Second Report

of the Republic of Bulgaria

on the fulfilment of the obligations

on the Convention on Nuclear Safety

October, 2001

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I. INTRODUCTION

1. Introduction

The Republic of Bulgaria having ratified the Convention on Nuclear Safety, took part in the first meeting for review of national reports that was held in Vienna, 12-13 April 1999. The Bulgarian National Report was submitted on the 28 September 1998, in compliance with section VIII of the first review meeting guidelines.
The report dealt with the status, achievements and activities undertaken in to meet the requirements of Convention. During the months prior to the first review meeting that was held in April 1999, in addition to preparing comments on other national reports, answers were prepared to the questions and comments on the Bulgarian report. These answers contained additional information on the measures taken to meet the Convention's obligations.

During discussions of the first national report at group meetings as well as at the final plenary session, a number of safety issues were discussed, concerning:

- Financing and human resources of the Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP);
- Improvement of the leaktightness of the steam generator boxes (confinement) of units with WWER-440/V-230 type reactors;
- Development of a Safety Analysis Report (SAR) for the Units with WWER-440/V-230 type reactors;
- Integrity of the reactor pressure vessel of WWER-440/V-230 type reactors;
- Development of a programme for ageing management;
- Acceleration of the fulfilment of the programmes for improving the units safety.

The system for regulation of the problems in nuclear safety and of the engineering aspects of the radiation protection at the NPP by a single regulatory body – CUAEPP was pointed out as a good practice.

Since the first review meeting, international missions identified the following areas needing attention:

- Increasing the independence of CUAEPP;
- Concentrating the CUAEPP activities on regulatory control of safety;
- Motivating personnel at Units 1 and 2 for safe operation during the several years prior to shut down;
- Providing good management for the large-scale modification programmes.

This report updates the first national report using a similar structure and addresses the measures taken to resolve all identified safety issues. Concrete actions have been undertaken on all problematic fields of safety both in the regulatory activity and on technical aspects of the nuclear facilities. New normative documents have been issued in the field of nuclear safety and radiation protection. Approximately 60% of the measures from the programme for reconstruction of units 1 – 4 and from the programme for modernisation of units 5 and 6 – approximately 50% have been fulfilled at mid-2001. The Republic of Bulgaria will demonstrate even bigger progress during presentation of the Second national report in 2002 in the achievement and maintaining an adequate level of safety. Appendices include data for existing nuclear facilities, information on national legislation, status of the modernisation programmes, quality assurance programme for the modernisation of Kozloduy NPP Units 5

and 6 and excerpts from reports of international review missions. The information, subject of the Convention, which is contained in these sections of the first national report, including the appendices, which are not updated or amended, remains in force.

2. Policy of the Republic of Bulgaria in the Field of Nuclear Power Production

Legislative Framework in the Republic of Bulgaria

Regulation of civilian nuclear power is covered in the Act on the Use of Atomic Energy for Peaceful Purposes, which was adopted in 1985 and amended in 1995 and 1998. This Act declares the first priority significance of the activities on assurance of safety and radiation protection of the personnel, the population and the environment.

The policy of the Republic of Bulgaria in the field of nuclear power production is carried out based on:

- Energy and Energy Effectiveness Law of 1999;
- National Strategy for Development of Energy production and Energy Effectiveness till the year 2010, adopted by the Council of Ministers in 1998. The National Assembly approved the principles and measures incorporated in it;
- The National Strategy for Safe Management of Spent Fuel and Radioactive Waste, accepted by the Council of Ministers in 1999.

An update of the National Strategy for the Development of Energy Production with a forecast up to 2015 is being prepared. It will consider the new tendencies of the economic growth and their influence on the energy consumption and electric power production, development of market relationships and preparation for the implementation of the Acquis Communautaire in the sector, as well as development of the regional energy market.

Institutional Framework

The Republic of Bulgaria has the necessary institutions to identify and carry out the national policy in the field of nuclear power production and to perform control and state regulation. These institutions are:

- Committee on the Use of Atomic Energy for Peaceful Purposes – performs the state regulation of the safe use of atomic energy;
- State Agency for Energy and Energy Resources (SAEER) – identifies and carries out the general energy policy;
- State Commission on Energy Regulation (SCER) – a specialised body related to price regulation and issuing permissions for production of electric and thermal energy to the companies in the energy sector.

Energy Market

The preparation for the liberalisation of the Bulgarian electricity market is at an advanced stage of development and is being carried out in compliance with the Energy and Energy Effectiveness Law (EEEL), which incorporates the basic requirements of the Council Directive EEC 96/92. The law covers the structure of the electric energy system, activities related to production, transfer and distribution of electric energy, commercial relationships,

obligations of the transfer and distribution nets operators and supply of electric energy to the consumers.

The EEEL allows creation of competition in the construction of new generating facilities and in the sale of electric energy to final consumers.

Since 1996 the electric energy system of the Republic of Bulgaria is connected to the second synchronised zone of the European energy system (The Union Co-ordination of Transmission of Electricity – UCTE), together with the countries from the Balkan region, and projects are being implemented in correspondence with a prescribed Catalogue of UCTE measures for its acceptance as a full-right member.

3. Ongoing National Programmes Related to the Nuclear Facilities

The following programmes are being implemented on the Kozloduy NPP site:

- Modernisation of Units 5 and 6 to assure a high safety level and to increase their reliability. The implementation period is 2001-2006 (financing with 80% credits);
- Reconstruction of Units 3 and 4 to assure a high safety level up to the end of the operational period. The implementation period is 1999 – 2002 (financing with 90% own funds);
- Construction of facilities for radwaste treatment and storage. The implementation period is 1997 – 2002 (financing with 75% own funds and 25 % European Union).

The basic safety issues are reconstruction of the system for localisation of accidents and increasing the leaktightness of the steam generator boxes (confinement) of Units 3 and 4, development of updated safety analysis reports for Units 3 through 6 (within the requirements of Western Codes) and increasing the reliability of the equipment. The results of the international missions and independent expert assessments held on programmes demonstrate correctly determined targets and adequate addressing of the identified safety deficiencies.

The decommissioning of Kozloduy NPP Units 1 and 2 is under preparation.

As noted in the first national report, according to the National strategy for development of energy and energy effectiveness up to 2010, a new nuclear facility is needed after 2006. The optimum term for the commissioning of a new nuclear unit with power between 600 and 900 MW is about 2010 or before the decommissioning of Kozloduy NPP Units 3 and 4. This is an important issue both for assurance of the electric-energy balance in the country and for the resolution of social problems related to the decommissioning of the four Kozloduy NPP Units.

II. ARTICLE BY ARTICLE REVIEW

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 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 Contents of the First National Report on Article 6 of the Convention

In the section of the First national report, related to the fulfilment of the requirements of Article 6, information is provided on the nuclear facilities in the Republic of Bulgaria. In the period after issuing the first national report, no new nuclear facilities have been built in the Republic of Bulgaria.
In Item 6.1 information is provided on the status of Units 1-4, the planned and the implemented improvements and safety assessments, as well as on intentions for the next period.
In Item 6.2 information is provided about the status of Units 5 and 6, the planned and the implemented improvements and safety assessments, as well as on intentions for the next period.
In Item 6.3 information is provided about the spent fuel storage facility, the implemented improvements, safety assessments, and the ongoing measures for further improvements.
In Item 6.4 information is provided about the radioactive waste treatment and storage facilities.
Additional information is provided in the written answers to the questions of the contracting parties, as well as in the clarifications during the discussions on the national report.
In the following section, the development in the field of the NPP safety improvement is presented, for the period after 1999. A list of the nuclear facilities is provided in Annex 1; the data about these facilities are presented in Annex 2.

2. Improvement at Kozloduy NPP Units 1 through 4

Safety Assessments

Since the first review meeting international experts have been used to review the safety status of the Kozloduy units:

- In 1999 an IAEA Mission was carried out to review the operational safety of Units 1-4. It covered the full scope of activities for an Operational Safety Assessment Review Team, OSART of operating NPPs. Overall, the operational safety of all units was found to meet the good international practices. Specific recommendations and suggestions were made [1], which were checked for implementation in a January 2001 mission. Of 49 items reviewed by the OSART Mission, 38 were assessed as “completely resolved”, 10 had satisfactory progress and only one that was not of mandatory character, had no satisfactory progress. Four strong

characteristics were safety management, personnel training, radiation protection and emergency planning. The Mission found that many items went implemented beyond recommendation's requirements.

- In October 1999 a team from the Western European Nuclear Regulators' Association (WENRA) reviewed the technical and operation safety aspects of the Kozloduy units. Prior to the Mission, answers were prepared to over 120 specific questions. The Mission recommendations have been reflected in the complex modernisation programme for Units 1-4 (PRG'97/A).

- In February 2000 a new revision of PRG'97/A was prepared that included 16 new Measures from recommendations of SIEMENS (Germany) and EdF (France) experts (1999) and those of WENRA. In view of the Understanding signed with the European Commission (?C) for final shut down and decommissioning Units 1 and 2 before the year 2003, the major accent of the updated programme is placed on Units 3 and 4.

- In October 2000 an IAEA Mission assessed the Complex modernisation programme PRG'97/A and reviewed the status of the recommendations from previous Missions concerning the technical issues contained in IAEA TECDOC-640. Out of 60 recommendations, 56 were assessed as "the intent of the recommendation was achieved", 1 - as "implementation ongoing" and 3 – as "the intent of the recommendation is partially achieved". The modernisation programme was assessed as being broad and realistic enough that after its implementation, Units 3 and 4 would reach acceptable safety levels comparable to modern plants [3].

Status:

Fulfilment of the measures on units 3 and 4 within the framework of PRG-97/A is approximately 60% complete and the remaining is under fulfilment. The main accent of the measures remaining for fulfilment is solution of the problems on the accident localisation system, primary circuit integrity and the hermetic compartments. Preparatory activities started on installation of the jet vortex condenser in the steam generator box at unit 4, activities on implementation of two auxiliary systems according to the "leak-before-break" concept and improvement of the leaktightness of the hermetic compartments within the framework of the outage programmes.

The design SAR for units 1 – 4 is updated till present, while the new document "Safety Substantiation Report" (SSR) is developed according to the requirements of the normative documents and generally accepted international practice and reflects the existing status of the units up to 2000. The CUAEPP recommended to use in the development of the SAR the report of the PHARE/BG/TSO/05 project entitled "Assistance to the BNSA on the Development of Requirements for the Safety Substantiation Report for the Kozloduy Units 3 and 4". The last revision of the SSR was finished at the end of 2000 and expert assessment was performed about the applicability of the SSR for development of a new SAR.

The list of measures for the Units and the status of implementation are presented in Annex 3.

Intentions:

The November 1999 Understanding between Bulgaria and the European Commission has influenced the safety modernisation programme.

Units 1 and 2

The Understanding calls for these Units to be shut down and decommissioning activities commenced before 2003. Measures from PRG'97/A will be implemented only if they are already ongoing or are necessary for safe shut down and decommissioning. Within the PHARE programme framework a detailed technical design for decommissioning is being

developed which will be completed by the end of 2001. The selected decommissioning option includes a post-operational period and a preparatory period for safe storage with a total duration of 5 years, followed by a safe storage period of 35 years and subsequent dismantling and site restoration. Prior to final shut down a detailed technical design for decommissioning, a Safety Analyses Report - SAR, an environmental impact assessment (EIA) and a radiation protection concept will be developed within the PHARE project. The measures to decommission Units 1 and 2 are listed in Annex 4.

Units 3 and 4

The completion of basic Measures in the updated complex programme PRG 97A is scheduled during 2002. Within this period, the exact year of their final shut down should be determined and agreed. The modernisation efforts will also include safety improvements which allow a clear distinction between the design of Units 3 and 4 and the model V-230. This could justify further operation within the design operational lifetime. For this purpose, a project for requalification of the improved reactor is under implementation. Implementation of the major package of technical Measures from the updated complex modernisation programme should enhance Units 3 and 4 to a safety level equivalent or close to the level of Units with WWER-440/V-213 type reactors. To reach this goal, the programme includes measures to ensure:

- reliable cooling of fuel for all design operational modes and for severe accidents;
- reliable performance of equipment during the design operational lifetime of the Units;
- limited effect of accidents on personnel, population and the environment, in accordance with modern norms;
- availability of competent and motivated personnel.

Activities have been planned on approval of the final version of the SAR and development of a programme for maintaining and updating the SAR.
It is envisaged to hold an IAEA mission in mid-2002 for assessment the degree of implementation of the programme PRG-97/A and the implemented upgrading.

The reliability and leaktightness of the steam generator box is a major issue. A modernisation project for an accident localisation system has been initiated to solve this problem. It envisages installation of a water jet vortex condenser to manage the pressure within the box during both design and beyond design basis accidents that includes a guillotine break of the main primary circuit pipeline. Installation of a hydrogen recombination and ventilation system is also planned. The systems will be installed after carrying out experimental justification and analyses supporting the modifications, including testing of localising functions. The major documents covering the experimental programme, the SAR and technical project documents have been assessed by two independent international companies - “British Energy” and “Empresarios Agrupados”.
The implementation schedule plans on the installation of water jet vortex condenser at Unit 4 in 2001, and at Unit 3 – in the beginning of 2002. The other systems will be installed during subsequent unit outages for refuelling.

3. Units 5 and 6 of Kozloduy NPP

Safety Assessments

On the request of CUAEPP an expert IAEA Mission was held in July 2000 to assess the technical adequacy of the modernisation programme Measures, the status of recommendations of 1995 IAEA Mission and the status of safety issues in IAEA-EBP-WWER-05 “Safety

Issues and Their Ranking for WWER-1000 Model 320 NPPs". The July 2000 Mission focused on six groups of safety issues [4]:

- General problems and operational safety;
- Reactor core and systems, including the containment;
- Component integrity;
- Electrical equipment and systems for monitoring and control;
- Internal and external risks;
- Accident analyses.

The major recommendations and suggestions directed at:

- The scope of Measures from the Modernisation programme to resolve safety issues in IAEA-EBP-WWER-05;
- The interface between existing and new systems;
- The interface among Measures;
- Analyses results and their consequences on implementation of design changes.

The Mission's major conclusion was that no safety measure existed in which implementation had not been started or completed to resolve issues in IAEA-EBP-WWER-05.

An additional expert IAEA Mission was held in July 2000 to perform an economic review of the modernisation measures, identify non-conformity between costs and the technical scopes of the measures and to help in the definition of implementation priorities.
The basic conclusions and recommendations covered engineering, equipment procurement, site works, project implementation and management.

Based on the recommendations made, a special directorate was formed to manage the modernisation and the reconstruction activities at Kozloduy NPP plc. The goal is to create effective co-operation and co-ordination of all activities related to the management of the large modifications and reconstruction. Helping the directorate are specialists from Parsons (USA), which has been selected as a consultant for the Units 5 and 6 Modernisation Programme Management.

Completed and planned activities for safety enhancement

Since 1987 more than 2200 design changes were introduced at Units 5 and 6 directed to enhance safety and reliability of operation.
The Modernisation Programme includes Measures for revising the safety documentation to international standards. This will include the qualification and ranking of safety-related equipment and systems based on safety, seismic and quality requirements. A corrected SAR will be developed with accident analyses meeting international practices. Analyses will also be carried out for beyond design basis accidents as suggested in IAEA recommendations. The existing probabilistic safety analysis for Units 5 and 6 will be updated and symptom-oriented emergency operation procedures will be introduced.
In line with IAEA recommendations, a study was carried out on modifications for steam piping and feed-water piping supports which ensure that the consequences of steam piping and feed-water piping breaks are limited taking into account the new seismic assessment. The seismic stability of the region of the confinement wall where this piping penetrates through was assessed. Analyses will be carried out for secondary circuit breaks related to the preparation of the updated SAR.
Multiple studies have been carried out, concerning the seismic safety of Kozloduy NPP which are complemented by specific studies from the Units 5 and 6 Modernisation Programme to

analyse the behaviour of equipment from the safety systems in case of an earthquake and the seismic stability of the buildings at 0.2g. The modernisation programme includes Measures to implement the suggestions for enhancing the seismic stability of the safety systems equipment, piping, and bearing structures.
In correspondence with the IAEA Mission recommendations, the Units 5 and 6 Modernisation Programme includes a Measure for improving the current programme for reactor vessel monitoring. Additional studies and technical solutions have been performed outside of the Modernisation Programme, which substantially increase the quality of the programme for reactor vessel monitoring.
Approximately 50% of the measures of the Programme for modernisation of these units are under implementation or implemented till September 2001. Within the framework of the main contracts signed till September 2001 for the implementation of the technical projects start is forthcoming of approximately 40% of further measures.
The first phase of the Units 5 and 6 Modernisation Programme was completed in the period 1998-2000. The necessary input data was prepared and presented to the contractors, Terms of Reference and Technical Project Documents were developed, and a part of the additional safety analyses were carried out during this phase.
The Main Contract for implementation of the second part of the Units 5 and 6 Modernisation Programme was signed in 1999. Technical Specifications for the implementation of the second phase of the Units 5 and 6 Modernisation Programme were agreed in the period 1999-2000.

The major stages of the second phase of the modernisation programme are:
- Development of detailed design;
- Manufacturing and procurement of equipment;
- Installation of equipment;
- Single and functional testing;
- Commissioning of the new systems.

Implementation of the second phase of the Units 5 and 6 Modernisation Programme is planned for the period 2001 - 2006. A list of the Modernisation Programme Measures which are included in the Main Contract, is presented in Annex 5.
Activities on the Programme will be performed mainly by Westinghouse (USA) and the European Consortium Kozloduy (?C?). A procedure was developed by the Inspectorate on the Safe Use of Atomic Energy (ISUAE) which is a part of the CUAEPP (see Annex 8) together with the Kozloduy NPP plc for licensing the activities of the programme. With this procedure the order and the documents, necessary for the licensing process are determined.
The first permissions for the first stage of the licensing procedure have been already granted by ISUAE, which marks the start up of the Main Contracts from Units 5 and 6 Modernisation Programme.
By mid-2001, 49 Measures had been implemented, 73 Measures were ongoing and implementation of another 82 was forthcoming. The list of the Measures and the implementation status is presented in Annex 6.

