Unit	July 1994
5.	SRM	V Unit	June 1995
6.	SRM - repeated mission for control on SRM -91	I-IV Unit	January 1996
7.	OSART'99	I-IV Unit	January 1999
8.	IAEA expert mission for review of the program for modernization of Units 5 and 6	V и VI Unit	10-14 July 2000
9.	OSART -Follow-up mission	I-IV Unit	15-19 January 2001
10.	SRM of IAEA	III и IV Unit	24-28 June 2002

2. ASSET MISSIONS

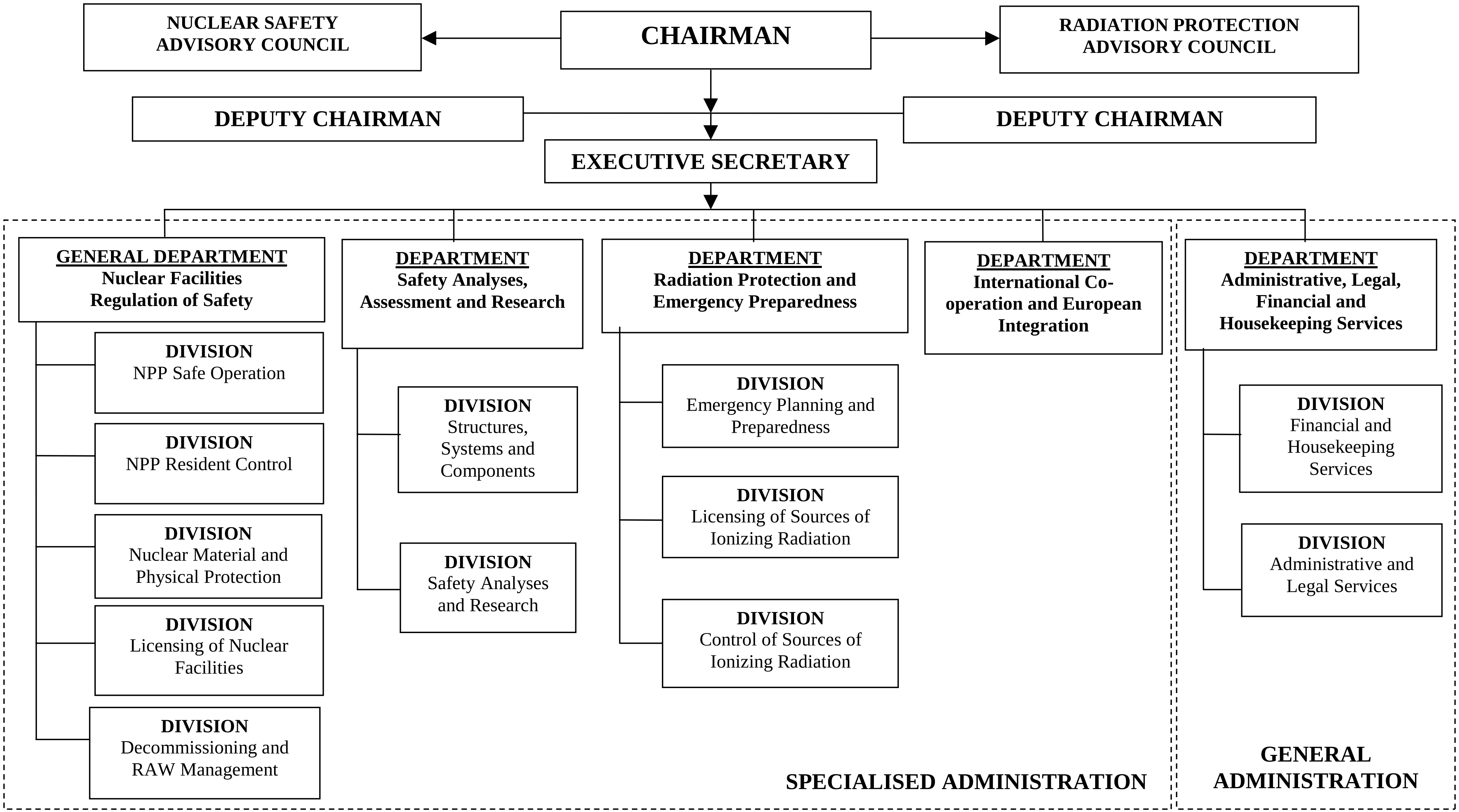
1.	ASSET	I-IV Unit	1990
2.	ASSET – repeated mission for control on the implementation of the recommendations from 1990	I-IV Unit	1992
3.	ASSET -Follow-up mission (final)	I-IV Unit	September 1993
4.	ASSET main	V -VI Unit	November 1994
5.	ASSET	V -VI Unit	November 1997

3. OTHER MISSIONS

1.	Mission G-24 on seismicity of NPP		February 1995
2.	Mission on radioactive waste		March 1995
3.	Benchmark mission on seismicity of NPP		May 1995
4.	Partnership control WANO mission	V -VI Unit	28.10-21.11.1995
5.	IAEA mission IPPAS for control of physical protection	I – VI Unit and IRT-2000	1996
6.	IAEA expert mission on development, validation and verification of emergency procedures	V -VI Unit	18-22.08 1997
7.	Expert mission on PHARE -Risk Audit (PSA-I level)	V -VI Unit	23-17 November 1998
8.	IAEA expert mission on development, validation and verification of emergency procedures	V -VI Unit	30.08-3.09. 1999
9.	Mission of EC - WENRA	I-IV Unit	October 1999
10.	IPERS mission	III и IV Unit	
11.	SRM mission for review of program for modernization	V -VI Unit	10-14 July 2000
12.	Mission for review of program for modernization (Cost /Benefit Analysis)	V -VI Unit	24-28 July 2000
13.	Expert mission for review of program for modernization of Units 1-4	I-IV Unit	October 2000
14.	IAEA mission for evaluation of the NPP "Kozloduy" organizational structure		19-23 February 2001
15.	IAEA mission IPPAS for control of physical protection (Follow-up)	I – VI Unit and IRT-2000	February 2002

