THE REPUBLIC OF BULGARIA

NATIONAL REPORT

ON FULFILLMENT OF THE OBLIGATIONS

ON THE CONVENTION ON NUCLEAR SAFETY

THIRD EDITION

Sofia, September 2004

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TABLE OF CONTENT

I. GENERAL 5

- 1. Introduction 5
- 2. Policy of the Republic of Bulgaria in the area of nuclear energy 6

II. REVIEW OF THE CONVENTION ARTICLE BY ARTICLE 12

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS 12

- 1. Brief review of the information presented in the first and second National Reports on the article 12
- 2. Units 1&2 of Kozloduy NPP 12
- 3. Units 3 and 4 of Kozloduy NPP 14
- 4. Units 5 and 6 of Kozloduy NPP 17

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK 20

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 20
- 2. Regulatory documents in the field of nuclear safety. Changes made in the legislative basis 20
- 3. System for licensing of nuclear facilities according to the Act on Safe Use of Nuclear Energy 21
- 4. System of regulatory inspections 23
- 5. Development of the regulatory basis 27

ARTICLE 8. REGULATORY BODY 29

- 1. Brief review of the information, presented in the framework of the first and second National Reports on this article 29
- 2. Change in the status of Regulatory authority of Republic of Bulgaria after enforcement of the new Act on Safe Use of Nuclear Energy 29

- 3. Implementation of the action plan of BNRA 34

ARTICLE 9. RESPONSIBILITY OF THE LICENCE HOLDER 38

- 1. Brief review of the information presented in first and second National Reports on this Article 38
- 2. Changes of the responsibilities of the License holder according to the changes in the Licensing regime in Bulgaria 38

ARTICLE 10. PRIORITY TO SAFETY 41

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 41
- 2. Policy of the Operator 41
- 3. Safety culture in Kozloduy NPP 42
- 4. Continuation of the activities on international co-operation 44

ARTICLE 11. FINANCIAL AND HUMAN RESOURCES 46

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 46
- 2. Financing of the safety improvement measures 46
- 3. Financing of the decommissioning activities and radioactive waste treatment 47
- 4. Provision of adequate human resources 50

ARTICLE 12. HUMAN FACTORS 53

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 53
- 2. Enhancement of the system for analysis and management of the human factor 53
- 3. Human factor and assurance of safe operation of units 1 and 2 in the process of their preparation for early decommissioning 54

ARTICLE 13. QUALITY ASSURANCE 56

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 56

- 2. System for Quality Management in Kozloduy NPP 56
- 3. Quality management during implementation of units' 5&6 modernization program . 59

ARTICLE 14. ASSESSMENT AND VERIFICATION OF SAFETY 63

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 63
- 2. Changes in the legal basis concerning the evaluation of safety of nuclear facilities ... 64
- 3. Evaluation of the safety of existing nuclear facilities 64
- 4. Inspection system and indicators 67

ARTICLE 15. RADIATION PROTECTION 71

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 71
- 2. Organization of the Radiation protection and radiation monitoring in the Republic of Bulgaria 71
- 3. Control bodies in the area of radiation protection 72
- 4. Radiation safety in the operation of Kozloduy NPP 73

ARTICLE 16. EMERGENCY PREPAREDNESS 78

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 78
- 2. Legal and regulatory basis for the emergency planning and preparedness 79
- 3. National emergency plan of the Republic of Bulgaria 80
- 4. Kozloduy NPP emergency plan 81
- 5. Emergency planning training and exercises 81

ARTICLE 17. SITING 83

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 83
- 2. Changes in the legislation and the regulatory basis of Republic of Bulgaria 83
- 3. "Kozloduy" Site 85

- 4. “Belene” site 87

ARTICLE 18. DESIGN AND CONSTRUCTION 88

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 88
- 2. Changes in the regulations about NPPs design and construction 88
- 3. Changes in the units design basis as a result from the implemented modernizations 90

ARTICLE 19. OPERATION 95

- 1. Brief review of the information presented in the framework of first and second National Reports on this article 95
- 2. Changes in the legal and regulatory basis 96
- 3. Organization of Kozloduy NPP operation 97
- 4. Analysis of the operational experience 101
- 5. Generation and treatment of radioactive waste 103

Attachments to the report: 104

List of reference documents 105

I. GENERAL

1. Introduction

The Republic of Bulgaria is amongst the Contracting Parties, ratified the Convention on Nuclear Safety (ratified with an Act, passed by the 37th National Assembly 14 September 1995, promulgated in State Gazette # 86,1995, in force for the Republic of Bulgaria since 24 October 1996, promulgated in State Gazette # 93, 1996). With this Act the country confirmed the national policy for maintaining a high level of nuclear safety, assurance of necessary transparency and the application of highest standards.

In accordance with the above, the Republic of Bulgaria took part in the two previous meetings on review of the National reports, held in 1999 and 2002, in compliance with Art. 20 of the Convention. During the meetings, the country presented the National Reports for the measures taken for fulfillment of its obligations according to the Convention.

The first and second National Reports consecutively presented the status of the correspondence with the requirements, as well as measures for fulfillment of the obligations, coming from the Convention, planned and implemented by the Bulgarian Government, its regulatory bodies and the Nuclear Operator. According to the adopted rules of the review process, answers of all questions asked on the Reports are provided in timely manner.

During the discussions on the second National Report in April 2002 at the IAEA Headquarters in Vienna, the contracting parties welcomed and supported the priorities in the Bulgarian policy:

- changes in the regulatory basis and the institutional framework, leading to the increase of regulatory authority independence;
- implementation of developed programs for the safety upgrading of the Kozloduy NPP units and total updating the units' SAR;
- Maintaining the level of operational safety of units, in accordance with good international practices;
- Management of the rest lifetime of systems, structures and elements.

As a result of the discussions during the presentation of the second National Report, the following recommendations were given to the country:

- Putting into force the new Act on Safe Use of Nuclear Energy as soon as practically possible;
- Implementation of the action plan of the regulatory authority in the shortest practical terms.

In the third National Report a review of the development of the major questions in the area of the nuclear safety assurance for the period, following the presentation of the previous Report, is presented. It provides information for the fulfillment of the country priorities, announced in the previous Report, as well as for the addressing of the recommendations.

Fulfilled in the period after the second National Report of the Republic of Bulgaria are the following:

- Complete change of the regulatory basis for safety, based on the new Act on Safe Use of Nuclear Energy, put in force July 2002;
- Introducing a new licensing regime for the activities in nuclear facilities and with ionizing radiation sources;
- Implementation of all measures of the Units 3&4 modernization program, that led to a new units' design basis;
- The obligation taken for Units 5&6 modernization.

As attachments are included list and data for the existing nuclear facilities, updated information for the legislation and institutional framework, modernization programs for different units, units 1&2 decommissioning program, extracts from reports of international review missions carried out upon country request, etc.

2. Policy of the Republic of Bulgaria in the area of nuclear energy

2.1. Nuclear profile of Republic of Bulgaria

During the last several years Kozloduy NPP has provided more than 44% of the total electricity generation in the country with the maximum of 47.36%, reached in 2002. After disconnection of units 1 and 2 from the national grid the percentage decreased to 40.6% in 2003.

The Bulgarian energy sector covers approximately 45% of the constant deficit in the total energy balance of the Balkan region, which is currently assessed as a serious input to the economical stabilization of the region.

The nuclear generating capacities of Bulgaria are presently concentrated at the Kozloduy NPP site. The existing nuclear facilities are presented in Attachment 1 and their main data – in Attachment 2.

In order to fulfill the obligations for preservation of the environment and reducing the emissions of CO_2, SO_2, NOx and ashes, Bulgaria plans to continue to rely on the nuclear energy and to

develop it according to the current requirements for nuclear safety, radiation protection, efficiency and reliability of operations.

Starting in 2003, in accordance with the announced basic economical priorities of the Government and with the approved by the National Assembly Strategy for development of the energy sector, intensive measures are being taken to restart the construction of a NPP at a second nuclear site – Belene NPP. At this site, in the period 1987 – 1990, a NPP based on Russian design of WWER-1000 was being constructed. In 1990 the construction was frozen due to the economical situation in the country.

In 2004, after performance of the necessary preliminary and feasibility studies of the recent nuclear technologies and the requirements of the regulatory documents in force in Bulgaria, the principle decision at the Governmental level has been taken for the construction of a new NPP at the Belene site. The process of choosing the technology and organization of the construction has started as well.

2.2. Legislative framework in Republic of Bulgaria

The Act on Safe Use of Nuclear Energy, promulgated July 2002, is based on the fundamental statements for establishment of the independent and competent regulatory authority, definition of clear and predictable regulatory environment through the development of obligatory requirements for nuclear safety, radiation protection, physical security and emergency planning and preparedness as well as implementation of the strong licensing regime, based on the in-depth evaluation of all safety aspects, regulatory inspections and implementation of administrative measures. The Act on Safe Use of Nuclear Energy rules the public relationships regarding to the state regulation of safe use of nuclear energy and ionizing radiation and safe management of radioactive waste and spent nuclear fuel as well as the rights and obligations of the entities performing these activities for assurance of nuclear safety and radiation protection.

The Act on Protection of the Environment, in force since September 2002 (superseded the Act from 1991) requires preparation of Environment Impact Assessment for civil works, activities and technologies, connected with facilities for treatment of irradiated nuclear fuel and facilities intended for:

- Production or enrichment of nuclear fuel;
- Treatment of irradiated fuel and/or high level radioactive waste;
- Final disposal of irradiated fuel;

- Final disposal of radioactive waste;
- Interim storage, for period not more than 10 years, of irradiated fuel or radioactive waste on site, different than this where they are generated;
- Facilities for conditioning and storage of radioactive waste.

The methods and conditions for performing Environment Impact Assessments are defined in "Regulation on the order and conditions for performing the Environment Impact Assessment of investment projects for civil works, activities and technologies", approved by the Council of Ministers by a decree from 07 March 2003, promulgated in State Gazette #25, 18 March 2003.

The Acts on Energy and on Energy Efficiency govern the public relationships in the energy sector related to the state management, regulation and effective utilization of the energy and energy resources. The Act defines the rights and obligations of legal entities in performance of activities on generation, import, export, transmission, distribution and realization of electrical and heat energy and natural gas, increasing energy efficiency and promoting the use of renewable energy sources.

2.3. Institutional framework in Republic of Bulgaria

The Republic of Bulgaria has organized the necessary institutions for definition and implementation of the national policy in the field of nuclear energy and for performance of state control and regulation. After introducing in 2002 of the new Act on Safe Use of Nuclear Energy the system of institutions responsible for the implementation of the legislative framework in Bulgaria is as follows:

- The Chairman of Nuclear Regulatory Agency (NRA) – regulatory authority on the nuclear safety and radiation protection, is responsible for the implementation of the national policy on safety in the process of nuclear energy utilization;
- The Minister of Energy and Energy Resources (MEER) is responsible for implementation of the state policy in performance of activities on generation, import, export, transmission, distribution and realization of electrical and heat energy and natural gas, increasing energy efficiency and promoting the use of renewable energy sources. He is also responsible for realization of the national strategy for development of the energy sector and for the management of spent nuclear fuel and radioactive waste;

- State Commission for Energy Regulation – promotes the state policy for control and regulation of the energy prices and issues licenses for the production of electrical and heat energy according to the Act on Energy of Bulgaria;
- The Minister of health promotes the state policy in the area of health protection. Through his institutions performs a specialized functions in the area of health protection in the process of utilization of nuclear energy and ionizing radiation. Such a specialized body is the National Center on Radiology and Radiation Protection. The Minister of health set up mandatory hygiene norms and requirements and sanitary rules on all issues of hygiene, radiation protection and epidemiology;
- The Minister of environment and waters promotes the state policy in the area of environment protection, protection and use of waters and underground resources. His authorities are defined by the Act on Environment protection. The Minister of environment and waters manage the National system for environment monitoring through the Executive Agency on Environment. The Minister is the competent authority for taking decision on performed Environment Impact Assessment, required for civil works, activities and technologies, connected with facilities for treatment of irradiated nuclear fuel and management of radioactive waste;
- The Minister of Internal Affairs. The Act on Safe Use of Nuclear Energy obliges the Minister of Internal Affairs for some aspects of the physical protection such as safeguard of nuclear facilities and connected objects decided as of special importance in regard to their physical protection;
- The State Agency on Civil Defense organizes preparation and training of the population on necessary behavior and actions in case of accidents, disasters and calamites. The Agency also carries out organizational development, preparation and management of the emergency response teams as well as the coordination with Ministries, institutions and regional bodies on prevention, coping and mitigation of the consequences of accidents, disasters and calamites. The Agency organizes development and maintaining of National Emergency Plan and measures for its implementation at national and regional level as well;
- The Minister of Transport and Communications and the Minister of Defense perform specialized functions in the area of utilization of nuclear energy and ionizing radiation. For example the Act on Safe Use of Nuclear Energy obliges the Minister of Transport and Communications together with the Chairman of BNRA for suggesting to the Council of

Ministers the order and conditions for transportation of nuclear material, radioactive waste and radioactive substances that should be ruled by a Regulation.

The interrelations between the institutions, responsible for implementation of the legislative framework are presented in Attachment 4.

2.4. Main directions in the field of nuclear energy of Republic of Bulgaria

The main directions of the country policy, introduced through the corresponding legislation and principles regarding nuclear energy development and included in the country's energy strategy are:

- Assurance of strong and independent regulatory authority;
- Harmonization of the legal and regulatory basis with the best international practices;
- Operation of the existing nuclear facilities in accordance with the requirements for high level of safety and implementation of the internationally recognized operational experience;
- Keeping the nuclear sector as a basic element in the energy balance of Bulgaria in the long term perspective;
- Conditioning and safe storage of radioactive waste, management of spent nuclear fuel and organization of the activities for decommissioning of nuclear facilities.

Providing that utilization of nuclear energy in peaceful purposes contributes to the country's development and to the increase in the life standard of the population, and confirming that protection of the public health and the environment through the safe management of nuclear energy has the first and highest priority, the key principles for the development of nuclear energy are:

- Keeping the highest safety standards in the process of nuclear energy utilization;
- Providing to the public clear and timely information for the safety of nuclear facilities;
- Taking into account the public opinion in formulation of the energy policy;
- Development of the safety culture of the management and other personnel;
- International cooperation in science, design, applicable and operational areas of the nuclear energy.

On this basis in the period since the second National Report in the process of implementation are: special action plan of the regulatory authority, programs for modernization of units 3&4 and 5&6 and program for preparation of Units 1&2 decommissioning.

The implementation of particular activities from above programs is directly connected with the introduction of the new nuclear Act and the following from there new licensing regime for the existing nuclear facilities. Attachments 5 – 7 present detailed information on the status of these programs.

II. REVIEW OF THE CONVENTION ARTICLE BY ARTICLE

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

1. Brief review of the information presented in the first and second National Reports on the article

As a whole the previous two Reports presented the approach and the scope of the safety assessment and measure, implemented in the framework of the programs for modernization of units 3&4 (PRG'97A) and units 5&6. The plans for preparation of the process of shutting down units'1&2 were presented as well.

In regards to the programs implementation, information was presented that for units 3&4, as of the second National Report, 60% of the measures of PRG'97A were implemented. The plans for the implementation through the end of 2002 were presented as well. For units 5&6, the process of starting the activities of the implementation phase of the program was presented.

During discussion on the second Report, the implementation of the announced programs was welcomed and was recommended to assure necessary means for the management of large number of projects.

2. Units 1&2 of Kozloduy NPP

In accordance with the preliminary announced plans, units 1&2 of Kozloduy NPP were operated until the end of 2002 and then were consecutively shut down and put in cold subcritical state. In the beginning of 2003, the nuclear fuel from the reactors was transferred to the reactor spent fuel pools and the units were brought to the corresponding mode according to the requirements of the Technical Specifications.

Taking into account the planned long term stay in the "cooling the fuel" mode, an overall review of the operating, maintenance and surveillance procedures was performed and particular rules, considering specifics of the mode were developed. Additional technical means for monitoring the

technical parameters, important for the safety during fuel storage and cooling were installed. The computerized operator support system was extended in regard to the automatically recorded and visualized parameters in Main control room.

In the beginning of 2004, after a review of the fulfillment of the specific requirements prescribed as additional measures for safety during long term stay of the units in such mode, BNRA issued licenses with term of 5 years validity. According to the licenses units 1 and 2 cannot be used for the generation of electricity and the activities are limited to the storage and cooling of irradiated and spent nuclear fuel in the reactor pools with no fuel in the reactor core.

In addition, the conditions of the licenses define the terms for further activities for implementation of the new organization for conduct of operations and updating the remaining operational documentation. The licenses also define the requirement to develop, by the end of 2005, an overall decommissioning plan based on the approved program of activities for preparation for safe decommissioning of units 1&2. For the implementation of this program, in 2000 a separate organizational unit has been established with the purpose to coordinate the implementation of different activities and projects of the program. Its functions and responsibilities are presented in more details in Attachment 5 to the Report. The Attachment also presents the major projects, implemented as a preparation for the next steps of the program.

Since the beginning of 2003 at Kozloduy NPP an expert team of BNFL and EDF personnel has been performing in the role of Project Management Unit (PMU). The task of the PMU is management of implementation of a number of projects, financed by Kozloduy International Decommissioning Support Fund (KIDSF), administered by EBRD. In the framework of this project as a first stage is foreseen:

- Construction of Dry Spent Fuel Storage Facility;
- Supply and installation of facility for treatment of low level liquid radioactive waste from hot showers and laundry;
- Physical separation of units 1&2 from the remaining in operation units;
- Supply of equipment for decontamination of pools and big tanks and cleaning the water;
- Supply and installation of facility for treatment of solid radioactive waste with high volume reduction factor and retrieval and conditioning of spent ion exchange resins and other sorbents;
- Supply of equipment for free release measurement;

- Supply of moveable facility for redressing and contamination monitoring outside the RCA.

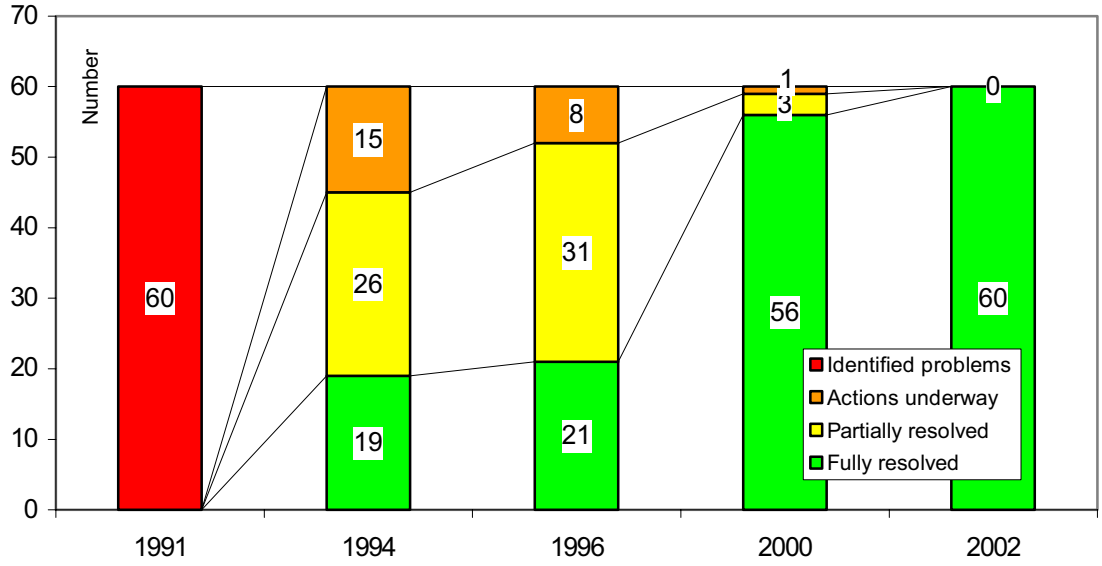
3. Units 3 and 4 of Kozloduy NPP

In the period since the second National report the measures for safety improvement have been implemented according to the announced plans, under the permanent control of the Nuclear Regulatory Agency. In this way, the implemented measures of the program PRG'97A allowed demonstration of the reached goals for units 3&4 before the end of 2002. The results are reflected in the new revision of units' SAR that finalized the process of detailed safety reassessment.

An overall assessment of the modernization program implementation was performed by IAEA with the specially dedicated Safety Review Mission, SRM 2002, requested by Bulgarian Government. The IAEA expert mission was held in the period 24 – 28 June 2002. The team reviewed the design basis, new design safety level and operational safety aspects of units 3&4 reached after the modernization program implementation. The mission concluded that all safety issues in both design and operational aspects, identified in IAEA TECDOC 640 have been addressed according to the requirements of IAEA safety standards and guidance, as well as the current international practices.

Measures of different plant programs, implemented during the last decade have brought these units to the level of safety that meets the contemporary criteria for the reactors in operation. This is demonstrated by necessary deterministic and probabilistic safety analyses with the scope and content in accordance with the most recent international practices and IAEA standards.

The mission evaluated the level of implementation of the particular measures as well as the level of resolution of safety related problems, identified by the IAEA experts in the document TECDOC 640. All of them have been found fully resolved by the time of the review. The following diagram represents the schedule of their resolution during the years according to official IAEA assessments.



The mission results are highlighted in IAEA Annual Report for 2002 GC(47)/2 as follows:

"A safety review mission to Kozloduy, in Bulgaria, reviewed the results of more than a decade of safety upgrades and assessments at units 3 and 4, including a series of actions recommended by various Agency review teams. The team concluded that the operational and design safety at Kozloduy now corresponds to the level of improvements seen at plants of similar vintage elsewhere. Many of the safety measures adopted for these plants in the design, operation and seismic areas exceeded those that were foreseen."

More detailed explanations of the IAEA evaluation results are given in the 2002 mission report executive summary. This information is presented in Attachment 9 (the IAEA Mission Executive Summary) and the full IAEA June 2002 Mission Report is given as Reference Document No 1.

The degree of changes reached in the units'3&4 design characteristics allowed classification of these units into a new model, underlining the principal differences of the new design basis compared to the original V-230 design. In order to define this new design basis and to identify it according to the corresponding rules, a special study was performed by the team of leading Russian organizations, including the general constructor, Scientific leader and general designer. According to the results of the study, after the completion of the complex modernization program, units 3 and 4 are classified as new model nuclear power units, defined as V-209M. The classification is formalized by the signing of a special technical certificate by the authors of the original design.

In 2002 a separate independent study of the safety level of units 3&4 was carried out, including a comparative study with model V-213 reactors. Several state-of-the-art approaches were used:

- Through evaluation of the IAEA recommendations fulfillment;

- Through evaluation of WENRA recommendations fulfillment;
- Through evaluation of the safety level according to the WPNS check list;
- Through evaluation of the meeting the general design requirements of US NRC;
- Through comparative evaluation with original and current design status of V-213 reactors, including IAEA requirements to this type of reactors.

The results of the study performed by a West European engineering organization and verified by highly ranked international experts, confirmed compliance of the new design status of units 3&4 with the current requirement for light water reactors in operation. The general conclusion of the study is:

„The safety level achieved at upgraded KNPP 3&4 is comparable with that of operating plants of similar vintage in the West and in the East with respect to international safety standards and practices. It did not find any safety issues that would prevent further operation of the plant."

The results of the study are presented in more detail in Attachment 9.

Based on the new design basis of units 3&4 and the current operational practice, reflected in the updated SAR, operational procedures and other documents, BNRA issued long term operational licenses. The unit 3 license was issued 22 June 2003 with an 8 years term of validity and the license of unit 4 was issued 26 February 2003 with a term of validity of 10 years.

The conditions of units 3&4 operational licenses contain requirements for the continuation of the implementation of measures, included in other programs (Attachment 6) as continuation of PRG'97A, aiming for further improvement of the safety level:

- Program for continuation of the activities on PSA;
- Program for continuation of the activities on modernization of the Accident Localization System;
- Program for qualification of non destructive examination of the components important for safety;
- Program for development and extension of the scope of the symptom-based emergency operating procedures;
- Program for further activities on seismic qualification;
- Program for continuation of the activities on modernization of the I&C systems;

- Program for implementation of measures for management of severe accidents and development of Severe Accidents Management Guidelines;
- Program for activities on rest lifetime management.

Currently in line with the conditions of the licenses, Kozloduy NPP is implementing the strategy for severe accidents management that goes beyond the goals of PRG'97A. This is the next important step for improvement of the units' safety level and it is in compliance with the best international practices.

The strategy includes development of Severe Accidents Management Guidelines and implementation of technical measures for management of the fuel cooling and radioactive releases in case of core degradation. Installation of hydrogen recombiners and forced filtered venting systems in the units' accident localization systems is in the process of implementation.

4. Units 5 and 6 of Kozloduy NPP

In the period since the second National Report the implementation of the modernization program has entered its final phase – implementation of the basic package of technical measures, unified in the following groups:

- Replacement of mechanical equipment of the basic production and safety systems;
- Modernization of electrical equipment and systems for reliable power supply;
- Replacement of monitoring and control systems with state-of-the-art digital control systems;
- Improvement of fire protection and seismic resistance;
- Optimization of the equipment working conditions.

The implementation of all activities of the program is assured by adequate funding from Kozloduy NPP's own funds and from the state guaranteed loan agreements with City Bank, Rosexim Bank and Euroatom. More details for the funding are presented in the information on Article 11 of the Convention.

To assure the necessary quality during the program implementation and in particular, quality of the program management, measures are taken to provide independent consultancy services to Kozloduy NPP by a permanent team of international experts. A special system for configuration management has been introduced in order to assure adequate reflection of the large number of modifications in the design and operational documentation of the units.

The status of implementation of the modernization program measures, considering those being implemented by the end of 2004 is presented in the following table:

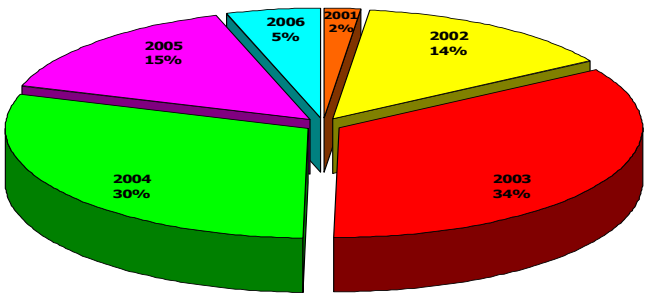
Total number	**Completed** (by the end of 2004)	**Being implemented** (after 2004)	**Planned to the end of 2006** (to be done)
212	**144**	**62**	**6**
	67.9%	***29.3%***	***2.8%***

Some of the most important measures implemented in the period are:

- Installation of systems for hydrogen monitoring and recombination;
- Replacement of the condenser tubes and installation of tube cleaning systems;
- Installation of additional autonomous diesel generators;
- Installation of diagnostic systems for monitoring of primary circuit integrity;
- Replacement of fire protection technical means;
- New set of radiation monitoring systems;
- Replacement of computerized information systems.

Implementation of the modernization program is being carried out in accordance with the declared schedules within the planned budget and in compliance with the terms and conditions of the operational licenses of units 5&6. Detailed information for the implementation of the measures is presented in Attachment 7 and for the issued licenses in the information on Article 9 of the Convention.

According to the implementation schedule the units 5&6 modernization program should be completed in 2006. The expected schedule by years is presented in following diagram:



By the end of 2005, the activities on main technological systems and replacement of electrical and I&C equipment should be completed. It is planned to complete the final studies, including update of units' SAR in 2006.

In October 2003, the Nuclear Regulatory Agency granted licenses for Units 5 and 6 operation with term of validity of 6 (six) years. The term is connected with the necessity to complete the modernization program and with the development of modern SARs.

The licenses' conditions include requirements for:

- Complete implementation of the units' modernization program, including continuation of the activities on Probabilistic Safety Assessment;
- Completion of the program for SAR development;
- On-line update of Technical Specifications, including their total update after the Program implementation;
- Continuation of the activities on Symptom-based Emergency Operating Procedures and placing them in operation, considering parallel implementation of the modernization program.

5. Facilities related to the assurance of the safety of spent nuclear fuel and radioactive waste

As is shown in the first National Report on Joint Convention on Safety in Spent Nuclear Fuel and Radioactive Waste Management [Ref.3], the management of the spent fuel is carried out in accordance with a special plan, approved by Minister of Energy and Energy Resources.

The key items of this plan, implemented and planned measures for maintaining the safety of the existing at Kozloduy NPP site interim spent fuel storage as well as detailed information for its characteristics are presented in the first Report on the Joint Convention, where its own separate mechanism for review is in force.

As additional information it might be noted that the updated SAR of the fuel storage is based on an extended spectrum of analyses, in accordance with the details presented in the first Report on the Joint Convention. In parallel, activities are ongoing for construction of a new interim Dry Spent Fuel Storage Facility. The capacity of the new storage facility considers the total amount of spent fuel to be generated untill the end of life of all units on site.

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.

2. The legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations;

(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence:

(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

1. Brief review of the information presented in the framework of first and second National Reports on this article

The first two Reports describe in detail the regulatory framework in force in 2001. The plans for development of the legislative and regulatory basis are also presented. The main task is development and enforcement of the new Act that should supersede completely the Act on Use of Atomic Energy in Peaceful Purposes in force at that time.

During the discussions on second Report in 2002 the Contracting parties mentioned that enforcement of the new Act is considered as an important tool for the needed further improvement of the independence of the regulatory body and thus was recommended to be done in a shortest term.

2. Regulatory documents in the field of nuclear safety. Changes made in the legislative basis

On 2 July 2002, the Act on Safe Use of Nuclear Energy was promulgated in State Gazette, superseding the Act on Use of Atomic Energy in Peaceful Purposes that was in force at that time. The new Act is in line with the contemporary tendencies in nuclear legislation including legal practice of the countries of European Union. During the development of the new Act the recommendations of IAEA experts who reviewed the draft, were also taken into account.