Intentions

The commenced implementation of Units 5 and 6 Modernisation Programme has to be completed within the planned schedule. For this purpose, the necessary organisation and the respective organisational structure have been created.

4. Spent Fuel Storage Facility

The first programme of Measures for enhancing the safety of the Spent Fuel Storage Facility (SFSF) was developed in 1991 with the new seismic characteristics of the Kozloduy site taken into consideration in 1992.
In 1998, with financing from the PHARE programme, a complete reassessment of the programme Measures was undertaken.
In February 2001 a revised plan of Measures was completed and accepted by the competent government body. In March 2001, the procedure for issuing operational permission by ISUAE was completed in compliance with the Act on the Use of Atomic Energy for Peaceful Purposes. A long-term programme has been developed for modernisation of SFSF according to the CUAEPP requirements.
Independent ecological assessments of the SFSF were made by a team from the Risk Engineering company (Bulgaria) and EIR by specialists of the Sofia University named after "St. Clement of Ohrid". Their results showed there would be an insignificant influence of SFSF operation on the environment.

5. Radioactive Waste Treatment Facilities

The concept for treatment of low and medium activity waste ensures economical treatment and safe temporary storage of the radioactive waste (RAW) both during the reactor operational period and during decommissioning.
For long-term isolation issues a facility was constructed for conditioning the radioactive waste into a form suitable for safe disposal. The selected technology was immobilisation of waste by encasement in a cement matrix and packaging in reinforced concrete containers. Following a licensing procedure, a commissioning permission was granted by the ISUAE in July 2001for the solid radioactive waste processing line, including model testing with both non-radioactive substances and radioactive waste at the end.
The facility is scheduled to be commissioned gradually by mid-2002 in compliance with the legislation of the Republic of Bulgaria in force. A special four-step procedure was developed in co-operation between ISUAE and Kozloduy NPP for licensing during the gradual commissioning of the facility:

- Commissioning of the solid waste processing line;
- Commissioning of the temporary storage for conditioned waste;
- Commissioning of liquid waste line;
- Operation of the waste treatment facility.

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

1. Brief Review of the Contents of the First National Report on Article 7 of the Convention

In Item 7.1 of the First national report a short description is provided of the national laws and secondary legislation, applicable to the nuclear facilities safety, including the basic act in the field of the use of atomic energy – the Act on the Use of Atomic Energy for Peaceful Purposes (AUAEPP)**.**
In Item 7.2 the legal and regulatory basis is presented, regulating the licensing process provided in the AUAEPP, in the Rules for its application and in the CUAEPP Regulation No. 5.
In Item 7.3 a short description is provided of the legal and regulatory basis, establishing the system of the regulatory inspections.
In Item 7.4 a short description is provided of the legal and regulatory basis, which assures the compliance with the respective legislative acts and issued permission conditions.

2. New and Updated Legislative Acts, applicable for the Nuclear Facilities

Hereinafter, a description is given of the new and updated Legislative acts, applicable for the nuclear facilities for the period after the presentation of the first national report.

?) Energy and Energy Effectiveness Law of 1999, amended in 2000.
This law regulates the public relationships in the energy sector, related to the state management and regulation, as well as the rights and the obligations of the juridical subjects at performing the manufacturing activities, import, export, transfer, distribution and sale of electric and thermal energy and natural gas, the increase of the energy effectiveness and encouraging the use of renewable energy sources.
b) The –Rule for Implementation of the Act on the Use of Atomic Energy for Peaceful Purposes
The Rules were amended by Council of Ministers Decree of 6-June-2001 in relation with the adoption of Organisational Statute of the CUAEPP and its administration in order to avoid antinomies and repetitions in matters, regulating by it. This necessity follows from the fact, that while the Organisational Statute concerns the relationships related to the composition and activities of the CUAEPP as a collective body and with the structure and functions of its administrative units, the Rule for Implementation of the Act on the Use of Atomic Energy for

Peaceful Purposes regulates and further develops the provisions of the law in the part outside the administrative statute.

c) Regulation for Basic Norms for Radiation Protection - 2000, (ONRZ-2000) of 2001

The Regulation was adopted by the Council of Ministers. The Regulation specifies the requirements for protection of people from harmful influence of the ionising radiation and safety at work with sources of ionising radiation without being an obstacle to useful activities, related to their use. The Regulation also specifies the basic exposure dose margins for the personnel, as well as the intervention levels for protection of the population.

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

e) The Regulation on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund "Safety and Storage of Radioactive Waste" and its management of 1999

The Regulation was adopted by the Council of Ministers and amended in 2000.

The Regulation defines the order for collecting, spending, and control of the means from the " Safety and Storage of Radioactive Waste " fund and the amount of the payments by the legal and physical entities, who, because of their activity, produce radioactive wastes.

f) Regulation for Emergency Planning and Preparedness for Action in Case of a Radiation Accident of 1999

The Regulation was adopted by the Council of Ministers. The Regulation specifies the obligations of the executive power authorities, the nuclear power plant (NPP) operator and the legal entities, performing activities on the territory of the Republic of Bulgaria, for planning actions in case of a radiation accident in the NPP, as well as for maintaining emergency preparedness.

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

g) Regulation No.4 on Accounting, Storage and Transportation of Nuclear Material (Regulation No.4 of CUAEPP)

The Regulation was repealed by the Regulation on Accounting, Storage, Transportation of Nuclear Material and Application of the Safeguards, pursuant to the Treaty on the Non-proliferation of Nuclear Weapons. The Regulation was adopted in April 2001, in connection with the ratified in September 2000 Additional Protocol to the Agreement between the International Atomic Energy Agency and the Republic of Bulgaria for Implementation of the Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons.

The Regulation defines the order for accounting, storage and transportation of nuclear material at its use in activities, related to the nuclear fuel cycle (NFC), as well as the order for provision of available information for scientific, research ant experimental design activities, which do not use nuclear material, but are linked to the NFC.

h) Regulation No. 10 on Safety during Decommissioning of Nuclear Facilities, adopted by the CUAEPP, in force since 2001.

The Regulation regulates fundamental safety issues during decommissioning of nuclear facilities, following from the specifics of the decommissioning activities, such as availability of sources of ionising radiation with high mass and level of activity, of radioactive substances and radioactive wastes.

The decommissioning of a nuclear facility, according to the Regulation, is a complex of

administrative and technical measures and activities, permitting partial or full exemption from the control of the Regulatory Body together with assuring the safety of the personnel, the population and the environment.
The Regulation contains the organisational and technical requirements, meeting of which is a necessary condition for the assurance of safety during nuclear facilities decommissioning.
i) Regulation No. 11 for safety of spent fuel storage facilities, adopted by the CUAEPP, in force since 2001.
The Regulation specifies the requirements for assuring safety during design construction, erection, commissioning and operation of independent facilities for storage, shipment and handling of spent nuclear fuel (SNF) from nuclear power plants with WWER type reactors, located on NPP site.
This Regulation also regulates specific safety aspects, following from the characteristics of the SNF as a special (fissile) nuclear material and a source of ionising radiation.

3. Draft Legislative Acts Applicable to the Nuclear Facilities

a) Draft Act on the Use of Nuclear Energy for Peaceful Purposes, which is being discussed within the National Assembly commissions
The Draft Act on the Use of Nuclear Energy for Peaceful Purposes aims at regulating the legal relationships, related to the use of nuclear power and ionising radiation in their full scope and in compliance with the international contract obligations, accepted by the Republic of Bulgaria, having as a subject the regulation of the use of nuclear power. The Draft envisages repealing of the current Act on the Use of Atomic Energy for Peaceful Purposes.
b) A draft Regulation, which will repeal the Regulation No.7 being in force
The new Regulation will define the safety requirements to the radioactive waste management activities, including pre-processing, processing, conditioning, storage and disposal of radioactive waste, as well as the requirements to the facilities for radioactive waste management, including to their safety assessment and the requirements to the safe decommissioning, respectively closure of the radioactive waste disposal facilities.
The draft of the Adoption of the Regulation by the CUAEPP is forthcoming.

The list of the international Treaties, Laws, and basic secondary legislation, applicable to the nuclear facilities, is presented in Annex 7.

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 organisation concerned with the promotion or utilisation of nuclear energy."

1. Brief Review of the Contents of the First National Report on Article 8 of the Convention

In that section of the First national report, which is concerning the regulatory body, information is included related to the measures for meeting the obligations of the Republic of Bulgaria, following from Article 8 of the Convention.
In the report, Item 8.1, a brief description is provided of the structure, the status and the authority of CUAEPP, of ISUAE and the advisory councils, according to the Act on the Use of Atomic Energy for Peaceful Purposes in force.
In the report, Item 8.2, a description is provided of the organisational structure of CUAEPP administration, of the issues related to the financial support of the CUAEPP activities and the functions of the CUAEPP administrative structural units.
In the report, Item 8.3, the role of the Council of Ministers is specified according to the Constitution of the Republic of Bulgaria and CUAEPP position in the governmental structure.
In the report, Item 8.4, CUAEPP relationships are described with those authorities and organisations, which are responsible for the encouragement of the development and the use of the nuclear energy.
In the report, Item 8.5, the recommendations are presented of the international regulatory review team mission on the regulatory activities in the Republic of Bulgaria, held in 1997.
In the report, Item 8.6, a general plan is included for resolving the recommendations and the suggestions of the international team for improvement of the regulatory activity.
Additional information is contained in the written answers to the questions of the Contracting Parties on this section of the national report.
In the process of discussions on the national report at sessions of the group, to which Bulgaria belongs, additional clarifications were provided on the texts of the national report and the written answers to the questions on Article 8 of the Convention.
Below information is given on the development, achieved in the period 1999 – mid 2001, at meeting the obligations of the Republic of Bulgaria pursuant to Article 8 of the Convention.

2. Legal Status of CUAEPP

As it was noted in the first report, CUAEPP is a state authority at the Council of Ministers and carries out the state policy for safety use of the atomic energy. The composition of the CUAEPP, defined with a decree of the Council of Ministers, includes vice-ministers and vice-chairmen of state agencies, as well as the Chief Manager of Kozloduy NPP, the Vice-chairman of the Bulgarian Academy of Sciences, the Head of the Nuclear research and nuclear energy institute and the Head of the design institute Energoproject plc.

On June 6, 2001, the Council of Ministers adopted a Decree, which approved the Organisational Statute of CUAEPP. The Organisational Statute regulates the legal authorities, the composition and the organisation of the CUAEPP activities; the structure, the work organisation and the functions of the administrative units, as well as the number of personnel and its administration. The recommendations of the international regulatory review team mission on the regulatory activities in the Republic of Bulgaria, held in 1997, were taken into consideration at the development of the Organisational Statute, according to the general plan for improvement of the regulatory activity, described in Item. 8.6 of the first report, as well as the problems identified as a result of international missions held during the passed period of time. Only those recommendations are not reflected, which require legislative measures.
The CUAEPP organisational structure includes, in addition to the CUAEPP Chairman and two vice-chairmen, vice-ministers of all ministries, as well as the Vice-chairman of the State Agency on Energy and Energy Resources, the Vice-chairman of the State Agency "Civil Protection" and the Vice Chairman of the State Agency on Standardisation and Metrology, that is, managers of companies, directly involved with the support for implementation or use of nuclear energy, are excluded.
The Status of the two advisory councils to CUAEPP remains the same, as it was presented in the First national report. Drafts of the Law on the Use of the Nuclear Energy for Peaceful Purposes, Basic Norms for Radiation Protection, and other normative documents were discussed at meetings of the advisory councils.
As a result of the new empowered laws, changes were made in the CUAEPP functions. According to the provisions of the Law for Technical Requirements to the Products, CUAEPP exercises control for technical safety of the facilities with excessive hazard on the territory of the nuclear power plants and defines the technical norms and rules for their design and safe operation.
By the Law for the ratification of the Additional Protocol to the Agreement between the International Atomic Energy Agency and the Republic of Bulgaria for Implementation of the Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons, CUAEPP is appointed as a co-ordinator for fulfilment of the obligations of the Republic of Bulgaria, following from the Additional Protocol.
By the law for the Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, CUAEPP was defined as a regulatory body, pursuant to Article 20 of the Convention and as a co-ordinator for the preparation of the national reports on fulfilment of the obligations of the Republic of Bulgaria, following from this Convention.

3. Change of the Administrative Structure and Functions of CUAEPP

With the Organisational Statute the CUAEPP, structure was changed and the administrative functions were specified. The structural changes are complying with the Administration Law. CUAEPP administration is organised in a Directorate General and four Directorates, distributed in General and Specialised Administration. The Executive Secretary exercises the administrative management of the administration.
The General administration assures technically the activities of CUAEPP as a State authority, to its specialised administration and activities on the administrative service of the citizens and legal entities. The General administration has 21 people on the pay roll and is organised in the "Administrative, Juridical, Financial and Housekeeping Service" Directorate.
The Specialised CUAEPP administration is organised in the Inspectorate on the Safe Use of Atomic Energy, which includes:

- Directorate General "Nuclear Facilities Safety Control" with a residential department in Kozloduy;
- Directorate "Analyses, Assessments and Investigations of Safety";
- Directorate "Radiation Protection and Emergency Preparedness";
- Directorate "International Co-operation and European Integration".

The Directorates mentioned above perform the CUAEPP activities, support and provide the exercising of CUAEPP legal authority, pursuant to the Act on the Use of Atomic Energy for Peaceful Purposes and the other laws. No substantial changes were made in the basic CUAEPP functions stated in the first report.
The organisational structure of CUAEPP administration is presented in Annex 8.

4. Changes in the Financing and the Administration Composition of CUAEPP

With the Law for the State Budget of the Republic of Bulgaria the out-of-budget account of the "Nuclear Research and Nuclear and Radiation Safety" fund, founded with the Law on the Use of the Atomic Energy for Peaceful Purposes, was closed. The available residual from this account was transferred to the CUAEPP budget for financing the expenses according to the designation of the fund. Since 1999 until now, the income from the fees for issuing CUAEPP permissions pursuant to the Law on the Use of the Atomic Energy for Peaceful Purposes are administered as CUAEPP budgetary income. The updated "Tariff for fees being collected in the system of CUAEPP pursuant to the Act on the Use of Atomic energy for Peaceful Purposes" entered into force in May 2001. This updating arranges the problem with collecting adequate resources for independent analyses. The total sum for material motivation of the CUAEPP staff is increased as well. 32 % of the income from the fees is used for purchasing necessary equipment. In 2000 1 502 208 levs (about 768 000 EURO) were spent for this purpose. For financing research and carrying out expert assessments, in relation to the exercising control activity 355 832 levs (about 182 000 EURO) were spent in 2000, and for 2001 586 077 levs (about 300 000 EURO) are scheduled. 8% of the fee income are used for additional payments to the CUAEPP personnel.
With a Decree of the Council of Ministers of 1999, the number of the CUAEPP personnel was increased from 77 to 88 pay-roll positions. At present there are 53 positions on the pay-roll at ISUAE, out of which 20 – nuclear installations safety inspectors, 8 – nuclear fuel management safety, radioactive waste and physical protection inspectors, 13 – radiation sources safety inspectors and 6 – emergency planning specialists. Seven of the inspectors work full time at Kozloduy NPP site. 95% of the inspectors have higher education and more than 60% of them have above 15-year experience in the nuclear power production.
With a Decree of March 2000, the Council of Ministers grants the CUAEPP administration Category ? 2, with which equals it to a ministry. This is one of the administrative measures to increase the payment and motivate the personnel and to help the attracting and maintaining of competent and experienced specialists.
It is envisaged in the Organisational Statute that the personnel get addition to the salary for work at the CUAEPP administration. The means for that are defined to be 25 % of the annual amount of means for the salaries of the personnel and this is envisaged to plan them in the Law for the State Budget for the respective year. This Statute gives the possibility and the procedures are ongoing to appoint the bigger part of the personnel pursuant to the Law for the State Officer, which creates possibilities for paying higher salaries (average of 65% more).

5. Relationships between CUAEPP and the Authorities Involved in Encouragement and Use of Nuclear Power

In the First national report, information was presented about the relations between CUAEPP and the Energy Committee and the National Electric Company (NEK JSC). After adoption of the Energy and Energy Effectiveness Law in 1999, the Energy Committee was transformed into the State Agency for Energy and Energy Resources (SAEER). The SAEER Chairman was assigned to develop and implement the energy policy in the country, including to propose to the Council of Ministers constructions of nuclear power plants, to manage "Safety and Storage of Radioactive Waste" and "Decommissioning of Nuclear Facilities" funds, to exercise control on the technical status and the operation of the energy facilities. Being state authorities, CUAEPP and SAEER co-ordinate their activities for carrying out joint state policy on the development of the nuclear power production and enhancement of the nuclear safety and radiation protection of the nuclear installations.
On 1 of May 2000, with a decision of the SAEER Chairman, the electric power production company "Kozloduy NPP" plc was founded, separated from NEC plc as an independent legal entity, registered pursuant to the Law on Commerce. The obligations of "Kozloduy NPP" plc as an operating organisation are stated in the section of the report on Article 9.

6. International Co-operation

During the passed period CUAEPP continued implementation of the co-operation of the Republic of Bulgaria in the field of peaceful uses of atomic energy with international organisations and, on a bilateral basis, with other countries. The efforts were addressed to the use of the international co-operation channels in order to increase the abilities of CUAEPP as a regulatory body on nuclear safety and radiation protection, for upgrading the operational safety of the nuclear facilities, for training and upgrading the qualification and safety culture of the Bulgarian specialists, for implementation of nuclear technologies, etc.
The following national projects in the field of nuclear energy were under implementation during the year 2000 with the financial support of the IAEA:

- Strengthening of the Capabilities of the Bulgarian Nuclear Safety Regulatory Authority;
- Failed Fuel Assembly Detection and Measurement;
- Technical Guidelines for NPP Seismic Re-evaluation;
- Energy and Nuclear Power Plant Study;
- Development of the Human Resources and Maintenance of the Nuclear Technology.