Annex L-9

NRA ORGANISATIONAL STRUCTURE



Annex L-10

HUMAN AND FINANCIAL RESOURCES

I. Human resources

Kozloduy NPP

The management of Kozloduy NPP Plc manifests engagement in terms of human resources aimed at ensuring:

- Employment of necessary qualified personnel in compliance with the qualifying requirements for the positions;
- training for the working place and maintenance of personnel qualification;
- employment of certified specialists in compliance with the requirements of the Act on the Safe use of nuclear energy.

The functions upon the preliminary selection, professional selection, personnel training and qualification are distributed in separate structural levels aimed at providing independence of assessment during personnel selection and assessment during training.

The administrative units, with the assistance of the structural units, where they will work, carry out the preliminary selection of the candidates.

Training and maintenance of personnel qualification is carried out by a separate structural unit - Training Centre Division.

The Training Centre of Kozloduy NPP is at the plant site. The centre has available the necessary modern equipment which allows the application of all modern forms of training.

The criteria and requirements for training, qualification and certification of human resources, engaged in the area of atomic energy, are formulated in Regulation № 6 from 1989 of CUAEPP. The latest requirements to the employees in the nuclear energy area are specified in the Act on the Safe use of nuclear energy (ASUNE) from 28.06.2002.

In compliance with the requirements of ASUNE activities, related to nuclear facilities safety, shall be carried out solely by qualified personnel, that possesses an employment permit.

Kozloduy NPP Plc implements the requirements to the personnel, regulated in the normative documents via Personnel training and qualification system. The system includes organisation, management, implementation and control of personnel training and qualification activities, structure and functional responsibilities of officials from NPP structure, levels of authorisation and cooperation of system elements during implementation of activities.

In terms of qualifying requirements, the personnel, engaged with radioactive waste and SF management, is differentiated in groups as follows:

- group A – operational and management personnel, subject to examination by the State Qualification Commission (specified in compliance with Regulation № 6 of CUAEPP positions);
- group B – managers, specialists, operating personnel within the structural units of Kozloduy NPP Plc, subject to examinations in technical operation not included in group "A" ;
- group C – managers, specialists, operating and assistant personnel within the structural units of Kozloduy NPP Plc, not included in groups A and B.

The qualifying requirements for occupying a position in Kozloduy NPP Plc are described in details in the job descriptions for the relevant working position. Job descriptions of personnel, directly engaged in radioactive waste and SF management, are co-ordinated with the Nuclear Regulatory Agency.

Job descriptions of the other personnel are approved by the executive director of Kozloduy NPP Plc, but they are subject to reviews by the Nuclear Regulatory Agency.

The Nuclear Regulatory Agency follows a clearly manifested policy for certification of personnel, employed in the area of nuclear energy utilisation, which requires:

- approved by the Chairman of the Agency list of the personnel, involved in radioactive waste and spent fuel management, subject to examination by the State Qualification Commission (SQC);
- conducting of examinations for the personnel, subject to qualification approval on the examination synopses approved by the Agency Chairman;
- the State qualification commission is appointed by the Chairman of the Agency, co-ordinated with the Minister of Health;
- the employment permit has a limited validity term – not more than 5 years.

Personnel, directly involved in radioactive waste and SF management is certified by the Nuclear Regulatory Agency.

The number of necessary personnel is specified in the job schedule, where the positions are specified, their number and minimal required educational level for the position. All activities on radioactive waste and SF management are ensured by sufficient number of qualified personnel.

To provide qualified and competent personnel a system for internal and external selection is applied. This system provides:

- control of applicants' compliance with the qualifying requirements for the positions;
- control of applicants' health status and further assessment for permission to work in ionising radiation environment
- control of psycho-physiological features of personnel, directly engaged in RAW and SF management and subject to certification by the NRA.

Personnel's training is implemented by standard training programmes and the control of qualification – by examination synopsis.

Admission of personnel to work independently, for which a certification is not required by the SQC, shall be done after examination (check to confirm the required qualification) by Institutional Examination commissions. The system for internal examination comprises of initial exams on safety on the working place, as well as periodical exams for all positions. All the personnel, examined for the given position, shall pass re-examination at different intervals of time for the different positions and categories of personnel.