After the promulgation of the Act, a set of Regulations for applying the Act were developed and approved (Attachment 3). During the development of the Regulations, the relevant IAEA documents, European Union legislation and the experience of the leading countries in the field of nuclear safety and radiation protection were considered.

The Act on Safe Use of Nuclear Energy, as a basic legal document in the field of nuclear safety, regulates the public relationships regarding the state regulation of the safe use of nuclear energy and ionizing radiation as well as the safe management of spent nuclear fuel and radioactive waste. The eleven chapters of the Act deal with General provisions, State regulation, Authorization regime, Management of radioactive waste and spent nuclear fuel, Regulatory control, Special-statutory areas (Control of the areas outside the site), Physical security, Emergency planning and preparedness, Application of the safeguards, Civil liability for nuclear damage and Administrative penalty provisions. The supplementary provisions as well as transitional and final provisions of the Act define the technical terminology used in the Act, supersede the old Act on Use of Atomic Energy in Peaceful Purposes and also define transitional conditions related to the use of existing Regulations issued on the basis of the superseded Act as well as validity of the permits issued according the provisions of Act on Use of Atomic Energy in Peaceful Purposes.

3. System for licensing of nuclear facilities according to the Act on Safe Use of Nuclear Energy

The Act on Safe Use of Nuclear Energy establishes a new licensing and authorization regime. The licensing process is carried out in conditions of transparency and equal treatment and is based on the following legal principles:

- nuclear energy and ionizing radiation are utilized in accordance with the requirements and principles of nuclear safety and radiation protection with the aim of protection of life, health and living conditions of today's and future generations, environment and material properties against the harmful impact of ionizing radiation;
- nuclear safety and radiation protection have priority over all other aspects of the activities;
- occupational exposure from ionizing radiation is kept as low as reasonably achievable.

Chapter three of the Act on Safe Use of Nuclear Energy defines the scope of activities, equipment and materials, which are subject to the authorization and licensing regime. Licenses are issued for operation of nuclear facility (nuclear power unit, facility for spent nuclear fuel management, facility for management of radioactive waste, research reactor). The maximal term of validity of a license is 10 (ten) years. In this way, the Operator is allowed long term planning of his activities and allocation of more funds for increasing the safety level. The possibility of license renewal based on the periodical safety review is introduced. The Act places exact and clear requirements on the Operator regarding to the conditions and criteria to be met for granting license, avoiding to the maximum extent subjectivism by the regulator in the decision making process. There are also

clearly defined conditions when the licensee should require license modification as well as basis for license termination and/or withdrawal.

For certain single activities, related to the nuclear safety and radiation protection, the Act foresees the issuance of permits in following cases:

- site selection of a nuclear facility;
- design of a nuclear facility;
- construction of a nuclear facility;
- commissioning of a nuclear facility;
- activities leading to the modification of:
  - (i) nuclear facility structures, systems and equipment related to nuclear safety and radiation protection;
  - (ii) limits and conditions for safe operation of a nuclear facility, that provide the basis for issuing of the operating license;
  - (iii) internal rules for carrying out the activity and procedures, including instructions, programs, Technical specifications, and the instruments that are attached to the license for operation of a nuclear facility;
- decommissioning of a nuclear facility;
- transportation of nuclear material;
- commercial transactions involving nuclear facilities and nuclear material;
- import and export of nuclear material;
- transit of nuclear material, radioactive waste, spent fuel or other radioactive substances.

The Act defines 9 (nine) months as the period for issuing license for operation of nuclear facility. The same period is foreseen for issuing permits for the main steps of the construction of a nuclear facility.

The Act foresees a procedure for appealing of issued licenses and permits. The license or permit itself, amendments to them or refusal of the Chairman of NRA to issue corresponding act may be appealed before the Supreme Administrative Court by the licensee or permit holder/applicant.

The way and conditions for issuing of licenses and permits are defined in the regulation for "Issuing licenses and permits for safe use of nuclear energy", approved by the Council of

Ministers and in force since May 2004. According to this Regulation the applicant for license or permit should submit documents to prove the compliance with requirements for nuclear safety and radiation protection. These requirements are defined mainly in the Regulation for providing the safety of NPPs and in the Regulation for Basic norms for radiation protection. The applicant should also provide evidence for compliance with other regulations for applying the Act, namely:

- Regulation for emergency planning and preparedness in case of nuclear and radiation accident;
- Regulation for providing the safety of research reactors;
- Regulation for the way and conditions for notification of the Nuclear Regulatory Agency for events in nuclear facilities and objects with sources of ionizing radiation;
- Regulation for providing of physical protection of nuclear facilities, nuclear material and radioactive substances;
- Regulation for safety during decommissioning of nuclear facilities;
- Regulation for the way and conditions for collecting information and filing the registers for the activities, subject to the guarantees according to the Nuclear Weapons Non-Proliferation Treaty;
- Regulation for the way and conditions for obtaining the professional qualification, way for issuing licenses for specialized training and documents for personnel qualification (certificates) for use of nuclear energy.

The Act on Safe Use of Nuclear Energy defines a special procedure for construction of Nuclear power plants. A NPP is constructed after the decision by the Council of Ministers on the motion of the Minister of Energy and Energy Resources, together with the results from public discussion of the evaluation of nuclear safety and radiation protection as well as management of the spent nuclear fuel and radioactive waste generated as a result of the operation of the plant.

The participation of the public in the regulatory process is also assured by the provisions of the Act on Protection of the Environment in force since 2002. The Act foresees public hearing on the results of Environmental Impact Assessment report for the nuclear facility.

4. System of regulatory inspections

The new Act on Safe Use of Nuclear Energy introduced in 2002 defines the responsibility of the Chairmen of the Nuclear Regulatory Agency for control of nuclear safety and radiation protection

during the use of nuclear energy and ionizing radiation and management of radioactive waste and spent nuclear fuel. The control is:

- preventive, through issuing of licenses and/or permits and documents for personnel qualification (certificates);
- permanent control for fulfillment of the conditions of issued licenses and permits and for maintaining the personnel qualification;
- follow-up control on the fulfillment of the recommendations and/or prescriptions given by the control bodies.

For application of his control authorization, the Chairmen of the Agency, through the authorized persons:

- performs periodical and non-scheduled checks (inspections);
- informs other regulatory bodies for specialized control in order measures in their competency to be taken;
- notifies the prosecution authorities if information for criminal intentions is available;
- changes or cancels the issued licenses and/or permits and documents for personnel qualification;
- imposes forced administrative measures and administrative penalties foreseen by the Act on Safe Use of Nuclear Energy.

The Chairmen of the Agency has the right to require from the persons, information on their activities and documents, necessary for the performance of the control and, if necessary, to require support by the specialized control bodies. In his work, the Chairman of the Agency is supported by specialized consultancy councils. Information for these councils is presented under Article 8 in the Report.

The common goal of the regulatory inspections and application of enforced measures is to assure all activities by the operator are performed in a safe manner and in compliance with the requirements, norms and rules for nuclear safety and radiation protection. For the fulfillment of this goal, the annual plan of Nuclear Regulatory Agency includes the areas of the regulatory control, stemming from the Act and the valid licenses and permits. When planning the inspection activities, the operational conditions of the nuclear facilities, results of previous inspections and planned modifications are taken into account, i.e. some coordination with planned activities of the

Operator is assured. The financial assurance of the inspection activities is in the framework of the budget of the Nuclear Regulatory Agency.

In its activities, the Agency is aiming to apply non-prescriptive approach, which is why there are the systematic contacts with the licensees and permit holders (in case of NPP-every day) where the open issues are discussed in an open dialogue. The intent is to support the licensees and permit holders in the fulfillment of the requirements of the Act and the secondary legislation in a way to allow the planned measures to be acceptable for both sides. The enforced administrative and penalty measures foreseen in the Act are applied only after all other possibilities do not produce results. The discussions are organized in operative manner either at the plant site or in the Agency, following an initiative of one of the sides.

The types of inspections and reviewed areas are within those defined by the Act on Safe Use of Nuclear Energy framework and are described in details in the Procedure for the inspection activities. This procedure was developed in accordance with the superseded Act on Use of Atomic Energy in Peaceful Purposes and previous Agency structure, but in its main part is fully applicable to the inspection activities carried out according to the new Act. An update of the procedure is planned in the framework of the quality management system for regulatory activities.

In the procedure the following types of inspections are included:

- routine inspections;
- topical inspections;
- general inspections;
- unplanned inspections.

In practice the first three types of inspections are planned ones and a preliminary notification is required, while unplanned inspections are carried out in each specific case when necessary.

The routine inspections are performed mainly by the inspectors on site and include review of the operational limits and conditions, status of the safety related systems and maintaining the operational order in the rooms.

The topical inspections are performed in different areas of supervision. Three to five inspectors with specialties close to the reviewed area normally take part in the inspections. For nuclear facilities the following areas of supervision are defined:

- quality assurance;

- personnel training and qualification;
- operation;
- maintenance;
- technical support;
- radiation protection;
- water chemistry and radiochemistry;
- emergency planning;
- fire protection;
- radioactive waste;
- nuclear fuel;
- nuclear fuel transportation;
- physical protection;
- nuclear materials and radioactive sources.

The general inspections include checks of objects in different technical and organizational aspects and normally are carried out prior to the performance of important stages of the facility life cycle or for review of the fulfillment of the conditions of issued license or permit. In general inspections, six to eight inspectors participate with different technical profiles and they cover the entire spectrum of supervised areas, applicable to the corresponding stage, purpose of the inspection and type of the facility.

Unplanned inspections are carried out when circumstances affecting safety exist and normally are connected with evaluation of operational events and failures of safety related equipment and systems.

The Chairman of the Nuclear Regulatory Agency authorizes persons from the Agency administration to make inspections and controls to fulfill the Act in accordance with their authorities. To carry out the controls the inspectors have rights:

- of free access to controlled persons and objects at any time for checking the status of nuclear safety, radiation protection and technical status of nuclear facilities and ionizing radiation sources;
- to require necessary data, information, explanations, operative and other information, including measurements and testing, for clarifying the technical status and conditions of operation for the facilities. They also have the right to require information on the

qualification of the personnel and any other information related to nuclear safety and radiation protection;

- to issue written statements on administrative infractions under the Act;
- to make suggestions for amendments, cancellation, termination or revocation of the permits and licenses and documents for personnel qualification;
- to issue obligatory written prescriptions for assurance of nuclear safety and radiation protection.

The prescriptions of the inspectors as per their authorities are obligatory.

The inspector on control of nuclear safety and radiation protection is authorized by an order of the Chairman of the Agency to perform controls in accordance with the Act on Safe Use of Nuclear Energy in compliance with the functions of the department where he is appointed. The specific requirements for the inspectors are defined in the Organizational Statute of the Agency and the most important of which are:

- have not been convicted on deliberate crime of general character;
- have no legal, commercial or other relationships with the entities performing activities according to the Act on Safe Use of Nuclear Energy;
- have at least five years experience in the field of state regulation of safe use of nuclear energy and ionizing radiation and/or safe management of radioactive waste and spent nuclear fuel.

5. Development of the regulatory basis

With the enforcement of the new Act on Safe Use of Nuclear Energy and the set of Regulations for applying it, the regulatory basis is established for the public relationships in the area of safe use of nuclear energy. Further development of the regulatory basis in the area is connected with the legislation of European Union as far as Bulgaria took the obligation to incorporate the European Directives. The improvement of the documents issued by international organizations like International Atomic Energy Agency (IAEA) and West European Nuclear Regulators Association (WENRA) is also used as a basis for both updating of the existing and development of new regulatory documents.

Immediately after the Nuclear Regulatory Agency became a member of WENRA, participation of Agency experts started in the activities of task forces of the organization for comparison and harmonization of the safety requirements for nuclear power plants and for safe management of

radioactive waste and spent nuclear fuel and for decommissioning. The representatives of the Agency in task forces take active part in the meetings and activities on development of reference safety levels as well as comparative assessment of national practices and requirements. Measures for harmonization of the new secondary legislation in the field of nuclear regulation with the reference safety levels are being also implemented in accordance with the obligations taken by the countries members of WENRA.

ARTICLE 8. 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 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

1. Brief review of the information, presented in the framework of the first and second National Reports on this article

In the framework of the first two Reports in details are described structure and functions of the regulatory authority acting in this period – the Committee on Use of Atomic Energy in Peaceful Purposes (CUAEPP). Information on the legal status of the Committee according to the legislation in force in 2001 and major changes in its structure and functions in the period is presented as well.

Also presented is information for the international contacts and co-operation between the Committee on Use of Atomic Energy in Peaceful Purposes and the IAEA as well as for the efforts for the improvement of the regulatory activities, strengthening of the licensing capabilities of CUAEPP, development of national standards and requirements in the field of nuclear safety and quality assurance of the inspection activities.

In the chapter for planned activities the development of the new Act on use of nuclear energy is established as a priority goal.

During the discussions on the second National Report the Contracting parties welcomed the plans for further improvement of the independence of the regulatory authority, its financing, quality management system and the technical support, including complete implementation of the developed Action plan in the shortest time practical.

2. Change in the status of Regulatory authority of Republic of Bulgaria after enforcement of the new Act on Safe Use of Nuclear Energy

In accordance with Art. 4 of the new Act, the state regulation of the safe use of nuclear energy and ionizing radiation and the safety of radioactive waste management and spent fuel management is implemented by the Chairman of the Nuclear Regulatory Agency (NRA). In the

Act the idea for independence of the regulatory authority is systematically introduced in several directions:

- political;
- financial;
- organizational.

This represents a significant change of the status of the regulatory authority in regard to the superseded old Act, presented in the previous two Reports. According to the old Act, the body of the executive power was collective body – the Committee on Use of Atomic Energy in Peaceful Purposes. Included in the Committee were representatives of other bodies and organizations, some of them having direct responsibilities for utilization of nuclear energy and NPP operation. In the new Act the independence of the regulatory authority is supported by the fact that in its functions the function of development support for nuclear energy utilization is not included, as it was in the old Act.

As an independent regulatory body in the system of the executive power, the Chairman of NRA reports directly to the Chairman of the Council of Ministers – the Prime Minister. In addition, the Chairman of the Nuclear Regulatory Agency informs the National Assembly about the matters of nuclear safety and radiation protection by participating at the sessions of the National Assembly and its commissions, when it is appropriate.

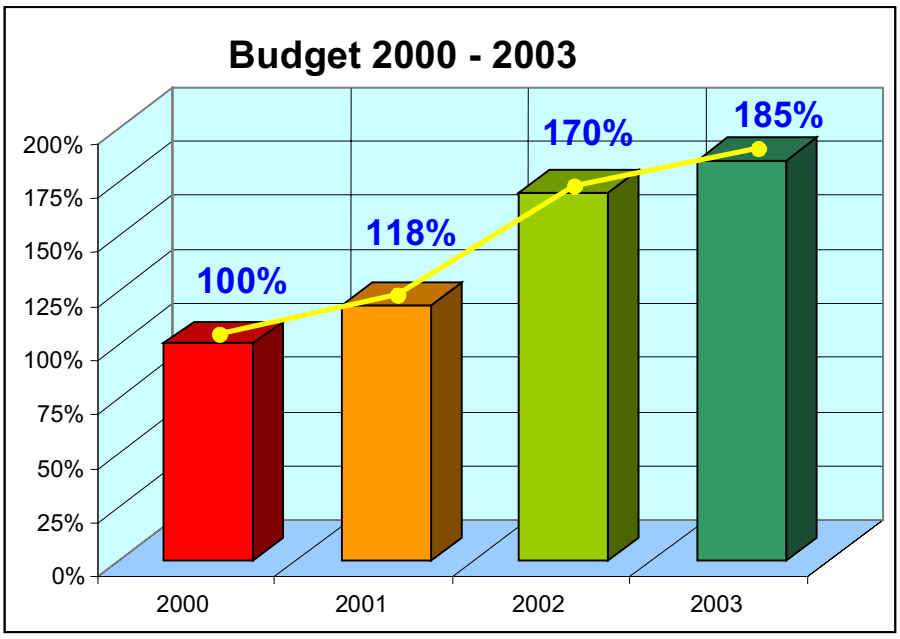
An important aspect of the political independence of the Regulatory Body is the appointment of its Chairman for a five years mandate. This is a guarantee for its independence against the specific composition of the Council of Ministers, which appoints him and ensures continuity of the policy of the Agency. The new Act set specific requirement to the person who may be appointed as Chairman of the Nuclear Regulatory Agency in regard to the education, experience in the nuclear field, etc.

The deputies of the NRA shall be designated by a decision of the Council of Ministers on a motion by the NRA Chairman. This is an additional element of the independence of the Regulatory Body and gives the Chairman a possibility for recruitment of an effective team of well-qualified experts.

The new Act creates conditions for financial independence of the regulatory authority. In accordance with the Act, the Agency operations are financed by the national budget and by income from the fees collected under the Act provisions.
The order of priority for expenditures of Agency financial resources is the following:

- financing of studies, analyses and expertizes connected with the assessment of nuclear safety and radiation protection and financing of regulatory activities under the Act;
- capital expenditures on development of the Agency infrastructure;
- training and qualification of Agency staff;
- additional financial motivation of the Agency personnel.

The following diagram presents the increase of the regulatory authority budget for last years, including the period of first two National Reports.



Regarding regulatory control, the Chairman of the Nuclear Regulatory Agency has the following responsibilities and functions:

- issues, amends, modifies, renews, suspends and revokes licenses and permits;
- develops regulations and guidelines;
- performs regulatory inspections and applies measures for carrying out control;
- imposes necessary administrative measures;
- provides information to other competent bodies, state institutions, international organizations and the public;
- performs control over the nuclear materials accounting;

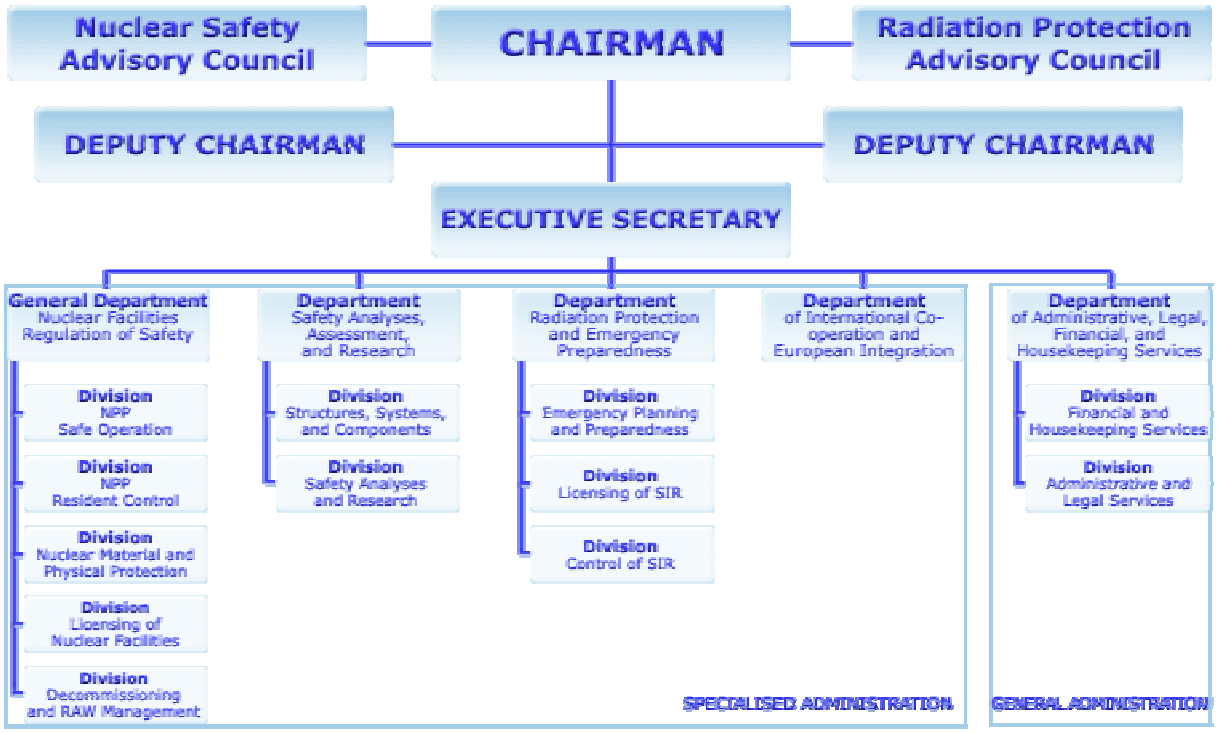
- organizes and coordinates fulfillment of the obligations coming from the international conventions and agreements;
- submits annual reports to the Council of Ministers on the status of nuclear safety and radiation protection and radioactive waste and spent fuel management, as well as on the transportation of nuclear materials;
- assigns research and studies according to the needs;
- develops and submits regulations for the application of the Act to the Council of Ministers for adoption.

In his work for fulfillment of the authorities under the Act, the NRA Chairman is assisted by an administrative organization in the Nuclear Regulatory Agency. The Agency's structure, operation and work organization, as well as number of staff shall be determined in the Organizational Statute to be adopted by the Council of Ministers on a motion by the NRA Chairman.

The decree for approval regulates the transfer of responsibilities, rights and obligations from the former Committee on Use of Atomic Energy in Peaceful Purposes to the new Agency. The Organizational Statute of the Agency, in force since September 2002, rules the total number of administered staff, the functions of the administrative departments of the Agency and appoints the Chairman of the Agency as a primary administrator of budget loans.

The new Act rules the establishment of the Advisory Council on Nuclear Safety and the Advisory Council on Radiation Protection. The NRA Chairman approves the composition of the Advisory Councils. Included in the Advisory Councils are prominent scientists and experts in the field of nuclear energy and ionizing radiation, radioactive waste management and spent fuel management. The Advisory Councils shall assist the Chairman by giving expert advice on the scientific aspects of nuclear safety and radiation protection.

The administration of the Nuclear Regulatory Agency is organized in one Main Directorate and four Directorates, split to General and Specialized administrations. The overall management of the administration is performed by Chief Secretary. Organizational and managerial flow chart of the Agency is shown on the figure below:



The total number of the administered staff is 102, including 37 inspectors of safety on nuclear facilities. Six of them are located permanently on Kozloduy NPP site. 95% of the inspectors have a university degree of education and 60% of them have over 15 years experience in the field of nuclear energy utilization.

The established regulatory system was highly evaluated by IAEA IRRT mission held in June 2003. The mission mentioned in its conclusions that "*... the new Atomic Act together with the complementary statutory framework incorporates all the legal prerequisites to provide for an independent sustainable Bulgarian nuclear regulatory system"*In addition the IAEA team mentioned that **"***... the NRA is provided with experienced and competent personnel who are motivated to work to high standards."*The established system was also positively assessed in the conclusions of the Peer review, held in November 2003 by an expert team of Atomic Questions Group of European Commission. In 2003, when the team assessed the degree to which the recommendations, formulated in 2001 by the team of the same organization, aiming to reach a high level of nuclear safety according to the EC requirements, have been addressed, it found that all recommendations related to the regulatory regime in Bulgaria were adequately addressed and no further monitoring on the regulatory system of Bulgaria by EC is necessary.

3. Implementation of the action plan of BNRA

In January 2002, a "Plan for improvement of the activities of Committee on Use of Atomic Energy in Peaceful Purposes" was approved. The plan included set of corrective measures with defined final terms and responsible persons for their effective implementation. As high priority measures were defined the quick and quality completion of the development of the new Act on Safe Use of Nuclear Energy, providing the BNRA with necessary number of personnel, assurance of adequate financial resources and establishment of system for technical support.

The Action plan was developed on the basis of performed self assessment for compliance of the activities with IAEA documents and considering the recommendations of several international organizations in their reports:

- Report of IAEA Mission to Review the Regulatory Activities in Bulgaria (November 1997);
- Report of West European Nuclear Regulators Association – WENRA (October 2000);
- Report 9181/01 of European Commission "Report on Nuclear Safety in Context of Enlargement – Nuclear Safety in Candidate Countries for Accession of EU".

In the period 2002-2004 the measures foreseen in the Action plan were implemented. The implementation of the Action plan was confirmed also by the results of the IAEA IRRT mission, held in June 2003.

The main results achieved with the implementation of the Action plan are as follows:

- Clear definition of the policy of the Agency in the field of regulation of the activities on the nuclear energy utilization;
- Approved structure of the Nuclear Regulatory Agency that covers all areas of the regulatory activities and developed clear job descriptions for each position;
- Increased number of the regulatory body staff;
- Developed program for improvement of the Quality Management System (QMS);
- Developed program for training of the personnel. Constructed and equipped a training center as a basis for establishment of the system for training and re-training of the Agency personnel;

- Established adequate system for personnel motivation (along the payment) – professional development and career, clear internal rules, awards and stimulations, good working conditions, etc.;
- Strengthening of on-site inspection.

On the basis of performed analysis of the competencies of and further challenges to the Regulatory Authority, in April 2002 the Council of Ministers approved an amendment to the Organizational Statute of the Agency and in particular increased the number of specialized administration personnel of the institution with 22 positions for the departments of the Agency involved in the control of the nuclear facilities.

After approval of the increased number of the administered staff a strategy for recruitment of new personnel was developed. The job profile requirements were supplemented with some additional criteria for nomination, for example, qualification, experience at nuclear facilities, good command of foreign languages, communication skills, team work abilities etc. A large number of specialists and experts applied for the vacancies. This significant interest to work in the organization is determined by the attractive work and environment conditions as well as the motivation system and the established team. The main factors attractive for applicants are the following:

- Civil servants status with all the positive consequences ensuing from this status;
- Significant possibilities for career development;
- Salary is more than twice of the average in the country;
- Additional material motivation of the employees in accordance with their contribution to task performance;
- Possibilities for additional individual and group training, improvement of qualification and re-training;
- Attractive environment determined by precise and clear requirements and expectations specified by the management; and etc.

In spite of the increased capacity of NRA experts, the agency looks for confidence in covering of all areas of nuclear facilities operation. Performing the developed strategy, NRA initiates active correspondence and discussions with the expert organizations in the country to develop data base that includes their expert skills, age profile, etc. As a result of these activities, framework agreements were signed in 2003 for the cooperation and expert support with 13 Bulgarian

engineering companies and scientific organizations in order to obtain the necessary independent technical support. The main goal of these agreements is to avoid conflict of interests during NRA's assigning of independent reviews related to licensing processes and safety assessments.

The changes of the status and structure of the Nuclear Regulatory Agency, new IAEA documents and change of the philosophy of ISO 9001:2000, compared to ISO 9001:1994 required an overall review of the Quality Management System and development of a new modern and comprehensive system.

At the end of 2002, a principle structure of QMS was developed and approved by the Chairman of the Agency and the leading person of the system was appointed.

The goal of the Quality Management System is to increase the effectiveness of the the Agency's performed activities and to satisfy the customers of these activities. The basic documents for establishment of the system are internationally recognized IAEA standards, with regards to the effectiveness, and international standards of the ISO 9000 series, with regards to the efficiency of the activities.

QMS documents are distributed in four hierarchical levels, in the following way:

- Level 1 – Documents, specifying the quality goals and policy, as well as the approach for their achievement;
- Level 2 – Procedures, specifying the NRA policy and the basic principles for performing activities;
- Level 3 – Work instructions, giving detailed instructions for planning and performing of activities;
- Level 4 – Guidance for supporting the implementation of procedures and instructions or the performance of assigned tasks and related documents.

For the establishment and implementation of an efficient QMS, the NRA management accepted "A project for QMS development". This project envisages 5 basic stages for the development and documentation of QMS:

- Stage 1 – development of level 1documents, including "quality management manual";
- Stage 2 – development and approval of procedures on the main and supporting activities, including regulations for the Advisory committees' proceedings;

- Stage 3 includes updating of the existing instructions and guidance in accordance with NRA policy, Quality Management Manual and procedures in other fields;
- Stage 4 includes development and approval of the basic part of the Quality Management System documents, instructions and guidance. Operations instructions and guidance development follows QMS-3-SS – detailed structure of Quality Management System, approved by the Chairman;
- Stage 5 is the system review and results record. This review is expected to improve the Manual for Quality Management QMS-5-QM and the System as a whole. This stage also includes analysis of public opinion, overall self-assessment of the system performance and effectiveness as well as internal and external audits of QMS application.

The implementation of the project requires allocation of significant human and material resources. Taking into account the large number of internal documents to be developed as a part of QMS, as well as a serious work load on the Agency staff for development of the secondary legislation on new Act on Safe Use of Nuclear Energy and preparation for issuing the long term operational licenses for all nuclear facilities, the completion of the project is planned for the end of 2005.

Until now, the first stage of the project is completed. Several procedures, considered as a high priority have been developed. Under the PHARE program a review of the overall structure of the system, program for development and Quality Management Manual was performed. An order of the Chairman of the Agency defined the set of procedures to be applied until the new documents are developed as far as they do not contradict with the Act on Safe Use of Nuclear Energy, Organizational statute of Nuclear Regulatory Agency and documents of Level 1.

An analysis has been performed of the necessary, both in quantity and specialties, inspectors on site. The new number of staff is defined in the Organizational Statute of the Agency. A plan for active involvement of on-site inspectors in the system for training and qualification has been developed as well as strategy and long term plan for assurance of necessary staff on site. In connection with the latter, a program has been developed for extending the presence of the headquarter inspectors at the site of NPP.

ARTICLE 9. RESPONSIBILITY OF THE LICENCE HOLDER

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

1. Brief review of the information presented in first and second National Reports on this Article

Presented consecutively in the framework of the previous two reports, is the transfer of the responsibility of the Operator from National Electric Company to Kozloduy NPP Plc, which was realized in 2001, as well as the scope of the responsibilities of the License holder according to the Act on Use of Atomic Energy in Peaceful Purposes in force in the period of first two Reports preparation.

The established organizational structure for assurance of the fulfillment of the responsibilities of the Operator – Kozloduy NPP and the results of international reviews of the structure were presented.

No specific recommendations were given during first two reports in discussions to the fulfillment of the obligations of Republic of Bulgaria to this article.