Ninety-five Bulgarian specialists took part in regional and inter-regional training courses and workshops, different in subject and in contents, organised in the year 2000 and supported by the IAEA. Twenty-five scientists and specialists were sent for training courses and scientific visits sponsored by IAEA.
Five IAEA expert missions and 6 training courses and workshops were held in 2000 according to the request of the Republic of Bulgaria.
Due to the bilateral co-operation with Japan, Federal republic of Germany and Slovakia 11 training courses and workshops were organised in 2000 where 19 Bulgarian specialists took part.
CUAEPP participation in the Forum of the regulatory authorities of the countries, operating type WWER reactors, including the expert working groups on the Spent fuel storage, equipment and structures ageing management, accident management and mutual inspection experience continued during the past period.

7. Planned Activities

With the adoption of the Draft Act on the Use of Nuclear Energy for Peaceful Purposes fully adequate framework for effective control will be created, which will exclude non-typical activities from the CUAEPP functions, will increase its independence through transforming it into a state agency and will open a legal possibility for permanent resolution of the financial situation.

An action plan for improving the regulatory activity is being elaborated and is scheduled to be completed by the end of 2002. The action plan is based on self-assessment of the independence, technical competence, activity organisation, financial situation, and other elements, characterising the good practice in the regulatory activity. To achieve complete and profound assessment, approaches will be used, based on the correspondence, effectiveness, and performance. In April 2001 a draft of the self-assessment in the part, concerning analysis of meeting the principles, requirements and recommendations, accepted at international level was prepared and had been in a process of approval.

In order to improve the regulatory activity on nuclear safety, the Republic of Bulgaria considers the instruments of bilateral and multilateral co-operation, as well as the co-operation with IAEA, as being especially useful. Since 1997, an IAEA model project has being implemented, which aims at strengthening CUAEPP abilities in the field of licensing, development of national standards and requirements on nuclear safety, and quality assurance of the inspection activity. This year, following a new project by the Federal Ministry for Environmental Protection and Nuclear Safety (BMU) of Germany, to support the regulatory bodies of the East-European countries, implemented by GRS, co-operation with CUAEPP and Bulgarian organisations, performing its technical support was commenced. The work is concentrated on the operating reactors, at which measures to enhance the safety are being implemented, as well as on the issues of decommissioning of Kozloduy NPP Units 1 and 2.

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 Contents of the First National Report on Article 9 of the Convention

In the First national report a description is given of the basic rights and obligations of NEC plc and Branch Kozloduy NPP as permission holders pursuant to the meaning of the Convention on Nuclear Safety. The temporary organisational structure of NEC plc and Branch Kozloduy NPP is also included and the rights and obligations are described both of the managing authorities and of the responsible officers. The regulatory activity of CUAEPP and ISUAE is also noted and the instruments, which provide fulfilment of the basic obligation for safety assurance by the permission holder.

2. Change of the Entity, Appointed as Kozloduy NPP Operator

By Decision No. 70 of the Council of Ministers, dated 20.02.2001, all the nuclear facilities on Kozloduy NPP site are defined as one nuclear installation, with Kozloduy NPP plc being its operator pursuant to the meaning of the Vienna Convention on civil liability for nuclear damage.

3. Description of the Basic Obligations of Kozloduy NPP plc

Kozloduy NPP plc, as an operator pursuant to the meaning of the Vienna Convention on civil liability for nuclear damage is the bearer of the respective civil liability and as "a permission holder" pursuant to the meaning of the Convention on Nuclear Safety has the responsibility for the safety of the nuclear facilities, located on Kozloduy NPP site. This status is reflected in the Kozloduy NPP plc. Statute (Article 2, paragraphs 2 and 3) and in the Organisational and Activity Rules (Articles 5 and 6).
Based on this, the company was granted a license by the State Commission on Energy Regulation for production of electric and thermal energy (Decision No. L-049, dated 11.12.2000 of SCER).
According to Article 15 of the Act on the Use of Atomic energy for Peaceful Purposes, (AUAEPP) the operating company is responsible to assure meeting of the safety requirements. The rights and obligations of Kozloduy NPP plc are specified in the Statute, the Company's Organisational and Activity Rules, the Rules for Structural Units Activities Organisation as well as in the job descriptions of the personnel all over the entire hierarchical management structure.
The responsibilities and the obligations of Kozloduy NPP plc are summarised in Article 7 of the Company's Organisational and Activity Rules and can be summarised as "performing activities for maintaining and enhancing the nuclear safety, radiation protection, physical protection, emergency preparedness, industrial safety, health protection of the personnel, the population and environmental protection".

With Kozloduy NPP plc Organisational and Activity Rules(Article 8) as a top priority in performing the entire company activities the principle is determined: “obeying the requirements for nuclear safety, radiation protection, as well as protecting the life and health of the personnel, the population and the environment have priority before the production and other public needs”.
Other principles are:

- Application of the quality assurance system as a part of the management system, in order to meet the nuclear safety and radiation protection requirements, to enhance the safety culture, to take the human factor into account, to provide engineering support, to minimise the radioactive waste, to apply the operational experience in correspondence with the IAEA recommendations;
- Keeping up a high level of nuclear safety, radiation protection, physical protection, emergency preparedness, fire protection and industrial safety.

4. Structural Assurance of the Relationships and the Conditions, which are Safety-Related

Kozloduy NPP plc is an independent legal entity, registered in compliance with the Law of Commerce, which makes up independent balance and has payment accounts.
A General Assembly and a Board of Directors manage the Company.
The General Assembly is supported in its activities by a Consultative council.
The Consultative council discusses and formulates proposals related to the activity of the Company. Activities with top priority are those, linked to the safety, production programme and the economic programme of the Company (Art.31 of the Statute); matters of strategy of the Company development; implementation of the normative acts in force related to the Company activity; programmes and projects, related to safety, radiation protection and environmental protection” (Article 6, Items “a”, ”d” and “e” of the Organisational and Activity Rules of the Consultative Council of Kozloduy NPP plc).
The Executive Director is responsible for performing activities and deals, according to Article 30 of the Company Statute.
Kozloduy NPP plc organises and manages its commercial activity in compliance with the Statute and Organisational and Activity Rules of the Kozloduy NPP plc. Within the framework of its subject of activity, the company can enter into legal and factual relationships with local and foreign legal and physical entities, national and regional state institutions and national and international non-governmental (public) organisations. The legal and factual relationships cover: the allowed deals, contacts, participation in and holding negotiations; agreements; provision and use of information (pursuant to the law) in the field of electric energy, produced by nuclear sources; investments; operation; scientific, research and development activities, including in the field of the professional qualification.
According to Article 2, Paragraph 2 of the Statute, “Kozloduy NPP plc exercises the rights of an operator of nuclear facilities as regards to the operation and safety pursuant to the meaning of AUAEPP.
According to Article 30, the Executive director of Kozloduy NPP plc:

- “Organises the activities of the company, provides the management and the protection of the Company property”;
- “Manages and is responsible for the activities performed on the site and in the zone of the emergency planning in normal and emergency situations”;
- “Is responsible for the fulfilment of the electric power production programme of the Company while meeting all the legislative safety requirements”;

- "Monitors and is responsible for the good economic status of the Company".

The Safety and Quality Council is founded as a consultative authority to the Executive Director, members of which are leading specialists and experts of the company. Their task is to carry out analyses for the safety status of given projects and technical solutions, as well as to suggest measures for its upgrading.
For managing the activities on control and assurance safe use of nuclear power, at Kozloduy NPP plc a directorate "Safety and Quality of NPP" was founded.
The Directorate is reporting directly to the Executive Director and consists of 3 Departments, which exercise control on Kozloduy NPP plc activities. The Departments are respectively "Safety", "Quality", and "Security".
The major task of the Directorate is organisation and control for creating and maintaining all the necessary conditions for safe use of nuclear energy, in compliance with the national legislation and the international codes and criteria (Article.5.1.1 of the Safety and Quality Directorate Organisational and Activity Rules). The Directorate is authorised by the Executive Director to lead the policy of the Senior management for assuring safety and quality, to perform internal control over the safe use of atomic energy according to the national legislation and the applied standards and norms.
The Directorate maintains relationships with CUAEPP, other interested ministries, departments and international organisations, exercises control on the execution of prescriptions and conditions of the permissions, granted by ISUAE.
The following legal powers are assigned to the Director of the Directorate, according to Article 60 of Kozloduy NPP plc Organisational and Activity Rules :

- To terminate immediately the execution of activities at finding violations to the safety requirements and the execution of activities violating conditions of ISUAE permissions, informing the Executive Director about it;
- To personally execute and give orders to the reporting personnel to exercise control on the activities of the whole NPP personnel for meeting the established requirements for safety use of the atomic energy;
- To issue obligatory prescriptions to the respective managers for preventing or eliminating violations to the requirements for safety use of the atomic energy.

All structural units in Kozloduy NPP plc have regulated relationships and officially approved organisational structures with clearly defined and documented scope of activity, rights, obligations and responsibilities, assuring fulfilment of the major obligations in relation to the held permissions.

The executive personnel, whose work is related to safety and quality assurance, is responsible for:

- Execution of its own obligations according to the developed written instructions and procedures;
- Documentation of the results of the performed activities;
- Maintenance of the technical availability of the assigned facilities and auxiliary equipment;
- Keeping up the professional knowledge.

5. Assessment of Kozloduy NPP plc Organisational Structure

An expert IAEA Mission for independent assessment of the organisational structure was held at Kozloduy NPP in the period 19-23.02.2001. The goal of the Mission was to help NPP in

achieving safety enhancement through executing external review of the organisational structure and assessment of its effectiveness. As a result of the presented information, the walk-downs, interviews with the managers and the rest of the personnel, the IAEA experts prepared a draft report for the results of the Mission.

Recommendations made in the report are addressed to improvement of the functional relations inside and between the NPP organisational units and to reassessment of the structure and the concept for quality assurance as well.

These recommendations have been taken into account by adoption in March 2001 of the Programme for development of unified managerial and working documents on quality and environmental management. The deadline for fulfilment of the Programme is December 2001.

Part of the extrinsic activities and functions of Kozloduy NPP have been removed from the Company composition.

The basic conclusions and recommendations of the IAEA Mission experts are presented in Annex 9.

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 Contents of the First National Report on Article 10 of the Convention

In the previous national report the priority of safety is declared, defined in the general principles of the Act on the Use of Atomic Energy for Peaceful Purposes (AUAEPP) as a basic principle. It is incorporated in the whole activity of all organisations, related to the nuclear power production and their respective policy for its meeting. Following this principle continues to be in the basis of all the activities, related to the safe use of the nuclear power.
The policy was reviewed of the Committee on the Use of Atomic Energy for Peaceful Purposes as a control body, carrying out the state policy in the field of the safe use of the nuclear power and the activities, through which this policy is implemented. The basic documents, forming this policy are presented. Attention is paid to the policy of the operating organisation. The role of other safety-related factors is discussed, as, except the normative basis and the legislation in the sector, – important factors turn out to be the financial and the personnel assurance of the nuclear power production. The issue of the importance of the Safety Culture to the safe use of the nuclear power is mentioned. There is a brief description of the applied practice and the ways in which Safety Culture is formed.
In the following sub-sections the basic changes, introduced in the period after 1998 are presented, imposed by structural changes and changes in the normative documents.

2. Safety Policy of the Operating Organisation

The policy of the Kozloduy NPP plc management is developed in correspondence with the requirements of the Convention on Nuclear Safety, AUAEPP, The National Strategy for Development of the Energy Production and Energy Effectiveness by 2010 and is in compliance with the principles, stated in the reports INSAG-3 "Basic Safety Principles for Nuclear Power Plants", INSAG-4 "Safety Culture" and INSAG-13 "Management of Operational Safety in Nuclear Power Plants", issued by IAEA.
In the company's document "Safety Policy in Kozloduy NPP plc" safety is raised as supreme priority in the operation of the NPP. The major goal of the safety policy is permanent raising and keeping up the level of safety culture in correspondence with the modern international standards and criteria, considering the achievements and the good practices of the leading countries with developed nuclear power production.
Kozloduy NPP plc declares its policy as regards to safe radioactive waste management in the document "Policy on Safe Radioactive Waste Management", and as regards to safe decommissioning – in the document "Policy on Safe Decommissioning of Units 1 and 2".
The basic priorities of the Kozloduy NPP plc Management are expressed in the Declaration on Safety Policy, namely:

- Consistent and permanent rising of the safety level, quality and safety culture in the NPP operation;
- Consistent and permanent implementation, analysis, and development of the system of methods and means for self-control and self-assessment of the activities;

- Planning, control, and analysis of the activities, related to safety, and maintaining a system for development of corrective measures for elimination of discrepancies;
- Establishment and development of a modern system for selection, qualification, and motivation of the personnel;
- Implementation and development of modern systems for: support of operators and technological teams, operational experience feedback, monitoring of the operability and reliability of the systems important to safety;
- Application of modern methods for effective management and mobilisation of the efforts of the whole personnel for achieving stated goals.

The following important documents have been developed and empowered for management of the basic safety-related activities:

- Programme for Safety and Effective Management of the Fuel Cycle at Kozloduy NPP plc;
- Complex Programme for Radioactive Waste Management;
- Programme for Bringing up the Activities at Kozloduy NPP plc in compliance with the requirements of the legislation on the environment and the ambient working conditions;
- Programme for Risk Assessment;
- Programme for Minimisation of Solid and Liquid Radioactive Waste;
- Programme for Enhancing the Level of Physical Protection at Kozloduy NPP plc.

3. Other Safety Related Factors

A system was created for keeping up, updating and prompt informing the Kozloduy NPP plc structures and units with changes and amendments made to the normative documents.
The managers are trained to apply modern means of control: teamwork; leadership; creating good communication vertically and horizontally; conflict resolving; management of changes.

4. Safety Culture and its Development

The basic characteristics of the Safety Culture find a clear expression in Kozloduy NPP plc activities. The Declaration of the Managers, concerning the policy, demonstrates the understanding, that assuring safety is a supreme priority in the whole performance of the NPP. The safety policy is made familiar to all levels of personnel.
The managing team possesses experience in the field of safety at NPPs. At the operative meetings at all levels the safety issues are discussed and analysed, and the especially important ones are subject to review by the Safety and Quality Council – consultative authority to the Executive Director.
In the organisational structure of Kozloduy NPP plc the responsibilities, concerning the safety-related activities are clearly defined. Establishment of the "Safety and Quality" Directorate as reporting directly to the Executive Director and the delegated wide range of authorisation demonstrate the priority of safety in the policy and practice of Kozloduy NPP plc.
As a part of the practice for implementing Safety Culture, special lectures and courses on safety culture are held, a big part of which have been developed based on international co-operation (with the USA, IAEA workshops, etc.). Special significance for the development of the safety culture is placed on the new programme "Twinning" for co-operation between Kozloduy NPP and NPP Bugey – France. Great attention is paid to the work of the personnel with external companies, with different culture of behaviour as regards to the training and the control of the activity performance at NPP.

In addition to the applied practice to assure safety culture, described in the previous report, an approach for self-assessment of the personnel is introduced and applied, aiming at training responsible, personal attitude to the activities, performed by everyone. The acronym "ЗОНА" is used (Задръж – wait a little, Обмисли – think over, Направи - do, Анализирай - analyse) as an illustration to this approach, which is identical to the STAR approach (initials of the English words. **S**top, **T**hink, **A**ct, and **R**eview). Based on the self-assessment being made by different structural units in the NPP through analysing the introduced system of indexes, the respective corrective measures are identified.

Special attention is paid to the operational experience feedback, both from the NPP and from others too, to improve the safety level. Based on the event and deviation analysis for Kozloduy NPP plc and other NPPs, as well as on internal and independent audits and safety reviews, the root reasons for the discrepancies with the safety criteria and standards are identified and corrective measures are planned.

A system for analysing the root reasons for events is applied according to ASSET methodology (initials of the English words Assessment of Safety Significant Events Team), which assures identification of the mistakes and their prevention by the expert authorities of Kozloduy NPP plc. The criteria for reporting and event analysis were expanded aiming at preventing some less significant events and deviations. The personnel are permanently trained and encouraged to report events and deviations.

The practice of applying penalty measures (obvious and of hidden character) is stopped, including fines and other administrative punishments to separate employees, who have allowed technological errors. Such a practice may discourage the personnel to disclose and report safety problems and deprive the operating organisation of a useful source of lessons.

The operational order on site and the working environment at Kozloduy NPP is maintained and permanently improved.

The policy and the practice of the operating organisation for the formation of safety culture is subject to a comprehensive assessment by the Missions, organised by IAEA.

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 Contents of the First National Report on Article 11 of the Convention

In Item 11.1 of the First national report, a description of the financial instruments and sources for financing the measures enhancing the Units safety is given, the sources of means for decommissioning and means for safety radioactive waste and spent fuel management in the branch Kozloduy NPP, as a part of NEC plc and without accounting profit, according to the Accountancy Law.
In Item 11.2 information is provided about the human resources in the field of the nuclear power production, about the legislative basis and the qualification requirements to the different groups of personnel, the responsibility for training and qualification. Information is provided about the educational system in the Republic of Bulgaria and the technical means for training and maintaining the qualification of the Kozloduy NPP personnel.