In Table L-10.1 is presented information on personnel education level within the structural units, which refer to RAW and SF management at Kozloduy NPP Plc and their basic functions:

Table L-10.1

Structural units	Main functions	Total number of personnel	Higher education	Secondary	Primary
Safety and Quality Department	- methodological management and coordination of safety ; - quality assurance; - independent internal nuclear safety and radiation protection; -metrological assurance and environment monitoring	**248**	**147** 59.28 %	**100** 40.31 %	**1** 0.41 %
Production Department					
Maintenance Division	- efficient lifetime management	**592**	**56** 9.46 %	**374** 63.18 %	**162** 27.36 %
Engineering Support Division	- engineering support of SFSF ; - planning, coordination and performance analysis of the production programme	**267**	**63** 23.60 %	**169** 63.3 %	**35** 13.10 %
"EP-1"	- operation of nuclear facilities with reactors WWER-440	**1610**	**369** 22.9 %	**1079** 67 %	**162** 10.1 %
"EP-2"	- operation of nuclear facilities with reactors WWER -1000	**1959**	**605** 30.9 %	**1277** 65.2 %	**77** 3.9 %
SFSF	- operation of SFSF	**55**	**20** 36.4 %	**32** 58.2 %	**3** 5.4%
Personnel and Training centre Division	- organises and conducts training process ; - qualification control	**72**	**45** 61.11 %	**24** 34.72 %	**3** 4.17 %
Testing centre Diagnostics and Control	-diagnostics and control of the base metal status and welds	**80**	**37** 46.25 %	**43** 53.75 %	**0**
RAW and SF Division	- collecting, sorting, transportation, conditioning and temporary storage of RAW	**174**	**48** 28 %	**123** 70 %	**3** 2%

<u>Nuclear research centre (NRC) at the Institute for nuclear researches and nuclear energy at BAS</u>

Qualification and amount of personnel at NRC complies with the requirements for implementation of the Program for ensuring nuclear and radiation safety at the shut down nuclear reactor IRT-2000. At present (March 2003) the NRC has available 24 people operational personnel, 12 with higher education and 9 people – with secondary education. Qualification requirements are regulated in the job description for the working place. Job descriptions of personnel, directly involved in SF and RAW management, are co-ordinated with the Nuclear Regulatory Agency.

The requirements for the personnel include:

- secondary education of the specialities mechanics, power engineering, electronics, turnery and other specialities – for the technical personnel;
- higher education of the specialities nuclear engineering, nuclear physics, electrical engineering and machine construction -for engineering personnel;
- acquiring of further qualification and permission to work in ionising radiation environment;
- additional training and qualification of personnel for the specific position.

A program for personnel training and qualification enhancement is prepared annually, and is implemented at the facility site, as well as off the facility. Specialised training of personnel includes:

- training in nuclear safety and radiation protection;
- studying of reactor systems, tools for nuclear fuel handling and technological systems for transferring of core fuel to the shaft repository of the reactor, system for collecting and storing of liquid radioactive waste, rules for their technical service and maintenance;
- conducting of drills for SF and RAW handling;
- conducting of drills for actions in case of emergency conditions;
- conducting of primary and periodical instructions in safety of work and radiation protection.

<u>PRRAW-Novi han</u>

PRRAW has available qualified personnel, necessary for the safety-related activities during facility operation.

Personnel selection, according the developed criteria and objectives in PRRAW:

- restriction of occasional selection of personnel;
- employment of personnel with high professional qualification;
- only people with medical permission to work in ionising radiation environment are employed.

The total number of personnel is 57 people, 34 of which have higher education in the area of nuclear physics, radiochemistry, radiobiology and engineering-technical specialities. All the people are qualified to work in ionising radiation environment.

Courses on qualification enhancement and acquisition of new skills are implemented in compliance with the document Programme for personnel qualification enhancement in PRRAW.

Qualification is enhanced also by participation in courses, fellowships and regional projects of IAEA in the area of safe management of RAW. Within the project of IAEA BUL4/005 the personnel participated in the organisation and conducting of the following international working seminars:

- Experience in safety enhancement in PRRAW, Borovets, 27-30 November 2000 .
- Safety enhancement of PRRAW for re-licensing, Sofia, 28-30 October 2002 .

In order to create a good psycho-physiological climate and motivation of the personnel, the following directions are pursued, namely:

- optimisation of structures, aimed at clearly defined functions, rights, responsibilities and relations;
- perfection of job descriptions;
- adequate payment in accordance with the assumed responsibilities.

II. Financial resources

As of 01.01.2003 by the Act on the Safe use of nuclear energy were established the Decommissioning of nuclear facilities fund and Radioactive waste fund. The order and way of financing activities related to decommissioning of nuclear facilities and radioactive waste management are established by the same act, as the principles for revenue and expenditure of resources are the following:

- revenue is collected, accounted and centralised in the system of the joint budget account, whereas separate transit accounts are used, opened at the Ministry of energy and energy resources;
- The resources are disbursed solely for financing of activities, specified by the Act on the Safe use of nuclear energy, and the expenses from both funds are annually stipulated in the budget of the Ministry of energy and energy resources;
- The undisbursed part of the resources, including those from past years, is accounted off-balance. The received interests from the deposits in the Bulgarian national bank, after co-ordination between the Minister of finances and the Minister of energy and energy resources are transferred on the accounts of the Decommissioning of nuclear facilities fund and Radioactive waste fund, on the account of the income from interest of the central budget
- Payments to both funds by legal entities and persons shall be recognised as current expenses for the activity;
- Funds are managed by the management boards, the chairman of which is the minister of energy and energy resources
- Accumulated resources for safety and storage of radioactive waste and decommissioning of nuclear facilities, including from previous years are transferred by transit accounts, opened at the name of Ministry of energy and energy resources.
- Funds resources are managed within the control and management of liquidity of system at a joint account.