2. Changes of the responsibilities of the License holder according to the changes in the Licensing regime in Bulgaria

After enforcement of the new Act on Safe Use of Nuclear Energy, the requirements to the License holder have changed significantly. The new Act describes the responsibilities of each entity in performing activities on use of nuclear energy and management of radioactive waste and spent nuclear fuel in regard to:

- meeting the requirements, limits and rules for nuclear safety and radiation protection, assurance of high quality of performance of the activities, taking measures for prevention and mitigation of the consequences of incidents and accidents;
- implementation of all necessary measures for the safe storage of nuclear materials, spent fuel, radioactive substances and waste, including physical security, control and monitoring of the parameters that characterized the nuclear materials and radioactive substances, systems for control and accounting, etc.;
- making assessments of nuclear safety and radiation protection and taking measures for improvement, considering their own and international experience and scientific

developments and using systems, equipment, technologies and procedures that correspond to these developments and internationally recognized experience;

- assurance of necessary financial and human resources, including systems for personnel qualification, insurance and financial guarantee against nuclear damage;
- performance of monitoring the radiological characteristics of working surroundings and environment and assurance of the objectivity of information provided to the public, governmental bodies and the society regarding the status of nuclear safety and radiation protection.

For the issuance of Licenses according to the new Nuclear Act, the applicant should provide evidence for obtaining the necessary financial, technical, material and human resources and the corresponding organizational structure for maintaining the high level of safety. The applicant should also assure compliance of the equipment and applied activities with the requirements, limits and rules of nuclear safety and radiation protection. He should have a system in place for maintaining a high level of safety culture and organization of the activities, allowing the doses to personnel and the public to be maintained as low as reasonably achievable.

Each issued license or permit defines the scope of the activities, general requirements for performance of the activities, responsibilities for maintaining the necessary financial, human and other resources as well as specific requirements to be met regarding:

- nuclear safety, radiation protection, physical security, quality assurance, emergency planning and preparedness, management of spent nuclear fuel and radioactive waste, coping with deviations and accidents;
- submitting the information required, including that required for the fulfillment of license conditions, required if change of circumstances occurs, and required for changes and extensions of license terms of validity;
- the obligations of the licensee in regards to performance3 of regulatory reviews, applicable legislation, relations with licenses and/or permits, etc.

A particular chapter of the licenses defines a list of additional organizational and technical measures for further improvement of the safety of the particular nuclear facility as well as the terms for implementation by the licensee.

The introduced licensing system, issued licenses and their conditions as well as demonstrated organization for fulfillment of the obligations by the licensee were highly evaluated as

established good practice in the Peer review carried out in November 2003 by the Atomic Questions Group of the European Commission.

The Act on Safe Use of Nuclear Energy also establishes a new entity for radioactive waste management – State enterprise "Radioactive waste". Persons, who perform activities that generate radioactive waste, are obliged to transfer them to the State enterprise within a certain period. Until the transfer, the responsibility for handling the waste is to the person who generates it and after the transfer, the waste becomes State ownership, managed by the State enterprise.

Details of the organization, the way of financing the activities and assurance of nuclear safety and radiation protection are presented in the first National Report on Joint Convention on Safety during SNF and RAW management [Ref.3].

ARTICLE 10. PRIORITY TO SAFETY

Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

1. Brief review of the information presented in the framework of first and second National Reports on this article

The previous two Reports defined the priority of safety, defined in basic statements of the Act on the Use of Atomic Energy in Peaceful Purposes and correspondingly by the policy of the regulatory body and the Operator for assurance of this priority. Other factors with impact on the process and the main characteristics of the safety culture and its development are discussed as well.

During the discussions on fulfillment of the obligations on this article by the Republic of Bulgaria, the Country's approach of development of effective safety culture and using international co-operation like "Twinning" with other Operators was welcomed and strongly supported**.**

2. Policy of the Operator

The policy of the Kozloduy NPP Plc as Operator of nuclear facilities at Kozloduy site is developed in compliance with the requirements of Convention on Nuclear Safety, the Act on Safe Use of Nuclear Energy, the national strategy for development of energy sector and energy efficiency and is in line with INSAG-3 and INSAG-13 reports, published by IAEA.

It is expressed in a form of Statement of the Safety Policy. The statement is distributed to the personnel as a fundamental document, defining the goals of the plant staff and is available through the local computer network (Intranet), posters at the working places, plant information magazine and other means.

The statement is provided to BNRA as an element of the document package, attached to the application for issuing operational licenses of different units, together with the evidence of the established system and availability of resources and mechanisms for fulfillment of the responsibilities of the license holder.

3. Safety culture in Kozloduy NPP

In order to guarantee priority of safety during NPP operation, the following aspects are reviewed by BNRA in the process of analyzing the readiness of the Operator for receiving an operational license:

- The Operator should have an established organizational structure for safe and reliable operation with clearly defined responsibilities, authorities and communication lines of the personnel that perform activities related to assurance and control of the safety;
- During the plant operation, conditions should be assured for performance of the necessary studies and consultations prior to taking decisions related to the safety;
- The necessary resources and conditions to the personnel for performing activities in a safe manner should be assured, and the performance should be adequately monitored;
- There should be an established and functioning system for the systematic analysis of its own and international operational experience, as well as scientific and technical developments in the area of nuclear industry aiming at continuous performance improvement.

According to the principles of the regulatory documents, the Operator should demonstrate the availability of sufficient number of qualified personnel who know and understand the design basis, safety analyses, design and operational documents of the unit for all operational modes and accident conditions. This also includes the authorization for management and control of persons performing work or providing services for the plant.

According to the regulatory documents the formation of safety culture includes:

- Performance of necessary recruitment, training, qualification and retraining of the personnel for each activity having impact on safety;
- Strict keeping of discipline with clear distinction of the personal responsibilities of management and staff;
- Development of and strict compliance with the requirements of the procedures in force for performance of the activities and their periodical updating considering its own and internationally recognized operational experience.

Fulfillment of the above requirements is the subject of review as an element of the process of issuing the operational licenses for the units. For this purpose, in the period 2003 – 2004 Kozloduy NPP, together with the license application presented for each unit the necessary

organizational documents, statutes, organizational rules, procedures for regulation of the activities, information for the availability and qualification of the personnel, performing different activities as well as available assessments of the effectiveness of the established up-to-the moment system.

As a result in the period 2003 – 2004, after thorough review and discussions of the presented evidence, BNRA issued operational licenses for all six units of the plant. Details on the licenses are presented in the information on Article 9 in this report.

An independent evaluation of the compliance of the Kozloduy practice with the internationally recognized requirements was carried out in June 2002, performed by Safety Review Mission of IAEA (The main results of the mission are presented in the chapter on Article 6 and in Attachment 8 to this report). Together with the technical aspects of the safety of units 3&4, in the framework of the mission an overall review of the operational safety was performed, in particular fulfillment of the recommendations in aspects with decisive impact on the safety culture as follows:

- Policy, organization and management; system for self assessment and internal control mechanisms; training and retraining of the personnel; quality assurance;
- Operational culture, use of individual protective and safety means, maintaining the good operational conditions;
- Organization and conduct of operation, procedures and operator aids, equipment labeling, monitoring of the safety systems, performance indicators, operational experience feedback, etc.

The evaluation of the IAEA experts for the fulfillment of the requirements, included in the generic document TECDOC-640, that all of them were already fully resolved in 2001, was presented during discussions on the second National Report. The follow-up review in 2002 confirmed this evaluation and demonstrated that the approach for continuously increasing the requirements and maintaining high level of operational safety is kept in all areas.

In addition, in the framework of the mission IAEA performed a second follow-up review of the fulfillment of the recommendation of the OSART'99 mission to units 1 – 4. During the first follow-up in 2001 the IAEA experts found that out of all 49 recommendations 98% are addressed at a degree in-line with the experts' expectations. The second follow-up in the framework of the 2002 mission found this percentage 100%.

It was also confirmed that all recommendations, assessed in 2001 as resolved, keep their status and no processes of decreasing the plant attention in all areas are identified. According to the official report of the mission [Ref.1] the IAEA team stated in the conclusions:

"...management expectations are well understood at all level in the organization, and high quality standards were observed in all areas dealing with operational safety. The SRM team made particular note of the improvements observed in the areas of training and qualification, implementation of symptom-based emergency operating procedures, and in the quality of management processes in the technical support area.

The team also noted significant improvements in the material condition and housekeeping of the plant. In several of the areas where improvements were identified, the issues were already evaluated as 'resolved' by a previous IAEA review team and OSART missions. The willingness of the plant to invite a second review to ensure that there was no decline in performance is an indication of the commitment by Kozloduy management and staff towards continuous improvement in operational safety. The team also recognized the effort by KNPP to implement a strong self-assessment program...

... During the entire Safety Review Mission the team mentioned the professionalism of the Main control room personnel and its readiness for carrying out open and transparent discussions with the team.

In the majority of the operational issues the team recognized meaningful improvements, revealing the aim of Kozloduy management and staff to continuously improve operational safety. Many examples of these relevant improvements are in the areas of quality and control of the plant documentation".

4. Continuation of the activities on international co-operation

In the period since 2002, Bulgaria continued the active policy of the exchange of information on technical and organizational questions and topics, related to the control of the technological process, resources and safety culture. Bulgaria hosted several international meetings and seminars organised by the IAEA. The technical meeting on Comparative Analysis of Assumptions, Models and Results of Accident Analyses, included in SARs and IAEA workshop on PSA Level 2 Modelling Techniques were hosted by the Kozloduy NPP. The 3rd Research Co-ordination Meeting on mechanism of Nickel Effect in Radiation Embrittlement of Reactor Pressure Vessel Materials and the Bulgarian-Russian seminar on issues of the WWER fuel were also held in Bulgaria.

Some other examples in the field of international co-operations are the following activities:

- In 2002, the 10-year programme of the Japanese government for training of specialists from Central and Eastern Europe and CIS in the field of NPP safety was finalised.
- In 2002, the German Federal Ministry of Environment, Protection of Nature and Nuclear Safety, organised three seminars, as follows:
  - Handling and storage of fuel assemblies in interim storage;
  - Physical protection of nuclear material in nuclear facilities in transport and measures against the illicit traffic of nuclear material;
  - Financing and implementation of the state tasks related to the use of nuclear energy for peaceful purposes.
- The German side supported the organisation of the working meeting "Physical protection of nuclear material and nuclear facilities on the basis of DBT and the threat of international terrorism".
- In 2002, co-operation was initiated between the NRA of the Republic of Bulgaria and the Institute for energy technology, Norway under the OECD project on the Halden reactor.

ARTICLE 11. FINANCIAL AND HUMAN RESOURCES

1. Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

2. Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety related activities in or for each nuclear installation, throughout its life.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the framework of the previous National Reports the mechanisms for financing the measures to improve safety, the decommissioning of nuclear facilities and radioactive waste treatment were presented in their respective stages of development. This was caused by the establishment of Kozloduy NPP as a separate trade company and the resulting provision of all inherent expenses as expenses covered by sales of electrical energy. The sources for financing the modernization programs of the Units were also presented.

In a separate section of the Second National Report, the personnel training system was presented, including the qualification requirements for different personnel groups.

2. Financing of the safety improvement measures

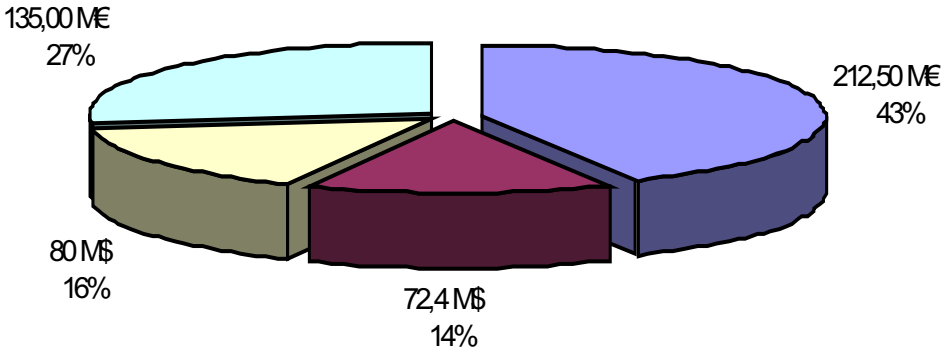
In the period since the second National Report the implementation of the Modernization program for Unit 3 and 4 was completed. The Program was financed mainly from the Kozloduy NPP's own investment program resources. For the implementation of the activities of the last stage between 2000 and 2002, USD 99 Million were spent.

The issued long-term licenses demand that Kozloduy NPP execute a complex of long-term programs for continuation of the activities in certain aspects. Financing of these programs in the next three years is planned to be € 28.4 Million, 91% of which are KNPP's own resources and the rest are already granted by the EU PHARE program.

During the same period the implementation of the Modernization program for units 5 and 6, which has been fully provided with resources, has started. For this purpose the plant has allocated € 135 Million from the cash flow of Kozloduy NPP and has secured the financing from the following sources:

- € 212 Million - EURATOM (loan)
- USD 80 Million - ROSEXIMBANK (loan)

- USD 76 Million - CITIBANK (loan)



The questions of the organization for the implementation of the modernization measures, the availability of adequate financing and resource planning was discussed in detail with the EU AQG experts, during the Peer review held in November 2003. The conclusion of the experts, stated in their Report in April 2004 is that the necessary financing is secured, the plans are realistic and the organization created guarantees implementation of all planned measures according to the declared plans.

3. Financing of the decommissioning activities and radioactive waste treatment

"Decommissioning of nuclear facilities" and "Radioactive waste" funds

Since 01.01.2003, with the Safe Use of Nuclear Energy Act the funds "Decommissioning of nuclear facilities" and "Radioactive waste" were created. These funds are successors of the "National nuclear facilities decommissioning fund" and the "Safe storage of radioactive waste fund", which were created in 1995 and were presented in the Second National Report.

In the period since the Second National Report the Regulations for the amount of the payments, collection, spending and control of the money in the "Decommissioning of nuclear facilities" and "Radioactive waste" funds were actualized to assure that:

- Adequate financial resources are available to assure the safety of the spent nuclear fuel and radioactive waste management facilities for the entire period of operation and decommissioning;
- Financial resources are available to permit the relevant institutional control and monitoring to be continued, taking into account the necessary closure of the storage facilities;

- During the operation of the Kozloduy NPP units, enough financial resources will be accumulated for their decommissioning and for long-term management (including final disposal) of the radioactive waste resulting from the decommissioning of the units;
- There will be enough accumulated financial resources from payments by the organizations generating radioactive waste, for long-term managements (including final disposal) of the radioactive waste;
- The funds are independent, the available financial resources are managed in a transparent and reliable way;
- There is control over the expenses – financial resources are spent only for reasonable purposes and according to the payments in the funds.

At this moment the Kozloduy NPP is depositing to the two funds around 18% of the income from sold electricity, which is exceptionally high percentage compared with other operators. According to the evaluation of the AQG experts, the Bulgarian policy on this matter leads to a very high rate of accumulation of resources in the funds, and the percentage of the payments is higher than all the European countries.

Financing of decommissioning of units 1 and 2

To ensure the nuclear facilities safety in the preparation and after their decommissioning, the required financing is provided by several sources:

- Kozloduy NPP own resources;
- National Fund on Decommissioning of Nuclear Facilities,
- European commission and other contributors grants (KIDSF).

Payments to the "Decommissioning of nuclear facilities" fund come from the following sources:

- Payments from operators of nuclear facilities
- Resources from the National Budget, allocated annually according to the National Budget Act for the year;
- Grants;
- Other income from the managements of the financial resources in the fund.

The Kozloduy International Decommissioning Support Fund (KIDSF) is established as a result of a Financial Memorandum, signed in December 2000 between the Republic of Bulgaria and European

Commission,. The grant funds made available by the Contributors of the Fund are administered by European Bank for Reconstruction and Development (EBRD) and will be used for the following:

- So called "nuclear window" - to finance or co-finance, through grants, the preparation and implementation of selected projects concerning the provision of technical assistance and the acquisition, installation and placing into operation of equipment necessary to support the decommissioning of Units 1,2 of the Kozloduy NPP;
- So called "efficiency window" - Measures in the energy sector which are consequential to the decision taken by the Republic of Bulgaria to close and decommission Units 1 & 2 of the Kozloduy NPP which would assist the necessary restructuring, upgrading and modernization of the energy production, transmission and distribution sectors as well as to improve energy efficiency.

Since the beginning of 2003 a Project Management unit (PMU), led by a consortium between BNFL and EdF, is operational in Kozloduy NPP. The amount released by the fund for the "nuclear window" is about € 70 Million, and the projects financed by this amount are:

- Construction of Dry Spent Fuel Storage Facility;
- Equipment and technologies for treatment and conditioning of radioactive waste;
- Equipment and technologies for decontamination;
- Equipment for measurement for free release of materials;
- Equipment for radiation contamination monitoring.

Financing of activities for radioactive waste management

The financing of the radioactive waste management activities comes from the Radioactive Waste Fund. The contributions to the Radioactive Waste Fund are operational expenses of the nuclear facility operators and are included in the price of electricity.

After 2001 financing of all Kozloduy NPP activities in the area of radioactive waste management is done with funds provided solely from the Bulgarian country, with the exception of the projects financed by the IAEA programs for technical cooperation. The long-term prognoses show that the resources available at the moment and the estimated future payments to the Fund will provide the financing of the activities for radioactive waste management for the entire period of operation of the Kozloduy NPP.

The financial resources for execution of the activities for radioactive waste management are planned annually and in mid-term (three year) plans. The proposal for financing of each financial

year is prepared by Kozloduy NPP and is approved by the board of managers of the "Radioactive waste" Fund.

Detailed information about the current status of all activities related to radioactive waste management is presented in the 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. [Ref.3]

4. Provision of adequate human resources

With the enforcement of the new Safe Use of Nuclear Energy Act the obligation to provide the necessary human resources is an element of the legal basis for issuing a license for operation. Article 35 of the Safe Use of Nuclear Energy Act requires, as a condition for issuing a license for operation, that the applicant must employ enough qualified and certified personnel with a sufficient level of education and training for all activities for operation of the facilities.

According to Article 64 of the Safe Use of Nuclear Energy Act, the activities related to the safety of nuclear facilities are carried out only by professionally qualified personnel, having a certificate. The certificates are issued after an exam before a qualification examining committee. According to article 98 the Chairman of the NRA exercises preventive control before the issuing of license and current control of the conforming to the conditions of the issued licenses.

Kozloduy NPP implements the personnel requirements stipulated in the Regulations through the "Personnel training and qualification system". The system includes the organization, management, implementation and control of the activities related to training and qualification of the personnel, the functional responsibilities of Kozloduy NPP officials, the levels of authority and the interaction between the elements of the system in the process of executing the activities.

The qualification requirements for each position in Kozloduy NPP are described in detail in the job description for the position.

The NRA applies a definite policy for recognition of the qualification of personnel in the nuclear energy field, based on:

- A list of the personnel occupied with the management of radioactive waste and spent nuclear fuel, subject to qualification exams before the State qualification committee, approved by the chairman of the NRA;
- Conducting exams of the personnel, subject to qualification exams, by approved questionnaires;

For the recruiting of qualified and competent personnel, a system for internal and external selection is implemented. This system ensures:

- Verification of the correspondence of the candidates with the qualification requirements of the positions;
- Verification of the health status of the candidates, and subsequent evaluation for issuing permission for work in an ionizing radiation environment;
- Verification of the psycho-physiological characteristics of personnel having direct relation to the radioactive waste and spent nuclear fuel management and subject to qualification exams by the regulatory body - the NRA.

The training of personnel is carried out with standard training programs, and the verification of qualification through exam questionnaires.

An independent evaluation of the correspondence of the Kozloduy NPP practice with the international requirements, in the period after the Second National Report, was made by the IAEA Safety Review Mission held in June 2002. As part of the mission a thorough review of the operational safety was carried out, including a review of all the IAEA recommendations regarding the system for providing the necessary qualified personnel. The conclusions of the IAEA Safety Review Mission held in June 2002 are that the plant policy and the system for recruiting, qualification and re-qualification are up to all modern requirements and that all of the IAEA recommendations, including these of the OSART mission held in 1999 are completely fulfilled.

Kozloduy NPP pays specific attention to the accumulation and transfer of the specific knowledge about the technology to its personnel. In relation to this, the implementation of large scale modernization projects for all units in the last decade and the deep reassessment of safety, based on modern methods, lead to exceptionally large amount of transfer of knowledge among personnel responsible for approval of the design changes, their implementation and commissioning.

Also contributing is the wide involvement of Kozloduy NPP specialists in the actualization of the Safety Analysis Reports, the development of the Probabilistic Safety Analysis, Symptom-based Emergency Operating Procedures, the complete revision of the operational documentation, the implementation of new computerized information and control systems, and the simulator complex.

In addition these factors stimulate the building of a specific scientific and engineering community in the country, which at this moment is working in cooperation with Western-European contractors for the modernization programs measures. As a result of this, Bulgarian engineering companies and scientific organizations participate in the development of projects like PRIMAVERA – regional European project for studying the processes of ageing of reactor pressure vessels, PHARE project on SAMG and others. This also includes the development of the educational foundation in the country, including the support for the specialties needed for using and developing the technology, which in the face of the Sofia Technical University takes part in the provisioning of personnel with university degree for all specialties needed in Kozloduy NPP, as well as realization of studies and projects on nuclear power plant subjects.

ARTICLE 12. HUMAN FACTORS

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two Reports, the overall policy for considering the human factor in the operation of nuclear facilities was presented. The organization and managerial issues related to human factor management, assurance of appropriate working conditions to the personnel as well as different studies performed on the role of the human factor and its management were described.

The plans of Kozloduy NPP for development of methodology for analysis of human factor as a cause for operational events, for updating of internal procedures and for extension of the computer data bases for event analyses with possibilities for additional human factor analyses were discussed.

2. Enhancement of the system for analysis and management of the human factor

The management of and responsibilities in the system for operational experience feedback are defined by an approved procedure. In order to increase the effectiveness of the process of root cause analysis and aiming to identify the role of the human factor, a Bulgarian engineering organization with direct participation of Kozloduy NPP experts developed “Methodology for analysis of events, caused by the human factor”.

The methodology is based on the Human Performance Enhancement System (HPES) of the Institute of Nuclear Power Operation (INPO) of USA. It includes definition of behavior factor and cause factor, using collection of additional information during the analysis of human failure for specific event, following specific procedure with use of methods of situation and barrier analysis. The methodology is enforced and is used in operational events analysis in parallel with ASSET methodology applied in Kozloduy NPP since 1997.

The existing events data base is amended and extended in a way, allowing storage and retrieval of all information on operational experience feedback in common information environment for all units in operation.

In regard to the lowering of the threshold for choosing of events for root cause analysis and aiming to be in line with the good international practice, the root cause analyses are performed not only on events, but of deviations as well. Periodical training is performed on the personnel, involved in the events analyses and the number of trained people in this area is permanently increasing.

An evaluation of the compliance of Kozloduy NPP practice with the international requirements was made by the IAEA Safety Review Mission carried out in June 2002. During the mission an overall review of the established operational experience feedback system and results of the implementation, including analyses results, was performed. According to the conclusions of the mission:

"... the plant has taken a comprehensive approach to address the recommendation for improving the reporting and analysis of events and near misses. The plant implemented measures, supported by international organizations that resulted in improved event analysis procedures with a focus on extended methodology for human factor analysis. The reporting of near misses is now managed through the plants total quality management system and has shown good improvement with experienced gained from other plants.

The plant also developed a human factor database that enabled them to analyze human induced events. The plant has implemented sufficient training to the staff involved in event analysis and has organized dedicated committees to perform these analyses. Currently, over 80% of events and about 35% of deviations receive a root cause analysis, of which 70% are attributed to human factor.

This is a remarkable improvement over the past several years. The team encouraged the plant to continue their efforts in this area."

3. Human factor and assurance of safe operation of units 1 and 2 in the process of their preparation for early decommissioning

Units 1 and 2 of Kozloduy NPP were shut down at 31 December 2002, following the decision of the Bulgarian Government. During the first quarter of 2003 the nuclear fuel was taken out of the reactors and units were transferred to the corresponding mode according to the Technical specifications.

In order to maintain the safety status of the units and for operation of safety and supporting systems, the necessary number of and qualification requirements of the personnel are defined.

With the aim of maintaining of the necessary personnel motivation in the beginning of 2002, a special “Program for management of the social consequences of decommissioning of units 1 and 2” was developed. The program foresees measures for social protection and reallocation of the personnel from units 1 and 2.

The following activities are being performed, aiming for long term retention of highly qualified personnel:

- Re-qualification of the personnel from units 1 and 2 for work at units 3 and 4;
- Re-qualification of the personnel from units 1 and 2 for work in the first stage of decommissioning.

In the collective labor contract between the management and the personnel, financial compensations are agreed in case of dismissals as a consequence of units 1 and 2 shut down. The compensations are considered sufficient for re-qualification for work in other branches or starting their own business. In order to decrease the number of dismissed personnel who require re-qualification, the labor contract also foresees financial compensations in case of early retirement.

The described set of measures demonstrated its effectiveness for keeping of necessary personnel motivation since the units’ shut down. No problems were identified during the operation as well as in the area of fulfillment of the conditions of the operational licenses by the regulatory authority.

ARTICLE 13. QUALITY ASSURANCE

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two National Reports, the historical development of the Kozloduy NPP Quality assurance system, the policy for quality during operation of nuclear facilities and later development of the system were presented. Details of the Quality assurance systems in the training of personnel, in performance of the activities on non-destructive examination and commissioning of the Complex for radioactive waste management were also given.

Different methods used for assessment of the effectiveness of NPP's Quality assurance system, such as internal and external audits, independent evaluations by the regulatory authority and/or international missions were shown. In particular the role of the regulatory authority in the process was presented.

Concerning the planned activities, mentioned were the continuation of the activities on development of the Configuration management system, development of the Quality management system for the process of radioactive waste treatment and Quality assurance program during decommissioning of units 1 and 2.

2. System for Quality Management in Kozloduy NPP

According to the Article 16 of the Act on Safe Use of Nuclear Energy, the entities that perform activities on nuclear energy utilization are obliged to maintain high quality of the activities they do. According to the new Regulation for providing safety of nuclear power plants the Operator of the plant shall maintain a system for quality assurance during operation of the plant, including one for the control of activities of persons that perform work or provide services to the plant. The system for quality assurance shall be based on the following principles:

- The managers assure planning, allocates resources and assist for achieving the set goals in safe manner;
- The personnel is familiar and trained to do the work according to the existing rules;

- There is independent evaluation available of the management processes and performance of the activities, which leads to achieving of high quality and implementation of corrective measures when necessary.

There is also a requirement that the quality assurance system shall cover all activities, rated according to safety importance, including but not limited to:

- Definition of the organizational structure, responsibilities, authorities, relationship and management processes;
- Maintaining and increasing the qualification of the personnel that carried out activities, related to the assurance and control of the safety;
- Supply, construction, installation, operation, maintenance and modifications in safety related structures, systems and elements;
- Assurance of adequate resources for fulfillment of the safety requirements.

For each safety related technical activity, verified in advance procedures shall be developed that describe the basic measures for quality assurance, specific conditions to be fulfilled prior to the start of work, necessary steps for the performance of the activity and for remedy of any deviation as well as procedures for reporting, evaluation and approval of the results and for taken corrective action when necessary.

The Regulation requires that all persons, performing safety related work for, or providing services to NPP shall also develop and apply quality assurance programs for the corresponding activities. They shall be in compliance with the quality assurance system of the NPP Operator.

As it was presented in the previous Report, since 2000 Kozloduy NPP Plc. is developing and implementing an updated quality assurance system in compliance with EN ISO 9001:2000, considering the recommendations of IAEA documents, in particular 50-C/SG-Q.

In the period after presentation of second National Report the development of the quality management system follows the requirements of IAEA documents and tendencies set by new standard ISO 9001:2000. The management of the activities, updating of the existing documents and development of new ones are performed considering the “process” approach.

The basic documents defining the system for assurance of the quality of different activities are:

- Quality management manual of Kozloduy NPP Plc.;
- Quality assurance program during operation of units 1 – 4 of Kozloduy NPP;

- Quality assurance program for safe operation of units 5 and 6 of Kozloduy NPP;
- Quality assurance program for operation of the Complex for treatment and storage of radioactive waste;
- Quality assurance program for acceptance and storage of spent nuclear fuel from units 1 - 6 in the interim storage.

Since the middle of 2003 in the plant was implemented a new system for self assessment at the corporate level. The structure of the system is developed by a task force of the plant experts and is approved by the Board of Directors. In the framework of the IAEA project RER/9/070 at the end of 2003 a workshop was held in Bulgaria on "Introducing the system of safety performance indicators" with participation of companies that had already implemented such systems (Iberdrola - Spain and CEZ – Check Republic.

A new revision of the Manual for project management of the modernization program of units 5 and 6 has been developed and implemented. The development of necessary set of quality procedures and working procedures for the project management is completed. The quality of performance of the contractors is controlled through engineering inspections in both contractors' and NPP sites and also by audits. With support of company BENIC (joint company of British Energy and leading Britain engineering company NNC) and financial support of UK Department of Trade and Industry, specialized training in the area of engineering inspections was performed for KNPP personnel, responsible for control of the contractors.

In 2002 the quality system of Non-destructive Examination Center of Kozloduy NPP was certified on standard EN ISO 9001:1994 by TÜV Rheinland InterCert Kft. In 2003 г. an audit was held and the system was re-certified on the new standard EN ISO 9001:2000.

An evaluation of the compliance of Kozloduy NPP practice with the international requirements was made by IAEA Safety Review Mission held in June 2002. In the framework of the mission the team reviewed the Quality assurance system, including addressing the recommendations of OSART'99 mission to the system. The conclusion of the mission was that identified issues and corresponding recommendations are fully resolved.