2. Management of the Financial Resources

In the year 2000, as a result of the separation of Kozloduy NPP as a self-managed commercial company in compliance with the Law of Commerce, the responsibilities for the provision of financial resources for the NPP's safety changed substantially.
A source of the resources at Kozloduy NPP plc disposal is the income from the electric energy sales. The company performs its financial activity in correspondence with the requirements of laws, effective for the whole country and secondary legislation and NPP internal documents.
According to Chapter II, Article 7 of the "Organisational and Activity Rules of Kozloduy NPP plc", one of the basic functions of the company according to the scope of its activity is " 12. Management of the Finance and the Material Resources of the Company". A Board of Directors by the Executive Director and his Deputy - Article 68(4), manages the whole economic activity of the company. This function is implemented through the Annual Business Plan of the company, which is developed and approved in correspondence to the requirements of Article 69 of the Rules.
According to Article.68 (2 and 3) of the Rules "The economic activity is performed by the basic structural units at the expenses of the company… Their activities are financed based on approved by the Board of Directors annual investment, operation and maintenance budgets and is based on the annual business plans".
As a result of the separation of Kozloduy NPP plc as a self-managed company and the development of the normative basis, all expenses, related to the fuel cycle are included in the structure of the Company expenses and are covered from the sale of electric energy. The structure of expenses is approved by the state Agency on Energy and Energy Resources and

after 01.01.2002 – by the State Commission on Energy Regulation. The revenues of the Company are formed mainly by the Contract for buying electricity and power signed with the National Electric Company.

Sources for Financing the Measures for Enhancing the Units Safety

With the separation of the NPP as a self-managed joint-stock company since 01.05.2000, the finances are provided from the income derived from selling electric power, credits and donations.

With the income from the sales are provided financial means for support of the production process.

Investments with own funds are financed from the profit and allowances for depreciation.

With own funds the measures are financed from the developed Complex Programme for Reconstruction and Modernisation of Units 1- 4. In 1998 the funds for the implementation of this programme were assessed to be up to $ 150 million. In relation to the decision for the earlier decommissioning of Units 1 and 2 and considering the amendments to the Complex Programme made by leading western companies, since the beginning of 2000 a new revision of the Programme is being implemented. By the mid-2001 the Programme was almost 60% implemented. The remaining part of the Programme is estimated to be $ 40 million and is scheduled to be completed in 2002.

The programme for the reconstruction of Units 5 and 6 of Kozloduy NPP is a high priority task from the Strategy for the development of the energy production and the energy effectiveness by 2010. It is a part of the Investment Programme of the Government. The completion of the implementation of the programme is scheduled to be in 2006 and it is financed by foreign loans.

Loan Agreements, with a total amount of about $ 380 million, were concluded with EURATOME, Citibank (USA) and Rosseximbank (Russian Federation) to finance the implementation of the Measures from the Programme for Units 5 and 6. State guarantees were presented for this purpose. The contracts with the Main Contractors: Framatome (France), AtomStroyExport (Russia) and Westinghouse (USA) were signed and are being fulfilled. The investment plans of Kozloduy NPP include about $ 50 million own funds for co-financing the Programme as well.

Besides these basic Programmes for reconstruction and modernisation of the Units, the investment plans of Kozloduy NPP plc include funds for enhancing the physical protection and the environment in the vicinity of the NPP.

The investments for the decommissioning of nuclear facilities and storage of radioactive waste are financed from the funds “Safety and Storage of Radioactive Waste” and “Decommissioning of Nuclear Facilities” and foreign donations.

Decree ? 15 of the Council of Ministers, dated 1999, approved “The Regulation on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund “Safety and Storage of Radioactive Waste”” and “The Regulation on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund “Decommissioning of Nuclear Facilities”. According to the requirements, provided in these Regulations, from 01.01.1999 to 31.12.2000 Kozloduy NPP contributed means equal respectively to 3% and 8 % of the gross electricity production. Since 01.01.2001, with the introduction of an amendment in “The Regulation on Determining the Amount of the Contributions and the Order for Collecting, Spending and Control over the Financial Resources of the fund “Decommissioning of Nuclear Facilities”, the contribution was changed from 8 to 15%. As a result of this, by the mid-2001 in the “Safety and Storage of

Radioactive Waste" fund 30 million levs are available, and in "Decommissioning of Nuclear Facilities" fund – 100 million levs.
The preparation and the decommissioning of Units 1 and 2 is financed with means from "Decommissioning of Nuclear Facilities" fund and by the International Fund Kozloduy, founded in 2001, financed mainly by the European Commission.
In 2001, according to the requirements of the Vienna Convention on the Civil Responsibility for Nuclear Damage, the preparation was commenced for provision of financial guarantee for covering the claims of third parties as a result of a nuclear accident. The type of this guarantee is defined by the Council of Ministers and is a Civil Responsibility Insurance.
Under the PHARE Programme – Nuclear Safety additional funds are still being granted for enhancing the safety of Units 1 – 6, and at the moment there are eight effective contracts of a total value of approximately 6 million EURO.
Under IAEA programmes financing of three projects for Kozloduy NPP has been planned.

3. Human Resources

Responsibility for the Training and Qualification

At the basis of the programme for training NPP personnel is the Bulgarian education system, the structure of which has not been changed after 1998.
Basic factor for the training and qualification of the personnel at Kozloduy NPP is the effective operational training. The Executive Director of Kozloduy NPP plc, the heads of the respective structural units and the Personnel Department at the Training Centre are responsible for the training of the personnel.
The Training Centre at Kozloduy NPP is located on the site at the plant. The construction of the Training Centre was completed in 1993 and it has been functioning since then.
In 2000 the simulator complex was built, with a full size simulator of WWER-1000, multifunctional simulator of WWER-440 and demonstration halls.

Qualification Requirements for Different Groups of Personnel

The requirements to the personnel, working in the field of the use of atomic energy are specified in the Regulation No. 6 of CUAEPP, dated 1989. The basic document, which regulates the organisation, management, performance and the control on training, retraining, maintaining and increasing qualification, recognising competence and qualification control of the Kozloduy NPP plc personnel is the updated in 2000 "Regulations for Training and Qualification of Kozloduy NPP plc Personnel".
From the point of view of the qualification requirements to the personnel, in 2000 the existing 5 groups of personnel were transformed into 3, as follows:

- Group ? – operative and management personnel, subjected to testimony by the State Qualification Commission (SQC) (the positions, specified in correspondence with Regulation No.6 of CUAEPP);
- Group B – managers, specialists and employees in the structural units at Kozloduy NPP plc, subjected to exams on technical operation and not included in group A;
- Group C – managers, specialists, employees and supporting personnel in the structural units of Kozloduy NPP plc.

The qualification requirements for assignment for each position in Kozloduy NPP plc are described in detail in the respective job descriptions. The job descriptions of the personnel, directly involved in the use of nuclear power, are agreed by CUAEPP.
The simulator training of the operators at Units 1-4 at the full size simulator is done at the Training Centre of Novovoronej NPP-Russia, and since 2000 additional training is carried

out, as well, at the multifunctional simulator of WWER-440 at the Training Centre of Kozloduy NPP plc.
Since 2000 the training of the operators of Units 5-6 at the full size simulator is carried out at the Training Centre of Kozloduy NPP plc.
The CUAEPP introduced certain changes, concerning the licensing policy for the personnel, after the presentation of the national report, in 1999, as follows:

- New exam questionnaires were developed and list of the management personnel, subjected to state testimony;
- The licensing of a part of the management personnel has being done through sitting an exam in front of the SQC. By 1999 the licensing was performed by internal NPP examining commissions;
- In 2000, the new full size simulator for Units 5 and 6 was licensed. It fully corresponds to the practice, described in the IAEA TECDOC-685 and the American Code ANSI/ANS 3.5;
- The use of the full size simulator is envisaged in the licensing process of the operative personnel of Units 5 and 6.

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 Contents of the First National Report on Article 12 of the Convention

The approach of the Branch Kozloduy NPP's at considering the role of the human factor in the operation of the nuclear Units is described in the first national report.
In the part, concerning Item 12.1, information is provided on personnel selection and work conditions, based on the requirements of Regulation No.3 of the Minister of Health, of the Law for Healthful and Safe Work Conditions, adopted in 1997. In the same part, information is provided about the consideration of human factors in the designs of the Kozloduy NPP nuclear Units.
In the part, concerning Item 12.2, information is provided about the functioning system for human error analysis at the Branch Kozloduy NPP, as well as about the studies performed on the human activities. The approach is described, as well, to personnel management at Kozloduy NPP.
In the part, concerning Item 12.3, information is provided about the operator's policy in the field of personnel management.
In the part concerning Item 12.4, information is provided about the role of the regulatory body in relation to the human factor.

2. Measures Taken to Guarantee the Consideration of the Human Factor after 1998

Organisational and Management Issues

The approach, which is applied by Kozloduy NPP plc, for taking into account the role of the human factor in the operation of the Units, is based on the document "Declaration of Kozloduy NPP plc Management on Safety Policy", dated 2000.

The engagement in relation to the human resources is recorded in the Declaration:

- Appointing the necessary personnel;
- Maintaining the personnel qualification;
- Creating normal work conditions at the work place;
- Appointing the best-prepared and competent specialists at key work positions.

During 2000, with the introduction of the new administrative structure of Kozloduy NPP plc, the functions on the preliminary selection, professional selection, training and qualification of the personnel were separated. The preliminary selection of the personnel is performed by a team, which is within the structure "Administration and Control" Department. The rest of the activities are performed by "Personnel and Training Centre" Department.
An uniform information system for Kozloduy NPP plc has been created and is under development. It is designated to accumulate and process data and covers the local networks of separate structural subdivisions. The Managerial Information System and Document Accounting and Decision Control System are under implementation.

Personnel Work Conditions

An optimised model of health monitoring of operational and maintenance personnel is being implemented at Kozloduy NPP plc.

The medical file of the workers and the officers of Kozloduy NPP plc, planned to be developed, is currently in the process of implementation and includes:

- Personal radiation passport;
- Personal health file of a Kozloduy NPP plc employee;
- Emergency medical fiche.

The activities of the Safety and Health Authorities for work at an NPP are regulated. They organise and carry out the activities, related to the protection and preventive measures towards professional risks and assurance of safe and healthy labour conditions.

A Work Conditions Committee and Work Conditions Groups were established at Kozloduy NPP plc.

Following the provisions of the Regulation No. 5 of 1999 of the Minister of Labour and Social Policy and the Minister of Health on the order, way and periodicity of risk evaluation:

- Assessment is made of the health hazards and safety for the workers and officers at Kozloduy NPP plc, which covers the work processes, equipment, rooms, work places, labour organisation, raw and other materials, and other side factors, which may initiate risk;
- Planning and implementation of specific measures to handle the professional risk at work places is forthcoming, and in case of residual risk – taking measures for employees' protection

In compliance with the provisions of the Regulation No. 7 of 1999 of the Minister of Labour and Social Policy and the Minister of Health on the minimum requirements for health and safe labour conditions at the working places and at using work equipment, measures have been taken to:

- Bring the labour conditions to the individual characteristics aiming at decreasing up to excluding their harmful impact on health;
- Introducing technical progress in the technological processes, machines and facilities;
- Replacement of hazardous manufactures, work equipment, tools, substances, raw and other materials with safe or less hazardous ones;
- Priority to the measures for protection against the harmful impact of group exposure to the individual exposure;
- Provision of the necessary information, concerning assurance of healthy and safe labour conditions for the workers and the officers of Kozloduy NPP plc;
- Labelling the existing hazards and the sources of harmful to the health and safety factors;
- Maintaining the work place and the work equipment in proper operating order and eliminating in the shortest possible time, all malfunctions, which may affect employees' health and safety;
- Regular cleaning of the work place, work equipment, and the routes to them;
- Checking and keeping in order the protection equipment and the collective and personal protection means;
- Maintaining the routes to the emergency exits and the exits themselves unoccupied;
- Maintaining and promptly repair of the work equipment during the whole period of its use and after its decommissioning, so that to avoid hazards to the employees' health and safety;
- Limiting the number of the people, using work equipment that bears potential risk for their health and safety.

Design Activities

KNPP units 1-4 have special design features that significantly reduce the probability of human errors such as negative power coefficient in the whole range of operational and accident conditions, large water reserves assuring long time margins in case of accidents, low power density in the core, etc. All these features are available now and will be still available when the upgrading program of KNPP 3&4 units is completed.

Moreover, KNPP has not only undertaken studies of human factors which are presented below, but also implemented important improvements aimed at facilitating the work of the operator under accident conditions.

The man-machine interface factor is taken into account in the technical Measures of the Modernisation Programmes for Kozloduy NPP Units. The Main Control Rooms of Units 1-4 have been modernised aiming at improved work conditions for the operators – lighting, labelling, air-conditioning and noise reduction.

The improvements aimed at preventing possible operator's errors include installation of Safety Parameters Display System in the control room and upgrading of main control room layout. The KNPP is also presently implementing SO EOPs, which may be of decisive importance for assuring correct operator's reaction during accidents. All these improvements reduce probability of human errors very much, assuring far greater reliability of plant operator's decisions than could be possible in KNPP 1- 4 units at the time of the original design.

Study on the Role of Human Factor

Psychological and physiological selection and assessment are made of the suitability of the Kozloduy NPP operational personnel according to psychological and physiological criteria. The entire investigation aims at argumentation of the reliability of the operational personnel taking into account the characteristic of the operator's work. The investigations carried out cover each newly appointed person for the operator position and all the persons applied to the Regulatory body for licensing and re-licensing for the relevant operator position. The investigation and assessment of the suitability according to psychological and physiological criteria is carried out in the internal NPP laboratory. The entire activity of the Psychological and physiological laboratory is to provide functional reliability of the operational personnel by initial selection, periodic control and consultative activity.

The following has been developed and added to the system for consideration of the role of the human factor, based on the IAEA ASSET methodology, through wide application of INPO (initialised from the Institute for Nuclear Power Operation) methodology for Human Factor analysis:

- Methodology for Identification of the Human Factor as Initiator of Events;
- Determination of the Type of Human Errors;
- Selection of Indicators for Defining Criteria for a Reliable Human Factor;
- Selection of a Methodology for Defining the Subjective Criteria for a Reliable Human Factor and Quantitative Assessment of the Subjective Reliability Criteria;
- Development of an Inquiry Card and Carrying out Inquiry among the Operative Personnel.

The "Methodology for Analysis of the Human Factor as a Cause for Operational Events Initiation" is about to be completed.

The following items are planned to be completed by 2002:

- Updating of the internal instructions of Kozloduy NPP plc and of the methodology for event analysis and feed-back from the operational experience based on the documents, enlisted above, as well as;

- Expanding the computer database for analysis of events with abilities for additional analysis of the human factor.

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 Contents of the First National Report on Article 13 of the Convention

In the part of the report on Item 13.1, the policy of NEC plc for assuring nuclear safety and radiation protection through the assurance of high quality of all activities at all levels of hierarchy is reviewed. The system of legal rights and obligations delegation at all levels of management is presented.
In the part of the report on Item 13.2, a historical review of the measures for quality assurance by 1990 is made.
In Item 13.3 the normative basis and the requirements of the normative documents, adopted by CUAEPP for development of a quality assurance programme during design, construction and operation of an NPP are reviewed.
In Item 13.4 the quality assurance system during design of the Units, its development and its current status are presented in detail.
In Item 13.5 the quality assurance system during construction and commissioning, the distribution of the responsibilities, the exercising of control and quality assessment are described.
In Item 13.6 the quality assurance issues during operation are described in detail and the quality assurance system at Kozloduy NPP is presented, including the quality assurance at the independent sub-divisions of KNPP and at using the services of external organisations and at implementing modifications.
In Item 13.7 the activities in the field of the regulatory control are described and Item 13.8 presents the planned actions for improving the quality assurance system at the Branch Kozloduy NPP.
Separate quality assurance aspects are specified in the answers to the questions asked to the national report.

2. Quality Assurance Policy

The separation of Kozloduy NPP plc as an independent company, the analysis of the results of the previous activities on quality management at Kozloduy NPP plc, as well as the forthcoming reconstruction and modernisation with the participation of partners from the USA and Western Europe, imposed reassessment of the former quality management system.
As a result, Kozloduy NPP plc has selected and has been developing and implementing a quality management system in compliance with the Bulgarian State Standard (BSC) EN ISO 9001:1996, taking into consideration the recommendations of IAEA incorporated in the IAEA documents 50-C/SG-Q.
Basic purpose of the Kozloduy NPP plc management is to reach a reasonably achievable and acceptable level of safety, reliable and economical performance of the electric energy generating equipment.
The company management in its Declaration on the Quality Policy states that:

- It applies the Quality management system as an element of the management system for reaching production goals under assured safety.
- The activities are managed aiming at meeting the requirements of the nuclear safety and radiation protection, enhancing the safety culture, considering the human factor, providing engineering support, and minimising the radioactive waste.
- The activity of bringing quality management system requirements to each member of Kozloduy NPP plc team is defined as a major task.
- Assigns to the managers at all levels of management to provide the necessary conditions for meeting the requirements of the quality management system.
- Demands from all employees to be familiar and to act in correspondence with their legal rights and responsibilities related to safety assurance and quality management.
- Assigns the Director of ”Safety and Quality” Directorate to perform the functions of a quality manager.

The requirements, brought by the changes of the legislation are reflected in the documents of the quality system at Kozloduy NPP plc.

3. Development of the Quality Management System at Kozloduy NPP plc

Since the end of 2000 a uniform quality management system is functioning at Kozloduy NPP plc, which is documented in the Quality Management Manual. The Quality Manual is developed, following the structure determined in BSS EN ISO 9001:1996 and describes:

- The management policy concerning the quality assurance;
- The structure of the documents of the quality system;
- The distribution of responsibilities concerning quality assurance, nuclear safety and radiation protection;
- The general requirements on quality assurance and documents, through which their implementation is assured.

At the separate basic structural units of Kozloduy NPP plc, quality assurance programmes are applied, developed and documented in compliance with the IAEA recommendations (Safety Series No 50-C/SG-Q). A part of the level I and II documents from the quality management system have been updated, taking into consideration the new organisational structure, while others are being updated. Their development is performed following an established programme. Procedures on configuration management have been developed and personnel have been trained. A pilot project in one of the structural units was completed. One of the elements of the configuration management was implemented – document management in the operation divisions. A system for configuration management is being developed to serve the Modernisation Programme for Units 5 and 6, by an external engineering organisation. The Quality Assurance Programme for the Modernisation Programme for Units 5 and 6 is presented in Annex 10.