By Ordinance № 15/2.02.1999 of the Council of Ministers are adopted Regulations for defining the amount of payments, way of collecting, expenditure and control of fund resources and their management. Updating of regulations is forthcoming and it foresees:

- to change the way for collecting revenues, as the amount of the payments per year, for Kozloduy NPP Plc shall be specified upon the predicted expenses for disposal of RAW, from the units operation /or the predicted expenses for decommissioning/ and design lifetime of units operation, but not as deductions from the price of generated electricity.
- To specify the normative time period, whereof the funds must be available for financing of overall expenses during decommissioning;

- To specify by normative documents, that funds resources are available and sufficient for financing of overall expenses for RAW disposal and for decommissioning (foreseen to control the normative period for re-consideration of preliminary assessment of overall expenses).

Expenses for decommissioning of nuclear facilities and for maintenance of safety on RAW management facilities are financed by external assistance. Under the PHARE program, continues the granting of resources for development of projects, related to decommissioning activities and RAW management. From the program for technical support of IAEA is financed a project for management of the project for decommissioning of units in Kozloduy NPP.

Kozloduy NPP

With the separation of Kozloduy NPP as an independent public limited company, the financial resources for management of spent fuel are coming from the realisation of production, of credits and from financial assistance.

With the revenue from sales are ensured financial resources for support of the production process. According to the approved Strategic plan for management of nuclear fuel cycle in Kozloduy NPP, expenses for maintenance of the safety of the Spent fuel management facilities, including expenses for spent fuel sending back to Russia are part of the operational expenses of Kozloduy NPP.

NRC

Financial resources for safety maintenance of the shaft repository of NRC at BAS are provided annually from the state budget.

PRRAW-Novi han

At present PRRAW has available sufficient financial resources for maintenance of facilities safety. Financing started in 1998 by payment from the state budget, and since 1999 by financial resources from the Radioactive waste fund. Financing is implemented on the basis of 3 year programs for development and one year contracts, signed with the management board of the Radioactive waste fund. Events for safety enhancement of facilities are financed.

RADIATION PROTECTION

1. Radiation protection in Kozloduy NPP

1.1. Organisation of radiation protection in Kozloduy NPP during RAW and SF management

The established administrative structure for radiation protection management in Kozloduy NPP covers all activities, related to RAW and SF management, while at the same time takes into consideration the specificity of these activities.

The functions and tasks of the different units, applying the radiation protection system upon implementation of internal institutional control, as well as their inter relations are documented.

In the operational documents, hierarchically structured, is specified in detail the application in practice of legal and normative requirements on radiation protection of staff and protection of population and environment, in normal operation as well as in cases of operational events during RAW and SF management.

1.2. Summarised data on radiation impact upon KNPP staff

The major factors of radiation impact upon staff are related to radiation parameters of the operating environment in the premises:

- Power of the gamma radiation dose;
- density of beta particles flux;
- density of flux and rate of the equivalent dose of neutrons;
- concentration and radionuclide composition of radioactive gases and aerosols in the air of the production premises;
- surface contamination with radioactive substances of building structures, equipment and staff clothing.

The conducted research of factors, determining the overall dose exposure, show that the main factor is external exposure, caused by the gamma radiation. Beta radiation has its contribution to the overall dose external exposure only in separate cases and is less than 10%. The contribution of thermal neutrons (chiefly in transport operations with spent fuel) amounts to less than 0,3 % of the dose.

The basic method for measurement of external exposure doses is thermoluminescent individual monitoring, with threshold of 0,10 mSv sensitivity. For the objectives of operational monitoring are used electronic dosemeters with direct counting (sensitivity 0,001 mSv).

The internal exposure of incorporated radionuclides is carried out by the whole body counter with “shadow” shielding and geometry of measurement “linear scanning”. Gamma – ray emitters with minimal detectable activity 400 Bq (for ^{60}Co) and 500 Bq (for ^{137}Cs) are detected for the whole body.

The averaged individual dose of exposure for the whole staff of NPP, including subcontractors and external organizations, for the last 10 years is within the limits of 1.10 mSv/a – 5.27 mSv/a.

Internal exposure doses, average for all the staff of NPP, as a rule represent not more than 5% of the overall exposure.

Summarised information on the dose exposure for the staff of the unit for management of RAW and SFSF (spent fuel storage facilities) is presented in Table L-11-1.

Table L-11-1

	1999			2000			2001		
	RAW	SFSF	NPP	RAW	SFSF	NPP	RAW	SFSF	NPP
Maximal individual dose, [**mSv]**	3.49	1.00	29.80	3.62	1.00	39.58	1.75	0.86	19.19
Annual collective dose, (incl. subcontractors), [**man.mSv]**	85.70	3.85	4530	75.09	3.99	6170	57.04	7.42	5590
Number of people with doses above 20 mSv	0	0	11	0	0	21	0	0	0
Average Annual individual effective dose, [**mSv]**	1.55	0.08	1.10	1.34	0.10	1.45	0.89	0.19	1.15
Internal exposure share from the annual collective dose, [**%]**	0.2	0.02	3.0	0.01	0.01	2.81	ND*	0.01	2.66

ND- internal exposure has not been registered

From the review of the submitted information about professional exposure of the RAW management and SFSF staff is concluded the following:

- maximal individual doses of staff in units, related to RAW and SF management are lower than those of NPP;
- the internal exposure in these units is lower than that for NPP as a whole;
- there are no persons from the staff of these units with annual doses higher than 20 mSv;
- staff exposure, in RAW and SFSF management, as well as in Kozloduy NPP as a whole, is in full compliance with the requirements of BSRP-2000 and with the internationally accepted standards on radiation protection.

1.3. The summarised data on radiation impacts upon population and environment

The normalised activity released through the vent stacks of Kozloduy NPP for the period 1999-2001 is presented in Table L-11-2.