The fulfillment of the requirements, introduced by the new regulatory documents is subject to review by Nuclear Regulatory Agency in the process of preparation for issuing the operational licenses and later during periodical inspections of the activities of the licensee. For this purpose, the documents that demonstrate the availability of appropriate Quality assurance system were

presented as an element of the documentation, attached to the license application according to the new Act on Safe Use of Nuclear Energy.

After review of the presented documents in the period 2003-2004, the Nuclear Regulatory Agency issued long term operational licenses for all six units of the plant. More detailed information for the issued licenses is given in the information on Article 6 in the Report.

The planned activities in the area of further development of the quality assurance system in Kozloduy NPP include:

- Development, implementation and preparation for certification of Environmental management system in accordance with ISO 14001;
- Analysis of the results from implementation of the system of indicators for self assessment with the aim of its improvement;
- Accreditation of the laboratories for calibration of measuring devices.

3. Quality management during implementation of units' 5&6 modernization program

The implementation of Units 5&6 Modernization Program brings to the forefront the importance of a proper management of units' configuration. The great number of Design modifications, resulting from implementation of new technologies and systems and the installation of equipment of different suppliers generate the need of establishing and maintaining a strict consistency between the plant documentation, installed equipment and design requirements.

For management of this process, according to the plans presented in second National report the Configuration management system is introduced, consisting of several components:

- Document control and records management
- Equipment configuration control
- Design change
- Design requirements

3.1 Document control and records management

An Information Control Module was developed and implemented, which encompasses the process:

- Control of documentation, including review, receipt, introduction, issuance of new revision, distribution, restoration of original copies, keeping and tracking the status of documents;
- Management of records, which defines the methods, responsibilities and requirements for development, archiving, keeping and accountability of the records and archive documents.

The system is based on the Standard ANSI/NIRMA CM 1.0 – 2000, Configuration Management for Nuclear Installations.

Main activities of this Project are as follows:

- Review of existing procedures for Document Management and development of new/revision of existing procedure for Document Control and Records Management
- Development of the application database, i.e. SmartDoc, and verification and validation of the application,
- Loading of Units 5&6 Modernization Program Measures information and existing data from old Database to SmartDoc

SmartDoc Data base is designed in such a way as to identify and control a broad spectrum of information relating to the physical configuration and design documentation. The new database is composed of a powerful application that operates in a modern expandable software platform. This allows extending the system scope, covering all Plant documents in the near future.

3.2 Equipment configuration control

In order to improve the process for equipment configuration control, a new database for Operational management (DB OM) is being implemented.

The design of the new database includes four modules:

- “Equipment” module
- “Operation” module
- “Design changes” module
- “Design requirements” module

A relation will be established between the registered documents and the registered equipment tag numbers by integrating the “SmartDoc” database and “Operational management” database. The forecast deadline or development of all 4 modules is the end of 2005.

3.3 Design change control

A procedure is developed that covers the activities related to control of all design changes, including the design changes, which are covered by the Modernization program. Each design change is assessed by qualified plant personnel with regard to:

- conforming to legislation requirements;
- impact on original design;
- impact on plant safety;
- impact on operation activities;
- impact on maintenance activities;
- conditions for implementation;
- design change tests;

Currently, for the purposes of controlling the design changes, EP-2 personnel use the "Technical decisions" database, which accumulates data about design change proposals, development of change package documentation, registration of approved design changes and recording the realization of the implemented design changes. After the implementation of the DB OM data base the data accumulated in it will be migrated into the new database.

3.4 Design requirements management

The original Russian design documentation is recorded in SmartDoc database. Each of the new design documents undergoes assessment and approval by competent plant personnel before the implementation of the project. The original plant design is used as input for the newly developed design projects. In this way the fulfillment of its limitations and requirements is controlled. The process of collecting and handling of the input data results in more precise and systematic input information. The effect of clarification of design requirements for each system, subject to modernization, is also reached.

The operation of the system till now demonstrated its high reliability in management of the complex project for modernization of Units 5 and 6. In the same time a process of upgrading of the system is ongoing in parallel with the modernization program implementation. When a problem is found it is solved through corresponding software modification. In this way in line

with the program implementation Kozloduy NPP develops a real mechanism for configuration management that will be used during further operation of the units.

The process of implementation of the above activities, the phases and established organization were presented in the information, provided by the plant in the process of preparation for Peer review mission held in November 2003 by Atomic Questions Group of European Commission in connection with a specific recommendation since 2001. The recommendation was considered as adequately addressed and no further monitoring is necessary.

ARTICLE 14. ASSESSMENT AND VERIFICATION OF SAFETY

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

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

1. Brief review of the information presented in the framework of first and second National Reports on this article

The approach and efforts of the Republic of Bulgaria for stage by stage updating of the Safety analysis reports of the units in accordance with the contemporary regulations are presented in the framework of the First and Second National Reports on the Convention. This includes a major program, consisting of thorough reviews of the safety of the existing nuclear facilities, updating of their Safety analysis reports, including deterministic and probabilistic safety analysis, surveillance programs and non-destructive examination.

In addition, detailed information was presented about specific activities like analysis of the condition of stressed pipelines and equipment, reactor pressure vessels, development and implementation of a specific system of indicators based on the IAEA approach, as well as about organization of the internal safety control, overseeing of fire safety, etc.

In the Second National Report the plans for completion of a thorough review of units 3 and 4 SAR in the near future and Units 5 and 6 SAR in accordance with the Modernization program were presented.

Also, the specific plans for continuation of the activities on the PSA and residual lifetime evaluation of units 3 and 4; non-destructive examination methods qualification; installation of additional leak detection systems, based on different detection methods, were presented.

During the discussions on the report in 2002, the Parties noted the intention of the Republic of Bulgaria for implementing contemporary requirements for the format and content of the SAR. The realization of these plans in the best practically achievable terms was supported.

2. Changes in the legal basis concerning the evaluation of safety of nuclear facilities

During the period since the last National Report, the regulatory requirements regarding the evaluation of safety of existing nuclear facilities were changed with the new Safe Use Of Nuclear Energy Act [Ref.4], the ensuing actualization of the legal basis, and in particular the Regulation for assurance of the safety of nuclear power plants.

A dedicated article in this Regulation states the basic requirements and procedures for initial and periodical safety review of nuclear facilities, the range of deterministic and probabilistic safety evaluations, requirements concerning the purposes of each analysis, as well as the tools used to perform the analysis (computer programs, data, assumptions etc.). The Regulation also provides the order for carrying out periodic safety evaluations, regulates the range of the periodic evaluations and the methods that should be used for these evaluations.

3. Evaluation of the safety of existing nuclear facilities

During the period since the Second National Report the activities on the evaluation and justification of the safety of existing nuclear facilities were carried out in accordance with the plans presented and taking in mind the requirements of the new Safe Use of Nuclear Energy Act enforced in 2002.

In compliance with these requirements an evaluation and licensing of all the operating Units was carried out. Detailed information about the activities regarding the licensing is presented in Article 9 of this Report.

3.1. Units 3 and 4

The new Safety analysis report of Units 3 and 4, reflecting the new design basis after the completion of the modernization program, has been developed in accordance with the contemporary requirements for safety and was presented to the Regulatory Body in July 2002.

The ground for development of the Safety analysis report are the requirements of the national regulative basis, applicable Russian and American standards, as well as the IAEA directions for the form and contents of Safety analysis reports. Specific additional requirements concerning the form and content of individual sections were developed with the help of West-European regulatory bodies in the framework of a project financed by the European Union under the PHARE program.

The new Safety analysis report reflects the results of the modernization, including the implementation of the LBB concept, Residual lifetime of the main equipment, seismic and fire

safety measures, actualized safety analyses for the full scope of events, actual probabilistic safety analysis etc.

The completion of the Safety analysis report of units 3 and 4 in accordance with the contemporary requirements practically completes the Safety Review Process of these Units by the methodology of IAEA for periodic safety review, initiated in 1996 with the development of the PRG'97 Modernization program for these units.

In June 2002 in the framework of the IAEA Safety Review Mission [Ref.1] an independent evaluation of the implemented activities on actualization of the Safety Analysis Reports was carried out. The conclusion of this Mission was that the new Safety Analysis Reports comply with the contemporary applicable guidelines and reflect the effects achieved by the safety improvement measures, which have been implemented until the moment. The Mission assessed the completion of the actualization of the Safety Analysis Reports as the most important achievement of the implementation of the PRG'97.

It was mentioned that in some degree, the range of analyses is enhanced in comparison with the range stated as necessary by the USA and IAEA guidelines. This is concerning mainly the analyses of beyond design basis accidents, which were reviewed in the Safety Analysis Reports with the main purpose to define the possible severe accident preventive and management measures.

On its part the NRA organized an independent technical review of the presented Safety Analysis Reports for units 3 and 4. By the end of 2003 a new edition of the Safety Analysis Reports for units 3 and 4 was developed, taking into account the notes from the NRA and the additional modernization measures implemented in the meantime.

During the period since the Second National Report, the periodic actualization and enhancing of the scope of the Probabilistic Safety Analysis (PSA) continued. The results of these analyses are used in the program for safety improvement for evaluation of the effect of specific measures and for defining of new measures. As a result some of the measures included in PRG'97 modernization program, are a direct result of the Probabilistic Safety Analysis evaluation.

At this moment each unit has an actual and specific level 1 Probabilistic Safety Analysis for every power level, including seismic PSA and assessment of the fire hazards. The results of the last actualization of the PSA for units 3 and 4 show that the total probability for core damage has been reduced to 3.4E-05/year. (internal events, seismic risks and fire hazards).

All PSA results are systematically controlled by the IAEA, through full scale IPERS missions and periodic reviews of specific PSA sections. The quality of the PSA was highly evaluated by the IAEA Safety Review Mission in 2002 [Ref.1.] and the Peer review by the EU Atomic Questions Group in November 2003.

A level 2 PSA and continued enhancement of the present PSA towards using them as a tool for safety assessment in the operation of nuclear power plants are being developed. In October 2003 the IAEA organized a specialized mission to review the quality of the data, methodology and the program for development of the PSA.

3.2. Units 5 and 6

In accordance with the plans presented in the Second National Report the next actualization of the existing SAR for units 5 and 6 is done in parallel to the implementation of the measures of the modernization program and will be completed in the middle of 2006. The SAR being developed will include a completely actualized list of postulated initiating events, and is being developed in accordance with the requirements of the national regulatory basis, the applicable Russian and American contemporary standards, as well as the IAEA guidelines.

Regarding the probabilistic safety evaluation, at the moment the level 1 PSA for full power is being actualized, including analysis of internal initiating events; analysis of flooding risks; fire hazards analysis. Another project concerning the low power PSA development is carried out in the framework of the modernization program. The complete actualization of the PSA including the results of the modernization program is planned for 2005.

In the modernization process of units 5 and 6, each individual package of documents for changes in the design is presented to the NRA to grant permission for implementation together with the specific parts of the Safety Analysis Report concerning the affected equipment, systems and components.

In accordance with the aforementioned, the preparation of the safety evaluation is assured as an element of the whole design process by the designer of the Modernization Program measure. In the process of reviewing of these documents the operator is supported by an independent team of engineering consultants and the NRA by TSO experts of West-European regulatory bodies by a special program financed under the PHARE program of the EU.

The approach for carrying out of the aforementioned activities, the individual steps and the organization, including the intense dialog between the Regulator and the Operator, were found adequate by the Peer Review of the EU Atomic Question Group held in November 2003. It was

ascertained that all necessary conditions for completion of these activities within the planned deadlines are present and no monitoring on the implementation is required by the EU. Detailed information about the measures being implemented, including related to evaluation of safety, is presented in Appendix 7.

4. Inspection system and indicators

During the period since the Second National Report the activities concerning inspections and diagnostics of the equipment including non-destructive examination were continued in the following general directions:

- Working out in details and provision of resources for the implementation of the programs and methods for operational control of both types of reactors, including modernization of the existing control systems and delivery of new equipment;
- Implementation of a program for qualifying the control methods including training and certifying of personnel.

The process of actualization and working out in detail of the programs and methods for operational control takes into account the existing operational experience and the results of the development of the non-destructive examination and diagnostic control. The implemented database system stores specific arrays of results of thermovision, thickness measurement and vibration diagnostics.

During the period a thorough modernization of the systems for external and internal inspection of the reactor pressure vessel of the WWER-1000 was carried out. The system for external inspection is based on the ultrasonic system MIDAS-NT and the system for the internal inspection is based on the TOMOSCAN-3 ultrasonic system. In relation with the implementation of the existing long-term program for improvement of the eddy current control in Kozloduy NPP a modernization of the software and hardware for data acquisition and analysis of the manipulators used, took place. A new manipulator with certified rotational probes for metal control of the steam generators of WWER-1000 units was commissioned.

Since 2002, a special program for qualification of non-destructive examination of safety related components is being implemented. Up to this moment, according to the schedules for implementation of the program, the methods for control of the reactor pressure vessel are qualified. The achieved criteria for finding and measuring of critical defects of the given components are up to the ENIQ (European Network for Inspection Qualification) advisable practices.

The work on the qualifying procedures is carried out under the control of a British qualification company, which is a consultant to the NRA on the matters of qualification of control. The completion of the program for qualification of the control methods in use is scheduled for 2005. For this purpose all necessary financial and material resources are provided, including test samples with built-in defects.

Under a project, financed by the British DTI, in a joint venture with British companies a methodology was developed for the periodic training of personnel carrying out the control activities, and examination of the skills of the personnel needed to work in a limited access and time environment, as well as specific training for working with new systems and methods for control. In 2003 the quality system for nondestructive examination and diagnostic control was certified under ISO 9001:2000 by TUV-Germany.

During the IAEA Safety Review Mission in 2002 the system for nondestructive examination and the program for qualification of the methods, was given a high evaluation. The activities were found to be adequate to the existing experience and the guidelines of IAEA and the EU. The bilateral exchange of experience with countries like Great Britain, Spain, Croatia, Russia, The Check Republic and others was found to be an effective way to keep the necessary modern level.

As part of the modernization program for units 3 and 4, a program for residual lifetime management of equipment, systems and components of these units was developed in 2002. This program is based on the experience in developing similar projects by leading German and Russian engineering companies. The results were presented to the NRA as part of the documents for the operational license of the units.

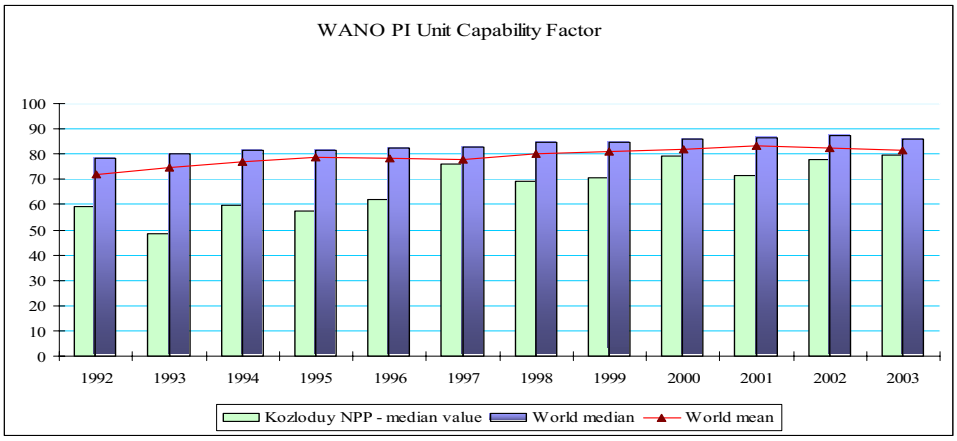
In the framework of this program was performed an evaluation of the existing residual lifetime of the equipment, systems and components, determination of the leading mechanisms for ageing and the critical components, determining the residual lifetime of the whole Unit. It was found out that for both Units, there are no mechanism of ageing which would prevent the operation of the units until the end of their design lifetime of 30 years or its prolonging for a further five or ten years.

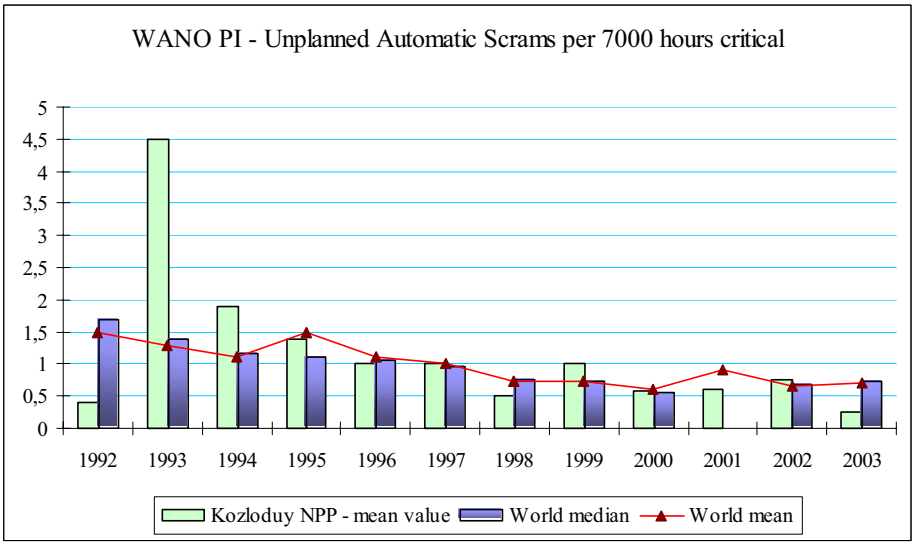
As part of this project a specialized database for processing the information concerning the residual lifetime of the main equipment was developed and commissioned as well as technical systems for automated acquisition and processing of data for the loading of key components and evaluation of the processes of ageing of main pipelines.

Finally as a result of this project a long-term program for optimizing the usage of the existing lifetime of the equipment was developed and is being carried out by the Plant.

In the period since the Second National Report the development of the indicator system used by Kozloduy NPP continued. The system is developed based on the IAEA documents and is periodically updated with respect of the experience gathered from its operation. In this moment the system includes 63 indicators, which are used to assess the effectiveness and the safety of activities of the divisions in Kozloduy NPP. The indicators are periodically monitored by the divisions and the trends are analyzed, corrective measures are taken where needed, and the strengths and weaknesses of the activities are determined. The results of the indicators are available to all the personnel through the Plant information system (Local area network). The results from the development of the system were assessed as adequate by the IAEA Safety Review Mission in 2002.

The results of the analysis of the indicators show the reliability of the nuclear power units for the period. This is best illustrated with the following indicators:





In 2003 there was only one non-planned actuation of the reactor protection system on unit # 3. During the year Unit 6 completed 7 years without actuation of reactor protection system and the record is held by unit 5 with 7 years and 7 months. These results show the stable trend toward high reliability of Kozloduy NPP operation comparable with the World practices.

ARTICLE 15. RADIATION PROTECTION

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two National Reports, the national policy in the area of radiation protection in the operation of the Nuclear power plant has been presented in detail, as well as the legal and regulatory basis, the structure and the functions of the control bodies, and the structure built for institutional control of the Kozloduy NPP.

The standards for radiation protection BNRP-2000 enforced in 2001, based on the international safety standards /BSS/, IAEA series No115 from 1996 and EU Directive 96/29 from 1996 have been presented, as well as the plans of the Republic of Bulgaria for further development of the regulatory basis towards synchronizing with the EU legislation.

2. Organization of the Radiation protection and radiation monitoring in the Republic of Bulgaria

Article 3 of the Safe Use of Nuclear Power Act states that the doses from ionizing radiation to the personnel and the population must be kept as low as reasonably achievable.

As presented in the Second National Report, the Regulation for basic standards in radiation protection (BNRP-2000) is based on the international safety standards /BSS/, Series № 115, published by IAEA in 1996 and the EU Directive 96/29 dated 13 May 1996.

According to article 16 of the Safe Use of Nuclear Power Act, the persons carrying out activities using nuclear power must meet the requirements, regulations and rules on radiation protection. License to operate nuclear facilities is granted to a legal entity, which:

- Possesses all the necessary technical means and has the necessary organization to keep the doses of personnel and population as low as reasonably achievable;
- Possesses approved emergency plans for action in case of an accident;
- Has provided the correspondence of the facilities and the activities to the requirements, regulations and rules for nuclear safety and radiation protection.

The technical specifications, containing the limits and conditions for operation also contain limits for radioactive releases to the environment. The limits for doses to the population as a result of radioactive releases to the environment in case of an accident are given in the Regulation for planning and preparedness in case of a radiation accident.

The gamma background in the 3-kilometer zone around Kozloduy NPP is measured continuously with an automated system for external radiation control "Berthold". The system has 10 monitoring stations for measuring the gamma background and the activity of ^{131}I in the ground level of the atmosphere, 5 water stations and 3 meteorological stations. The radiation monitoring system in Kozloduy NPP is integrated with the similar system of the Ministry of environment and waters. Information is exchanged on-line.

The radiological monitoring in the country is carried out according to a program which is a part of the National Automated System for Ecological Monitoring (NASEM) and includes a network of surveillance points, periodicity and a complex of radiological indicators being monitored. The radioactive contamination of the atmosphere, soils, ground waters, underground waters and other objects of the environment is being monitored.

The continuous surveillance of the equivalent dose rate across the territory of the Republic of Bulgaria is carried out with the National Automated System for continuous monitoring of the gamma background. It consists of 26 local monitoring stations, covering the whole of the territory of the country, regional monitoring stations – in the regional inspectorates of environment and waters Varna and Vratza and a central monitoring station in the Executive agency of environment, where the centralized database is kept.

The information is gathered in real-time and is transmitted to the emergency center of the NRA and in the national reaction center in the State Agency for Civil Protection.

3. Control bodies in the area of radiation protection

The NRA exercises a regulatory control for assuring that the radiation protection requirements in the operation of nuclear facilities are met.

According to article 148 of the Environment Protection Act the Ministry of environment and waters controls the components of the environment and the factors that influence them.

The preventive control is done through ecological evaluation at the stage of approval of plans and programs and trough environmental impact evaluation being a condition for granting a sketch (visa) for design in the development of the investment process.

Besides preventive control the Ministry of environment and waters carries out routine control through auditions, monitoring and measurement including access to the data of the self monitoring of the object carried out by the operator. Also a follow-up control is carried out through control of the implementation of the measures given in the Environmental impact evaluation and implementation of corrective measures issued during auditions.

Attached to the minister of environment and waters there is an Executive Agency of Environment which carries out management, coordination and information functions regarding the preservation of the environment in the Republic of Bulgaria. This Agency is a managing body to the National System for Ecological Monitoring and is the National reference center of the European environment agency.

Radiometric measurements in real-life conditions, sample taking and analytical activities are done by a laboratory for radiation measuring in the Executive Agency of Environment and radiological control laboratories in the Regional Inspectorates of Environment and Waters in Burgas, Varna Vratza, Montana, Pleven, Plovdiv and Stara Zagora. The results of the radiological monitoring are published in periodical issues of the Executive Agency of Environment and an annual report on the Environment is prepared which is approved by the Council of Ministers.

4. Radiation safety in the operation of Kozloduy NPP

4.1. Radiation impact on the personnel

In the Kozloduy NPP policy, safety during the operation of the units has top priority. The IAEA Safety Review Mission in June 2002 reviewed the addressing of all the recommendations in the area of radiation protection. The team came to the conclusion that all of the recommendations have been completely addressed. There are proofs of systematic application of the ALARA principle.

The corporate structure for control of the radiation protection in Kozloduy NPP is presented in the previous two Reports. Independent control of the occupational irradiation is done by the “Health Physics” department. Data about the occupational irradiation in Kozloduy NPP for the last 5 years is presented in Table 1

Table 1. Kozloduy NPP professional irradiation, 1999 - 2003.

№	Indicator	1999	2000	2001	2002	2003
1	Collective effective dose [manSv]	4.5	6.2	5.6	3.7	3.1
2	Share of the internal irradiation in the occupational exposure [%]	3.6	3.2	2.3	2.8	2.9
3	Number of persons exceeding of the annual limit for occupational exposure 50 mSv (BNRP'2000)	0	0	0	0	0
4	Average individual effective dose of the controlled persons [mSv]	1.10	1.44	1.15	0.65	0.49
5	Maximum effective dose [mSv]	27.20	36.88	19.19	19.91	18.21

The workers and specialists with occupational exposure in 2003 are 16.3% less than the exposed in 2002. Their share has dropped from 65% of all controlled in 1999 and 2000, to 44% in 2002 and 34% in 2003.

The collective effective dose in Kozloduy NPP for 2003 is by 16% lower than the previous year. Figure 1 shows the trend of the collective effective dose for the last 5 years (Note: In 1999 the unit outages are one less than the rest of the years).

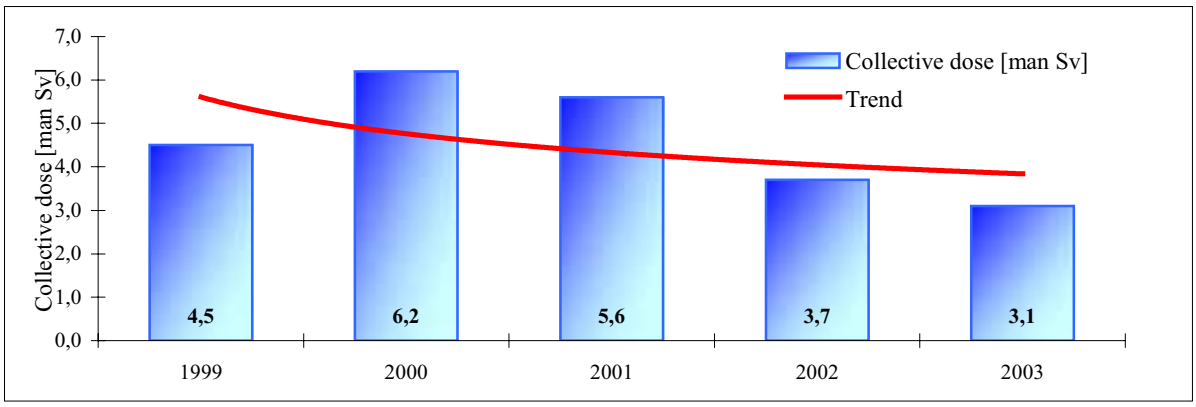


Figure 1. Collective effective dose, Kozloduy NPP, 1999-2003

Normalized to the number of reactors in operation, the collective dose for Kozloduy NPP is 0.52 manSv/unit, which is lower than the average value for this indicator for 255 PWR type reactors in 2002 - 0.80 manSv/unit, as reported in the "WANO'2002 Performance Indicators" Report. The same indicator for 2002, averaged by the ISOE for 257 WWER reactors is 0.89 manSv/unit (figure 2).

Normalized to the number of reactors in operation the collective dose for 2003 is 0.54 manSv/unit, for WWER-440 units and 0.45 manSv/unit for WWER-1000 units. The averaged value of this indicator for Kozloduy NPP in the last five years keeps the decreasing trend, and in 2002 it is lower than the averaged value of the WANO and ISOE indicator for the year.

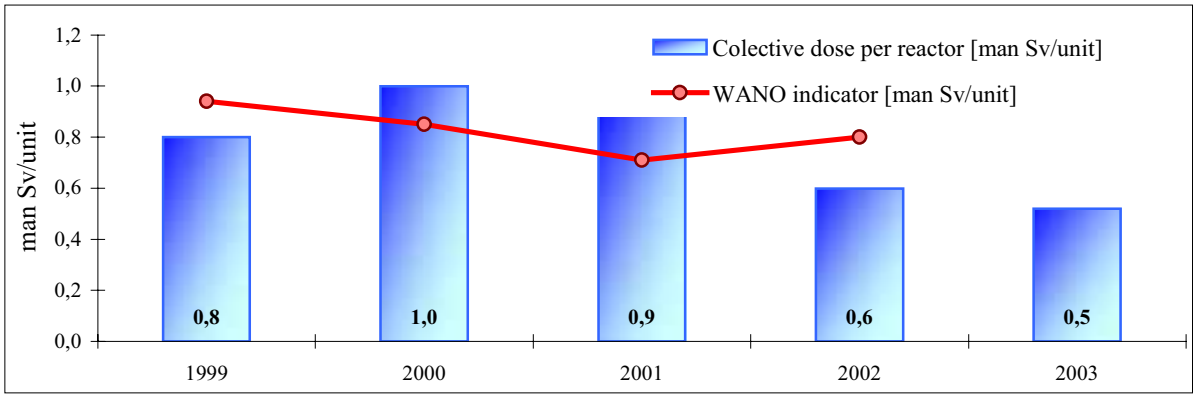


Figure 2. Collective dose per reactor, Kozloduy NPP, 1999-2003

The average individual annual dose for 2003 for the controlled persons in Kozloduy NPP is 0.49 mSv, which is by 25% lower than the previous year and has a constant decreasing trend in the last 5 years. (Figure 3).

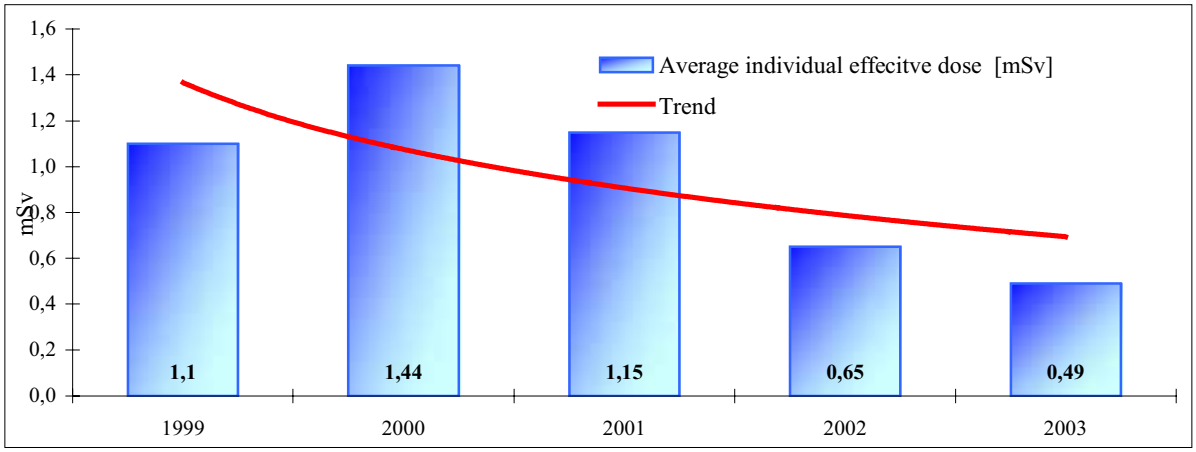


Figure 3 . Average individual annual dose, Kozloduy NPP, 1999-2003

During the last five years in Kozloduy NPP there has not been registered an individual dose exceeding the limit for occupational irradiation of 50 mSv, according to BNRP'2000.