In the structural unit "Personnel and Training Centre (TC)", the activities of which are directed to selection and appointing qualified personnel and initial and periodical personnel training, including the personnel of the external organisations, a quality system was introduced at the beginning of 2001. This programme was developed based on the requirements of BSS EN ISO 9001:1996 and is documented in the Manual for Quality Assurance in the “Personnel and Training Centre” Division.

In the structural unit Test Centre “Diagnostics and Control” a quality system based on the requirements of BSS EN ISO 9001:1996 was introduced. The system was documented in Manual on Quality Management in the Test Centre “Diagnostics and Control”, which was empowered in the beginning of 2001.

The commissioning of the Radioactive Waste Processing, Conditioning and Storage Facility as a new facility was performed in compliance with "Quality Assurance Programme at Commissioning". The Programme is a necessary condition for obtaining CUAEPP permission for commissioning.

Kozloduy NPP plc, being an operating organisation, is responsible for quality assurance of the services provided by external organisations as well. Prior to concluding a contract, all submitted quality assurance documents of the external organisation are reviewed (Quality Manual, Quality Assurance Programme, Quality Plans, etc., proving the capability of the external organisation to perform a good quality job in correspondence with the contract requirements). The activities, important to safety, performed by external organisations are in correspondence with approved Quality Assurance Programmes for the activity and, if necessary, they are assessed through audits and inspections. As it is noted in the First national report, these activities are performed based on contracts and in compliance with the requirements of the Regulation No. 5 of CUAEPP and of "Instructions for Work of External Organisations under a Contract Signed with Kozloduy NPP plc". The order for using services of external organisations, the distribution of responsibility for safety and quality assurance, the requirements to the quality assurance plans of the external organisations are specified in the instruction.

The IAEA Mission for the assessment of the organisational structure, held in February 2001, assessed the work with the external organisations as adequate to the IAEA recommendations.

4. Methods for QA System Effectiveness Assessment

The assessment of the QA system effectiveness at Kozloduy NPP plc is made through:

- Internal audits of the quality system within the separate structural units of the company;
- External audits of the quality systems of the external organisations, working under contracts, signed with Kozloduy NPP plc;
- Independent ISUAE assessments;
- Independent assessments of international expert missions.

The audits are held according to an annual plan. The planning takes into consideration the importance of the performed activity to safety. The order for performance, reporting and control of the corrective measures is determined in a document, approved by the Executive Director of Kozloduy NPP plc. The "Safety and Quality" Directorate exercises control on the implementation of corrective and preventive measures.

The results of audits and the implementation of the corrective measures are used as input data for the analysis of the nuclear facilities safety status, carried out annually. As a result of the analysis, additional preventive measures are applied at repetition of the found discrepancies and at comparison with the data from the analysis of the operational experience.

“Safety and Quality” Council reviews and proposes for approval by the Executive Director top-tier quality assurance documents and the periodic reports of the structural units concerning the quality status of the company.

This approach ensures a continuous improvement of the quality system at Kozloduy NPP plc.

The independent review of the quality assurance system is performed during the OSART mission, held in the beginning of 1999. The implementation of the necessary measures taken for the resolution of the findings and for meeting the recommendations and suggestions was assessed by the FOSART mission, held in the beginning of 2001.

5. The Role of the Regulatory Body

The ISUAE performs the following basic activities in meeting the requirements of the legislation:

1. Approval of the Quality Assurance Programmes

The quality Assurance Programme is one of the documents, presented by the operating company with the application for obtaining permission for certain activity (design, construction, operation, including for services and procurement of equipment). The approval is formalised through the issuing of permission to the operating organisation for the performance of the activity.

2. Check on the application of the Quality Assurance Programmes

A mandatory element of the inspections, performed by CUAEPP is to check the practical application of the Quality Assurance Programmes. The inspections are held in correspondence with an approved programme and the results are documented following the order of an internal instruction.

6. Activities, Planned by Kozloduy NPP plc for the Development of the Quality System

The following activities have been planned for the improvement of the Quality Assurance System:

- Continuing the activities for the implementation of the configuration management system in the operational sub-divisions;
- Development of a Quality Assurance Programme for Operation of the Radioactive Waste Management Complex by 2002;
- Development of a Quality Assurance Programme and the other documents for the decommissioning of Units 1 and 2 by the end of 2002.

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 the 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 Contents of the First National Report on Article 14 of the Convention

In the "Safety Assessment" sub-section of the First national report, there is a review of the licensing process for nuclear facilities, as well as the requirements to the safety analyses reports. The initial status is presented and the implemented measures are addressed for improving and updating of the safety reports for bringing them into conformity with the given recommendations, contained in the "Structure and Contents of the Safety Substantiation Report for the Operating Units 3 and 4 with Reactor Type WWER 440/B230" and with the modern international practice. These measures aim at reflecting the actual status of the Units and the safety level, taking into consideration the introduced and forthcoming design changes and improvements.

In "Safety Review" sub-section, there is a review of the necessary and current activities for ensuring conformity between the technical status of the nuclear facility and its design, as well as the operation margins and conditions according to the normative requirements. The most important programmes for reviews of the technical status are enlisted, which are used by the operating organisation, including the ones that are being developed at that time. In addition, there are other specific programmes of the operating organisation, concerning the safety review. The order for the review performance and using the output results are specified.

CUAEPP prescribed programmes and safety review measures, which are planned to be implemented by the NPP, are also stated. The international programmes, implemented during the last 10 years and related to safety review and assessment are also mentioned.

Further in this section, the activities performed in relation to the safety review and assessment for the reported period 1998 – 2001 are also described.

2. Status of Updating the Safety Analyses Reports for the Period 1998-2001

Following an ISUAE prescription to make a profound assessment of the current safety status of Units 1-4 of Kozloduy NPP plc, the initial version of the "Safety Substantiation Report" (SSR) for Units 1?4 was developed. SSR was developed for each Unit, considering the modifications introduced as compared to the original design.

Working in close co-operation with international organisations, Bulgarian organisations have reached a high level in their calculation skills, use modern, fully verified and validated codes and have already produced a large spectrum of analyses covering all important areas of

accident analysis. They are well prepared to the task of adaptation of the existing analyses and studies to the internationally accepted format. After completing the development of SSR, in December 1999 with participation of Bulgarian engineering organisations a plan was prepared for the final revision of the SSR and its development into a complete safety analyses report - SAR in correspondence with the widely accepted practice.

The developed SSR reflects the status of Units 1?4 of 1999 and gives assessment of the activities, necessary for its further development into a complete SAR. The basic differences compared to SAR are in the level of development of the separate sections, primarily in the deterministic safety assessment. Carrying out of new analyses is not included into the scope of the SSR, but only assessment of the applicability of the analyses that have been carried so far for the SAR purposes and identifications of the deficiencies. The final revisions of the SSR for each Unit were completed in the end of 2000 and presented to CUAEPP for review.

A consortium of Bulgarian engineering companies based on an approved TOR has been developing SAR. The activities on the first version of SAR for Units 3 and 4, according to the approved schedule, have to be completed in the beginning of 2002. An independent international expert review of the SAR is envisaged to be performed.

The status of the activities by mid-2001 is:

1. A part of the LOCA analyses (Initial. of Loss of Coolant Accident) DN 200 has been presented for independent expert review from Pisa University;
2. The preparation activities for the development of the SAR are completed and a ISUAE permission was issued for the SAR development;
3. A frame contract with EdF was concluded for technical support, including development of the SAR;
4. The planned activities for the development of SAR have been commenced.

Analyses of design and beyond design basis accidents are planned to be carried out in the Modernisation Programme for Units 5 and 6 in order to bring SAR in conformity with the international practice. The implementation of each technical Measure from the Modernisation Programme for these Units considers the necessity of changes in the SAR.

As it was noted in the first national report, probabilistic safety analyses (PSA) were carried out - level 1 for Units 1 and 2, 3 and 4, 5 and 6. The probabilistic safety analyses for Units 3 and 4 and Units 5 and 6 are reviewed by IAEA Missions for assessment of methodology and analyses results (International Peer Review Service – IPERS). Updating of PSA – level 1 for Units 3 and 4 was done considering the reassessed level of seismic activity for the site, the improvements made in the seismic stability of equipment and the availability of an Complementary Steam Generator Emergency Feedwater Supply System. The PSA for WWER-440 is being developed for low power levels and shut down reactor, which will be completed by the end of 2001. A PSA is envisaged within the Modernisation Programme for Units 5 and 6 for operation at low power levels and shut down reactor.

3. Safety Review

The accomplishment of comprehensive and systematic safety reviews aims at ensuring correspondence of the technical status of the nuclear facility to its design and the operational margins and conditions.

After reassessment of the existing situation with the reactor vessels and the results, received until present, the former programme for control during operation has been expanded and improved:

- The scope of the programme for testing the reactor pressure vessel during operation as regards to the non-homogeneous welds at the primary circuit pipe connections to the vessel (nozzle welds) was increased. The non-homogeneous welds at the primary circuit pipe

connections to the reactor vessel are tested from the inside by non-destructive ultrasonic method of control and eddy-current method;

- For calibration purposes at Units 1 and 2, a calibration block is used with samples with a ground up section, corresponding to the places, where templates were taken from, with thickness of 1.87 to 3.2 mm and surface of 11.7 to 20.4 mm^2. For Units 3 and 4 a calibration block with cladding is used;

- The test of the inside surface of the reactor vessels is performed by ultrasonic non-destructive method, using a manipulator. The visual non-destructive method of testing is carried out following a special procedure by means of a sub-water camera. Non-destructive ultrasonic method of testing and dye penetrant inspection are applied for the check of the outside surface of Units 5 and 6.

In the period 1998-2001 a non-destructive testing of all the Kozloduy NPP reactor vessels was carried out. No unacceptable indications were registered neither any substantial change of those registered from previous inspections was observed.

An assessment was made on the rate and the level of radiation embrittlement of the weld N?. 4 at Units 1 and 2, having repeated analyses of irradiated samples, prepared from the templates taken in 1996 and 1992 respectively from the spots with highest fluence on weld No. 4. The results show, that the integrity of the reactor vessel of Unit 1 is ensured for 27 refuelling cycles more, and at Unit 2 up to 15 refuelling cycles after the annealing performed. A conservative approach was applied at the assessment.

A programme for neutron metal embrittlement monitoring of the reactor vessels at Units with WWER-1000 at Kozloduy NPP is being implemented. The results obtained till present show that the rate of the radiation embrittlement of the reactor vessel remains within the design data, due to the applied low-leakage refuelling schemes for the reactor cores.

Assessment of the residual resource of equipment and facilities is being implemented and an ageing management programme is being developed, which has to be completed for Units 3 and 4 by the beginning of 2002. The scope of activities, envisaged in this project, is a continuation of the work performed till present within the previous PHARE projects on the major equipment. The programme for ageing management is assigned to all components and equipment, which are important to safety and critical as regards to the residual resource. The following documents for Units 3 and 4 are close to completion:

- Justification of the strength of the reactors internals according to the current norms;
- Operation reliability analysis for the primary circuit piping with diameter DN 200 and DN 500;
- Determination of the parameters inside the containment in case of a primary circuit large diameter pipe break;
- Static and dynamic strength analysis of the primary circuit and implementation of the necessary restrain;
- Determination of the resource of the reactor vessels;
- Updating of PSA - level I based on results from previous studies.

In order to improve the capability of the non-destructive testing to identify and measure non-conformities (indications), activities for qualification of the non-destructive control are being performed in correspondence with the recommendations of the IAEA document "Methodology for Qualification of In-service Inspection Systems for WWER Nuclear Power Plants" and taking into consideration the documents, issued in the European Network for Inspection Qualification. Within the framework of an IAEA pilot project, qualification of the ultrasonic control of weld N?. 3 of the Unit 5 reactor vessel is going on. Technical Specification has been developed and a project for the technical justification is prepared, which will be discussed by the end of 2001. In co-operation with the AEA Technology (UK) documents have been developed for the qualification of the eddy-current control of the SG

heat exchange pipes at Kozloduy NPP. Test samples for equipment, personnel and the control methodology checks are being prepared. For the purposes of the qualification process and in correspondence with the recommendations from IAEA document "Methodology for Qualification of In-service Inspection Systems for WWER Nuclear Power Plants", a new qualification centre was established at Kozloduy NPP plc and the basic documents, regulating its activity were prepared.

The non-destructive metal control of the Units equipment has been performed in compliance with documents, updated in 2000and approved by ISUAE: "Instruction for carrying out operation control of the basic metal, cladding and welded joints of equipment and piping in NPP with WWER-440" and "Instruction for Operational Control of the basic metal and welded joints of equipment and piping in NPP with WWER-1000". The accumulated operation experience, the new international approaches and modern requirements are reflected in these documents. The scope of control is expanded, so as to cover systems and components, implemented as a result of modernisation and reconstruction. New technological maps for ultrasonic control of primary circuit joints and equipment have been prepared.

New modern programmes for primary and secondary circuit metal control have been developed for units under operation and at present they are being reviewed and approved by CUAEPP. This Measure from the Modernisation Programme for Units 1 through 4 covers improvement of the existing ultrasonic control system PSCAN for application to several critical welds in primary circuit piping system. All welds on primary circuit piping, including the part of SG steam and feedwater piping within the confinement, are controlled by ultrasonic non-destructive method and dye penetrant inspection.

Additional systems for leak detection are being analysed and qualified for the purposes of application of the "leak before break" concept. It is planned to install two more systems for leak detection s and which will be based on different performance principles.

A "Programme for Improving the Eddy-Current Control at Kozloduy NPP for the Period 2000 – 2005 ?." was developed which aims at increasing the quality of eddy-current control activities and the reliability of the results. These goals will be achieved through procurement of additional equipment, personnel training and development of improved control methodologies. It is also envisaged in this programme to develop new criteria for plugging at registering indications and documents, necessary for the qualification of the eddy-current control.

The results of the control on the SG heat exchange pipes made in 1998-2001 show that no intensive corrosion processes are presented there.

The "Programme for Profound Study and Analysis of the SG Blow-down Pipe Status for Units 1 through 4 of Kozloduy NPP" and "Study and Strength Analysis of Feedwater Piping in the SG box of Units 1 through 4 of Kozloduy NPP" have been completed. All measures following from the conclusions made have been implemented.

At Units 5 and 6 a technical analysis of the applied system for tension of the containment was carried out. As a result of the analysis, based on the comtainment tension systems used in West Europe, a new original system for preliminary tension of the bundles and the respective technology were developed and accepted for implementation.

The preventive maintenance was improved through introduction of technical systems for control of the systems important to safety (thermovision; expanded vibrocontrol; control on the status of the breakers and the electric processes; control on the status of the insulation of the electric cables and penetrations). A computer system for defect monitoring was introduced; the internal control on the performed maintenance activities was increased through expanding the functions of the structural units for maintenance activity control.

The safety status is reported on a periodic basis through a system of specified, strategic and generalised criteria, developed after the IAEA methodological documents and Kozloduy NPP

experience. The system was introduced in 2000. The criteria are used by the sub-divisions to follow the tendencies in their activities and are used to help in their self-assessment. An annual report is prepared to assess the tendencies of the criteria.

The internal control on the safety-related activities is exercised by “Safety and Quality” Directorate. Planned and periodic reviews are made on the safety status at separate units and structural levels of Kozloduy NPP by the inspectors from the Directorate. As a result of this control, in case discrepancies are found, corrective measures are demanded.

The Kozloduy NPP as a site with a special status is under supervision of the Directorate National Office "Fire and Emergency Safety”. Complex review of the fire and emergency safety condition is performed annually. The regional office "Fire and Emergency Safety” at Kozloduy NPP performs 24-hour duty for the status for fire and emergency safety of the operational facilities and the civil building fund.

Article 15 - Radiation Protection

"Each Contracting Party shall take the appropriate steps to ensure that in all operational steps 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 the prescribed national dose limits."

1. Brief Review of the Contents of the First National Report on Article 15 of the Convention

In the section of the first national report, concerning Article 15, a review is provided of the national policy in the field of radiation protection during the operation of an NPP, the legislative and regulatory basis in the field of radiation protection, the structure and the functions of the radiation protection controlling authorities, the internal radiation protection controlling structure at Kozloduy NPP and the summarised data for the impact of Kozloduy NPP on the personnel and the environment.

In the section of the report on Item 15.1, the national policy in the field of the radiation protection is presented in the way it is defined in the national legislation:

- The use of the nuclear power is done in compliance with the goals and the principles of the nuclear and radiation safety, the protection of human life and health and the environmental protection being with higher priority than the economic and the other public needs;
- The use of nuclear power is controlled by the state authorities within the frame of their competence as defined by a law;
- Mandatory hygienic norms and requirements and sanitary rules are established on all hygienic, radiation safety and epidemiological issues;
- The healthy and safe labour conditions at sites, production, processes, activities, work places and work equipment are assured in the process of their designing, construction, reconstruction, modernisation commissioning and operation;
- Decreasing human health and environmental hazards and their relation to the suffered damages and missed profits are the basis for the formulation of the national ecological policy;
- Assessment of the impact on the environment is made.

In the part of the report on Item 15.2, the basic laws and sub-legislative normative acts in the field of the radiation protection are presented. A brief description of the requirements of the Basic Norms for Radiation Protection of the Republic of Bulgaria (ONRZ-92), of the Regulation for the Construction, Operation, and Development of the National Automatic System for Monitoring the Radiation Gamma-Background in the Republic of Bulgaria and the national plan "Environment – Health" is presented.

In that part of the report, concerning Item 15.3, analysis of ONRZ-92 is presented. The limits of the effective dose and the limits of the equivalent dose of exposure of specific organs and systems for the different categories of exposed individuals are presented, the restrictions for women at fertile age, for individuals aged below 21 and for the planned increased exposure at mitigation of an accident.