Table L-11-2

Normalised indicators	Unit of the measured value	1999	2000	2001
Radioactive noble gases	TBq/(GW.a)	143	121	132
Iodine – 131	GBq/(GW.a)	1.62	1.57	1.72
Radioactive aerosols	GBq/(GW.a)	0.58	0.57	0.70

In the period 1999-2001 in the Danube River were released a total of 557 393 m^3 service water with the following overall normalised activity (Table L-11-3):

Table L-11-3

Normalised indicators	Unit of the measured value	1999	2000	2001
Liquid discharges, without tritium	GBq/(GW.a)	2.12	3.07	4.03
Tritium	TBq/(GW.a)	11.20	7.52	6.76

The released activity with gas aerosols and liquid discharges by Kozloduy NPP is within the limits of 1,6 % according to the standards in force in the Republic of Bulgaria and is comparable with the usual practice of other countries, operating WWER nuclear reactors.

The maximal value of the individual effective annual dose within the 30 κm area, as a result of the gas aerosol discharges of Kozloduy NPP in the period 1999-2001 is within the range of 2.68×10^{-7} to 3.75×10^{-7} Sv/a. This exposure is less than 0.016 % of the background exposure, typical for the region of Kozloduy NPP and less than 0.5% of the established level of population exposure of 200 μSv/a.

The maximal collective effective annual dose of population exposure within the 30-kilometers area, as a result of gas aerosol discharges of Kozloduy NPP is evaluated in the limits from 2.76×10^{-3} to 3.58×10^{-3} man.Sv/(GW.a). These are limits, completely comparable to UNSCEAR-98 data for a large number of reactors type PWR.

Exposure of the population critical group members on the account of liquid discharges is within the order from 1.17×10^{-11} to 1.66×10^{-11} Sv/a, which is insignificantly low. Normalised collective effective dose of the population within the 30 κm area, due to liquid discharges, is evaluated in the limits 1.3×10^{-8} to 2.9×10^{-8} man.Sv/(GW.a).

The received in 1999-2001 data about the dose exposure of population within the 30 κm area of Kozloduy NPP are completely comparable to previous years' data and confirm the deductions for insignificantly low impact upon environment and population.

Radiation gamma background within the 3 κm area around Kozloduy NPP is measured constantly, via a system for automated external radiation monitoring "Berthold". In the system are included 10 monitoring stations for gamma background measurement and the composition of ^{131}I in the ground layer of the atmosphere, 5 water stations and 3 meteorological stations. The system for constant radiation monitoring of Kozloduy NPP was integrated in the National automated system for constant radiation control of the gamma background in the Republic of Bulgaria. Operational exchange of information is ensured in both directions.

In the period of 1998-2001 dose rate of the gamma radiation at the site boundary, as well as in all control posts within the 100 κm area around Kozloduy NPP, is within the natural gamma background of 0.08 – 0.15 μSv/h and is completely comparable to other populated areas in the country.

Within the program, performed by Kozloduy NPP, annually are analysed about 2000 samples from different sites in the environment in the 100 κm surveillance area in the Kozloduy NPP. Basic methods for analysis are gamma-spectrometry, low background radiometry of the total activity of beta - radiation radionuclides and liquid- scintillation spectrometry.

The results from the analyses of basic environment components such as air, water, soil and plants, as well as typical for the region of Kozloduy NPP foods are within the normal limits for these latitudes. The measured concentration is many times lower than the established by the national legislation maximum values and is completely comparable to the previous years data and pre-start-up period (1972-1974).

During the period of operation of Kozloduy NPP the additional dose exposure of population is significantly lower not only than the recommended by the International commission on radiological protection, maximal limit 300 $\mu Sv\cdot a^{-1}$ (Issue 77 of МКРЗ, 1998), but also than the requirements of BSRP-2000 for exemption from control (1 $man.Sv\cdot a^{-1}$ and10 $\mu Sv\cdot a^{-1}$). This gives the reason for the deduction, that population exposure doses, caused by Kozloduy NPP , *"are* *maintained at a reasonably low level and that there isn't a person whose dose exposure exceeds the specified national dose limits."* .

The pointed out deductions on radiation impacts upon population and environment are confirmed by an independent expert assessment in the report about Kozloduy NPP environmental impact assessment (EIA)(2000).

2. Radiation protection at the Nuclear research centre

2.1 Organisation of radiation protection in RAW and SF management

Radiation control in and around the building of IRT-2000 and the site territory is carried out in Radiation safety Department and the Laboratory on radiation dosemetry. Their activity is controlled by the INRNE department Control of nuclear safety and radiation protection. Additional radiation monitoring of the site territory is carried out by the National institute of meteorology and hydrology at BAS.

2.2 Summarised data on the radiation impact upon staff, population and environment

Radiation control in the NRC includes radiation control, individual monitoring and environment control .

Radiation technological control includes:

1. determination of total activity of beta-radiation radionuclides of water in the reactor pools and the shaft repository once a month.
2. specifying of the dose rate once a month for the following dosimetric points:
   - ДК-82, located at the reactor site;
   - ДК-79, located at the shaft repository;
   - ДК-77, located at a pipe of the Ist circulation loop.
3. determination of dose rate and control of surface contamination once a month for the following premises:
   - reactor hall;
   - compartment of the Ist circulation loop;
   - ventilation centre;
   - working premises, laboratories and corridors in the building of IRT-2000.