4.2. Radiation impact on the population and the environment

The activity released trough the vents of Kozloduy NPP for the period 1999-2003 is as follows:

Normalized indicators	Dimension	1999	2000	2001	2002	2003
Radioactive noble gases	TBq/GW.a	143.0	121.3	131.6	115.8	128.5
Iodine – 131	GBq/GW.a	1.62	1.57	1.72	1.27	1.31
Radioactive aerosols	GBq/GW.a	0.58	0.60	0.70	0.74	0.67

During the same period the total activity of the water released into the Danube is as follows:

Normalized indicators	Dimension	1999	2000	2001	2002	2003
Liquid releases, without tritium	GBq/GW.a	2.12	0.98	1.03	0.85	0.86
Tritium	TBq/GW.a	11.2	7.52	6.76	8.83	9.82

During the period the activity released from Kozloduy NPP trough the gas-aerosol and liquid releases is in the margin below 1.2% of the national norms and is comparable to the practices in other countries operating nuclear reactor of the WWER type. The tritium activity in the liquid releases is below 11% of the limits.

The maximum of the **individual effective** dose in the 30 kilometer zone, due to the gas-aerosol releases from Kozloduy NPP in the period from 1999 to 2003 is in the region from 2,68E-7 to 3,76E-7 Sv/a. This radiation is less than 0.02 % of the background radiation typical of the region of Kozloduy NPP and below 0.04% of the legal norm of 1 mSv for the population according to BNRP-2000.

The maximum normalized **collective effective annual dose** for the population in the 30-kilometer zone, due to the gas-aerosol releases from Kozloduy NPP is estimated in the region from 2,68E-3 to 3,58E-3 manSv/GW.a. These values are fully comparable to the world practice for PWR reactors based on data from UNSCEAR-2000.

The irradiation of a person from the critical group of the population due to the liquid releases is in the region from 1,14E-11 to 1,66E-11 Sv/a, which is so small, it could be ignored. The normalized collective effective dose for the population of the 30-kilometer zone, due to the liquid releases is estimated in the region from 1,14E-8 to 1,60E-8 manSv/GW.a.

The data for the doses to the population in the 30-kilometer zone for the period 1999-2003 are fully comparable to the data from the previous years and confirm the conclusions for the neglectfully low impact on the environment and the population. The annual maximum individual dose does not exceed 1 μSv, and the collective 10 man mSv. The doses correspond to the best practices worldwide.

During the period 1999-2003 the gamma dose rate on the plant site and in all of the control points within the 100-kilometer zone around Kozloduy NPP is within the natural radiation background 0.07-0.15 μSv/h and is comparable with other populated places in the country.

In a total of 36 control points within the 100 kilometer zone samples are taken from main ecological components like air, water, soil and vegetation for the purpose laboratory analysis of technological radioactivity. Outside of these control points, water from the Danube and internal water basins and typical agricultural goods and food products are analyzed. Over 2000 samples are subjected to more than 400 analyses annually. The methods used for the analyses are proven in practice modern radio-analytic methods like gamma-spectrometry, low background radiometry of total beta activity and radio-chemically isolated strontium, liquid-scintillation tritium spectrometry, allowing detection of the smallest deviations of the radiation parameters from their natural levels.

The results from the analyses of main components of the environment like air, water soil and vegetation, as well as foods typical for the region of Kozloduy NPP, are in the natural limits for the geographical latitude. The measured concentrations are many times below the legal norms and are comparable to the data from previous years and the period before the commissioning of the plant, 1972-1974. Like in previous years in 2003 there is no registered deviation in the radio-ecological parameters caused by the operation of the Nuclear power plant. The radiation situation in the 100 kilometer zone is stable and favorable.

The aforementioned basic conclusions are confirmed by the independent expert evaluation in the Environmental impact report of Kozloduy NPP. The studies, analyses and expert evaluations allowed the authors of the report to conclude that:

"In Kozloduy NPP the main issues are solved in accordance with the Bulgarian Legislation and the international criteria and standards and the main goals are achieved to assure the nuclear safety and the radiation protection.The radiation impact of Kozloduy NPP on the atmosphere, the waters, soils, plant and animal world and protected territories, as well as the risk for the environment and the health of the population in the controlled zone are insignificant."

ARTICLE 16. EMERGENCY PREPAREDNESS

1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and offsite emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two National Reports, the integrated system for emergency planning built in the country was presented in details, as well as it legal and institutional framework.

The organization and interaction between the various structures, existing emergency plans and in particular the emergency plan of Kozloduy NPP were presented in details. Information about the training courses and practice drills for improving the emergency preparedness was given, as well as about the participation of the country in international exercises.

The “Planned activities” section contained the perspectives for development of the national emergency plan with emergency planning for accidents with other sources of ionizing radiation, including radioactive waste, transportation of radioactive materials and others in accordance with the IAEA recommendations TECDOC-1162 in the framework of the RER/9/050 IAEA project.

The foreseen improvement of the early warning system in case of a nuclear accident through improving the prognosis for spreading of the “radioactive cloud” and through expansion of the continuous monitoring system of Kozloduy NPP were also presented in details.

In the discussion on the Report in 2002 the Agreeing parties mentioned the created legal basis and the achieved practical results, particularly concerning the participation in international exercises.

2. Legal and regulatory basis for the emergency planning and preparedness

With the enforcement of the new Safe Use of Nuclear Energy Act the following legal requirements were introduced:

- According to Article 16 of the Safe Use of Nuclear Energy Act the entities operating nuclear facilities, are obliged to take measures for prevention of incidents and accidents as well as for limitation of their consequences;
- According to Article 35 of the Safe Use of Nuclear Energy Act a license for operation of a nuclear facility is granted to a legal entity, in possession of approved emergency plans for action in case of an accident;
- In case of an accident the licensee/the holder of the permission is obliged according to Article 122 of the Safe Use of Nuclear Energy Act:
  - to inform immediately the population and the mayors of the municipalities in the emergency planning zone, as well as other competent bodies;
  - to perform actions for limitation and liquidation of the consequences of the accident;
  - to monitor and regulate the irradiation of the persons taking part in the limitation and liquidation of the consequences of the accident;
  - to provide continuous monitoring of the release of radioactive material in the environment;
  - to take part in the activities included in the National system for Ecological monitoring;
- According to Article 117 of the Safe Use of Nuclear Power Act the measures for emergency planning are defined in emergency plans as follows:
  - for protection of the population (external emergency plan), which regulates the zones for emergency planning and defines the actions of the competent bodies for protection of the population, property and environment in case of an accident;
  - of the nuclear facility (internal emergency plan), which defines the actions of the licensee or the holder of the permission for limitation and liquidation of the consequences of the accident in accordance with the external emergency plan.

As presented in the previous National Reports the organization of the development, support and coordination of the execution of the external emergency plan is done by the Permanent Commission for Protection of the Population from Disasters, Accidents and Catastrophes (The

Permanent Commission) to the Council of Ministers and the State Agency for Civil Protection to the Council of Ministers. The external emergency plan is passed by the Council of Ministers on motion from the State Agency for Civil Protection.

The development of the external emergency plan, its resource and personnel provision, the maintaining of the emergency preparedness and the implementation of the measures are financed from the state budget.

The conditions and the order for development of the emergency plans, the persons who implement them, their obligations, the measures for limitation and liquidation of the consequences, the ways for informing the population, as well as the measures for controlling the emergency preparedness are defined in the 'Regulation for planning and preparedness for a radiation accident' and the 'Rules for organization and actions for prevention and liquidation of the consequences of disasters, accidents and catastrophes'.

In the period since the Second National Report the 'Regulation for planning and preparedness for a radiation accident' has been amended to include the obligations for emergency planning and preparedness in the nuclear facilities for managing spent nuclear fuel and Radioactive waste, which by the moment are defined in various regulations.

3. National emergency plan of the Republic of Bulgaria

Since the preparation of the previous National Report the following amendments in the existing national emergency plans were introduced:

- National basis plan (National Emergency plan) for execution of rescue and urgent emergency-reconstruction activities in case of disasters, accidents and catastrophes, (in force since April 2002);
- Emergency plans of the local administration and local governments, ministries and Departments (last revision 2000 – 2003);

Since the presentation of the previous National Report the country participated in a series of national and international practice exercises as follows:

- An exercise for actions in case of an accident in Kozloduy NPP (2002);
- Full-scale national exercise for actions in case of an accident in Kozloduy NPP (2002)
- Full-scale national exercise of the National Service on Fire and Emergency Safety for actions in case of fire on Kozloduy NPP site (2002)

- Bi-lateral Bulgarian-Turkish exercise for actions in case of illegal trafficking of nuclear material (2002);
- International exercise of the INTEX (International Technical Exercises) series, organized in cooperation with NATO and the IAEA (2002);

The republic of Bulgaria continues its participation in international projects in the area of emergency planning, preparedness and response, as follows:

- IAEA project RER/9/050 - "Harmonizing the emergency planning in the Central and Eastern Europe countries " and its continuation – IAEA project RER/9/064 with inclusion of issues for medical response in case of radiation and nuclear accident;
- A PHARE project for the installation of the RODOS (Real-time on-line decision support) system in Bulgaria;
- An EU program for joining the project for early notification and information exchange in case of nuclear or radiation accidents, ECURIE (European Community Urgent Radiation Information Exchange).

4. Kozloduy NPP emergency plan

For the period from 2001 to 2004 six actualizations of the Kozloduy NPP emergency plan have been made and the expiration date of the plan now is 12.01.2007. The Emergency plans for actions in case of accidents related to the transport of fresh and spent nuclear fuel nave been updated as well

In 2003 an information system for the Accident management center has been commissioned in Kozloduy NPP. This information system automates the processes for collecting data, data exchange, its' processing and presenting the data to the emergency teams in the Accident management center. The program modules that have been developed can be used for preparation of scenarios for exercises, carrying out the exercise and in case of a real accident.

As mentioned in the Second National Report, additional measures and emergency plans for action in case of natural disasters have been prepared in Kozloduy NPP, which are actualized and maintained according to the Kozloduy NPP established order for documentation management.

5. Emergency planning training and exercises

During the period 16–20 June 2003 in Mol (Belgium) a training course was held for Off-site Emergency Planning and Response to Nuclear Accidents, (SCK•CEN, Mol (Belgium), June 16 –

20, 2003), in which representatives from Kozloduy NPP and the State agency for Civil Protection took part. The subject of the course was in the area of emergency planning and accident managements, reaction, decision making, medical and technical support, prognosis of the accident development, etc.

In October 2002 on the Kozloduy NPP site, a complex emergency exercise was held as part of the national exercise “Protection of the population and the economy in case of a radiation accident in Kozloduy NPP”. The scenario was: “Rupture of a primary circuit pipeline of Unit 2”.

In December 2003 on the Kozloduy NPP site, a complex emergency exercise was held with the scenario “Total loss of electrical power on unit 5”.

The exercises were held in the Accident Management Center, situated on the NPP site, and in the emergency centers in the regional and national institutions. Training questions related to evaluation of the emergency condition, activation of the emergency plan (notification and gathering of the emergency reaction teams), actions of the emergency reaction teams for accident management and personnel protection (sheltering and evacuation) and information exchange.

ARTICLE 17. SITING

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two national reports the legal and regulatory basis in force until 2002 was presented, as well as the results from the research done on the two sites in Bulgaria chosen to be sites for nuclear facilities – Kozloduy and Belene.

The additional research activities on these sites, including those after the beginning of the construction works, were presented. Detailed information was given about the last compliance evaluations, taking into account the independent research organized by the IAEA.

The Reports present the existing agreements with the governments of neighboring countries – Romania, Greece and Turkey for warning in case of an accident and for information exchange about existing or planned nuclear facilities.

During the discussion of the Report in 2002 the contracting parties noted the achieved results in the seismic reinforcement of Kozloduy NPP.

2. Changes in the legislation and the regulatory basis of Republic of Bulgaria

With the enforcement of the new Safe Use of Nuclear Energy Act in 2002 changes were introduced to the permit regime for nuclear power plant site selection. The evaluation of the impact of the facility on the environment, including the border crossing aspects of this evaluation is defined in the Environment Protection Act.

The Environment Protection Act requires that a public discussion of the environmental impact assessment results with the municipality and the relevant body issuing the environmental impact assessment must be organized. Representatives of the municipal administration, state and public organizations, the general public and concerned physical and legal entities take part in this discussion.

The procedure for issuing a permit for site selection is defined in the new Regulation of the order for issuing of licenses and permits for safe use of nuclear energy, and the requirements of the site are defined in the Regulation for assurance of the safety of nuclear power plants. These two regulations are based on the new Safe Use of Nuclear Energy Act.

According to the Regulation of the order for issuing of licenses and permits for safe use of nuclear power, for issuing a permit for site selection, the applicant presents a general characteristic of the nuclear facility and criteria for site acceptance. The scope of the information necessary for evaluation of the site suitability is described in an Appendix to the Regulation – geography, demography, human activities, meteorology, hydrology and hydrogeology, geology, geotechnics, seismology.

For approval of the selected site the applicant presents a preliminary report for the analysis of the safety of the nuclear facility, which should contain a comparison of the proposed sites from the viewpoint of nuclear safety and radiation protection, the results of the research of the characteristics of the selected site, etc.

The selected site is approved by the chairman of the NRA if it meets the established requirements and it is proven that the characteristics of the site are determined, the events and phenomena which may influence the design, and that during the normal operation and design based accidents the radiation exposure of the personnel and the population is as low as reasonably achievable, without exceeding the established limits.

The requirements for the sites for nuclear power plants are defined in Chapter 3 of the Regulation for providing of the safety of nuclear power plants. Suitable for NPP are sites for which the following conditions are met:

- Compliance with the environment protection legislation, the Regulations and rules for radiation protection, the specific requirements for civil protection, the fire protection requirements for the technological buildings and the requirements for physical protection;

- Geological and geographic facts, like low intensity of the safe shutdown earthquakes, non-floodability of the site, lack of differentiated movements of the earth crust, potentially active or extinguished landslides or other dangerous slope processes;

- Climate prerequisites, like wind characteristics, intensity and relevance of origination of storms, hurricanes and other climate extremities.

The regulation defines the scope of the engineering studies and research of the processes, phenomena and factors of natural or technological background, which may influence the safety of the nuclear plant, as well as the relevant technical measures to be taken in order to minimize the risk for/from the NPP to the necessary degree.

These engineering studies include research of the aerologic, hydro-meteorological, hydro-geologic and geochemistry conditions for dispersion, migration and accumulation of radionuclides and the natural radiation background, creation of a prognosis for the change of these conditions for the entire period of operation of the NPP. Determination of the characteristics of the migration of radionuclides in the surface and underground waters and the accumulation of radionuclides on the bottom of water basins must be done, taking in mind the possible radioactive contamination.

The Regulation requires that when selecting the site for a nuclear plant, the radiation situation for all operational modes and accident conditions must be determined and technical and organizational measures for providing the safety of the population to be developed. The consequences of possible radiation impact on the population and the environment in the monitored zone, of radioactive releases in case of an accident during the operation of the nuclear plant must be determined with the necessary conservativeness and the specifics of the designed nuclear facility and the selected site.

3. “Kozloduy” Site

During the period 2002 – 2004 on the Kozloduy NPP site the intensive implementation of activities, regarding to the seismic security continued. These activities included activities in the area of seismic monitoring, completion of the seismic qualification of units 3 and 4 and implementing measures, part of the modernization program, for improving the seismic stability of units 5 and 6.

In the period after the second National Report the project for technical cooperation with the IAEA BUL /09/19 was completed, which resulted in the commissioning at the end of 2002 of a

system for seismic monitoring and control. With the realization of this project the requirements of US NRC RG 1.12 and RG 1.166 for instrumentation of nuclear facilities were met, and specific requirements for determination of exceeding of the design basis earthquake were developed for the Kozloduy NPP site. As a part of the project, a "Plan for the action of personnel in case of an earthquake" was developed. This plan also meets the US NRC RG 1.166 and RG 1.167 and allows the personnel quickly to determine the necessary actions for operative management after an earthquake.

In April 2002, with the support of IAEA the "Manual for seismic reassessment and design of nuclear facilities – method for seismic qualification of Kozloduy NPP" was updated and reissued.

In the period since the Second National Report the activities for seismic qualification of units 3 and 4 were subject to an overall evaluation from the IAEA. As part of the Safety Review Mission in June 2002, the seismic stability of the equipment of these units was reviewed as separate section, parallel to the rest of the technical aspects and the operational safety of the units. The IAEA evaluation [Ref.1] clearly defines the seismic capacity of units 3 and 4 to be completely provided-for, in accordance with the modern requirements.

According to the IAEA conclusions: "*The evaluation and the reinforcement are carried out systematically for all elements required for safe unit shutdown, as well as these used for limitation of the consequences of ruptures in the steam generator compartment. Furthermore, the new equipment delivered and installed as part of the modernization program is seismically qualified trough the use of well defined procedures, IAEA Standards and modern international practices. ... There is a tangible new understanding, in the technical and the management levels of the questions related to seismic safety which guarantees that the plant will keep a positive attitude to this subject."*

In accordance with this policy since 2002 a separate program of activities for seismic qualification of lower priority is being executed. The purpose of this program is to complete the entire potential scope of seismic reinforcements of the systems and equipment for units 3 and 4. The program is executed in stages, with schedules for completion by the early 2005. The execution of the program is monitored by the NRA as part of the long-term operational licenses of the Units.

In the framework of the execution of the modernization program for units 5 and 6 since the previous national report, practically all necessary analyses for evaluation of the capacity of the equipment and constructions due to be qualified. For a large part of the studied subjects the conclusion is that the required capacity is secured taking into account the actualized seismic

evaluations. For the rest of the subjects, projects are developed and are being implemented. According to the schedules the implementation should be completed by the end of 2005.

4. "Belene" site

For the realization of the plan for development of the energy sector with minimal expenditure until 2020 in the period since the Second National Report, the Council of Ministers of the Republic of Bulgaria decided to resume the procedures and licensing processes for the construction of Belene NPP.

By an Act of the Council of Ministers in December 2002 the Ministry of Energy and Energy Resources was given the task to organize the preparation of evaluations of the nuclear safety, radiation protection, environmental impact, physical protection, radioactive waste, spent nuclear fuel and their management, as well as the social-economic importance of the construction of Belene NPP.

According to the provisions of the Environment Protection Act in 2004 an Environmental impact assessment report was prepared. The Republic of Bulgaria has informed the Romanian authorities of its investment intention for construction of the Belene NPP. For the Environmental impact assessment in the trans-border context, for which Republic of Bulgaria is the state of origin, the scope of information has been determined and is included in the Report, with specific attention to the trans-border impact aspects and the measures for their limitation.

In June 2004 the NRA has received an application for issuing a permit for site selection for a new nuclear facility from the National Electric Company. The application is accompanied by all necessary documents and is being evaluated by the Regulatory body.

ARTICLE 18. DESIGN AND CONSTRUCTION

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

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

1. Brief review of the information presented in the framework of first and second National Reports on this article

The original design basis of Kozloduy NPP nuclear units was presented in details within the two first national reports taking into account the different phases of construction correspondingly units 1 and 2; 3 and 4; 5 and 6. The design basis of Belene NPP initial design was presented as well.

Additionally, in response to questions asked during the presentation of the second national report, information about numbers of important units 1-4 design changes as a result of their modernization and more specifically about the significant departure of units 3 and 4 from their original design basis. Units 5 and 6 modernization plans were presented as well.

In the framework of the discussion on 2002 report the contracting parties notified the achievement of significant changes in the units 1-4 design basis and plans to address the severe accidents management. Realization of these plans in the earliest practically achievable term was supported.

2. Changes in the regulations about NPPs design and construction

Within the period since the previous national report the authorization regime for nuclear facilities design and construction activities was changed as a result of the enforcement of the new Safe Use of Nuclear Energy Act in 2002 (Reference 4). The procedure for issuance of permits for execution of design or construction activities is defined in the Regulation for licenses and permits issuance order. The corresponding requirements for safety during the design and construction of nuclear facilities are identified in the Regulation for assurance of the safety of NPPs.

The regulation for assurance of the safety of NPPs defines the main safety criteria and rules as well as the organizational measures and technical requirements for providing of safety during sitting, design preparation, construction, commissioning and operation. The regulation stipulates also the requirements for industrial safety, fire and security protection, emergency planning and preparedness of the NPPs resulting from the application of the defense in depth concept.

According to the principles of this regulation a nuclear power plant is considered safe if in all operational conditions its radiological impact is kept bellow the limits, identified by regulations for internal and external personnel and public exposure, and is on a reasonably low level, as well as if during all accidents, including very low probability ones, the radiological impact can be limited.

The regulation defines the NPP safety assurance through systematical application of defense in depth concept, based on the application of a system of physical barriers against spread of ionizing radiation and radioactive materials into the environment and a system of technical and administrative measures for barriers protection and for preserving their effectiveness as well the protection of the public, personnel and the environment.

The articles of the regulation are specifying requirements about:

- Design basis of the nuclear facility;
- The approach for assessment and justification of the design safety level;
- The requirements for the site characteristics and the evaluation of the different factors of natural or industrial origin.

A specific article of the regulation identifies safety requirements for a nuclear power plant and its systems which shall be insured during the design including:

- Requirements to the construction and characteristics of the reactor core;
- Requirements to the reactor coolant circuit and to the systems for heat removal to the final heat sink;
- Requirements to constructions, functional characteristics and reliability of the protection, localization and support safety systems;
- Requirements to technological process control systems and to the reactor protection systems.

The regulation defines the design requirements also with regard to the operation of the NPP like management of radioactive wastes, handling and storage of nuclear fuel, radiation protection and others.

A specific article of the regulation defines the requirements for safety during the construction, commissioning and operation of the nuclear power plant. Special attention is paid on the assurance of high quality level during all phases of the activity. Preserving the high level of quality is a responsibility of all individuals, conducting activities related to SUNEA and the regulation identifies requirements to the quality assurance system of the organization, responsible for construction and operation of the nuclear power plant, including the specific requirements to the different stages of the commissioning process.

The new regulation for assurance of the nuclear power plants safety is developed in compliance with the requirements of INSAG-12 and with the available results from the ongoing project of the western nuclear regulators association WENRA for harmonization of the regulatory requirements on the basis of defined reference requirements.

3. Changes in the units design basis as a result from the implemented modernizations

3.1. Units 3 and 4 design basis changes

During 2002, through the realization of the measures of the Program for modernization of WWER-440, the necessary degree of compliance with the goals of the Program was reached with regard to units 3 and 4, practically finalizing the process of their periodical safety review. A total update of nuclear installations Safety Analysis Report was performed, which is the final phase of this process according to the IAEA methodology.

The complex approach for WWER-440 units' modernization, which has been systematically applied since last decade in close cooperation with IAEA, WANO and other international organizations resulted in a number of essential changes in their design basis:

- Significant extension of the list of postulated events with which the safety systems of the units can cope with consideration of requirements commonly accepted contemporarily;
- Major change of the capacity and the reliability of units' accident localization systems up to a degree when it is demonstrated that the consequences from the potential postulated events are restricted bellow the permissible limits for radiological impact;

- Considerable reduction of the core damage frequency to a level substantially lower than the target values, established worldwide for the power reactors currently in operation;

- Full justification of the new design basis in a scope in compliance with the contemporary international practices and standard requirements, by application of current computer calculation models and methodologies for deterministic and probabilistic assessments.

The overall completion of the periodic safety review process, demonstrated in 2002 resulted also in an enhancement in the operational practices and safety culture by a wide application of the corresponding international standards.

The IAEA review on the units 3 and 4 safety level, conducted in June 2002 confirmed that all IAEA recommendations are met and that through the implementation of the modernization program these units are brought to a safety level, comparable with the level of safety of other NPPs of the same vintage. (Attachment 8).

In addition to the IAEA assessment, the major design basis changes presented above were also confirmed by other evaluations conducted by Russian and Western European engineering and expert organizations. In 2002, after an one-year-lasting study of the overall effect from the conducted reconstruction on units 3 and 4 the Main Designer of the original reactor installation B-230 concluded that, taking into account the initial substantial differences of these units from the base B-230 model and the subsequent modifications implemented until 2002, the units design basis is totally modified and brought in compliance with the current standards requirements.

The review of all chapters of the units design package confirmed the generic changes of every one of them, substantially developing their original design scope. As a result of this conclusion in 2002 the Main Designer, the Architect Engineer and Scientific Supervisor of the initial design of units 3 and 4 agreed on an official document according to which the aforementioned changed design basis of the units are identified as a model V-209M.

This assessment was confirmed by an independent comparative assessment of the reached level of safety of units 3 and 4 toward other nuclear installations from the same type, including a comparison with installations V-213, conducted by the West European company ENCONET Consulting in 2002. In the framework of this study the level of safety of the new design basis of units 3 and 4 was evaluated by use of several current approaches:

- by assessment of the IAEA recommendations;

- by assessment of the WENRA recommendations;

- by assessment of the safety level according the EU AQG/WPNS check list;
- by assessment of the fulfillment of US NRC General Design Criteria;
- by a comparative assessment with the original design and the current status of NPPs on reactors WWER B-213 including also the consideration of IAEA recommendations to these reactors.

The results of this assessment (Attachment 9), independently verified by highly reputable international experts, confirmed the correspondence of the new design status of units 3 and 4 with the contemporary requirements for light water reactors in operation. The identified differences in the units 3 and 4 from B-213 reactors were assessed by the IAEA methodology for defense in depth, the approach fro lines of defense, used in UK and the USNRC method for quantitative prioritization. It was demonstrated by all methods that the significance of the remaining questions, subject of potential discussion is negligible and not determinative.

The conclusions of the Peer review, conducted by the Atomic Question Group (AQG) of EU in the end of 2003 were in line with these assessments. The goal of the review, requested by the Bulgarian side, was to assess the level of fulfillment of the recommendations on the safety level of the units, identified by the same group in a special report on assessment of the level of nuclear safety in the countries in the process of EU accession, issued in 2001. The AQG review report, presented in April 2004 stated that all recommendations with regards to units 3 and 4 are adequately addressed.

3.2. Main modernizations implemented in the design of units 5 and 6

In the period after the Second National Report the implementation of the Program for Modernization of units 5 and 6 entered its final stage – implementation of the main package of technical measures.

As it was presented in the previous National Report, the IAEA review on the scope of this modernization, conducted in 2000 demonstrated that there is no single problem, related to safety which is not addressed by this program and that in many of the areas plant activities are going substantially beyond the IAEA requirements. This is characterizing the level to which the design basis of these units is being set by the realization of this phase of the program.

During the period 2003 – 2005, within the planned annual outages of the units the main scope of installation and commissioning activities of this phase is being implemented targeting its completion as a whole in 2006. Information about the main implemented measures is given in the

chapter of this report dedicated on article 6. In the Attachment 7 more detailed information about the whole scope of the Program activities is presented.

The realization of this program, the organization of its implementation and more specifically the planned measures related to high energy secondary circuit pipework were assessed very high by the EU AQG experts, who made a review on the site in the framework of the November 2003 Peer Review (see the item 3.1 here above). The planned measures, the organization for implementation, and the level of resolution of the problem were assessed by AQG experts as realistic and fully adequate to the European requirements for assurance of high level of nuclear safety.

3.3. Severe accidents management measures

As a continuation of the different modernization activities on units 3 and 3 and units 5 and 6 currently NPP Kozloduy is developing a strategy for severe accident management which is considered as the next important step for enhancement of their safety level in line with the current world trends.

This includes development of severe accident management guidance and implementation of a number of technical measures for management of the fuel cooling and of the radiological releases in case of the core degradation. Currently the accident localization systems of all units are equipping with hydrogen recombination systems and filtered venting systems.

In parallel since the middle of 2003, severe accident management guidance are being developed in the framework of a special international project “Phenomena investigation and development of Severe Accident Management Guideline“. The main aim of the project is development of guidelines for management of severe accidents for units 3 and 4 and for units 5 and 6 of Kozloduy NPP. It includes the following main activities:

- Comparison of different approaches for severe accidents management and selection of the one for Kozloduy NPP;
- Development of a plant specific data base for SAMG preparation;
- Development of detail SAMG for WWER-440 (units 3 and 4) and WWER-1000 (units 5 and 6) for Kozloduy NPP;
- Review of the existing documentation and operational accident procedures for compliance with the new SAMG;

- Verification and validation of the developed SAMG.

The project activities are carried out in compliance with the applicable West European standards and on the basis of similar developments, realized in the West European countries taking into account the specifics of the reactors WWER-440 and WWER-1000 of Kozloduy NPP. Within the scope of the work it is foreseen to identify plant specific vulnerabilities from the point of view of severe accidents management for Kozloduy NPP units 3 and 4 and for units 5 and 6 as well.

On the basis of the identification of the particular specific the group of consequences with risk significance is analyzed and the corresponding severe accident processes are assessed. The corresponding severe accident management guideline is being developed on the basis of this assessment made on the functional level.

3.4. Preparation for construction of an NPP on the site "Belene"

After the Second National Report, in fulfillment of Council of Ministers decree from December 2002 for organization of the activities, related to safety and environmental impact assessments and the others aspects of construction and operation of NPP "Belene", the Ministry of Energy and Energy Resources invited companies, supplying nuclear installations to present proposals for construction of a new nuclear capacity on the site "Belene".