In the part of the report on Item 15.4, the CUAEPP, the Ministry of Health and the Ministry of Environment and Water functions are described, being the controlling authorities in the field of radiation protection. Information is provided for the national system for monitoring and control on the status of environment and the sites, which require public discussions of the reports on the assessment of their impact on the environment.

In the part of the report on Item 15.5, the internal radiation protection structure of Kozloduy NPP is presented.
In the part of the report on Item 15.6, summarised data are presented on the radiation impact of the operation of Kozloduy NPP on the personnel, and in Item 15.7 – on the environment.

2. Analysis of the National Norms in the Field of the Radiation Protection - Development in the Normative Basis and Sate Control

In 2001, new basic radiation protection norms were accepted (ONRZ - 2000). They are based on the international Safety Codes /BSS /, series ? 115, issued by IAEA in 1996 and Directive 96/29/EURATOM, dated 13.05.1996.
The main targets of ONRZ-2000 are:
- exclusion of the appearance of deterministic effects harmful to health;
- decreasing the possibility for appearance of stochastic effects harmful to health to a level determined as acceptable.

Conditions are created by ONRZ-2000:
- for non-allowance of exceeding the prescribed exposure dose limits;
- for non-allowance of any exposure where the risk of a possible harm caused by an exposure additional to the natural background is bigger than the benefits to the individual and the society;
- to keep at levels as low as possible, considering the real social and economic conditions, both the number of the exposed individuals and their total individual doses as a result of exposure from all activities with sources of ionising radiation.

The activities, for which ONRZ-2000 are applied, are:

- Manufacturing, processing, using, owning, storing, shipping, import, export of ionising radiation sources, radioactive waste management and all the other activities, including education and training, which are related or can be related to exposure to radiation of a human;

- Each activity in the field of the nuclear fuel cycle, including electric power production by nuclear facilities;

- Each activity, which is related to exposure by natural sources of ionising radiation during processing materials because of their radioactivity, because of their fissile property, and also in the cases, when this exposure is increased and cannot be neglected for the sake of the radiation protection;

- Operation of whatever electric facilities and devices emitting ionising radiation and containing components, operating with potential difference above 5 kV;

- All other activities, which are related or can be related to irradiation, by the judgement of the competent state authorities.

Exposures, for which ONRZ-2000 are applied, are:

- Any professional exposure;

- Any exposure of the population, caused by activities or sources of ionising radiation.

The following dose limits of professional exposure are defined in ONRZ-2000:

- The limits of the effective doses are 100 mSv for a period of 5 successive years, or 50 mSv for one separate year at meeting the requirement for the dose for five successive years;

- The limits of the annual equivalent dose, at meeting the restrictions for the effective doses, are-150 mSv for eye lens, 500 mSv for skin (this limit is related to the average dose, received by each surface of $1cm^2$, independent of the size of the exposed surface), 500 mSv for the arms below the elbows, the feet and the ankles;

There are additional requirements introduced, for the exposure of working women during pregnancy or lactation, the embryo or foetus to be protected the same way, as a member of the population and no possibility exists for radiation contamination of the mother.

The following dose limits of exposure of the population are defined in ONRZ-2000:

- The limit for the annual effective dose for a member of the population is 1 mSv;
- Annual effective dose up to 5 mSv can be allowed only at specific circumstances and in case, that the average effective dose for 5 successive years will not exceed 1 mSv;
- Limits for annual equivalent doses, meeting the limits for the annual effective dose for a member of the population, are as follows: for an eye lens - 15 mSv, skin - 50 mSv (this limit is related to the average dose, received by each surface of $1cm^2$, independent of the size of the exposed surface).

The competent state authorities are obliged to provide measurement of the exposure doses of the population.

People up to 18 are not allowed to work with sources of ionising radiation. In the cases when trainees and students between 16 and 18 are undergoing education, which is held in an environment of ionising radiation, the following requirements to their exposure are additionally introduced: the limit of the annual effective dose - 6 mSv; limits of the annual equivalent doses - 50 mSv for an eye lens and 150 mSv for the skin, the arms below the elbows, feet and ankles. The possibility for radioactive contamination of trainees and students is excluded.

Increased exposure of personnel is allowed in case of emergency situations, when it is necessary to apply protective measures or countermeasures and in any other situation, requiring action by the judgement of the competent state authorities. Each member of the personnel, who is subjected to permitted increased exposure, should receive from the employer:

- Preliminary official information for the expected effective and equivalent doses, the nature of work, protection measures, and radiation hazard, and to give a written consent;
- Official information about the real received doses after the completion of the respective work or at each moment upon his request.

For the purposes of the radiation protection secondary control levels and secondary/derived/ limits of exposure of personnel are defined.

For the purposes of the operational control, the competent state authorities agree upon control limits. The values of the control limits are defined in such a way, so that they do not exceed the limits of the annual doses and the ALARA principle to be obeyed.

The competent state authorities, within their competence, exercise the control on the dose limits and the exposure of the population. The control on obeying the norms at performing activities is an obligation of the employer.

During the reported period, the following sub-legislative deeds in the field of the radiation protection have been developed:

- Regulation concerning the norms for the purposes of radiation protection and safety during liquidation of the consequences of the uranium industry in the Republic of Bulgaria (dated 01.05.1999);
- Regulation No. 6 for emission norms of acceptable contents of harmful and hazardous substances in the sewage water, poured in water objects (dated 09.11.2000.).

In addition to the information on Item 15.4 of the first national report:

The Executive Agency on the Environment (EAE), as a unit under the Minister of the Environment and Water, has been founded for the performance of management, co-ordination and information functions concerning the control and protection of the environment in the Republic of Bulgaria. The Agency is the managing authority of the National System for Environmental Monitoring (NSEM) and is a National Reference Centre within the European

Environment Agency. The radiation monitoring is performed following a programme, which is a part of the National System for Environmental Monitoring and includes a net of monitoring points, a respective periodicity, and a complex of monitored radiological indicators. The information about the environmental radiological status in the country is processed, analysed, and summarised in the Sector "Ionising Radiation" to "Monitoring" Directorate of EAE. The results of the radiation monitoring are published in the AEA periodicals and annual report on the environmental status is prepared and further approved by the Council of Ministers.
The National plan "Environment – health" was updated with a priority direction "Investigation of the Kozloduy NPP impact on the environment and the population and determination of a complex of measures for protection of the biosphere from contamination".

3. New Internal Radiation Protection Structure at Kozloduy NPP plc

In the new organisational structure of Kozloduy NPP plc the radiation protection control is centralised in the "Safety and Quality" Directorate, which reports directly to the Executive Director of Kozloduy NPP plc. The "Safety" Department, included in the structure of the Directorate, controls the radiation protection of Kozloduy NPP plc through:

- The "Radiation Protection" Division;
- The " Personal Dose Metering" Division;
- The "Environmental Monitoring" Division; and
- The "Emergency Preparedness" Division.

The prescriptions of the "Safety" Department for corrective measures to be taken are obligatory for the personnel of the electric power production companies within the NPP.
The radiation protection issues and its optimisation are discussed at meetings of the councils for the application of the ALARA principle at the electric power production companies and at the "Safety and Quality" Council to the Executive Director of the company.

4. Summarised Data for the Radiation Impact on the NPP Personnel

The conducted studies on factors, defining the total personnel exposure dose, show that the basic input comes from the external radiation, leading of which is gamma-radiation. Beta-radiation participates in the total external exposure dose only in separate cases and never more than 10%. The input from the thermal neutrons does not exceed 0.3% of the dose. The average weighted individual exposure dose of the NPP personnel for the last 10 years is within the limits 1.10 mSv – 5.27 mSv per year.
The average individual dose of internal radiation, created by the presence of radioactive aerosols in the air of work compartments is determined to be about 0,50 mSv per year. The doses from the internal exposure, determined through direct measurements, do not exceed 10% of the total exposure.
Basic measurement methods of the external exposure are the film and the thermoluminescent individual dosimetry control, with sensitivity threshold of 0.20 mSv and 0.05 mSv respectively. Electronic dose meters and ionising chambers with direct reading are used for the purposes of the operation dosimetry control (with sensitivity of 0.01 mSv and 0.10 mSv respectively).
Measurement of internal exposure by incorporated nuclides (fission and activation products) is made with whole-body counters with "shadow" protection and geometry of measurement "linear scanning". Gamma emitters are detected with minimum detectable activity within the range of 400 Bq (for ??-60) and 500 Bq (for Cs-137) for the whole body.

5. Summarised Results of the Radiation Impact on the Population and the Environment

The active effluents through the ventilation stacks of Kozloduy NPP for the period 1998-2000 are as follows:

Normalised indicators	Dimension	1998	1999	2000
Radioactive noble gases	TBq/(GW.a)	121	143	121
Iodine – 131	GBq/(GW.a)	2.81	1.62	1.57
Radioactive aerosols	GBq/(GW.a)	0.61	0.58	0.57

During the period 1998-2000 a total of 499100 ?^{3} of over-balance water with the following total activity was released into the Danube:

Normalised indicators	Dimension	1998	1999	2000
Liquid emissions without tritium	GBq/(GW.a)	3.60	2.12	0.98
Tritium	TBq/(GW.a)	7.60	11.2	7.52

The radioactivity released from Kozloduy NPP with the gas, aerosol, and liquid effluents is within 1.6 % of the norms in force for the Republic of Bulgaria and is comparable with the routine practice in other countries, operating WWER reactors.

The maximum value of the individual effective annual dose within the 30 ?m zone, as a result of gaseous and aerosol effluents from Kozloduy NPP for the period 1998-2000 is within the range of $2{,}68.10^{-7}$ to $3{,}51.10^{-7}$ Sv/a. This exposure is lower than 0.015 % of the background exposure, typical for Kozloduy NPP region and below 0.1% of the established limit of 1 mSv for the individuals of the population, according to ONRZ-2000.

The maximum collective effective annual exposure dose of the population within the 30-kilometer zone, result of gaseous and aerosol effluents from Kozloduy NPP, is evaluated to be within the range $2{,}76.10^{-3}$ to $3{,}58.10^{-3}$ manSv/(GW.a). These are values, fully comparable with UNSCEAR-98 data for a large number of NPPs with PWR type reactors.

The exposure of a typical individual from the critical group of the population caused by the liquid effluents is below 10^{-6} Sv/a. The normalised collective effective dose of the population within the 30-kilometer zone, due to liquid effluents, is evaluated to be within the range $1{,}3.10^{-8}$ to $2{,}9.10^{-8}$ manSv/(GW.a).

The data about the dose of the population within the 30-kilometer zone of Kozloduy NPP for the period 1998-2000 is comparable with the data from previous years and confirms the conclusions, that it represents a negligibly small impact on the environment and the population.

The radiation gamma-background in the 3-kilometer zone around Kozloduy NPP is continuously measured by the "Berthold' system for automatic external radiation monitoring. During the period 1998-2000 the gamma-radiation dose rate at the border of the site, as well as at all control points in 100-kilometer zone around Kozloduy NPP is within the range of the natural radiation background of 0.08-0.15 μSv/h and is fully comparable with other settlements in the country.

About 2000 samples from different objects from the environment in the 100-?m zone of monitoring around Kozloduy NPP are analysed each year. Basic methods for analyses are

gamma-spectrometry, low-background radiometry of the general beta activity and liquid-scintillation spectrometry.
The results from the analyses of basic environmental components, such as air, water, soil and plants, as well as of foods typical for Kozloduy NPP region, are within the normal range for this geographic latitude. Measured concentrations are many times lower than the legal norms and are comparable with the data from previous years and the pre-commissioning period (1972-1974).
The assessment of the collective effective annual doses for the population from the 100 km zone, resulting from gaseous and aerosol effluents from the Kozloduy NPP do not exceed 1man·Sv·a^{-1}; the assessments of the maximum individual effective annual dose during the same period does not exceed 1 μSv·a^{-1}. The conservative assessment of the individual effective annual dose for individuals from the critical group of the population, resulting from effluents of over-balance water into the Danube during the same period, does not exceed 1 μSv·a^{-1} either.
During the entire period, the additional dose load of the population resulting from the operation of Kozloduy NPP is considerably lower not only from the recommended by the International Commission for Radiation Protection a maximum limit of 300 μSv·a^{-1} (Publication 77 of ICRP, 1998), but also lower than the requirements of ONRZ-2000 for exemption of control (1 man·Sv·a^{-1} and 10 μSv·a^{-1}). This allows the conclusion, that the exposure doses received by the population as a result of Kozloduy NPP activities, are kept as low as reasonably achievable and that no individual is exposed to radiation doses which exceed the prescribed national dose limits.

6. Actions Planned in the Field of the Radiation Protection

The development of new and the updating of the existing legislation in the field of radiation protection, is imposed by the requirement for synchronising them with the Acquis Communauter in the European Union. A programme has been developed with priorities and executives defined, in which the development of 19 legislative acts is envisaged, related to life and health protection of the population and environmental protection from the harmful impact of ionising radiation and improvement of the action and notification procedures in case of emergency situation, related to the nuclear safety and radiation protection.

Article 16 - Emergency Preparedness

"1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site 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 Contents of the First National Report on Article 16 of the Convention

In Item 16.1 of the First national report, information is presented on the following:

- The legislative and regulatory basis of the emergency planning and preparedness;
- Organisation Activity for prevention and liquidation of the consequences from calamities, accidents and catastrophes;
- The structure of the Permanent Commission for protection of the population in case of calamities, accidents and catastrophes;
- International conventions and agreements in the field of emergency planning, in which the Republic of Bulgaria is a party.

In Item 16.2 information is presented about the purposes, organisation and the levels of emergency planning.

In Item 16.3 the content of the National Emergency Plan is presented, which contains 14 sections and 42 separate attachments, concerning different actions, assessments, check-ups and data. There is a description of the procedures for investigation and radiation control, measures for protecting the population, farm animals and agriculture, the order for activation of the plan, international obligations, measures for training in and learning emergency plans.

In Item 16.4information is presented for the organisation of the emergency response and personnel training according to the emergency plan of Kozloduy NPP

In Item 16.5 information is delivered concerning the planned activities in the field of emergency planning.

In the process of discussions of the First national report on this article, additional written information was presented answering the questions, asked by other countries.

In the next Section the development is presented in the field of the emergency planning improvement in the Republic of Bulgaria after 1999.

2. Development of the Legislative and Regulatory Basis of the Emergency Planning and Preparedness

As it was noted in the first national report, the organisation, management, co-ordination, and control of the activities for prevention, mitigation and liquidation of the consequences from calamities, accidents and catastrophes are managed by the Council of Ministers. For this purpose, a Permanent Commission for Civil Protection in Case of Calamities, Accidents and Catastrophes (Permanent Commission) is founded to the Council of Ministers. The Permanent Commission executes its activities through Ministries, Authorities, local authorities, governmental and non-governmental organisations (Annex 11). The State Agency "Civil Protection" is authorised to function as headquarters of the permanent Commission.
The state agency "Civil Protection" is founded in March 2001 with a Decree of the Council of Ministers and is the successor of the "Civil Protection" Department to the Ministry of Defence. The State Agency performs the activities related to protection of the population and the national economy in case of calamities, accidents and catastrophes. The Directorate General "Crisis Management" and "State Control and Preventive Work" Directorate at the State Agency have the following assignments:

- Execute the organisational structuring, preparation and management of the Agency formations and the co-operation with the ministries, organisations and territorial divisions concerning the prevention, handling and overcoming the consequences of calamities, accidents and catastrophes;
- Organise the development and the support of the National Plan for Crises Management as well as activities for its adoption at national and territorial level;
- Notify the population for the kind of hazard;
- Organise and manage the functioning of the communication and information systems of the Agency.
- Develop and apply uniform methodology for filing the potentially hazardous facilities of the national economy;
- Analyse and control the status and preparedness of the facilities of the national economy to prevent accidents and to liquidate the harmful consequences of calamities and accidents and develop programmes for increase of their preparedness;
- Organise the protection of the population in case of calamities, accidents, and catastrophes and its provision with individual and collective protective means.

The regional "Civil Protection" Directorates are directly reporting to the Directorate "Crises Management". After the new administrative division of the Republic of Bulgaria two regional Directorates "Civil Protection" in the town of Vratsa and in the town of Montana are responsible through "Accident and Rescue Activities" Departments for the radiation accident management in the zone of the emergency planning of Kozloduy NPP. The officers in these departments have undergone additional specialised training for action in a radiation emergency situation at nuclear facilities.
To improve the co-ordination and the organisation for emergency planning and preparedness, the Regulation for emergency planning and preparedness in case of a radiation accident was adopted by Ordinance No. 58 of the Council of Ministers in 1999. The Regulation defines the obligations of the executive authorities, the NPP operator and the legal entities for planning the actions in case of an accident at an NPP on the territory of the Republic of Bulgaria or in case of transboundary transfer of radioactive substances. The criteria for decision-making on application measures for civil protection in case of a radiation emergency are specified. The executive authorities, the NPP Operator and the legal entities are obliged to maintain permanent preparedness for action for protection of the personnel, public and the

environment. In order to create the necessary organisation for emergency response and preparedness, development of emergency plans is required. It is required to inspect the preparedness for action in case of radiation emergency through periodic training.

In compliance with this Regulation CUAEPP:

- Collects and processes incoming data and forecasts the development of the accident;
- Presents expert conclusions and suggestions for the protection of the population and the environment to the Permanent Commission;
- Specifies, in co-operation with the executive power authorities, the Permanent Commission and the NPP Operator, measures for protection of the population and the environment;
- Determines norms for accident exposure of the population in co-operation with the Minister of Health;
- Receives and presents to the International Atomic Energy Agency and to the neighbouring countries information as required by the signed international conventions and agreements;
- Informs the Council of Ministers and the State Agency "Civil Protection" for the initiation of a radiation emergency or transboundary transfer;
- Ensures functioning of the organisational unit for emergency preparedness;
- Maintains an emergency station to the National Automatic System for Monitoring of the gamma-background on the territory of the Republic of Bulgaria;
- Assigns and finances performance of scientific research and studies in the field of nuclear safety and radiation protection related to the emergency planning and preparedness.