Individual dosimetry control is implemented according to the Program for individual monitoring. Thermoluminescent dosemeters and directly counting dosemeters are used.

In the SF management there are no dose exposures above the permissible limits. In Table L-11-4 are presented the maximal and minimal dose exposure of the staff for the last three years.

Table L-11-4

Year	Maximal individual dose [mSv]	Minimal individual dose [mSv]
2000	4.4	1.0
2001	3.1	0.6
2002	2.3	0.5

Subject to for radiation monitoring of environment are the following:

- reactor facilities water, drainage and rainfall water (quarterly);
- plants and fruit from the region, perennial and annual (seasonal);
- soils from the region (quarterly);
- ground layer air (every day);

- radiation gamma background in the radiation protected area (twice a year).

The received data from the measurements of the controlled sites allows assessment of the content of gamma – emitters (gamma spectrometry analysis), of total activity of beta-radiation radionuclides in the examined samples and of radiation gamma background of the controlled region.

3. Radiation protection in PRRAW-Novi han

3.1 Organisation of radiation protection in SF and RAW management

In PRRAW-Novi han was established the "Nuclear safety and radiation protection" Department with the following functions:

- radiation monitoring of operational staff in reception, shipment and storage of RAW;
- radiation monitoring of members of PRRAW emergency group, participating in elimination of emergency situations in the country, occurred during using or finding of sources of ionising radiation (SIR) and radioactive contaminated materials;
- radiation monitoring of contractors' staff, carrying out maintenance and construction activities at the PRRAW site;
- radiation monitoring of special transport vehicles;
- radiation monitoring of PRRAW site;
- radiation monitoring of the site, radiation protected and surveillance area of PRRAW.

The activity is controlled by the INRNE department "Control of nuclear safety and radiation protection".

3.2 Summarised data on the radiation impact upon staff, population and environment

According to the Program for radiation monitoring of RRAW is carried out operational radiation monitoring and constant radiation control.

Operational radiation monitoring is carried out before, during and after completion of work.. The following parameters of working environment in the premises are controlled, on the site and special transport vehicles:

- power of gamma radiation dose;
- density of beta particles flux;
- density of alpha particles flux;
- surface contamination with radioactive substances of working surfaces, equipment and staff clothing.
- density of flux and rate of the equivalent dose of neutrons in reception of neutron sources.

The constant radiation monitoring is carried out by a permanent dosimetry network of 44 fixed points at the site of PRRAW. The following parameters are controlled twice a month:

- power of the gamma radiation dose;
- surface contamination of beta -emitters.

Constant control of the activity of gamma - radiation radionuclides in the surface air, control of atmospheric air for radioactive aerosols and gases, constant control of incoming and outgoing transport vehicles at the entrance of PRRAW, automatic measurement of dose rate in specific points at the site with stationary located detectors.

Analysis of results show, that in the operation of PRRAW:

- increase of radiation background around facilities has not been allowed for disposal and storage of radioactive waste above the permissible limits – rate of the equivalent dose at the distance of 1 m from the external surface 28 μSv/h;
- radioactive contamination of PRRAW site has not been allowed;
- aerosol activity of ^{137}Cs, ^{60}Co, ^{241}Am, isotopes of Pu in concentrations above the norms for the population is not present;
- uncontrolled carrying in and out of radioactive materials has not been allowed.

The basic factor, determining the dose exposure of the staff, is the external exposure, the main contributor being the gamma radiation. Beta radiation and alpha radiation have contribution to the overall dose of external exposure solely in separate cases and it is not more than 1%. The contribution of neutrons is not more than 0.1 % of the dose.

Individual monitoring is carried out by individual thermoluminescent dosemeters with a threshold of sensitivity 0.5 mSv and digital electronic dosemeters with direct counting with threshold of sensitivity 0.001 mSv. The averaged individual dose exposure of the staff for 2002 is 1.18 mSv; for 2001 is 1.72 mSv; for 2000 is 2.36 mSv and for 1999 is 1.98 mSv.

Control of the internal exposure of staff direct whole body counting is carried out by the National Centre of Radiobiology and Radiation Protection once a year. Analysis of results show that the individual dose of internal exposure does not exceed 0.89 μSv.

In addition to the routine specialized medical examinations of the staff, once a year are carried out additional examinations:

- molecular and biochemistry for people with increased health hazard ;
- cytogenic screening for establishing the presence or lack of damages to DNA structures;
- assessment of cancer hazard for formation of malignant tumors.

There are no cases of specific radiation pathology.

Radiation monitoring of environment sites is regulated in the Program for radiation monitoring of PRRAW, which covers the:

- site of PRRAW;
- radiation protection area with radius of 1 km;
- surveillance area with radius of 5 km.

29 fixed points, located in the three areas are controlled. Subject to radiation monitoring are the following:

- water samples of the constructed at the site of PRRAW and in the radiation protection area piezometers
- water samples of permanent water sources Murata and Krastevi kladentzi, located in the radiation – protection area of PRRAW at 680 m and 280 m respectively;
- water samples of seasonal water sources;
- water samples of the water sources nearby - in Novi Han and Gabra;
- soil and vegetal samples.

The frequency of analytical sampling is once a month for water samples of the piezometers and permanent water sources, once a year for the rest water samples, soil and plant samples. Direct measurement of dose rate, on-site gamma-spectrometry, and laboratory gamma spectrometry analysis is carried out, the overall activity of beta radiation radionuclides, low background liquid – scintillation specification of tritium, ^{90}Sr and alpha emitters. In addition piezometers are equipped with system for control of environment parameters– determination of water level, temperature, pH, electricity conductivity and allow measurement of gamma-spectres.