The received proposals were selected on the basis of a cost-benefit study. Within this study all issues related to the nuclear fuel cycle of the different proposals, the generated radioactive wastes by type, gaseous, liquid and solid, low- medium- or high level radioactivity and by physical and chemical composition are being reviewed and an analysis of their treatment and conditioning is carried out

The preliminary assessments carried out including technological, safety, economical as well as the environment impact assessments conducted at this stage, are confirming the necessity and expediency of the second nuclear power plant completion on the "Belene" site, based on a modernized design.

On that basis with a decree from April 2004 the Bulgarian Council of Ministers took decision for construction of nuclear power plant "Belene" NPP and authorized the Ministries of Economy, of Finances and of Energy and Energy Resources to organize and conduct negotiations with the expressed investment interest companies as well as with financial institutions for preparation and placement of contracts for execution of the project.

ARTICLE 19. OPERATION

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

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

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

(vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

1. Brief review of the information presented in the framework of first and second National Reports on this article

In the previous two Reports, the existing organization and system of documents for ruling of the operation of the plant and in particular the system of permits for start up of nuclear facilities and modification of their design are presented.

The practice of development and maintaining of Technical specifications for different nuclear facilities, their link with the other operational documentation and the process of updating of the later is also presented.

As a specific element of the system of operational documentation, in the second National Report the status of the activities on development of a new kind of emergency operating procedures based on the symptom oriented approach is presented in details.

Also presented is the existing system for reporting of events and analysis of operational experience, including information regarding the number, character and classification of the registered operational events.

Data for generated radioactive waste, system for radioactive waste management and programs for waste minimization are presented as well.

In the framework of the discussion on the this report in 2002 the contracting parties mentioned the achieved level of operational safety and express support to the implementation of the plans for further activities and in particular introducing of the Symptom-based Emergency Operating Procedures and development of Severe Accidents Management Guideline..

2. Changes in the legal and regulatory basis

According to the new Act on Safe Use of Nuclear Energy [Reference 4], enforced after presentation of second National Report, the operation of nuclear facilities may be performed only by the legal entities that have got license for operation of the facility. License is issued after fulfillment of the conditions of the predecessing commissioning permit.

In Article 35 of the Act are described conditions that the licensee shall meet. Together with the application for license, the applicant shall submit to the Nuclear regulatory Agency documents, which prove that the facility, as it is built, corresponds to the design and safety requirements, necessary organizational structure and system of internal rules are established and necessary competent personnel for assurance of fulfillment of the licensee obligations is available (for details see information for Article 9).

The requirements for assuring the safety are described in details in the new Regulation for providing the safety of nuclear power plants. According to the Regulation the operator of NPP shall adopt a document that defines the safety policy during operation of the plant. There should be statement for the priority of the safety over all other aspects of the activities and undertaking of clear obligation for continuous improvement of the safety and encouraging the personnel for critical attitude to the performed work aiming achievement of highest results. All personnel and persons performing works for and providing services to the plant shall be familiar with safety policy statement.

For the implementation of the safety policy the Operator of the plant is required to develop strategy, which contains goals, tasks and methods that are easy for implementation and control. The Operator also shall have substantiated organizational structure for safe and reliable operation

with clear defined responsibilities, authorities and communication lines of the personnel who performs activities related to the assurance and control of the safety.

The Regulation defines that during the plant operation:

- Decisions, related to the safety, shall be taken after necessary studies and consultations;
- The necessary resources and conditions to the personnel for performance of the activities in a safe manner shall be assured;
- The performance of the safety related activities shall be controlled continuously;
- The own and international operational experience as well as scientific and technical developments in the area of nuclear industry shall be analyzed systematically, aiming continuous improvement of the performance.

The Regulation requires the Operator to have available sufficient number of qualified personnel. The sufficiency and qualification of the personnel shall be analyzed and confirmed in systematic documented manner. It also required development of long term plans for recruitment of personnel for performing of the activities, related to assurance and control of the safety.

In Article 19 of the Act on Safe Use of Nuclear Energy the content of the license is defined. One of the mandatory elements of the license is the requirement for reporting of the events, related to the nuclear safety and radiation protection. The way and conditions for notification of Nuclear Regulatory Agency for operational deviations, events and accidents, related to the nuclear safety and radiation protection are defined in the Regulation for way and conditions for notification of Nuclear Regulatory Agency for events in nuclear facilities and objects with ionizing radiation sources.

For fulfillment of the requirements of Article 16 of the Act on Safe Use of Nuclear Energy the licensee shall develop procedures for analysis of the operational experience.

The fulfillment of the above requirements and established organization for this are subject to review by the Regulatory Agency initially in the process of evaluation of the license application and further on during the process of control of fulfillment of the license conditions.

3. Organization of Kozloduy NPP operation

After enforcement of the new the Act on Safe Use of Nuclear Energy all Kozloduy NPP units passed through procedure for licensing according to the new Act and the Regulatory agency granted long term operational licenses (see information for Article 9).

During the licensing process were presented and evaluated:

- Organizational structure of the plant, established internal rules and the systems for quality assurance and self assessment;
- Measures for personnel training and maintaining of the personnel qualification and planning of necessary key competencies;
- System of operating procedures, operational limits and conditions, procedures for actions in case of deviations and emergency operating procedures;
- System for evaluation of operational experience feedback, notification and analyses of direct and root causes;
- The processes of operation, maintenance, technical support, analysis of operation and following of the own and international experience.

For units 1 and 2, taking into account the planned long term stay in the mode "cooling the fuel" an overall review of the operating, maintenance and surveillance procedures was performed and particular rules, considering specifics of the mode were developed. Additional technical means for monitoring of the technical parameters, important for the safety during fuel storage and cooling were installed. The computerized operator support system was extended in regard to the automatically recorded and visualized parameters in Main control room.

The changes in the organization of the activities in the plant, considering implementation of specific projects related to the preparation for decommissioning of units 1 and 2 are presented in the information for Article 6 in the report.

In the period after presentation of the second National Report one of the major activities in the area of improvement of the operation of units 3 and 4 was implementation of symptom-based emergency operating procedures (June 2002 for unit 3 and September 2002 for unit 4). The procedures are developed in accordance with the modern operational safety standards on the basis of Westinghouse approach. The results of the process were highly evaluated by IAEA Safety Review Mission in 2002 and by Peer review of Atomic Questions Group of European Commission in 2003.

In addition to this for units 3 and 4, bearing in mind the big number of design modifications and complete update of units' Safety Analysis Reports, an extended review of the Technical specifications was done and they were updated to be in line with the results of updated Safety Analysis Reports. The Technical specifications are integral part of the Safety Analysis Report and

also part of the document package, submitted by the plant as attachment to the operational license application.

The issued operational licenses of the units include conditions for further development of number of the plant programs with direct relation to the plant operation such as:

- Continuation of the activities for development Symptom-based Emergency Operating Procedures and development of Severe Accidents Management Guideline;
- Continuation of the activities in the area of Probabilistic Safety Assessment.

For the purpose separate long term (two years) programs for both topics are developed. In order to extend the scope of the Symptom-based Emergency Operating Procedures in the framework of this program are being developed guidance for transition and relation with the guidelines for management of scenarios with severe accidents. More details for Severe Accidents Management Guideline development are presented in the chapter for Article 18 of the report.

In connection with the start of the next phase of implementation of the units 5&6 modernization program activities the organizational structure of the plant was modified after the presentation of the second National Report. A new separate engineering structure, subordinated directly to the Executive Director was established with the task for complex project management. In the project management the plant is supported by international consultancy team, located permanently on site. A special system for configuration management was developed and implemented aiming assurance of the necessary conditions for proper and smooth introducing of the big number of design changes for units operation. More information for the established organization is presented in the chapter for Article 6 in the Report.

The granted licenses for operation of units 5&6 reflect the established organization and requirements of Nuclear Regulatory Agency in regard to:

- Implementation of the modernization program itself, including continuation of the activities on Probabilistic Safety Assessment;
- Total update of the SAR after completion of the modernization program;
- On-line updating of the Technical specifications including its total update after completion of the modernization program;

- Continuation of the program for development of Symptom-based Emergency Operating Procedures and their implementation, considering the parallel implementation of the modernization program.

In the period after presentation of the second national report the country continued development of the policy for wide application of the mechanisms of international assessment and peer reviews.

In June 2002 IAEA held in Kozloduy NPP a mission for review of the results of units WWER-440 modernization. Due to the early termination of operation of units 1 and 2 the mission concentrated its attention to the evaluation of the design safety level of units 3 and 4. The results of the mission are presented in the chapter for Article 6 of the report and conclusions of the review team are given in Attachment 7.

Regarding to the operational safety an overall review of the organization of operation was performed. All elements of the process were the object of the review. IAEA experts once more (after 2001) evaluated all recommendations of TECDOC-640 in the operation area as fully resolved.

The IAEA mission carried out also second follow-up review of the OSART mission from 1999. Once again (after 2001) the fulfillment of the recommendations of first mission was checked, including these, evaluated during first follow-up as “issue fully resolved”. The review during 2002 mission found that all recommendations OSATR’99 mission are fulfilled according to the expectations of the experts. The results and conclusions of the mission regarding operational aspects are presented in the information for Article 10 in the Report. The unique experience of carrying out second follow-up OSART mission allowed the plant to continue to use the independent evaluation of the operational practices, provided by IAEA, to the maximum extent.

In June 2003 a WANO Peer review to units 3 and 4 was held. The Peer review was organized by WANO Moscow center and it was a full scope review (areas of organization and administration, operation, maintenance, technical support, operational experience feedback, chemistry, radiation protection, training and qualification, fire protection).

In the conclusions WANO team evaluated the progress in last years as impressive. Highly evaluated was the approach of adequacy of the efforts in technical areas of safety (large scale investments for the plant modernization) and the efforts in operational area (organization, operational conditions, documentation, etc.).

The carried out in November 2003 Peer review by the team of Atomic Questions Group of European Commission made a review of fulfillment of the set of recommendations included in the report of the group from 2001 regarding achievement of high level of safety in operation of nuclear facilities. There were general and specific recommendations regarding to:

- Use of the mechanisms of periodical safety review;
- Development of modern emergency operating procedures;
- Application of state-of-the-art methods for analysis of the operational experience;
- Application of modern approaches for probabilistic safety assessment;
- Management of large scale modernization projects.

The results of the review, presented in the report of Atomic Questions Group from April 2004, demonstrate adequate addressing by Bulgaria of the requirements of AQG in each recommendation and non necessity for further monitoring by European Commission in this area.

4. Analysis of the operational experience

As it was presented in the previous National Reports, since 1997 in Kozloduy NPP, applying the ASSET methodology a systematic approach for analysis of the operational experience is introduced. Since that time the plant practices for operational experience feedback are continuously assessed and updated. In order to achieve compliance with the internationally applied approaches, plant practices were subject of several external reviews, performed mainly by expert teams of IAEA (the last was held June 2002) and WANO (2003).

The management of the activities and responsibilities, related to the operational experience feedback, are defined in a set of procedures that is element of the documents package, submitted to the Regulatory authority as attachment to the license application of the units. The licenses itself define the obligations for and the scope of reporting of operational events as well as the obligations of the licensee for assurance of adequate depth of the event analyses.

The system covers internal and external operational experience, analysis of deviations, trends, “near misses” and performance indicators. In order to improve efficiency of the process of root cause analysis and to identify the role of the human factor a “Methodology for analysis of events caused by human factor” was developed and implemented, based on the HPES methodology if institute INPO of USA.

With the aim of lowering the threshold for selection of events for root cause analysis, the latter are analyzed not only of events, but also for deviations of procedures, programs and personnel, which are obviously below the reporting criteria. A computerized data base for analysis and recording of all events, occurred at the site, is developed and implemented.

Additional training is given to the personnel who participate in the event analyses. In the framework of the "Twinning" program with Bugey NPP in France the experience in the analysis of "potential" events and low level events.

Regarding the external operational experience Kozloduy NPP uses widely contacts with other plants with WWER reactors. The exchange of information on technical issues is done through E-mail and participation in the WANO Moscow center workshops.

Republic of Bulgaria, represented by Nuclear Regulatory Agency, participates in the IAEA information system INES. Kozloduy NPP participates directly in the WANO information system for events reporting.

In 2001 in Kozloduy NPP altogether 70 events are reported. Two of them are deviations resulted from routine activities on site and the rest 68 are operational events. 44 of them are evaluated as safety related and are assessed as "zero" level according to the international scale INES. The rest 24 events and two deviations are evaluated as no safety related and are connected mainly with unplanned power decrease. During the year no events are assessed above "zero" level of INES.

In 2002 in Kozloduy NPP altogether 81 operational events are reported. 72 of them are analyzed using ASSET methodology and the rest nine – using different methods according their specifics. 53 of the events are evaluated as safety related and are classified as "zero" level according to the international scale INES. The rest 28 are not safety related and are assessed "out of INES scale".

In 2003 in Kozloduy NPP are registered 56 operational events and 38 of them are reported to the Nuclear Regulatory Agency according to the reporting criteria. The rest are reported out of the criteria. Based on the conclusions of analyses teams 31 events are evaluated as safety related and classified as "zero" level according to the international scale INES and four of the reported events are assessed "out of INES scale".

Three of the operational events are classified as level 1 (anomaly) according to the international scale INES:

- 20 January 2003 at unit 3 occurs a leak of primary coolant to the hermetic confinement as a result of leak from pipeline of the primary circuit make-up system. As a result of the event the unit is shut down automatically by the reactor protection system. No violations of

operation limits and conditions are registered as well as no radiation impact on the personnel and environment. Detailed report for the event is distributed through the channels for international exchange and is presented to a IAEA workshop in 2003.

- 20 February 2003 at unit 3 when performing control in the framework of the surveillance program of safety systems a decrease of the concentration of boric acid in one of the tanks of the emergency system. The event did not lead to the real consequences to the safe operation of the unit. Detailed report for the event is distributed through the channels for international exchange.

- 24 march 2003 at unit 2, which is operated in the mode of cooling the fuel in reactor spent fuel pool, during the maintenance of a pump of the pool cooling circuit a leak from the cooling circuit occurs that lead to the short term inoperability of the system. No violations of operation limits and conditions are registered as well as any radiation impact on the personnel and environment. Detailed report for the event is distributed through the channels for international exchange.

5. Generation and treatment of radioactive waste

In the period after second National Report presentation on Kozloduy NPP site the Complex for treatment, conditioning and storage of radioactive waste was commissioned and put in operation. The complex includes a line for supercompaction of solid radioactive waste, a line for treatment and conditioning of liquid radioactive waste and interim storage for conditioned radioactive waste.

Currently the activities on radioactive waste in Kozloduy NPP include collection, handling, conditioning and storage of liquid and solid radioactive waste on the plant site. The gaseous radioactive substances, generated during the process of operation of the nuclear facilities on the site are released in the environment after purification as permitted by the regulatory authority emissions. Information for the gaseous emissions is presented in the chapter for Article 15 of the report.

In details the policy for management of radioactive waste and spent nuclear fuel, information for quantities and facilities for conditioning and storage are presented in the National Report on Joint Convention for safe management of radioactive waste and spent nuclear fuel [Reference 3]

Attachments to the report:

Attachment 1	List of the nuclear facilities
Attachment 2	Data for the nuclear facilities
Attachment 3	List of secondary legislative acts on application of safe use of nuclear energy act
Attachment 4	Flow chart of the relationships of the institutions, applying legislative framework
Attachment 5	Measures undertaken for decommissioning of units 1 and 2 of Kozloduy NPP
Attachment 6	Long term programs under implementation on units 3 and 4 of Kozloduy NPP in compliance to the conditions of their operational licenses
Attachment 7	Units 5 and 6 modernization measures. Status of implementation
Attachment 8	IAEA SRM 2002 Executive Summary
Attachment 9	ENCONET 2002 Units 3 and 4 comparative safety assessment

List of reference documents

Ref.1. Report of The Expert Mission To Review The Results of Safety Upgrading Activities of the Kozloduy NPP Units 3&4 IAEA-TCR-001142, Vienna, June 2003

Ref.2. The International Regulatory Review Team (IRRT) Mission to Bulgaria, July 2003

Ref.3. 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.

Ref.4. Safe Use of Nuclear Energy Act

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Attachment 1

LIST OF THE NUCLEAR FACILITIES

1. Kozloduy NPP

Location: North-East Bulgaria, 3.5 kilometers south-east from town of Kozloduy

1.1. Power units 1 and 2, WWER-440 (disconnected from the national grid, in operation in mode "cooling the fuel in the reactor spent fuel pools");

1.2. Power units 3 and 4, WWER-440, (in operation without limitations in operational modes);

1.3. Power units 5 and 6, WWER-1000, (in operation without limitations in operational modes);

1.4. Interim storage for spent nuclear fuel, pool type (in operation);

2. Belene NPP

Location : North Bulgaria, 4 kilometers east from town of Belene

2.1. Power units 1 and 2, WWER-1000, under construction (construction stopped in 1990)

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Attachment 2

DATA FOR THE NUCLEAR FACILITIES AT KOZLODUY NPP

Kozloduy NPP

1. Main characteristics of the nuclear facilities

The main characteristics are presented in Attachment 1 to the second National Report of Republic of Bulgaria on fulfillment obligations on the Convention on Nuclear Safety.

For the period after the second National Report there are no changes in the main characteristics of the facilities.

2. Updated data for the Nuclear power Units

Facility	Type	Start-up date	License #	Term of validity	Comments
Unit 1	WWER-440	October 1974	E-00707	20.02.2009	In mode of "cooling the fuel in reactor spent fuel pool"
Unit 2	WWER-440	November 1975	E-00613	15.01.2009	In mode of "cooling the fuel in reactor spent fuel pool"
Unit 3	WWER-440	December 1980	E-00174	22.03.2011	
Unit 4	WWER-440	June 1982	E-00008	26.02.2013	
Unit 5	WWER-1000	November 1987	E-00429	09.10.2009	
Unit 6	WWER-1000	August 1991	E-00419	03.10.2009	

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Attachment 3

LIST OF SECONDARY LEGISLATIVE ACTS ON APPLICATION OF SAFE USE OF NUCLEAR ENERGY ACT

1. **Rules of Procedure of the Nuclear Regulatory Agency**

(Decree of the Council of Ministers # 199, 22 August 2002, promulgated in State Gazette # 86, 2002)

The Organizational Statute determines the structure, activity, organization of work, functions and number of personnel of the Agency and its administrative units. According to the Organizational Statute, since 01.January 2003 The Chairman of the Agency is a primary administrator of budgetary credits.

2. **Regulation for the procedure for issuing licenses and permits for safe use of nuclear energy**

(Decree of the Council of Ministers # 93, 04 May 2004, promulgated in State Gazette # 41, 2004)

The regulation defines all matters related to the procedures for issuing, changing, renewing, canceling, revoking and controlling the licenses and permits demanded by the Safe Use of Nuclear Energy Act. The structure of the regulation takes into consideration the specifics of the types of nuclear facilities, activities and sites with sources of ionizing radiation. The scope and contents of the required documents is specified taking into account the necessary measures for providing the nuclear safety, radiation and physical protection. For activities with certain types of ionizing radiation sources, based on the lower risk for the population and the environment, alleviations of the required documents is provided.

3. **Regulation for the conditions and procedure for transfer of radioactive waste to the state enterprise "Radioactive Waste"**

(Decree of the Council of Ministers # 164, 14 July 2004, promulgated in State Gazette # 64, 2004)

The entities, which generate radioactive waste as a result of their activities, are obliged to transfer the waste to the State enterprise, which is responsible for the management of the radioactive waste after the deposit.

The regulation defines the conditions and procedure for transferring the radioactive waste to the State enterprise "Radioactive Waste" and the terms for the transfer, as well as the radioactive waste not eligible for transfer. Specific procedures are defined for transferring radioactive waste generated from previous activities, radioactive waste with unknown owner, or which has been imported to the country and cannot be returned.

The radioactive waste becomes state property at the moment of its transfer to the State enterprise.

4. Regulation for providing the safety of nuclear power plants

(Decree of the Council of Ministers # 172, 19 July 2004, promulgated in State Gazette # 66, 2004)

The regulation settles the matters related to the basic criteria and rules for the safety of nuclear power plants based on the concept of in-depth defense.

Subject to regulation are the organizational measures and technical requirements for providing of the safety during site selection, design, construction, commissioning and operation of nuclear power plants. The regulation contains detailed instructions related to the determination of the design basis and safety evaluations, the characteristics of the site and the safety requirements for the nuclear power plant and its systems.

The regulation is developed based on the IAEA safety standards and the reference levels for harmonization of the safety requirements for nuclear power plans, defined by the West European Nuclear Regulators' Association (WENRA).

5. Regulation for radiation protection during activities with sources of ionizing radiation

(Decree of the Council of Ministers # 200, 4 August 2004, promulgated in State Gazette # 74, 2004)

The regulation defines the basic requirements and rules for radiation protection during activities with sources of ionizing radiation and the condition and the procedure for accounting of the sources of ionizing radiation. The regulation puts in place requirements for radiation monitoring during activities with sources of ionizing radiation.

The regulation specifies technical and organizational rules for conforming to the established in Bulgaria basic norms for radiation protection.

6. Regulation of the conditions and procedure for notification of the NRA about events in nuclear facilities and sites with sources of ionizing radiation

(Decree of the Council of Ministers # 188, 30 July 2004, promulgated in State Gazette # 71, 2004)

The regulation defines the obligations of the licensee or the holder of a permit for creation of a system for collecting, registration, investigation, analysis and evaluation of events and determination of corrective measures.

Also defined are the requirements for usage of the information about events, including for analysis of the operational experience, determining of the importance of the events for safety, as well as the procedure and terms for providing information to the citizens for events of different importance.

7. Regulation of the conditions and procedure for exempting small amounts of nuclear material from the Vienna convention for civil liability for nuclear damage

(Decree of the Council of Ministers # 201, 04 August 2004, promulgated in State Gazette # 72, 2004)

According to the Vienna convention for civil liability for nuclear damage the operator of a nuclear facility is responsible for nuclear damage caused by a nuclear accident and is obliged to maintain an insurance or other financial guarantee, covering his liability.

Every agreeing country has the right to exempt small amounts of nuclear material from the application of the convention, up to a maximum limits defined by the managing board of the IAEA. According to Article 135 of the Safe Use of Nuclear Energy Act the Council of Ministers is delegated the authority to accept a Regulation, in which the conditions and procedure for exempting small amounts of nuclear material from the application of the Vienna convention to be determined.

The regulation was developed in accordance with the decision of the managing board of the IAEA dated 14-15 September 1978 for establishing the maximum limits for exempting small amounts of nuclear material from the application of the Vienna convention and with the IAEA safety standards for transportation of nuclear materials.

8. Regulation for providing the safety of spent nuclear fuel management

(Decree of the Council of Ministers # 196, 02 August 2004, promulgated in State Gazette # 71, 2004)

The proposed draft for the regulation defines in detail the matters related to the basic criteria and rules for providing nuclear safety and radiation protection in the management of spent nuclear fuel according to the provisions of the Safe use of nuclear energy act, as well as the specific

organizational measures and technical requirements for providing the safety during site selection, design, construction, commissioning and operation of facilities for spent nuclear fuel management.

Matters related to the technical safety, fire and physical protection, emergency planning and emergency preparedness of the spent nuclear fuel management facilities are defined in the draft of the regulation, to the extent that follows from the in-depth defense concept.

9. Regulation for safe management of radioactive waste

(Decree of the Council of Ministers # 198, 03 August 2004, promulgated in State Gazette # 72, 2004)

The Regulation defines the requirements, regulations and rules for safety during site selection, design, construction, commissioning and operation of facilities for radioactive waste management.

The regulation also defines the obligations of the entities carrying out radioactive waste management activities. The entities which generate radioactive waste as a result of their activities are responsible for its safe management from the moment of generation of the radioactive waste to the moment it is transferred to the State enterprise "Radioactive waste" or until it is released from regulatory control.

10. Regulation of the conditions and procedure for acquiring professional qualification and for the procedure for issuing licenses for specialized training and certificates for qualification for use of nuclear energy

(Decree of the Council of Ministers # 209, 06 August 2004, promulgated in State Gazette # 74, 2004)

The regulation defines the conditions and procedure for acquiring professional qualification for execution of activities in nuclear facilities, and facilities with sources of ionizing radiation, the positions for which qualification is required, the procedure for issuing licenses for specialized training and certificates for qualification, as well as the conditions and procedure for carrying out exams for acquiring qualification.

11. Regulation for emergency planning and emergency preparedness in case of nuclear and radiation accident

(Decree of the Council of Ministers # 189, 30 July 2004, promulgated in State Gazette # 71, 2004)

The regulation defines, in accordance to the provisions of the Safe Use Of Nuclear Energy Act, the conditions and procedure for developing emergency plans and the obligations of the persons who apply them.

The actions and measures for limitation and liquidation of the consequences of nuclear or radiation accident are also defined as well as the criteria for decision taking for their activation and the methods for informing the population. Subject to definition is also the maintenance and control of the emergency preparedness and the interaction between the executive authorities and the licensees or holders of permits according to the Safe Use of Nuclear Energy Act.

12. Regulation for the provision of physical protection of nuclear facilities, nuclear material and radioactive substances

(Decree of the Council of Ministers # 224, 25 August 2004, waiting promulgation in State Gazette)

In the Regulation, according to the Safe use of nuclear energy Act and the convention for physical protection of nuclear material, the matters related to physical protection of nuclear facilities, and during use, storage and transportation of nuclear materials and radioactive substances are defined.

The provisions of the Regulation take into consideration the specifics of the different kinds of nuclear facilities, nuclear materials and radioactive substances, which demand different levels of physical protection, depending on the category of nuclear materials and radioactive substances and the degree of risk.

13. Regulation for the basic norms for radiation protection

(Decree of the Council of Ministers # 189, 30 July 2004, promulgated in State Gazette # 73, 2004)

The regulation reflects the requirements of the 96/29/EURATOM Directive, setting the basic standards for protecting the health of personnel and population from the damaging influence of ionizing radiation. The basic principles of radiation protection are developed, and the dose limits for personnel and population are set.

In accordance with the provisions of the Directive, the concept for releasing from control of radioactive substances due to permitted activities, and the concept for limitation of irradiation are introduced.

The Regulation sets requirements for monitoring of the working quarters, and the individual irradiation, as well as for the registration of the results of this monitoring.

The requirements of Directive 90/641/EURATOM for operational protection of outside workers from the damaging influence of ionizing radiation during their activities in the controlled areas are introduced.

In relation to the engagements of the Bulgarian side in the negotiations with the European Union, the Regulation introduces the basic principles and requirements for radiation protection from medical irradiation, taking into consideration Directive 84/466/EURATOM for health protection from the damaging influence of ionizing radiation from medical irradiation.

14. Regulation of the conditions and procedure for establishing of zones with special status around nuclear facilities and sites with sources of ionizing radiation

(Decree of the Council of Ministers # 187, 28 July 2004, promulgated in State Gazette #69, 2004)

In the regulation the criteria for determining the size and boundaries of the zones with special status, the procedure for creating the zones and for exercising the powers of competent state authorities according to the law are established.

The regulation sets requirements for the activities of licensees and holders of permits, according to the Safe Use of Nuclear Energy Act, in the zones with special status, including for, provision of radiation monitoring of the environment and the population. Criteria are defined for the compensations for damages suffered from restrictions over usage of private real estate in the zones.

15. Regulation for the conditions and procedure for gathering and submitting of information and keeping records of the activities subject to guarantees according to the Non-proliferation of Nuclear Weapons Treaty

(Decree of the Council of Ministers # 210, 06 August 2004, promulgated in State Gazette # 74, 2004)

According to Article 126 of the Safe Use of Nuclear Energy Act, the Regulation specifies the conditions and procedure for gathering and submitting of information and keeping records of the activities subject to the Agreement between Bulgaria and the IAEA for applying the guarantees related to the Non-proliferation of Nuclear Weapons Contract and the Additional Protocol to the Contract.

According to the provisions of the Safe Use of Nuclear Energy Act, the entities carrying out activities subject to the Agreement and the Additional Protocol, develop and apply internal rules and instructions for registration and Control of the type, quantity, location and movement of the

nuclear material and its transportation. They present to the Chairman of the NRA the information necessary to comply with the obligations of the Republic of Bulgaria, due to these international contracts and grant access to the sites to the IAEA inspectors, and the NRA inspectors accompanying them, in accordance with the provisions of the Safe Use of Nuclear Energy Act.

16. Regulation for the safety of the decommissioning of nuclear facilities

(Decree of the Council of Ministers # 204, 05 August 2004, promulgated in State Gazette # 73, 2004)

The regulation provides that the safe decommissioning of nuclear facilities to be implemented trough preliminary and interim panning, determination of a concept and developing of a plan for decommissioning, while for each stage of the planning, the safety of the decommissioning activities must be validated.

The Regulation defines the basic safety requirements during decommissioning for the maintenance of the safety related systems and equipment, for the deactivation and dismantling of the equipment, for the radiation protection and for the radioactive waste management. It is foreseen that with the completion of each stage of the decommissioning of the nuclear facility, the holder of the permit should develop and present to the regulator an actualized report on the safety evaluation of the completed stage.

17. Regulation for the procedure for paying the fees ensuing by the Safe Use of Nuclear Energy Act.

(Decree of the Council of Ministers # 206, 17 September 2003, promulgated in State Gazette # 85, 2003)

The Regulation determines the procedure for paying the fees for consideration of applications and for issuing of licenses and permits for activities, in accordance with the provisions of the Safe Use of Nuclear Energy Act.

18. Tariff for the fees collected by the NRA in accordance with the provisions of the Safe Use of Nuclear Energy Act

(Decree of the Council of Ministers # 206, 17 September 2003, promulgated in State Gazette # 85, 2003)

The tariff determines the size of the fees collected by the NRA for consideration of applications and for issuing of licenses and permits for activities, in accordance with the provisions of the Safe Use of Nuclear Energy Act. The sizes of the initial and annual license fees, as well as the fees for issuing of permits are determined depending of the complexity and the range of the

regulatory control, and of the specifics of the relevant activity subject to state regulation in accordance with the provisions of the Safe Use of Nuclear Energy Act.

19. Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Nuclear facilities decommissioning" Fond.

(Decree of the Council of Ministers # 300, 17 December 2003, promulgated in State Gazette # 112, 2003)

The regulation determines the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Nuclear facilities decommissioning" Fond under auspices of the Minister of Energy and Energy Resources. The Fond is managed in a manner to assure implementation of the annual program of the permit holder for decommissioning of a nuclear facility. The revenues of the Fond are collected mainly from contributions from nuclear facility operators and national budget resources, allocated annually pursuant to the National Budget Act for the relevant year.

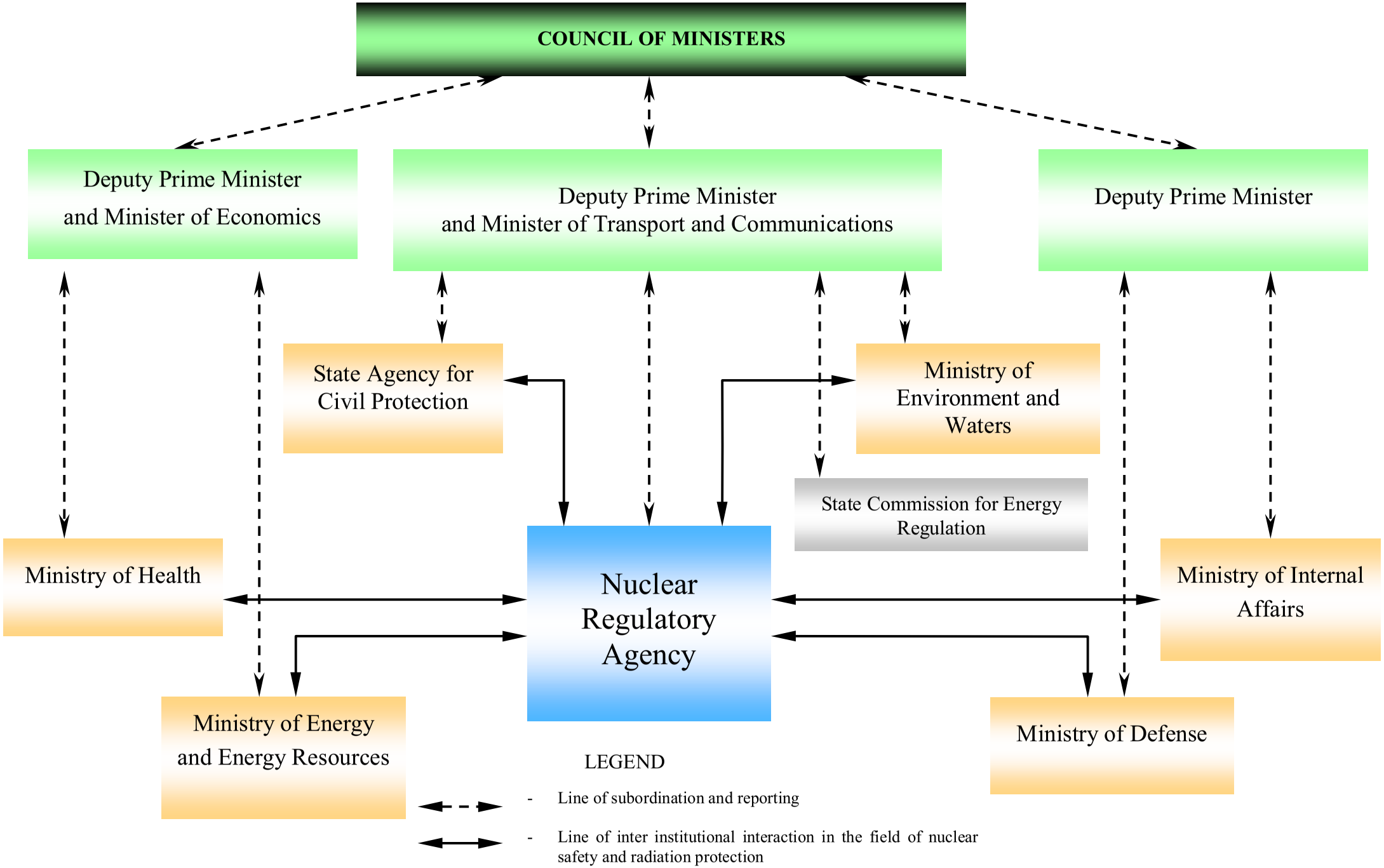
20. Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Radioactive waste" Fond.

(Decree of the Council of Ministers # 301, 17 December 2003, promulgated in State Gazette # 112, 2003)

The regulation determines the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the "Radioactive waste" Fond under auspices of the Minister of Energy and Energy Resources. The Fond is managed in a manner to assure implementation of the activities for radioactive waste management. The revenues of the Fond are collected mainly from contributions from legal and physical entities, which generate radioactive waste, due for transfer to the state enterprise "Radioactive waste", as a result of their activities as well as from national budget resources, allocated annually pursuant to the National Budget Act for the relevant year.

Flow chart of the relationships of the institutions, applying legislative framework

Attachment 4



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Attachment 5

MEASURES UNDERTAKEN FOR DECOMMISSIONING OF UNITS 1 AND 2 OF KOZLODUY NPP

1. Decommissioning strategy

According to Decision № 848 of the Council of Ministers of the Republic of Bulgaria, dated December 19, 2002, units 1 and 2 were disconnected from the national grid at the end of 2002.

The decommissioning plan for units 1 and 2 was developed in the technical design for decommissioning of units 1 and 2 of Kozloduy NPP, April 2000. It consists of the following stages:

- Final ceasing of operation - term 3 years;
- Preparation for safe enclosure - term 2 years;
- Safe enclosure - term 35 years;
- Postponed dismantling – liquidation of the safe enclosure – the term has not been evaluated because of its remoteness in time (according to an expert evaluation if using the present methods for dismantling and demolition of structures, the duration of this stage can be ten years).

2. Organizational aspects

In 2000, a separate division was established in Kozloduy NPP – Decommissioning Division – aimed at assuring safety during the management and implementation of all necessary activities for the preparation of the 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 and has the following sections:

- Technology and radiation protection;
- Decontamination and radioactive waste;
- Engineering support and quality.

The initial number of administered staff of the division is 20 people.

Managers and specialists from the Decommissioning division, as well as other Kozloduy NPP specialists attended training courses on decommissioning of nuclear facilities in Mol (Belgium) and Greifswald (Germany).

The activities, functions and tasks of the sections within Decommissioning division, as well as the rights, obligations and responsibilities of the division staff are defined in the "Rules for the organization and activities of Decommissioning division".

3. Preparation for decommissioning

A number of activities in the implementation of the technical preparation and beginning of decommissioning activities on units 1 and 2 are completed or in their final stages:

- A structure for decommissioning management was established and developed in Kozloduy NPP. Special training of the personnel has started and is continuing.
- The following projects have been 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 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
  - Project BUL/4/008, financed by the IAEA – Information system for management of the decommissioning activities for units 1 and 2 of Kozloduy NPP, completed January 2004
- A contract has been signed for consultant for a Project management unit (PMU) for the projects financed by the Kozloduy International Decommissioning Support Fund (KIDSF). The PMU is operational since February 2003. For three of the planned projects, contracts have been signed, open international tenders have been announced for other five projects, and for the remaining two projects the approval for the financing by the assembly of the donators to the Fund is expected.
- A Plan-account is prepared each year for the expenses from the national "Decommissioning of nuclear facilities" Fund, which provides the financing of the activities planned to be performed during the year. The account is approved with the signing of a Contract between the managing board of the Fund and Kozloduy NPP.

4. Financing of decommissioning

For the financing of the activities on decommissioning of nuclear facilities, according to the provisions of the Safe Use of Nuclear Energy Act, the "Decommissioning of nuclear facilities" Fund was established to the Minister of Energetics and Energy resources. The revenues to the fund are collected, accounted and centralized in the system of the unified budget account, trough

the use of a separate transit account, opened to the Ministry of Energetics and Energy resources in the Bulgarian National Bank. The revenues to the Fund come from the following sources:

- Payments from the entities operating nuclear facilities, in amounts defined by the Council of Ministers
- Resources from the National Budget, allocated annually according to the National Budget Act for the year;
- Interest from the accumulated amounts in the funds, and from delayed payments by 1 above.
- Grants;
- Other revenues from the management of the financial resources in the fund.

The size of the payment for Kozloduy NPP at the moment is 15 % of the revenue from selling electrical energy.

The careful planning is the foundation for the implementation of the decommissioning activities in a safe and as effective as possible from the financial point of view way.

The activities, sources of financing and the financial assets for covering the expenses for the decommissioning of the Units until 2007 are planned in the actualized Program for decommissioning of units 1 and 2, in the stage “Preparation for safe enclosure”.

5. Decommissioning planning

Kozloduy NPP gathers, processes, and stores the following documentation, necessary for planning and performing the decommissioning activities:

- Complete design documentation and relevant design changes related to reconstruction and modernizations;
- Documents and data related to the changes of the state and conditions on the site;
- Results from engineering and technical studies, reviews and reports for the functional status of the constructions, systems and equipment;
- Reports for the status of nuclear material, its location and the status of the facilities for its storage;
- Information about the types and amounts of radioactive and other dangerous waste and substances, their locations, and the locations of the facilities for their storage;

- List of the systems, equipment and components which are sources of ionizing radiation and their radiological characteristics;
- Documents and data for the status and the maintenance of the safety related equipment and systems, etc.

As part of the technical project information for all systems of the units is not only stored in an appropriate way, but more is done – actualization of the status and classification of the systems is performed, namely:

- Evaluation of the status and functions of all systems during the periods of final shut-down, preparation of safe enclosure and safe enclosure itself;
- Determination of the design changes and adaptation of the existing systems and economical analyses;
- Development of the parts of the project for transition of the systems to the new conditions;
- Determination of the necessity for new systems, conservation of systems, construction and demolition works, including expense and value analysis;
- Determination of the necessary control and monitoring activities, checks and maintenance of the systems and constructions during the safe enclosure.

6. Radiation protection

For providing of radiation protection of the personnel and the population during the preparation and implementation of the decommissioning of the units, the same organizational and technical measures will be taken, as in the operation of Kozloduy NPP, on the site of the plant and off it.

As part of the technical design for decommissioning of units 1 and 2, a report on the environmental impact evaluation and a concept for radiation protection have been developed and approved.

The concept for radiation protection has the following main aspects:

- Preparation activities – they include all engineering, technical and administrative preparation tasks to be performed before performing decommissioning activities of the restricted access area;
- Control activities, including environment monitoring activities;
- Evaluation of the individual and collective doses to the personnel and radiation protection during the various stages of the decommissioning of units 1 and 2;

- Evaluation of the releases to the environment and radiation protection of the population in a short-term and long-term aspect.

The conception includes description of the approaches and measures, organizational and technical means and methods for assurance of the ALARA principle implementation for radiation protection of the personnel and the public.

The application of the ALARA principle is guaranteed by addressing of the following key issues in radioactive waste management as well as by meeting of the limits, shown below:

- Regarding the radiation protection of the personnel:
  - Detailed preparation of the activities to be carried out in the Radiologically Controlled Area (RCA);
  - Monitoring of the individual and collective doses in the process of performance of the works and application of corrective measures in case of deviations from the preliminary set targets.
- Regarding the radiation protection of the environment and the public:
  - During the safe enclosure preparation – keeping of the radioactivity releases at the levels lower than during the normal operation of the units;
  - During the safe enclosure operation - keeping of the radioactivity releases at the levels less than 5% (conservative evaluation) of those during the normal operation of the units;
  - Minimizing of the quantity of conditioned waste, generated during the stages of safe enclosure preparation and safe enclosure operation and limitation of the waste activity to the values, lower than the waste acceptance criteria.

7. Radioactive waste management

The management of the radioactive waste, generated during the activities on decommissioning until the transfer to the State enterprise “Radioactive waste” for conditioning and following storage or disposal covers:

- Providing the information and concurrence during the process of preparation of the Technical design for decommissioning of units 1 and 2 of Kozloduy NPP;
- Arrangement of radiological investigation of the units and preparation of radiological inventory lists and radiological map;
- Characterization of the radioactive waste and identification of the different waste streams;

- Training of management and the personnel on the radioactive waste management;
- Supply of the necessary equipment for decontamination and handling and initial treatment of the radioactive waste generated from the activities on decommissioning;
- Development of procedures for decontamination and handling and initial treatment of the radioactive waste as well as procedures for waste minimization and control;
- Assurance of the development of packages for transportation and storage of the decommissioning waste;
- Agreement of criteria, requirements and procedures for handling, transportation and transfer of the radioactive waste to the State enterprise "Radioactive waste.

8. Emergency planning

The emergency planning and preparedness during the decommissioning is organized in the framework of the common for the whole Kozloduy NPP site emergency plan, considering the specifics of the decommissioning process as they are shown in the part "Safety analysis report" of the Technical design for decommissioning of Kozloduy NPP units 1 and 2.

9. International support

For the fulfillment of the Understanding signed between European Commission and Bulgarian Government and dated 29 November 1999 a Financial memorandum was established so called Kozloduy International Decommissioning Support Fund (KIDSF). The European Bank for Reconstruction and development (EBRD) was appointed as administrator of the fund and Framework agreement between republic of Bulgaria and the Bank was signed, dated 15 June 2001. The fund is intended for financing through grants of implementation of selected projects for support of the decommissioning.

In the framework of the activities financed by KIDSF a Project Management Group (PMU) is established and is operable since February 2003. The task of the PMU is to manage, coordinate and supervise the procurement of goods, works and services for the implementation of selected projects, financed by KIDSF. The PMU established appropriate organizational structure for providing of specific procurement, engineering and other services. The PMU is composed of consultants from contracted consortium BNFL/EDF and includes Kozloduy NPP experts with suitable qualification. The assignment is performed in accordance with the Rules of KIDSF and EBRD Procurement Policies and Rules.

10. Social aspects

A leading principle of the personnel policy of Kozloduy NPP is the keeping at maximum extent the staff potential (especially of highly qualified staff) in the process of transition from operation of nuclear facilities to decommissioning. The working approach of the plant management is decommissioning to be performed by the own human resources, supported when necessary by external contractors. This approach have a social effect but also at least two practical reasons: (i) the existing personnel, who have wide experience in the operation and know well the units is used at maximum extent and (ii) many of the decommissioning activities are similar to the maintenance activities, for which are already on place corresponding procedures. Until complete removal of the spent nuclear fuel and decontamination of the primary system the number of the personnel will be kept close to the levels for the operation of the units. During first stages of the decommissioning process some activities of the decommissioning projects will be performed by the operation personnel. That is why training of the operation personnel of units 1 – 4 on the Technical design for decommissioning of unit 1 and 2 was done.

A “Program for personnel management” was developed. In the program is included annual profile of personnel reduction, specific for Kozloduy NPP and Units 1 – 4, taking into account fact that two out of the four units still remain in operation.

The management team the decommissioning includes personnel with adequate knowledge, skills and experience for the fulfillment of the corresponding tasks. These personnel have been involved in the operation of the units and know very well the units and their history.

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Attachment 6

Long term programs under implementation on units 3 and 4 of Kozloduy NPP in compliance to the conditions of their operational licenses

After enacting of the new Safety Use of Nuclear Energy Act and taking into account the achieved results in modification of the units 3 and 4 design status in 2003 new licenses for long term operation of units 3 and 4 have been issued. Unit 3 license was issued on 22nd of June 2003 and is valid for 8 years of operation. The unit 4 license was issued on 26th of February 2003 and is valid for 10 years of operation.

The licenses include the NRA requirements with regard to continuation of the implementation of measures for further increasing of the safety level beyond the level demonstrated after completion of the modernization programs, presented within previous National Reports. For this purpose the licenses include conditions for fulfillment of number long term programs in the area of modernization, developed for its continuation.

This Attachment presents information for the most important activities which are in progress within these separate programs..

1. Program for continuation of the activities in the area of probabilistic safety assessment

The program foresees conducting of the following main activities:

- Development of PSA level 2 for units 3 and 4;
- Units 3 and 4 safety monitoring system;
- Precursor Events analysis

According the developed plans all activities will be completed in 2005.

2. Program for continuation of the modernization of accident localization systems

The program foresees implementation of the following main activities:

- Implementation of systems for management of hydrogen concentration in the localization systems of units 3 and 4 in case of severe accidents;

- Implementation of forced filleted venting systems of units 3 and 4 localization systems in case of severe accidents;

According the developed plans all activities will be completed in 2005.

3. Program for development and extension of the scope of the symptom based emergency procedures

The program foresees conducting of the following main activities:

- Extension of the scope of the implemented symptom oriented procedures;
- Development of software tools for support of the symptom based emergency procedures set;
- Coupling of the developed symptom based emergency procedures with the results from development of the severe accidents management guidance.

According the developed plans all activities will be completed in 2005.

4. Program for continuation of the modernization of the I&C systems

The program foresees conducting of the following main activities:

- Modernization of the units 3 and 4 computerized systems for support of the control room operators;
- Completion of the units 3 and 4 systems for post accidents monitoring;
- Additional measures for replacement of units 3 and 4 I&C systems.

According the developed plans all activities will be completed in 2005.

5. Program for implementation of measures for management of severe accidents and development of severe accidents management guidance

The program foresees conducting of the following main activities:

- Development of a guidance for management of severe accidents on units 3 and 4;

- Implementation of measures for management of severe accidents (taking into account the effect of implementation of other parallel programs like the program for continuation of the modernization of the accidents localization systems).

According the developed plans all activities will be completed in 2005.

6. Program of activities for units rest lifetime management.

The program foresees conducting of the following main activities:

- Continuation of the activities for monitoring of units 3 and4 main components rest lifetime, including the reactor pressure vessel;
- Implementation of the separate measures for management of the lifetime, developed in the framework of the concept for units 3 and 4 rest lifetime management within the Complex program for modernization.

According the developed plans all activities will be completed in 2009.

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Attachment 7

UNITS 5 AND 6 MODERNIZATION MEASURES

STATUS OF IMPLEMENTATION

Measure Title / Description	Status*
Replacement of boron meters Type NAR-B with those of the other Type to Ensure Continuous Measurement with Required Accuracy, Speed & Automatic Calibration	Completed
Replace neutron monitoring system with a more sophisticated/sensitive system	Completed
Install an integrated, continuous reactivity measuring system	Completed
Install a core subcriticality measurement system	Completed
Replace group 5 control rods - with long, full length absorption control rods	Completed
Replace control rod assemblies with 18 absorption rods assemblies	Completed
Ensure primary circuit boron make-up system (TK, TB10) availability - for all conditions	Completed
Ensure actuation of planned & emergency core cooling - without hydraulic shock	Completed
Install a steam-gas mixture detector in the reactor vessel (AEE lead + FGER Support)	Ongoing
Replace thermal insulation of equipment and piping located in the reactor building	Ongoing
Upgrade EFWT filtering system GA 201 to guarantee availability of the latter in any accident condition	Resolved
Provide redundancy of heat exchangers (TQn0W01)	Resolved
Provide redundancy of cleaning water for LP safety injection pumps (Tqn2) seals	Completed
Change electric power supply to RL50, UA20 aux. FW pumps	Completed
Provide conditions for TX system operation for 24 hours	Completed
Enhance the reliability of SG safety valves	Completed
Develop a system for continuous neutron flux measurement on Reactor Pressure Vessel structure	Ongoing
Heating water for high and medium pressure safety injection above 55 ^{o}C	Ongoing

Optimize the core refueling chart (for Proposed 3-year fuel cycle)	Completed
Quick detection & localization of leakage from primary to secondary circuit	Completed
Ensure continuous measurement of main (primary) coolant pumps vibrations	Completed
Ensure detection of loose parts	Ongoing
Implement a system for detection & localization of leakage from the reactor upper block (FLUS)	Ongoing
Improve detection of minor primary circuit leaks	Ongoing
Reduce the impact of thermal cycles on coolant system piping (FAMOS)	Ongoing
Install hydrogen detection and recombination systems	Completed
Use of normal ventilation for hydrogen extraction	Completed
Modernization of TF system to exclude residual effects of intersystem leakage	Completed
Install equipment for measuring activity of gas releases	Completed
Improve containment test procedure and install measuring devices and computation facilities	Completed
Implement a critical parameters monitoring system for accident and post accidents (PAMS)	Ongoing
Implement a safety parameter display system (SPDS)	Ongoing
Replacement and Upgrading of the Existing Computer Information System ("Titan") (CIS)	Ongoing
Replace the "Hindukush" (CM-2M) system with a more efficient one	Ongoing
Replace MCR recorders	Ongoing
Replacement and Upgrade of the Universal Control System UKTS - YKTC	Ongoing
Replacement of the Turbine Control System ASUT - ACYT	Ongoing
Replace pressure drop sensors "Sapphire"	Ongoing
Modernize ECCS valves' control circuits	Ongoing
Replace actuator end switches	Completed
Upgrade electrical power supply systems	Completed
Improve the reliability of relay protection and automatics of the main distribution circuit	Ongoing

Mark cable raceways of the safety systems	Ongoing
Improve the control of pressurizer electrical heaters	Completed
Improve the reliability of 6 kV breakers (replacement)	Ongoing
Improve the control of batteries (UPS)	Completed
Install state-of-the-art troubleshooting facilities for direct current power system	Completed
Modernize electrical power supply system Cat. I by replacing the existing and installing additional inverters, and back-fitting other UPS equipment	Completed
Enhance reliability of electrical power supply to radiation monitoring system	Completed
Upgrade the resistance of fire doors	Ongoing
Check fire propagation through air ducts. Install fire dampers and provide automation of the ventilation system	Ongoing
Modify the gas fire extinguishing system	Ongoing
Ensure smoke removal	Completed
Improve the starting speed of diesel fire pumps	Completed
Quality fire alarm facilities for conformance with seismic stability requirements	Completed
Limit the effect of secondary circuit water or steam piping breaks in containment	Ongoing
Enhance the seismic stability of carrying structures (buildings)	Ongoing
Implement the proposals to enhance the seismic stability of mechanical equipment	Ongoing
Implement the proposals to enhance the seismic stability of piping	Ongoing
Carry out Fire Hazard Analysis + Implementation	Ongoing
Carry out an analysis of the consequences of internal flooding	Ongoing
Analyze the behavior of safety systems' equipment in the event of an earthquake	Ongoing
Study the seismic stability of buildings with the site seismicity of 0,2g	Completed
Change over to three-year refueling cycle	Completed
Study the shutdown subcriticality margin	Ongoing
Rank NPP equipment according to its Importance to safety in conformity with OPB-88, considering NUSS ranking and other international norms	Completed
Analyze documentation concerning safety important equipment qualification	Completed

available in Kozloduy NPP, applying internationally accepted procedures	
Qualification of computer codes for accident analysis (FGER part)	Completed
Qualification of computer codes for accident analysis (FFRA part)	Completed
Develop a program for studying reactor metal samples and determine critical brittleness temperature	Ongoing
Study the irradiation resistance of reactor vessel during the implementation of new refueling cycle	Completed
Mechanical substantiation of the welds on reactor upper block air duct pipe bend	Completed
Pressure Thermal Shock Analysis (FGER part)	Completed
Pressure Thermal Shock Analysis (AEE part)	Completed
Study the risk of primary circuit cold over pressurization and the necessity for installing of an automated device for cold over pressurization protection	Ongoing
Study of the mechanical behavior of the connection between primary circuit piping and SG heater	Completed
Enhance leak-tightness of steam generator header flanges	Completed
Mechanical analysis of the pressurizer vent line	Ongoing
Mechanical substantiation of supports of safety important piping	Ongoing
Mechanical analysis of primary circuit piping subjected to specific thermal loads	Completed
Study and install a valve on piping upstream of SD-A facility (BRU-A lines)	Ongoing
Clarification of mechanical composition of primary circuit water filtering systems (TK)	Completed
Study the mechanical composition of bimetal joints of primary circuit equipment	Completed
Check the seismic stability of the wall between reactor compartment and turbine hall	Ongoing
Mechanical analysis of penetrations in compartment 820 taking into account the new seismic evaluation	Ongoing
Qualification of cable penetrations and provisions for replacement thereof	Completed
Analysis of containment bypass	To be done
Study of implementation of additional protective functions for 6kV and 0.4kV motors	Completed
Study the upgrading or replacement of 6kV and 0.4kV equipment	Completed

Study diesel generator auxiliary protection	Completed
Study loading scheme for consumers supplied by batteries	To be done
Study the necessity of upgrading or replacing the 220 VDC equipment (UPS)	Completed
A complete list of analyses of design and beyond design accidents should be compiled	Completed
Bring the safety analysis report in conformity with international practice (Siemens part)	Ongoing
Bring the safety analysis report in conformity with international practice (FFRA part)	Ongoing
Update SAR based on PNAE G (FGER lead + FFRA support)	Ongoing
Accident analyses using validated computer codes	Completed
Analysis of Emergency Feed Water System (TX)	Ongoing
Study processes which may lead to unmanaged accident in the event of safety control system failure	Ongoing
Carry out safety analysis to additional scenarios (non-LOCA accidents)	Ongoing
Compile a list of additional accident scenarios, carry-out relevant analyses	Ongoing
Study the core cooling after a design basis accident	Ongoing
SG Behavior in case of SLB, FWLB and LOCA	Ongoing
Study of radiological consequences of in event of heat exchangers de-pressurization	Completed
Carry-out studies of possible causes of leaks from the primary to the secondary circuit, and propose solutions for localizing the accident	Ongoing
Carry on a study of feed and bleed mode using pressurizer vent line or YR to YP 20 line	Ongoing
Carry out a study of consequences of dilution of boron solution in the primary circuit in the event of a break of heat exchangers TQ/10/20/30W01	Ongoing
Initiating event identification and analyses of a primary coolant dilution mode	Ongoing
Provide substantiation for each accident of the impossibility of formation of critical mass	Ongoing
Analyze the case of a total loss of electric power supply	Ongoing
Analyze the case of a total loss of heat sink (VC,VB)	Ongoing

Analyze the case of a total loss of SG feed-water and emergency feed-water	Ongoing
Analyze the case of Anticipated Transients Without Scram	Ongoing
Study the possibility of providing filtering ventilation in case of severe accidents	Ongoing
Analyze consequences of a break of suction pipe from high pressure make-up tank to TQ pumps and a loss of high pressure make-up tank water	Completed
Evaluate capabilities of design system to manage beyond design accidents	Ongoing
Study hydrogen generation and accumulation process	Completed
Study the risks of shutdown accidents	Ongoing
Determine test frequency, maintenance periods, safety systems acquisition & repair times	Ongoing
Develop a system for daily evaluation of operating hazards	Ongoing
Update of PSA Level 1	Ongoing
Carry-out a Probabilistic Safety Analysis (PSA), Level 2	Ongoing
Carry-Out a Probabilistic Safety Analysis (PSA), Level 3	To be done
Quantitative reliability analysis of emergency electric power supply system, Category II	Ongoing
Breakdown, analysis and qualification of ventilation system according to seismic requires and rules for NPP	Completed
Improvement of the reliability of diesel generators	Ongoing
Study the optimization of the radiation monitoring facilities	Completed
Introduce methods and means to determine the service life of cables	Ongoing
Ensure uninterruptible control of winding insulation of the turbine generator stator	Completed
Ensure uninterruptible control of 6 kV motors stator windings	Ongoing
Ensure the control of operating temperatures for the windings of main and house transformers	Completed
Modify TTV 1000 excitation transformers to eliminate 3rd harmonic	Completed
Replace power breakers KAG24	Ongoing
Enhance reliability of generator excitation	Completed
Install one additional DG per each unit for unit consumers	Completed

Enhance reliability of turbine/generator vibration control system	Completed
Enhance main (primary) circulating pump thermal protection	Completed
Enhance reliability of main circulating pump anti-reversing gear	Completed
Improve quality of neutron monitor chamber & temperature control system seals	Completed
Provide methods & means for efficient steam generator second stage washing	To be done
Extend remaining life of SG blow-down system pipes	Ongoing
Maintain minimum permissible temperature in TX system	Completed
Reduce vibration level of turbine/generator bearings	Completed
Redesign turbine high pressure vessel first stage	Completed
Reduce condenser high pressure heater & moisture separator / reheater vibration level / eliminate hydraulic shocks	Completed
Extend residual life of secondary circuit pipes operating in two-phase medium	Completed
Enhance reliability of pipe bundles LP superheaters	Completed
Enhance operation of HP superheaters level regulators	Completed
Improve service life of I/O Regulators of HP superheaters spirals	Completed
Improve HP superheater tube protective screen resistance to steam inlet temp.	Completed
Improve maintenance conditions for heat exchanger VK	Completed
Modernize RN70 pumps' flow passages	Completed
Replace condenser tube bundles with bundles manufactured from stainless steel	Completed
Reduce Unit 5 steam lines' vibration levels	Completed
Change type and replace steam bleed III valves	Completed
Replace the cast iron valves in turbine hall	Completed
Install separator on steam bleed I to moisture separator reheater	Completed
Upgrade of SPP and modernization of ISSRS	Completed
Implement a moisture separator reheater preservation system	Completed
Improve spillway operation for moisture separator reheater condensate stage I	Completed
Reconstruct booster pump for main turbine feed pump	Resolved

Replace turbine feed pump seals with face seals	Resolved
Improve the reliability of circulation water filter of turbine condensers – Unit 6	Completed
Study & take measurements to reduce vibrations of VB pumps	Completed
Reduce pump & piping vibrations to T/G rotor hydraulic lifting system	Completed
Enhance reliability of hydrogen & nitrogen receivers' safety valves	Completed
Study measures to reduce regulation oil feed pump SC50 vibration levels	Completed
Develop an information system	Completed
Revise technical specifications for Units 5 & 6	Completed
Develop symptom-oriented procedures	Ongoing
Develop a periodic tests program for equipment in accordance with technical specifications and considering the guidelines of IAEA, ASME, ENJQ and others	Completed
Develop procedures for repairs, policy and organization	Completed
Classify equipment for residual life & develop rest life time evaluation system	Ongoing
Design ultrasonic and eddy current inspection equipment for SG & primary circuit	Completed
Delivery visual and TV equipment inspection facilities	Completed
Provide SG tube leak detection facilities	Completed
Design special tools for reactor head channel (temp control sensors) repairs	Completed
Develop transportation/handling facilities & test equipment for circulating pumps (VC)	Completed
Improve quality of tightening of main circulating pump studs	Completed
Enhance facilities for primary circuit SG isolation during repair	Completed
Design, manufacture and install equipment for providing high quality reactor seal	Completed
Develop maintenance instructions based on IAEA recommendations	Completed
Develop methodology and techniques for replacement of small diameter piping sections provided with protection sleeves	Completed
Develop methodology for repair SG headers	Completed
Develop post-maintenance tests & acceptance criteria according to technical spec's	Completed

Install an adequate VVER 1000-320 simulator for Units 5 & 6	Completed
Design and implement a system for monitoring radio-nuclide releases through air ducts	Completed
Install automated independent radiation monitoring f/each safety system channel (I, II, III)	Ongoing
Implement and operate a meteorological station	Completed
Install automated systems for control of emergency exits from restricted zone	Ongoing
Develop and implement a centralized radiation monitoring computer system	Completed
Develop training systems (training grounds) to train personnel in principles of dose load reduction	Completed
Develop program for reducing Received Doses with subsequent amendment of repair procedures	Completed
Provide more alpha, beta and gamma radiometers and equipment for extreme measurement of radio-nuclide content in human body	Completed
Provide meteorological lab equipped with ionizing radiation measuring facilities	Completed
Develop and implement a radiation monitoring system for severe accidents	Completed
Upgrade AKRB detectors	Ongoing
Upgrade lighting of industrial areas	Completed
Take analyses of beyond design basis into account in internal emergency plan	Ongoing
Develop an accident management center	Completed
Implement connection between spent fuel pool (SFP) cooling system and the Emergency Boron Make-up tank (EBMT) to ensure emergency cooling of the SFP through the EBMT	Completed
Provide facilities for implementing a tightness control system for fuel rods	Ongoing
Design and build a spent nuclear fuel storage loading/ unloading equipment	Completed
Develop a spent fuel storage scheme	Completed
Implement a design for radioactive waste treatment	Completed
Implement a system for continuous monitoring and maintenance of the main primary circuit water chemistry	Ongoing
Implement a SG blow-down water continuous monitoring system	Completed
Install systems and facilities for primary circuit sampling under accident	To be done

conditions	
Design an automated information system for water treatment of units	Ongoing
Modify water treatment system and reagent inventories	Completed
Draft a decommissioning program	To be done
Development of design for replacement of steam generators	Ongoing

The following definitions are used to express the status of any separate measure of the program:

- Completed - planned measures are fulfilled and the problem is eliminated;
- Resolved - effect is achieved by other measures or activities;
- Ongoing - implementation of the measure is in progress at the time of the report;
- To be done - activities on the measure are not started till the time of the report.