Amendment of the Regulation is planned based on the IAEA recommendations from TECDOC 1162 "Generic Procedures for Assessment and Response during a Radiological Emergency". The Regulation amendment will also include requirements to the contents of the emergency plans.

An expert Mission is planned to be held by the end of 2001, following an IAEA project, to review the Regulation for emergency planning and preparedness in case of a radiation accident.

3. Updating the National Emergency Plan

The Permanent Commission for Protection of the population in Case of Calamities, Accidents and Catastrophes approved the last updating of the National Emergency Plan with a Decision, dated 1996.

To improve the emergency preparedness at a national level and in compliance with the requirements of the legislative acts, international recommendations and new concepts in the field of emergency planning and response, an interministerial task force was created in 2000 for updating Section V? of the National Emergency Plan "Carrying out rescue and urgent post accident rehabilitation activities and for protection of the public and the national economy in case of a radiation emergency at Kozloduy NPP or at a nuclear facility outside the territory of the Republic of Bulgaria". In the updating, the IAEA recommendations, incorporated in the TECDOC-953 "Methods for Development of Emergency Emergency Response Preparedness for Nuclear or Radiological Accidents" and TECDOC-955 "Generic Assessment Procedures for Determining Protective Actions During a Reactor Accident" are being used. For this purpose, Energoproject plc developed in 2000 the document "Beyond Design Basis Accident Forecast Characteristics".

The Section of Part VII of the National Emergency Plan "Plan for Liquidation of Consequences and Civil and Environmental Protection in case of Radiation Accident during Spent Fuel Shipment along the Danube" was developed. The document is presented for approval to the Republic of Romania.

4. Improvement of the Emergency Plan of Kozloduy NPP

The emergency plan was totally redeveloped in 2000 based on the recommendations of the OSART Mission of IAEA of 1999, concerning mainly improvement of comprehensiveness and applicability of the emergency plan. The emergency procedures and instructions to it have been rewritten in separate attachments; thus the recommendation was closed by the next, FOSART Mission in January 2001. The redeveloped emergency plan was agreed with the competent state authorities.
Subjects of review and classification are both radiation accidents and, also, events without direct radiation consequences, creating prerequisites for considerable decrease of safety level of equipment, personnel and for environmental impact. The classification of the radiation accidents was done according to the IAEA recommendations. For action at natural calamities at Kozloduy NPP have been developed:

- Measures at emergency low water in the Danube;
- Measures in case of petrol product stains in the Danube;
- Inseparable part of the emergency plan of Kozloduy NPP is the Emergency Action Plan during Earthquakes, Fires and Other Natural Calamities;
- Emergency Action Plan of the Personnel during Emergency Situations at the Existing Hydrotechnical Facilities in Kozloduy NPP;
- Emergency Action Plan of the Personnel of the "Open Switchgear Yard" at covering power transmission lines with ice.

The OSART Mission Team defined the emergency preparedness co-operation between Kozloduy NPP and the competent state authorities as a good practice.

5. Training in Emergency Planning and Drills

The following courses and drills for increasing the emergency preparedness have been held during the reported period:

- Regional Training Course in the Field of Emergency Preparedness

In the period March – July 2000 in the town of Trnava (Slovakia) eight training courses were held for preparation of national instructors for training emergency teams to act in case of a radiation emergency off the NPP site.
The topics of the course were in the field of the emergency planning and emergency management, response, decision making, medical and technical support, and forecasting the accident development.
Twenty-seven specialists from the Republic of Bulgaria of different management levels have undergone training in emergency preparedness.

- INTEX Drill

On 24-March-2000, the Republic of Bulgaria participated in the INTEX international drill, organised together with NATO and the IAEA. The aim of the drill was to check reporting and information exchange systems in case of a nuclear explosion or re-entry of a satellite with a

nuclear reactor or one carrying out experiments with radioactive substances and spreading radioactive fragments on the surface of the Earth. Representatives of Civil Protection and the CUAEPP Emergency Centre participated in the drill.

- Drill at Kozloduy NPP

On 12-December-2000, a drill was held at Kozloduy NPP with a topic "The Actions of the Emergency Response Authorities and the Rest of the Personnel in Case of a DN 200 Pipe Break in the System for Emergency Core Flooding of a Unit with Reactor WWER-440/230". Study questions were exercised, concerning the assessment of the emergency situation, activating the Emergency Plan (informing and organising the emergency response authorities), actions of the emergency response, authorities for managing the accident and personnel protection (sheltering and evacuation) and information exchange.

6. Planned Activities

Expanding the Scope of the National Emergency Plan

It is envisaged to expand the National Emergency Plan with emergency planning and response in case of accidents with other ionising radiation sources, including radioactive waste, during radioactive substance shipment, satellite fall, etc. This part will be developed following the IAEA recommendations from TECDOC-1162 "Generic Procedures for Assessment and Response during a Radiological Emergency".
The updating of the National Emergency Plan is supported by IAEA with Project RER/9/050 "Harmonisation of the Regional Emergency Planning and Preparedness".

Improving the Early Notification System

Improvement in the Early Notification System in case of a nuclear accident is envisaged in the following directions:

- Improving the forecast for the spread of "radioactive cloud"

Since the end of September 2000, as a result of performing activities on topic "Improving the Early Notification System in Case of a Nuclear Accident", the so called "straight tracks" in graphic format, which are calculated on daily basis, showing the direction of spread of the radioactively contaminated air masses during eventual emission of radioactive substances in case of an accident at NPP, are received at CUAEPP. After the completion of the activities on the topic in 2001, it will be possible to make precise dispersion calculations, through which the expected exposure doses of the population can be defined.

- Expanding the Permanent Radiation Monitoring System of Kozloduy NPP plc.

The permanent radiation monitoring system of Kozloduy NPP plc is integrated with it's analogue - the National system for permanent radiation gamma-background monitoring. Operative information exchange in both directions is ensured. Upgrading and modernisation of the permanent radiation monitoring system is forthcoming, which includes transition to a new radio frequency signal and the introduction of intelligent gamma probes.

Participation in International Projects

The Republic of Bulgaria continues its participation in the following international projects concerning emergency planning, preparedness and response:

- IAEA Project RER/9/050 on topic "Harmonisation of the Regional Emergency Planning and Preparedness ".
- European Union Project under the "PHARE" programme for holding a training course on Topic "Off-site Emergency Planning and Response in Case of a Nuclear Accident"(2001).

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 Contents of the First National Report on Article 17 of the Convention

In the section on Item 17.1 of the First national report a description of the legal and the regulatory basis is given on the issues, related to the siting of nuclear facilities in the Republic of Bulgaria and on the way of selection of the sites of the operating nuclear installations and for Belene NPP. The scope of the information, necessary for the assessment of the suitability of the site as regards to geography, demography, human activities, meteorology, hydrology and hydrogeology, geology, geotechniques and seismic rating was stated.

In the section on Item 17.2 of the First national report the studies are presented, carried out for the NPP sites in the Republic of Bulgaria and the results of these studies. The new seismic characteristics of the site are clarified, which will be used for the assessment of the seismic capacity of the existing civil structures and systems. It is noted, that the studies on the influence of the human activities and the infrastructure in the region of Kozloduy NPP site show, that there are no sources, which could endanger the NPP's safety. No extreme natural phenomena such as hurricanes, tornadoes, etc. have been registered either.

To specify the data for the Belene site, following a suggestion by IAEA - project BUL/9/012, a programme was developed for carrying out additional studies. The results of the whole complex of studies of engineering geology, tectonics and seismicity of the site and the region were discussed and confirmed by the IAEA Mission, held in July 1997 in Sofia. Additional Seismological studies were recommended, aiming at unconditional data substantiating.

In the section on Item 17.3 of the First national report information is presented for the bilateral agreements between the government of the Republic of Bulgaria and the governments of Romania, Greece, and Turkey for early notification in case of a nuclear accident and information exchange concerning the nuclear facilities. According to these agreements, the contracting parties inform each other in case of envisaged construction of new nuclear facilities and present the necessary technical information on these facilities.

2. New Circumstances on the Site Studies

Kozloduy NPP Site

In 2001, following public discussions, a "Report on the Impact of Kozloduy NPP on the Environment" was accepted in compliance with the legislation of the Republic of Bulgaria. It was noted in the report, that the study for the period 1994 - 1999 and previous years, the studies carried out, analyses and expert assessments give the grounds to summarise that:

"The radiation impact of Kozloduy NPP on the atmosphere, waters, soils, the flora and the fauna, and the protected territories, as well as the risk for the environment and human health in the monitored zone around the NPP are insignificant."

Based on the publicly defended report on the impact on the environment, permission was issued by the Minister of Environment and water for production activities at Kozloduy NPP. .

Belene Site

The recommended additional seismic studies from the concluding IAEA Mission, held in 1997 for proving the absence of local seismic sources, were carried out by the mid-1999 by the Geological Institute at the Bulgarian Academy of Sciences. The basic conclusion from these additional studies at the Belene site [5] is as follows: "under the Belene site and in the nearest vicinity (in the local 5-kilometer zone) there are no traces of expressed active faults during the quaternary (or at least during the last several hundred thousand years), including along the Danube. From this point of view, the site meets the IAEA requirements (Items 601 and 604, Page 27 of Safety Series 50-SG-S1, Rev. 1, 1991) and is suitable for the construction of a nuclear power plant."

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 Contents of the First National Report on Article 18 of the Convention

In Item 18.1 of the first national report, detailed information is provided for the regulatory basis at the design and construction of nuclear installations. It is noted, that in the process of construction of Kozloduy NPP the normative requirements for safety assurance underwent several changes. It is noted that the basic document, in force in the Republic of Bulgaria and regulating the basic safety requirements during design, construction and operation of an NPP is Regulation No. 3 of CUAEPP. The necessary documentation, conditions, order and terms for issuing permissions for design and construction of a NPP, are specified in Ordinance ? 5 of CUAEPP. At each one of the stages, documents have to be presented, certifying that the established safety requirements are met.

In Item 18.2 information is provided about the design basis of Units 1 and 2 of Kozloduy NPP. It was noted, that the design of the Units was developed at the end of the 60's (1967-1968) in correspondence with the general industrial norms, standards and industrial sector regulations, then in force in the ex-USSR. The envisaged design measures for protection against accidents meet the accepted in those years and for this reactor type principle for limited leak from the primary circuit coolant through an opening with an equivalent diameter of 32 mm. The background for the application of this principle and the accepted maximum design basis accident (MDBA) were clarified. The system for the localisation of radioactive products was designed in correspondence with the adopted scale of the MDBA. In the design of the safety systems the principle of redundancy of their elements was adopted. The design reactor cores possess negative power coefficients of reactivity. It is noted that analyses of the design, carried out later, demonstrate that many positive, even perspective solutions were incorporated in it.

In Item 18.3 information is provided about the design basis of Units 3 and 4 of Kozloduy NPP. The design of the Units was developed in the beginning of the 70's, in the conditions of establishment of specialised normative and technical provisions for nuclear energy installations in the ex-USSR. It is noted that the major difference from Units 1 and 2 is the existence of a three-train structure of the safety systems, each one of the trains being capable of completely performing the design functions of the respective system. Although the Maximum Design Basis Accident remained the same, at Units 3 and 4 already exists division of the reactor emergency core cooling system in two separate systems – high pressure and low pressure injection in the primary circuit. Design solutions for partial spatial and physical separation of the trains of the safety systems already exist.

In Item 18.4 information is provided about the design basis of Units 5 and 6 of Kozloduy NPP. The designs for Units 5 and 6 of Kozloduy NPP were developed in the beginning of the 80's based on a unified reactor design WWER-1000/B-320 in the ex-USSR. The technical solutions of the design are based on managing an accident with primary circuit maximum-diameter pipe break. The reactor and the equipment with radioactive coolant are located in a hermetic chamber (containment) with a protective cover of reinforced concrete, holding in the fission products in case of a maximum design accident. The safety principles, incorporated in the designs of these Units, as a whole are in correspondence with the INSAG-3 report "Basic Safety Principles for Nuclear Power Plants".
In Item 18.5 information is provided about the design basis of Belene NPP. Belene NPP design was developed in the period 1986-1987 and is an analogue of the Kozloduy NPP Unit 5 and 6 designs. Some new solutions were incorporated, directed towards enhancing safety and reliability.

2. New Circumstances in the Design and Construction of an NPP

In the period after the First national report, there are no changes in the legislation and the regulation basis for design and construction of nuclear installations. However, the progress achieved in upgrading KNPP 3&4 has made it possible to introduce the terms "Upgraded Design Basis" and "Upgraded SAR". The requirements of BNSA to the upgraded design have been formulated and analyses have shown that KNPP 3&4 can meet these requirements for a wide spectrum of accidents reaching high above the original design basis. The design changes made at the existing nuclear installations are enlisted in the part of the report on Article 6.

Article 19 - Operation

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

(i) the initial authorisation 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 organisations 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 Contents of the First National Report on Article 19 of the Convention

In Item 19.1 information is provided about the order for obtaining permission for commissioning nuclear installations, the legislative and regulatory basis and the documentation, which has to be presented to the state authorities.

In Item 19.2 information is provided about the requirements of the regulatory body for establishment of the conditions and the limits of safety operation, the order of their reviewing and changing

In Item 19.3 a detailed description is provided of the organisation and the scope of documentation related to the operation, technical maintenance, inspection and testing of the nuclear facilities.

In Item 19.4 information is presented about the procedures, defining the response actions of the personnel in case of expected operational events and accidents. There is also information about the activities and the intents for further development and improvement of these procedures.

In Item 19.5 a description is provided of the organisation of the engineering support, performed during the commissioning and the operation of nuclear installations, the system for maintaining the scientific support of an NPP and the regulatory body requirements to the engineering support activities, performed by external organisations.

In Item 19.6 information is provided about the requirements for reporting the registered operational changes and events, as well as accident status related to the nuclear and radiation safety and with the accounting, storage, and shipment of nuclear material. The basic requirements are also stated to the system for notification the CUAEPP, established at Kozloduy NPP.
In Item 19.7 information is provided about the system for collecting and analysing the operational experience, the methods for analysing operational events and receiving information from other NPPs.

2. Commissioning Permission

The basic normative documents, regulating the commissioning of nuclear facilities, are the AUAEPP and Regulation No. 5 of CUAEPP. They determine the order and the stages for issuing the commissioning permissions, which have not been changed during the past period.
In relation with the ongoing and forthcoming big reconstruction and modernisation of Kozloduy NPP Units (See Article 6), the ISUAE practice of issuing permissions for operation of the nuclear units for a period of one refuelling cycle is maintained.
To facilitate the licensing process for the implementation of big modifications, e.g. for reconstruction of the system for accident localisation at Units 1-4, in addition to the requirements of the normative documents, a procedure was developed and implemented by ISUAE and Kozloduy NPP plc, which defines the stages of licensing and the documents, necessary for each licensing stage. A similar procedure was developed, too, for licensing the Units 5 and 6 modernisation programme activities.

3. Operational Limits and Conditions

By 1998 General Technical Specifications for operation of a WWER-440/B230 reactor were applied. The implemented reconstruction and modifications, the big quantity of analyses and assessments, the results from the periodical inspections and tests, as well as the application of the national and international experience imposed basic review of the Technical Specifications. As a result, at the end of 1998 separate Technical Specifications were developed, specific for each WWER-440 nuclear unit. After review by the ISUAE and training of the personnel, the Technical Specifications became effective.
Due to the same reasons in 2000 was established a new Technological Regulation for the Units with reactors, type WWER-1000.
In 2001 the Technical Specifications for the Spent Fuel Storage Facility became effective.
The Technical Specifications are updated after the implementation of modifications, concerning the limits and the conditions for safety operation. Each change in the Technical Specifications is reviewed by the regulatory body. Based on and as an addition to the Technical Specifications operational documentation is developed, the basic requirements to which are presented in the following section.

4. Operational Documentation

In correspondence with the updated and developing quality assurance system, at Kozloduy NPP plc instructions and procedures are developed and implemented, which cover both the organisational aspects of the operational activities and their technical aspects.
In the governing quality assurance documents, defining the requirements to the documentation requirements are included also to the document management during the period

of their life cycle. Rules are introduced and methods for checking and assessment of applicability of the operational documentation are defined immediately before their use.
For the past period updating of the basic operational documentation was performed and it was brought up in correspondence with the requirements of the quality assurance instructions.
The procedures for the periodic functional testing of the systems important to safety have been updated, and the specific requirements to the different stages of the tests have been determined.
New operational documents have been developed, specifying the requirements to: uniform labelling of the equipment; periodic inspection of the status of the systems and equipment by the operational personnel and managers; organisation of the operation activities at the Main Control Room, etc.
The assessment of the keeping up the documentation in an updated status is included in the system for internal assessment.
Independent assessment on the status of the operational documentation is given in the report of the IAEA experts from the FOSART Mission held in the beginning of 2001.

5. Emergency Procedures

During the period 1998-2000, the development of the symptom oriented emergency operation procedures (SOEOP) continued and training of the personnel started. The adopted approach for their development corresponds to the Westinghouse (USA) approach, and the methodological guidance is provided by PNNL (Pacific Northwest National Laboratory) (USA).
The status of development of the SOEOP for WWER-440 type reactor is as follows:
42 instructions for optimum and functional recovery were developed, which take into consideration the specific features of WWER type reactors and their differences compared to PWR. In the present package of instructions such are included, that cover beyond design basis accidents. The analytical validation of the instructions has been completed, using the methodology, developed by PNNL. The results from the analytical validation are included as a part of the basic SOEOP documents.
Schemes for control of the status of the critical safety functions were developed (CSF), following the adopted approach and taking into consideration the implemented or the forthcoming modifications of Units 3 and 4.
Certain activities were performed for the preparation and the development of Severe Accident Management Manual simultaneously with the development of the SOEOP:

- Analyses of severe accidents aiming at the development of procedures for severe accident management at Units with WWER-440 type reactors;
- Analyses of severe accidents, aiming at the development of concepts for reconstruction of the system for localisation of accidents, with installation of jet vortex condenser, active filter system, and hydrogen recombination system;
- Analyses of severe accidents, aiming at definition of the input conditions for the development of an emergency plan for Kozloduy NPP;
- Analyses of severe accidents aiming at defining the conditions in the steam generator box for the qualification of the equipment for Units WWER-440.