The analysis of results show, that there is no passing of technogenic radionuclides into the environment water samples. In the soil samples has been found solely ^{137}Cs with specific activity in the limits of 11.5 to 32.1 Bg/kg, which is within the specific activity of ^{137}Cs in the soils of the country as a result of the contamination of the Chernobyl accident. In the plant samples are registered ^{137}Cs (under 0.2 Bg/kg for vegetal products 1.14 Bg/kg for grass) and ^{90}Sr (below 10 Bg/kg for both products), which correspond to the values, in consequence of the Chernobyl accident. The results show that, radiation impact of PRRAW upon environment is insignificantly low.

The annual effective dose of people from the critical group of population is assessed. The value is lower than the 10μSv/a and does not need specifying by using more realistic dosimetric models.

Annex L-12

MEASURES UNDERTAKEN FOR DECOMMISSIONING OF UNIT 1 AND 2 OF KOZLODUY NPP

In compliance with Decision № 848 of the Council of Ministers of the Republic of Bulgaria of December 19, 2002, units 1 and 2 of Kozloduy NPP were disconnected from the grid at the end of 2002.

A number of activities on the implementation of the technical preparation and beginning of decommissioning activities of these units are in its final stage:

1. A structure for decommissioning management was established and developed in Kozloduy NPP. Special personnel training has started and is in the process of implementation now.

2. The following projects have ben prepared:
   - Conceptual technical project for decommissioning of units 1 and 2 of Kozloduy NPP– contract under the PHARE program BG 9608-01-01-L001, completed in April, 2000 ;
   - detailed technical project for decommissioning of units 1 and 2 of Kozloduy NPP- Contract under the PHARE program BG 9809-02-03, completed in December, 2001 .

3. In process of implementation is the project BUL/4/008, financed on behalf of IAEA, decommissioning project management. The term for completion and implementation of the system is July 2003.

4. Pursuant to the agreement between the European commission and the Bulgarian Government dated 29.11.1999 and the framework agreement between the Republic of Bulgaria and the European bank for reconstruction and development (EBRD) from 15.06.2001 was established the International fund Kozloduy for support in decommissioning activities - KIDSF. European bank for reconstruction and development administers KIDSF and the submitting of gratuitous resources to the Receiver for financing and co-financing of preparation and performance of selected projects.

5. Within the financing activities of the international fund KIDSF was established a Project Management Unit (PMU), which shall manage, coordinate and monitor the projects; provide goods, activities and services, financed by KIDSF; specify appropriate organizational structures, for the performance of specific engineering and supplier's and other services.

6. Each year is prepared a plan-account of expenses of the Decommissioning of nuclear facilities fund, with the help of which is provided the financing of activities, planned to be performed during the relevant year. The account is approved together with the approval of the state budget.

The decommissioning plan of unit 1 and 2 of Kozloduy NPP was developed within the framework of the conceptual technical project for decommissioning of units 1 and 2 of Kozloduy NPP, April 2000 г. It consists of the following stages:

- final shut-down – term 3 years;
- preparation for safe enclosure - 2 years;
- safe enclosure - term 35 years.;
- postponed dismantling (liquidation of safe enclosure) – the term has not been evaluated , because of its remoteness in time (according to an expert evaluation, by using the present methods for dismantling and demolition of structures, the duration of the stage can be ten years).

Within the technical project for decommissioning of units 1 and 2 were developed: Safety Analysis Report, Report of the environment impact assessment (EIA), Quality Assurance Program and Conception on radiation protection.

The guiding principle of the human resources policy of Kozloduy NPP is keeping to significant extent the human resources (and especially – of highly qualified personnel) during the transition from operation to decommissioning of nuclear facilities. The operational approach, adopted by the company management, is to carry out the decommissioning with internal resources, assisted where necessary by specialists on external contracts.

The program for personnel management is in a process of development with an attached annual schedule of personnel reduction, which is specific, because two of these four units which are in one organizational structure, are still in operation.

In 2000 at Kozloduy NPP Plc was established a separate unit - Decommissioning Division – aimed at ensuring safety during the management and implementation of all necessary activities for the preparation of decommissioning and the decommissioning of units 1 and 2. Decommissioning division has a statute of a structural subdivision, which is directly subordinated to the Executive Director of Kozloduy NPP Plc and has the following sections:

- technology and radiation protection;
- decontamination and radioactive waste;
- engineering support and quality.

The initial number of personnel is 20 people.