Attachment 8

IAEA SRM 2002 EXECUTIVE SUMMARY

Final Report
Of the IAEA Safety Review Mission to Kozloduy NPP units 3 and 4
June 2002

EXECUTIVE SUMMARY

General Comments

Kozloduy NPP (KNPP) began a systematic safety evaluation and improvement of Units 1 – 4 in 1991 with the assistance of the IAEA, which organized a series of missions to assess the status of the units and to support the efforts of the plant management. Since that time, with the support of international organizations, the plant has successfully implemented several modernization programmes for safety upgrading in terms of design and operational safety.

At present, the plant is implementing the final phase of the safety improvements for Units 3 and 4 within the framework of the overall modernization programme.

The last review of the programme was performed by the IAEA during a specially organized mission for the evaluation of Units 3 and 4 in October 2000. In general, the mission assessed positively the overall modernization programme of the plant, as well as the status of resolution of the design safety issues of TECDOC 640. Additional suggestions to improve the process were also provided by the IAEA review team at that time.

In parallel, the operational practices of the plant were thoroughly evaluated by the IAEA OSART mission in 1999 and its follow-up in 2001. It was concluded that the plant operational safety is a priority for KNPP management and that in the process of its improvement the plant has reached a level that corresponds to the level of plants of the same vintage worldwide.

This report presents, in a broad perspective, the overall plant safety upgrading approach, results of the activities implemented as of June 2002 and the assessment of the safety status of units 3 and 4 by the IAEA Safety Review Mission . The mission was requested by the Government of Bulgaria as a follow up to assess all previous recommendations and suggestions made for Units 3 and 4 including design safety, seismic safety and operational safety.

It is also important to indicate that the approach of KNPP technical staff and management to safety and quality has significantly evolved over the past decade. This approach will be the

fundamental tool for maintaining plant safety in all aspects of KNPP operation in compliance with IAEA Safety Standards and current international practice.

Specific Comments

Regarding Units 3 and 4, in the course of the Modernization Programme, the main safety functions were improved to the level, or in some cases beyond the level, which meets the IAEA initial recommendations of TECDOC-640.

Controlling reactor power in all operational states and accident conditions has been realized to meet the safety objectives of the extended design basis for KNPP Units 3 and 4.

Cooling the core in all conditions is now based on successive layers of defence-in-depth going beyond initial expectations in some cases.

Since a jet vortex condenser has been installed in the confinement, the core cooling and confinement functions are now fulfilled for the whole spectrum of primary pipe breaks up to Dn 200 with conservative assumptions, and, for the largest one (Dn 500) using realistic assumptions.

Leak tightness of the confinement was also largely improved using the experience of other plants of this type.

Concerning primary circuit integrity, all baseline information on material composition, mechanical properties and in-service inspection is of good quality. A comprehensive international project for a more precise assessment of RPV embrittlement after annealing (Unit 3) is under way. UT ISI qualification programme for critical weld areas is a high priority for the management. The results of investigations indicate that the RPV integrity is maintained and that its remaining lifetime is at least equal to the design lifetime.

The LBB concept application on the primary piping including surge lines provides solution for the primary piping integrity. It also eliminates the leading PTS scenario due to a double ended break of the pressurizer surge line.

Significant improvements were also implemented in the safety function support systems such as I&C, Electrical Power, Service Water and Air-conditioning. Concerning the electrical systems as well as components important to safety the plant has set up a programme for upgrading all electrical components and systems concerning reliability, as well as quality in accordance with IAEA Safety Guide recommendations, during the outage of 2002. Concerning the I&C systems important to safety the plant has also set up a modernization programme as well as a

qualification programme in accordance with IAEA Safety Guide recommendations. These programs are also to be finalized during the outage of 2002. Both modernization and qualification programs will be accompanied by periodical PSA as well as reliability investigations. All electrical as well as I&C issues are assessed in accordance with IAEA TECDOC 640 as intent of recommendation met.

Due to the significant improvement in plant's defence in depth and protection against all sources of common cause failures (fire, flooding, etc.) the safety functions can now be performed with a high level of reliability in all plant conditions including shutdown states.

The KNPP (Units 3&4) have implemented an extensive programme of seismic re-evaluation and upgrading of structures, systems and components as a consequence of a change in the seismic design basis of the plant. The seismic hazard analysis was performed (between 1990 and 1992) following a recommendation of the IAEA and using IAEA safety standards and current international practice. The re-evaluation and upgrading was performed systematically to all items in the safe shutdown path as well as those used for mitigation and confinement. Furthermore, new equipment procured and installed within the framework of the modernization programme have been seismically qualified using well defined procedures and following IAEA standards as well as current international practice. The plant has modern seismic instrumentation which was recently reviewed by the IAEA and there are procedures in place on operator and plant actions following an earthquake. There is perceptible renewed awareness at the technical and management levels to issues related to seismic safety which provides assurance that the plant will keep up the positive attitude towards this area.

The new accident analyses have been performed for the full scope of the postulated initiating events and for a spectrum of selected beyond design basis accidents, applying qualified tools, methods and practices. Major progress was achieved by developing a new Safety Analysis Report for each of the units in 2002.

Probabilistic Safety Analysis (PSA) Level 1 was used in support of safety decisions. In particular, PSA contributed to justification of the safety measures implemented and to evaluation of their impact on overall plant safety. It showed that major risk contributors have been significantly reduced and that the core damage frequency already achieved is significantly lower than the INSAG target of 1.E-04/reactor.year adopted by the plant for reconstruction.

The SRM team encouraged KNPP to continue its work for updating the Probabilistic Safety Analysis for shutdown operational modes, and for further development of a comprehensive

Accident Management Programme for mitigation of severe accidents which would go beyond the initial IAEA recommendations, but represents recent trends in nuclear safety.

In the assessment of operational safety, the SRM team noted that management expectations are well understood at all level in the organization, and high quality standards were observed in all areas dealing with operational safety. The SRM team made particular note of the improvements observed in the areas of training and qualification, implementation of symptom-based emergency operating procedures, and in the quality of management processes in the technical support area. The team also noted significant improvements in the material condition and housekeeping of the plant. In several of the areas where improvements were identified, the issues were already evaluated as 'resolved' by a previous IAEA review team and OSART missions. The willingness of the plant to invite a second review to ensure that there was no decline in performance is an indication of the commitment by Kozloduy management and staff towards continuous improvement in operational safety. The team also recognized the effort by KNPP to implement a strong self-assessment program. The team noted that significant improvements have been made to complete the maintenance training facilities and the second Emergency Control Center as well as upgrading associated training materials. The Team further supports the plant activities to continue to explore methods to enhance team training for control room staff on the use of abnormal and symptom based emergency operating procedures. During the entire SRM the team noted the professionalism of the control room staff and their willingness to provide open and frank discussions with the team.

In the majority of the operational issues the team recognized meaningful improvements, revealing the aim of Kozloduy management and staff to continuously improve operational safety. Many examples of these relevant improvements are in the areas of quality and control of the plant documentation".

Attachment 9

ENCONET 2002 UNITS 3 AND 4

COMPARATIVE SAFETY ASSESSMENT

The history and results of the process of modernization of units were subject of an independent comprehensive design and operational safety assessment on Kozloduy NPP, Units 3&4 conducted by a qualified Western consultancy organization in 2002.

This document represents the final conclusions of this study (ENCO-FR-(02)/ July 2002):

Kozloduy Nuclear Power Plant Units 3 and 4 (KNPP 3&4) were commissioned in 1980/82. At the beginning of nineties these units were the subject of criticism because it was felt that they did not meet international nuclear safety standards. The prevalent European opinion was that the first generation Units of Russian design, the so-called WWER 440/230, could not be upgraded at reasonable cost. This was in contrast to a later WWER 440/213 design, which was considered to be upgradeable to an internationally acceptable safety level. Although more similar to WWER 440/213 units, KNPP 3&4 were ranked among WWER 440/230 plants, and as such considered non-upgradeable at reasonable cost.

Nevertheless, the Kozloduy NPP decided to embark on a series of upgrading programmes designed to address safety deficiencies identified by the International Atomic Energy Agency (IAEA) and other international entities. Upgrading programmes were developed and implemented over the past decade with support and assistance by both the plant's General Designer and many Western organisations in the nuclear field. The aim of those programmes was to bring KNPP 3&4 to a safety level as required by the recent international safety standards of today.

The first objective of the study was to independently evaluate the level of safety achieved at KNPP 3&4 after implementation of all measures in design and operation planned in the safety improvement programmes, in particular the Complex Modernisation Programme for KNPP 3&4. The evaluation was based on the requirements of current safety standards and international safety practice.

A further objective of the study was to review the resolution of the safety deficiencies identified in the past, and to determine the extent to which the Upgraded Design Basis which has been

established at KNPP 3&4 is in compliance with the EU's request for approaching a *'high level of nuclear safety'*.

Finally, the study was to compare the safety level of KNPP 3&4 with that of other NPPs of the same vintage accepted by the EU for further operation, in particular WWER 440/213 NPPs.

As there is no common standard on reactor safety for all EU countries, the evaluation used the *current international safety standards*. This included, in particular, the revised IAEA safety standards, as well as those of leading Western countries such as France, Germany and the USA. Safety guidance formulated in the European Utility Requirements, developed for advanced nuclear power plants was considered.

To assess the level of the upgraded plant design and operational safety, the checklist developed for the EU's AQG by the WPNS was utilized. The list of issues raised by the IAEA was analysed as well . This multiplicity of approaches was selected to provide a comprehensive picture of the plant's safety.

Main areas of evaluation

- Design Basis
- Core Characteristics
- Inherent Safety Characteristics
- RPV and Primary Pressure Boundary
- Confinement
- Safety Systems
- Instrumentation & Control (I&C) Systems
- Beyond Design Basis and Severe Accidents
- Safety Assessments and Documentation
- Organization, Procedures, O&M
- Safety Culture and Management, QA

Where the assessment found differences between the upgraded KNPP 3&4 status and current international safety standards and practice, the actual safety relevance of those (defined as potential risk from accidents and radiological releases) was determined using three internationally recognized approaches:

- *the IAEA's Common Basis approach;*
- *the UK Lines of Defense approach and;*
- *the US NRC quantitative prioritization method.*

Specific safety relevant features of KNPP 3&4 were compared with those of WWER 440/213 units, both on deterministic and probabilistic bases. This included issues such as the broader

spectrum of Design Basis Accidents (DBAs) that KNPP 3&4 is able to cope with.

Upon completion, the Study was subject to an international peer review of both the methodology and the findings. The peer review concurred with the methods used, the appropriateness and completeness of the material studied and the conclusions reached.

The study confirmed that, due to specific plant inherent safety features of KNPP 3&4 such as large inventory of water in the cooling circuits or low power density in the core, there is a significant room for safety upgrades. Very large safety margins had been built into the original design, and the basic structure with 3x100% redundancy made it possible to upgrade the plant to the level corresponding to current safety requirements.

KNPP 3&4 weaknesses which were identified more than a decade ago by the IAEA were all resolved. Many of those weaknesses were rectified through very extensive upgrading programmes realized in KNPP 3&4. Scope of those upgrading programmes was larger than on any WWER 440 reactor in operation today.

Recent IAEA missions concluded that upon the completion of the Short Term Programme (STP) and the Complex Modernization Programme (CMP) at KNPP 3&4, all known safety deficiencies in design and operation have been resolved to the level required by the current safety standards and international safety practice.

Safety deficiencies raised by reviews within WENRA and WPNS are also found to have been addressed in full.

At present, the safety of KNPP 3&4 is at the same level as that of other reactors in operation that are internationally accepted for continued operation. In particular, the safety of upgraded KNPP 3&4 design is found to be well comparable with that of WWER 440/213 reference plants.

The comprehensive review of upgraded KNPP 3&4 safety features in design and operation revealed high compliance of the plant with nearly all contemporary safety requirements applied to operating NPP in the West, i.e. no major safety concerns were identified. Moreover, the "Upgraded Design Basis" of KNPP 3&4, which is the foundation of the safety design of the plant, now corresponds to the contemporary nuclear safety requirements.

The study went in depth to assess the status of the resolution of the safety issues identified by the IAEA, by WENRA and by WPNS. The main safety improvements, which fully resolved safety concerns raised by those entities at KNPP 3&4 include the following:

- ***Enhancing redundancy, separation and qualification of equipment.*** In the original design those were insufficient. Nowadays, after modernisation, all safety important

equipment has been provided with the necessary redundancy and the required reliability is achieved. All necessary measures to ensure satisfactory separation of the safety related systems has been done. The qualification of equipment for accident conditions including seismic events has been evaluated and assured.

- An example of increased reliability is the ***complementary emergency feed water system***, that provides water to steam generators in case of an accident, which is built in addition to an existing emergency feedwater system. The system is located in a specially built, seismically resistant building and provided with equipment fully qualified to work in accident conditions. Another example is the ***reactor trip system*** that originally could not be tested during reactor operation without significant loss of its capability. After the implementation of and the necessary improvements the system currently satisfies Western standards.

- ***The strength of the Reactor Pressure Vessel (RPV)*** was not adequately justified at the original design and there was uncertainty if the material which is subject to neutron irradiation could resist thermal shocks. Now a day the problem is completely resolved by large number of measures including a special surveillance programme and a protection system installed to prevent pressurized thermal shocks. The new hardware includes French-designed and manufactured power operated relief valves with control units of high reliability. In service inspection capacity has been also very much improved, with incorporation of the latest techniques and equipment supplied from EU countries. Now the safety margins are such as to allow for a safe operation of the RPV over and above the design lifetime of the plant.

- ***To prevent the break of the largest pipes*** of the reactor cooling system, the concept of Leak Before Break (LBB) was applied. It involved upgrading of supports of the primary system and installing three independent and highly sensitive, qualified systems for early detection of leaks from the reactor cooling system. The analyses to prove the applicability of LBB concept were performed under the supervision of Siemens of Germany. The leak detection capabilities now satisfy all requirements for such systems which guaranties that in case of a leak the reactor will be safely shut down well before large pipe rupture conditions are reached.

  In addition, in spite of application of this concept all necessary analyses were performed to confirm that, even in the case of a large break, the Emergency Core Cooling System (ECCS) can maintain the temperature of the fuel below the limits and assure safety of the

plant.

- ***Fire protection has been strengthened*** to eliminate weaknesses in the original design. A comprehensive fire risk analysis has been completed, new fire detection systems installed and qualified for accident conditions, and measures to prevent fire spreading implemented. Fire fighting systems were reconstructed. All this work was done in close cooperation with French companies and new equipment was based on proven Western technology. The defence in depth concept of fire protection at the site was achieved in all levels, organizational basis for fire safety at the plant was established and regulatory requirements are met. The present status fully reflects current safety international practice.

- ***Seismic upgrading has been very extensive.*** All safety related equipment were tested under the most severe seismic and environmental conditions. If any component was not performing satisfactorily, it was replaced with a new, Western one. Buildings and structures were strengthened in line with the seismic protection needed for the Kozloduy site. Now all KNPP 3&4 ***systems are fully qualified for safe shut down of the reactor in case of any of the expected seismic events.***

- ***Strengthening the confinement of KNPP 3&4*** was one of the most important tasks for ensuring the units nuclear safety. Originally, the confinement could not withstand breaks of pipes larger than 32 mm. Its leakage rate was very high. With the installation of the Jet Vortex Condenser (JVC), and by an increase of leak-tightness the containment function is now assured for all accidents. The thermal hydraulic characteristics of the JVC were experimentally confirmed. Its effectiveness was verified by specialized Western organizations. The use of the JVC means that the maximum pressure in the confinement remains well below the design limit. The confinement can keep its integrity after a break of the largest pipe in the reactor cooling system. The integrity is assured even during severe accidents with simultaneous failure of safety systems. thanks to the improved leak-tightness that the releases of radioactivity after accidents do not exceed limit values, even in the case of severe accidents.

- ***Radiological consequences of Design Basis Accidents do not exceed regulatory limits*****,** and in many instances they are less than in PWR NPPs operating in the US and the EU countries.

  A comparison of the maximum radiation dose after LB LOCA in KNPP 3&4 with the lifetime dose due to natural background shows that this dose makes very small difference

to an inhabitant living 2.7 km away from the plant, and is negligible to people living 20 km away. It worth to mention that the probability for such an accident is estimated like once for 1 000 000 years of reactor operation and that a dose of 15 mSv is much less than the differences in lifetime doses among various countries. As a result the overall risk from the consequences of this kind of accidents is negligible.

- ***Operational practice and improved housekeeping*.** Early IAEA reviews indicated deficiency in management, procedures and maintenance at the plant as a source of concern. As a result the management and staff at KNPP3&4 accepted the policy for continuous enhancement of plant operational safety. Currently the plant has reached a level that corresponds to the level of plants of the same vintage worldwide. The achievements are widely visible in housekeeping and material conditions, and no major safety concern remains. The management clearly and consequently ranks nuclear safety and radiological protection as primary goals, more important than electricity production. Emissions in normal operation are steadily kept at the levels hundred times lower than the allowed limits. This confirms the efficiency and the level of radiological protection and the care that the plant gives to keeping radiological loads as low as reasonably achievable. A recent mission of the Operating Safety Review Team (OSART) of the IAEA confirmed very good status of operational safety at KNPP 3&4.

- ***Emergency operating procedures (EOPs)*** in the original plant required an immediate and fully accurate recognition of symptoms of an accident to choose appropriate actions by the plant operator.

  Now, the plant followed Western practice and developed Symptom Oriented EOPs, which are based on the information available in the control room and do not require any guesswork to perform the correct actions for bringing the plant to a safe shutdown state. The implementation of symptom oriented EOPs in June 2002, based on the Westinghouse technology was a major step to bring the KNPP 3&4 Units to the modern safety standards.

- ***Operator training*** is intensively pursued, including training on plant simulator which is build using modern technologies. The professional experience and knowledge of the operational crew is very high, and the operational achievements of the plant were highly praised by a recent IAEA mission.

Opinions of IAEA on KNPP 3&4 achievements in safety upgrading

Issue	IAEA opinions, 28 June 2002
Cooling the fuel in normal/transient conditions	"Addressed even ***beyond initial expectations"***
Cooling the core in all conditions	"Defense in depth going ***beyond initial expectations*** in cases"
RPV integrity and RPV rest lifetime	"Assured for ***safe operation*** at least until design lifetime"
3 independent leak detection systems	***"Fulfil standard regulatory requirements"***
Reactor heat removal to the ultimate heat sink	"Improved even ***beyond the initial recommendations"***
Common cause failures	"***High level of reliability in all plant conditions "***
Scope of analysis in Safety Analysis Report	***"Goes beyond the usual scope*** required by US and IAEA"
All areas dealing with operational safety	***"High quality standards*** observed"
Control room staff attitude	"Professionalism and ***open and frank discussion"***
Approach to safety and quality	"The ***fundamental tool to maintaining plant safety"***

Severe accidents

In spite of all hardware improvements and operator training, in safety analysis it is assumed that accidents can in extremely improbable cases exceed the bounds assumed in the design and become ***severe accidents*** due to simultaneous failures of several safety systems. Therefore the safety systems have been upgraded so that simultaneous failures due to common causes are prevented. Moreover, the confinement is process to be provided with two special systems, protecting its integrity even in the case of a severe accident. A system of hydrogen recombiners is under design, as in Western plants, to prevent the explosion hazard. In addition, Filtered

Venting System is on the way so that the hazard of uncontrolled leakages and confinement failure also in a long term is prevented. After these measures implementation, KNPP 3&4 will be able to withstand even a severe accident without exceeding radiological hazard limits.

Probabilistic Safety Assessment (PSA)

The results of probabilistic safety assessment for KNPP3&4, periodically performed in parallel to the modernizations implementation, confirmed a significant safety enhancement achieved through the upgrading programme. The core damage frequency has been reduced to 1.6 E-05/year (which includes internal events, seismic and fire hazards). That is nearly an order of magnitude better than the international target for operating plants set by IAEA INSAG at 1E-04/year.

- ***The Safety Analysis Report*** (SAR) of the original design was judged in the beginning of 90-ties to be not comprehensive enough and it's safety analyses were not acceptable by Western standards. To overcome this deficiency during the modernization very high number of new accident analyses were performed using the current methods and computer modelling codes.

Based on requirements formulated by Western regulatory organizations, a totally new SAR was developed in spring 2002 where the full set of actual safety analyses is presented in the required scope. The range of accidents considered in the new SAR is even larger than required in the US and EU regulations, and compares favourably with that in WWER 440/213 units. Calculations codes are validated and the safety documentation now fully corresponds to the requirements of contemporary safety practice in Western Europe.

To compensate for potential human and mechanical failures a ***defense in depth concept is implemented*** centered on several levels of protection including successive barriers preventing releases of fission products to the environment. It ensures that ***even combinations of failures that are only remotely possible would lead to little or no injury***.

New design basis of the units is established

Presently, the plant can cope with an extended set of internal and external hazards. This set corresponds to the current international safety practice in Western plants of the same vintage.

The measures to strengthen plant capability to cope with transients and accidents have resulted in a well balanced system of defence in depth, which assures plant safety even in the case of accidents occurring simultaneously with a single failure in any safety system.

The mitigative capacity has also been strengthened to reduce the effects of hypothetical accidents going beyond the range of design basis accidents. Also in this respect the achievement of KNPP 3&4 complies with the international safety practice.

In particular:

- The required high degree of redundancy and independence of the equipment and systems related to safety has been achieved and confirmed as satisfactory by Western organizations.
- The plant is capable to withstand fire, flooding, earthquake and other site related phenomena, all essential equipment is qualified for combinations of seismic and environmental conditions.
- Leak Before Break approach to prevent breaks of large size piping in the RCS has been successfully implemented.
- Plant safety systems are shown to be able to cope with the break of the largest pipe in the RCS.
- The localisation systems of the units have been very much improved by installation of Jet Vortex Condenser, which assures their structural integrity after all RCS breaks including 500 mm break and good retention of fission products.
- Confinement leak tightness has been significantly improved and radiological requirements are fulfilled for all postulated events (DBAs and BDBAs).
- Capability of Reactor Trip System has been improved, and the analog Emergency Safety Feature Actuation System (ESFAS) has been replaced with based on digital technology.
- The level of fire safety reached in KNPP 3&4 fully conforms to the actual Western requirements in this area.

Comparison with WWER 440/213 NPPs

A detailed review of all features important to safety showed that KNPP 3&4 compared favourably with the WWER 440/213 plants (upgradeable, and operation without limitations as per European Commission statement) not only as they were at the end of the previous decade, but also as they are now (in June 2002). Out of 140 measures to cope with various shortcomings of the original design, only in four cases are WWER 440/213 plants superior to KNPP 3&4, and in each these measures to compensate for these shortcomings have been implemented or in progress on KNPP 3&4. In 12 cases KNPP is superior to at least some of the reference group of

WWER 440/213 plants. In the remaining cases the situation is similar in KNPP as in the WWER 440/213 units. The results of PSA confirm this assessment.

- ***Safety issues identified by the IAEA.*** In addition to addressing safety issues identified by the IAEA for WWER 440/230 reactors, KNPP 3&4 resolved all the applicable issues identified by the IAEA for WWER 440/213 reactors. This makes KNPP 3&4 the ONLY plant to have done so. This achievement is unique and fully supports the conclusion that as a result of the modernization KNPP 3&4 are in a new safety case that corresponds to the current safety requirements.

Cooperation of Western organizations to upgrade safety status of KNPP 3&4.

The proposals for upgrading of the original design of KNPP 3&4 have been developed in close collaboration with the IAEA, Riskaudit, WENRA and other Western technical organizations in an open atmosphere for discussion of the safety issues and their possible solutions. The upgrading measures were gradually introduced over the decade in close cooperation with the Western organizations, which provided technical expertise and supplied qualified equipment. The measures related to reactor pressure vessel, primary and secondary cooling system and safety systems were implemented in cooperation with Siemens (Germany), EdF and Framatome (France), equipment qualification with Empresarios Agrupados (Spain) and SAR was prepared following the guidance of Riskaudit. Jet Vortex Condenser was designed and installed by VNIIAES (Russia) and independently evaluated by Empresarios Agrupados and British Energy. Accident analyses made by Energoproekt were reviewed and verified by the University of Pisa (Italy), leading in thermal hydraulic analysis. More than 80 positive reports were published on independent reviews of safety features of KNPP 3&4. The actual status of the plant has been judged by the IAEA expert missions to be very good, both in the area of design and of operational safety.

SAFETY level at KNPP 3&4 TODAY

Taking into account all the achievements of KNPP 3&4

– in hardware and software upgrading,

– in improving all levels of defense in depth, including enhancement of the confinement,

– excellent operational safety and safety culture,

– addressing all the IAEA, WENRA and WPNS safety issues and doing more than required,

and

considering that according to EU position* "Plants in candidate countries should not be required to fulfill higher safety requirements than those in force in EU countries"** ***[AQG], the ENCONET Study found that:

The safety level achieved at upgraded KNPP 3&4 is comparable with that of operating plants of similar vintage in the West and in the East with respect to international safety standards and practices. It did not find any safety issues that would prevent further operation of the plant.

Resolution of WENRA and WPNS issues

Comments of	Issue	Measures	Status
WENRA 00, WPNS	RPV embrittlement	Surveillance programme, Protection system against pressurized thermal shocks,	Safety margins OK
WENRA99, WPNS 01	Primary integrity	Supports, LBB, detection system	Status as in EU plants
WENRA 99, 2000	ECCS capability	Demonstrated ECCS can cope with LB LOCA	Problem resolved
WENRA99, WPNS 01	Confinement integrity	Jet Vortex Condenser. Leakage reduced	Problem resolved
WENRA 99	Fire, flood, seismic	Fire systems installed, seismic strengthening	Good protection
WENRA 99	Redundancy	All safety systems 3x100%, independent power.	Problem resolved
WENRA 99	Qualification	Fully completed, for seismic and environmental	Problem resolved
WPNS 01	Reactor protection	Equipment, design & reliability improved,	Problem resolved
WENRA 99	Primary to sec. leaks	Fast-acting valves installed, Collector change	Plant could withstand

WENRA 99	Severe accidents	Symptom Procedures, hydrogen, filtered venting	Follows the EU practice
WENRA 99	Safety Analysis , SAR	SAR & accident analyses completed	Problem resolved

Further measures directed towards increasing and maintaining a high level of nuclear safety and radiation protection will be taken resulting from the terms and conditions of long-term licenses for operation of units 3 and 4 issued by the NRA:

- Installation of an additional filtered ventilating system of the corpus of units 3 and 4;
- Installation of a system for detecting and hydrogen burning in the confinement;
- Measures directed towards improving the safety and lifetime management of units 3 and 4.

The implementation of reconstruction and modernisation programmes, the achieved level of design and operational safety and the issued long-term licenses for operation of units 3 and 4 demonstrate how efficient international cooperation in the field of nuclear safety could be.