LIST OF PERFORMED ANALYSES, IMPLEMENTED PROJECTS AND PLANNED ACTIVITIES RELATED TO SFSF SAFETY

I. LIST OF ANALYSES, RELATED TO SFSF SAFETY

No	Month, year	Analyses name
1	03.90	Analysis of safety of SFSF under internal and external impact of various initial events of the parts designed by НИТИ "ЕП"
2	03.90	Analysis of security at the SFSF building site under external influence (explosion wave)
3	12.91	Analysis of seismic stability of the structure, including foundations under the equipment I category of SFSF in compliance with ПНАЕГ-5-006-87 and specifying of admissible security
4	12.91	Check of seismic stability of casings WWER-440 in the SFSF pools
5	10.91	Analysis of possibilities and technical decisions for stability enhancement of steel and roof forms under extreme wind and snow loads of SFSF
6	06.93	Evaluation of seismic hazard from the operation of SFSF
7	06.94	Control of seismic stability of casings in SFSF pools of Kozloduy NPP
8	94	Calculational research and analysis of hypothetical accident
9	07.95	Research and decommissioning of SFSF
10	12.95	Analysis of conditions for liquefaction of sands under the SFSF, part I. engineering, hydro geological and geo mechanical conditions
11	07.96	Analysis of conditions for liquefaction of sands under the SFSF, part II. Research for liquefaction of sands under seismic influence
12	05.96	Control of seismic stability of the structure of cranes with load capacity of 160/32/8t with the cross-piece and rod 16t
13	01.97	Technical report "Evaluation of events on the Programme for safety enhancement of SFSF"
14	12.97	Expert evaluation of probability sand leakages at the site of the SFSF under seismic influence
15	01.98	Control of load capacity of the structure of SFSF pools under emergency falling of casings
16	08.98	Neutron dosimetric research of units 1-4 and SFSF

17	12.98	Substantiation for storage term extension of fuel rods assemblies of reactors WWER-440 in SFSF of Kozloduy NPP”
18	3.99	Wet Spent Fuel Storage Safety Analysis Report Review
19	05.00	Updated level spectrums of reinforced structure of SFSF
20	05.00	Updated level spectrums of reinforced structure of SFSF - Addition
21	06.00	Updated level spectrums of reinforced structure of SFSF. Seismic stability and qualification of equipment
22	07.00	Updated level spectrums of reinforced structure of SFSF. Seismic stability and qualification of equipment, edition 1
23	12.00	Updated SAR of SFSF
24	02.01	Analysis-comparison of the tension in fittings and equipment caused by the pipelines of the new lines for demineralized water and service water in SFSF
25	02.01	Analysis of seismic stability heat exchanger pipe bundle for cooling of pool water 630ТНГ-16-Б6-0/20-3-2
26	07.01	Research of radiation parameters in the environment in SFSF premises– by the National centre of radiobiology and radiation protection
27	10.01	Seismic qualification of equipment and pipelines in SFSF, part 1. Basic conditions and methods
28	12.01	Seismic qualification of equipment and pipelines in SFSF, part 2, volume 1. Seismic qualification of machine and technological equipment (MTE) of the fuel cooling system (KV 30)
29	12.01	Seismic qualification of equipment and pipelines in SFSF, part 2, volume 2. Seismic qualification of MTE of the pool feed water system (HD 30), version 1
30	12.01	Seismic qualification of equipment and pipelines in SFSF, part 2, volume 3. Seismic qualification of MTE water purification system (KV 40), version 1
31	10.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification of pipelines and fittings
32	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification of pipelines and fittings, Annex 1
33	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification of pipelines and fittings, Annex 2
34	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification of pipelines and fittings, Annex 3
35	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification of pipelines and fittings, Annex 4

36	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification pipelines and fittings, Annex 5
37	11.01	Seismic qualification of equipment and pipelines in SFSF, part 3. Seismic qualification pipelines and fittings, Annex 6
38	12.01	Seismic qualification of equipment and pipelines in SFSF, part 4, volume 1. Qualification of electrical and I&C equipment by an expert, analytical and combined methods. Specification of experiment and equipment by an experimental method
39	12.01	Seismic qualification of equipment and pipelines in SFSF, part 4, volume 2. Qualification of electrical and I&C equipment by an experimental method
40	4.02	Seismic qualification of equipment and pipelines in SFSF, part 2, volume 4. Seismic qualification of MTEO of the system for organised leakages (KV 01), version 2
41	4.02	Seismic qualification of equipment and pipelines in SFSF, part 5. Specification for reinforcement design and delivery of qualified equipment, version 2
42	10.02	Seismic qualification of equipment in SFSF. Systems KV01, HS55 (system for special drainage), HS56 (drain gully water system), version 0
43	10.02	Seismic qualification of equipment in the SFSF. System for decontamination (HD50), version 0
44	12.02	Seismic qualification of equipment and pipelines in SFSF, part 2, volume 5. Seismic qualification of MTE of systems HS55, HS56, HD50, version 1

II. IMPLEMENTED PROJECTS FOR SFSF SAFETY ENHANCEMENT

Earthquake-proof reinforced for seismic impact 8th grade according to MSK-64 scale (maximal calculated earthquake- SL-2) are:

- building structure of SFSF;
- roof structure of SFSF;
- undercrane roads in SFSF;
- cranes for transport of SF;
- systems important to project safety.

In addition new seismically stable lines of independent sources have been established for:

- cooling water
- feed-up water for sectors with SF
- electrical supply of SFSF (independent spare diesel generator).

III. PLANNED ACTIVITIES FOR MODERNIZATION AND SFSF SAFETY ENHANCEMENT

Till the end of 2003 is planned to be implemented the following projects:

- modernisation of bridge crane management 160/32/8 t;
- automatic measurement of electricity conduction of water streams in SFSF;
- installation of noncontact digital level gauge at the sections of SF storage and other tanks;
- replacement of equipment, which has not passed successfully the seismic qualification.

Till the end of 2004 the following projects are planned to be implemented

- modernisation of radiation control system;
- enlargement of temperature control at the sectors;
- development and implementation of information system on the status of equipment and technological parameters of SFSF.

Till the end of 2005 the following projects are planned to be implemented:

- equipment at sectors for receiving and refuelling of SF by the handling machine for SF from WWER-1000 and WWER-440;
- replacement of the protection and interlock system with digital one.