Generally the progress already achieved in the development of Symptom Oriented Emergency Operating Procedures is very good and the decision to implement them in KNPP 3&4 has been firmly taken. When SO EOPs are implemented in the operational practice, the hazards of accident will be greatly reduced, as shown by very positive experience with SO EOPs in the US and EU.

The status of development of the SOEOP for WWER-1000 type reactors is as follows:

- Thirty-eight emergency procedures have been developed and checked, having used the instructions for Beaver Valley NPP (USA) and considering the differences between reactors WWER and PWR.
- The analytical verification of SOEOP has been completed using methodologies and programmes, provided by the US Department of Energy.
- A Guide for SOEOP validation was developed.
- The validation of the SOAI was commenced at the full-scale simulator at Kozloduy NPP.
- The pilot project of the US Department of Energy was completed for the development of training materials for training of the operators.

All the activities for the development and the implementation of SOEOP are performed with the support of American consultants and following American methodologies.

The following important activities related to SOEOP are envisaged to be performed at Kozloduy NPP:

- Specific analyses to be carried out, addressed to complete bringing the SOEOP of Kozloduy NPP to the Westinghouse (USA) standard and related to the justification of different criteria for using the facilities important to safety in emergency situation;
- Introduction of the Emergency Instructions in operation having completed the SOEOP validation and trained the operational personnel to use them on a full scale simulator;
- Development of Severe Accident Management Manual.

6. Engineering Technical Support

In addition to the information, presented in the First national report, the involvement of external engineering companies for the NPP's engineering support continues. The participation of leading foreign engineering companies such as SIEMENS (Germany), Framatome (France), Westinghouse (USA), "Gydropress" (Russia) and others has considerably grown in relation with the implementation of the large-scale modernisation and reconstruction.

In relation to the restructuring of Kozloduy NPP plc, centralisation of the engineering support activities in given fields was made.

The performance of the engineering support activities is done in compliance with the normative requirements, quality assurance programmes (please, refer to the section on Article 13 of the Convention) and the special CUAEPP requirements.

7. Event Reporting and Analysis of Operational Experience

In mid-1997, the Instruction for analysing operational events at Kozloduy NPP was updated in accordance with recommendations from the ASSET Mission. The scope was expanded of the criteria for reporting and analysing root reasons, including reporting and analysing events with small significance for the safety. Because of this, the number of the events, reported to CUAEPP rapidly grew.

The increased number of events is due to the open policy of the operator – Kozloduy NPP to the CUAEPP and to the more strict for reporting events, e.g. all events are reported without consideration their safety significance according to the IAEA international INES scale. In 1999 56 events were reported to the CUAEPP related to nuclear safety and radiation

protection and 8 events according to the information exchange between the Kozloduy NPP and CUAEPP. Of them 48 (75%) are assessed as level "0" (deviations), 1 event (2%) as level "1" (anomaly) and rest 15 events (23%) have no relation to the safety or are below the bottom threshold of the INES scale. In 2000 61 events were reported to the CUAEPP related to nuclear safety and radiation protection and 9 events according to the information exchange between the Kozloduy NPP and CUAEPP. Of them 52 (85%) are assessed as level "0" (deviations), 5 events (8%) as level "1" (anomaly) and rest events have no relation to the safety or are below the bottom threshold of the INES scale. The comparative analysis of the events reported in 1998, 1999 and 2000 shows that their quantity remains the same (62 in 1998, 56 in 1999 and 61 in 2000) while the number of the reported events after assessment by the NPP senior management increases. It has to be pointed out that there is improvement in the system for reporting, analysis and development of corrective measures.
In 1999 an Instruction for operational experience feedback – analyses of the deviations in the performance of the equipment, procedures, and personnel entered into force. This Instruction considers the new tendency in the development of the system for operational experience feedback, requiring reporting at an internal level and analysis of insignificant deviations from the normal equipment operation, the procedures, and the personnel of the type "near-miss events". All failures and deviations are registered in a database aimed at collection of information for the equipment reliability, quality of the documentation and actions of the personnel. The units for analyses of operational events in the divisions for engineering support of units 1 to 4 and 5 and 6 respectively have been properly staffed.
In addition to the ASSET methodology, Kozloduy NPP plc developed a new methodology for profound analysis of the operational events caused by the human factor. A personnel training in the new methodology is planned. A similar methodology is already in use at ISUAE for independent and profound analysis of selected operational events.
In the end of 1998 an Instruction for the operational experience feedback from organisations external to Kozloduy NPP has entered into force. The major sources of information from other NPPs are - IAEA/NEA Incident Reporting System (IRS) and IAEA databases, WANO information exchange, etc.

8. Radioactive Waste Generation and Treatment

The generated amount of solid radioactive waste in 2000 for the 6 Units is 860 m^3 or 230 m^3/GWe.a. After super-compacting and decontamination of the waste, only 40 m^3 /Gwe.a remain for storage. The average amount of generated solid radioactive waste for the world nuclear power production is about 500 m^3/GWe.a [IAEA Bulletin 39/1]. In 2000 all the newly generated solid radioactive waste was treated, as well as a part of the waste of Category I and II generated in previous years and stored but not treated. Totally 1223 m^3 of compactable solid radioactive waste and 25.4 m^3 of metallic radioactive waste was treated by the compacting method. As a result, of the measures applied during the last years for minimising the radioactive waste, a stable tendency for decreasing the total volume of solid radioactive waste, subject to a long-term storage, was achieved.
About 7140 m^3 of liquid radioactive waste were kept in the liquid radioactive waste storage facilities at Kozloduy NPP plc by the end of 2000.
With the implementation of the "Complex programme for radioactive waste management at Kozloduy NPP plc", adopted in 2000, a considerable minimisation of the solid and liquid radioactive waste generated in Kozloduy NPP plc will be achieved and conditions will be created to get closer to the results of the countries from the European Union - 100 m^3/GWe.a, as well as for their safe long-term interim storage and subsequent disposal.

With the final commissioning of the Radioactive Waste Treatment and Storage Complex, conditions are created for treatment of the generated radioactive waste in the process of operating the Units. In parallel to this, the processing of waste accumulated for about 5 years will be performed. The treated radioactive waste storage will resolve the problem with the storage for about 30 years.

REFERENCES

[1] Report of the OSART Mission to the Kozloduy 1 to 4 Nuclear Power Plant, Bulgaria, 11 to 28 January 1999, IAEA-NSNI/OSART/99/102

[2] Report of the OSART Mission 11 to 28 January 1999 and the Follow-up visit 15 to 19 January 2001, to the Kozloduy 1 to 4 Nuclear Power Plant, Bulgaria, IAEA-NSNI/OSART/01

[3] Report of the Expert Mission to Review the Modernisation Programme of Kozloduy Nuclear Power Plant Units 1 to 4, Bulgaria, 2-6 October 2000, IAEA-TCR-00275

[4] Report of the IAEA Mission on the Expert Mission Related to Programme for the Modernisation of Units 5 and 6 of the Kozloduy Nuclear Power Plant, Bulgaria, 10-14 July 2000, IAEA-RU 9359

[5] Additional Geological Examination of the Belene NPP Region, Bulgarian Academy of Sciences, Geological Institute, 1999 (Bulg.)

Annex 1

A LIST OF THE NUCLEAR FACILITIES

I. Kozloduy NPP

Location: Northwest Bulgaria, 3.5 km South-east of the town of Kozloduy;

1.1. Units 1 and 2, WWER-440/V230 (in operation);

1.2. Units 3 and 4, WWER-440/V230 (in operation);

1.3. Units 5 and 6, WWER-1000/V320 (in operation);

1.4. Spent Fuel Pool (in operation);

1.5. Low and medium radioactive waste storage and conditioning facilities (in a process of commissioning).

II. Belene Site

Location: Northern Bulgaria, Danube kilometer marker 571, 4 km east of the town of Belene;

2.1. Units 1 and 2, type WWER-1000/V320 (under construction, frozen).

Annex 2

NUCLEAR FACILITIES DATA

I. Kozloduy NPP Units

1. Major Characteristics and Parameters of Kozloduy NPP Nuclear Facilities

The six Units, erected on site have been designed and procured by the ex-USSR. They were commissioned as follows:

Unit 1	- October 1974	- WWER-440/V-230
Unit 2	- November 1975	- WWER-440/V-230
Unit 3	- December 1980	- WWER-440/V-230
Unit 4	- June 1982	- WWER-440/V-230
Unit 5	- November 1987	- WWER-1000/V-320
Unit 6	- August 1991	- WWER-1000/V-320

Table 1. ***Basic Parameters and Characteristics***

Title	Units	Unit 1-4	Unit 5-6
Reactor:		WWER-440	WWER-1000
Type		V-230	V-320
Reactor Power:			
- thermal	MW	1375	3000
- electric	MW	440	1000
Primary Circuit Pressure	MPa	12.3	15.7
Coolant temperature at the reactor inlet	^{0}C	268.7	289
Coolant temperature at the Reactor outlet	^{o}C	301.3	320
Average heating temperature In the reactor core	^{o}C	28	30.3
Fuel assemblies	Number	349	163
Control rods	Number	37	61
Fuel Rods in a Fuel Assembly	Number	126	312
Average Density of the thermal flow	W/cm^2	44	57.9
Average linear thermal flow	W/cm	125	165.7
Number of Primary Circuit Loops	Number	6	4
Coolant flow rate	m^3/h	45000	84800
Maximum fuel Enrichment U-235	%	3.6	4.4
Steam Generators:			
Type		ПГВ-4Э	ПГВ-1000
Number (per Unit)	Number	6	4
Steam generation	t/h	425	1480
Thermal power	10^6 kJ/h	827	2690
Steam pressure	MPa	4.6	6.27
Feedwater temperature	^{o}C	225	220
Turbines:			
Type		K-220-44	K-1000-60/1500
No. per Unit		2	1
Power	MW	220	1000
Fresh Steam Parameters:			
- Pressure	MPa	4.3	5.9
- Temperature	^{0}C	256	274.3

Title	Units	Units 1-4	Units 5-6
Main Circulation Pumps			
Type		MCP-310 glandless	MCP-195M inertial
No. per Unit	.	6	4
Generators:			
Type		TBB-220-2	TBB-1000-4У3
Nominal Power	MW	220	1000
Generator Voltage	kV	15.75	24
Voltage to the net	kV	400/220	400

Table 2. ***Improvements in Basic Engineered Safety Features (ESF) of KNPP 3&4 Units***

Engineered Safety Features	WWER 440/230 Original design	KNPP 3&4 Upgraded Design
High Pressure Injection System	2 trains	3 x 100%
Low Pressure Injection System	-	3 x 100%
Emergency Feedwater System	Not safety grade	2 x100%, safety grade
Confinement Spray System	Not safety grade	3x100%, safety grade
Hydrogen Monitoring System	-	Installed
LBB concept implemented	-	2 qualified systems, the third planned
Valves for Bleed and Feed on Steam Generators.	-	Qualified
Valves for Bleed and Feed on Pressurizer	-	Qualified
Service Water System	Not adequate for operation under accident conditions	Upgraded, redundant, qualified, backup planned
Fire Protection System	One train	2 x100%, redundant
Emergency Power Supply	Not safety grade	3x100%, safety grade
Emergency Control Room	-	Yes
Safety Parameter Display System	-	Yes
Seismic resistance	Unqualified	Upgraded, verified

Table 3. ***Improvements concerning the main components in barrier system in KNPP 3&4 units***

Component	Parameter	Original Design	Upgraded actual design
Reactor Pressure Vessel	Embrittlement	High, Annealing needed	Low, design lifetime assured
Pressurizer Safety Relief Valves	Qualification	No	Fully qualified
Steam Generator Safety Valves	Qualification	No	Fully qualified
Fast Closing Main Steam Isolation Valves	Qualification	No	Fully qualified
Protection against Pressurized Thermal Shock	Effectiveness	-	Very good, equipment qualified and automatic
Systems for leak before break concept	Implementation	None	Implemented, presently two systems qualified, the third will be installed*
Confinement	Leakage rate	High	Reduced 10-fold, further work follows* under contract
Confinement	Structural capability	Unknown	Can stand LOCA 200 mm
Confinement	Prevention of uncontrolled releases after LOCA	No	Planned implementation of water jet vortex condenser*

* The dates of implementation of all planned upgrading measures are set and funds are available

2. Description of the Site

2.1 Location and Hydro Geological Characteristics

Kozloduy NPP site is located 3.5 km South-east of town of Kozloduy, about 12 km northwest of the town of Mizia in the territory of the county of Montana, and 3 km from the Romania border – the Danube.

The site is borders the Danubian valley (elevation 20 m above the sea level) To the North, and the slope of the water-split plateau (elevation 90 m above the sea level) to the South. The site cannot be flooded and the absolute elevation is +35 m above the sea level. The relief of the site is a hilly plain with absolute elevation 100-200 m, indented by the beds of the rivers Tsibritsa, Ogosta and Skat, between which are formed oblong, wide and flat ridges, separating virgin soil, the biggest of which being the Zlatiya plateau. The bank of the Danube in the region of Oryahovo and to the West of Kozloduy is higher and reaches 100-110 m, while the lowest riverside place is the Kozloduy valley with 25-30 m above the sea level.

Geologically, the site is consisting of Pliocene and Quaternary deposits. The upper layer of 14-15 m consists of loess and loess like clay, the superficial layer of about 7 m being of loess good for plants. The Pliocene deposits start at a depth of 18-20 m (marl dense clays and sands). 10 m-thick deposit of sand begins at a depth of 35 m the total amount of the Pliocene deposits is about 100 m.

Underground aquifers are contained in water – carrying alluvial gravel-sand deposits and Pliocene sands. They are located at an absolute elevation of +29.0 m with flow direction to the Southwest and Northeast. The underground waters are not corrosive to concrete.

2.2 Seismic Characteristics

The region of the site is seismically active, but active tectonic cracks miss it. The Maximum design-basis earthquake of 8^{th} scale (MDBE) and a design-basis earthquake of 7^{th} scale are defined according to the MSK-64 scale. In case of an earthquake, no residual deformations of the soil are expected or other secondary phenomena.

The whole region is located on the Mizian platform, which, based on its seismics, is classified as 7^{th} scale according to the MSK-64 scale.

2.3 Meteorological Data

The climate is temperate continental with cold winters and hot summers and covers the Northern climate region of the Danubian valley. The fact that the zone is open to the north and northeast propitiates the push of cold air, especially during the winter.

The absolute maximum temperature measured is $+43.2^{o}C$ (in August). The absolute minimum temperature measured is $–26.6^{o}C$ (in January). The average temperature of the air is $11.5^{o}C$.
The strongest winds are observed in the spring – up to 25 m/sec.

2.4 Demographic Data

The density of population is irregular. The region with highest density is around the town of Oryahovo (100-120 people/km^2) and the town of Mizia (20-30 people/km^2), the average density of the population is 60-80 people/km^2.

3. Reactor Installations

3.1 Reactor Vessels, type WWER-440/V-230

The reactor is a vertical cylindrical vessel, consisting of a vessel (with internal reactor devices installed in it) and a removable upper block.

The vessel has an internal diameter of 3580 mm and wall thickness of 140 mm. The fuel assemblies are accommodated in a cylindrical pit and stainless steel basket inside in the vessel. The thickness of the basket steel, the pit and the layer of the coolant circulating between them and the reactor vessel wall, protect the vessel steel from neutron flux damage. 36 screening assemblies are installed in the periphery of the reactor core of Units 1, 2 and 3 to increase vessel operation life.

The 12 orifices of the reactor with internal diameter of 500 mm are located in a thickened belt at two levels. The lowest point of the lower belt of orifices is located 1450 mm higher than the upper end of the reactor core.

The upper reactor block, consisting of a spherical lid with pipes for the control assemblies and a metal structure for transportation is attached to the main flange of the reactor vessel.

3.2 Reactors Vessel, type WWER-1000/V320

The type WWER-1000 reactor vessels are structurally an analogue of the type WWER-440 vessels. The WWER-1000 vessel of has eight orifices with internal diameter 800 mm, located in two levels. The major characteristics of the reactor are:

- Vessel diameter - 4535 mm;
- Vessel length - 10880 mm;
- Length of reactor with upper reactor block - 24770 mm;
- Reactor vessel mass - 304 tons.

3.3 Reactor Core, type WWER-440/V-230

The reactor core of type WWER-440 is composed of 349 fuel assemblies, consisting of 312 static fuel assemblies and 37-movable ones used by the control and protection reactor system. Units 1, 2 and 3 have 276 static nuclear fuel assemblies and there are 36 static screen assemblies at the periphery of the core.

A fuel assembly consists of a hexagonal zirconium alloy tube, containing 126 fuel rods regularly spaced in a triangular grid. A fuel assembly contains an average of 118.5 kg of uranium, distributed in 126 fuel rods. The length of the fuel column is 242 cm (cold).
The shape of the reactor core is cylindrical (approximately) with a diameter of 288 cm and 242 cm height. The mass of uranium in the rector core is about 37000 kg (for Units 1, 2 and 3) and about 41200 kg for Unit 4, the average U-235 enrichment is 2.4% and the average fuel burn up, in stationary mode, is 29.0 MW.d/kg U.

The movable control assemblies consist of two parts: lower – fuel assembly and upper – neutron absorber (boron steel). During operation, the upper parts of the control assemblies are completely drawn out of the rector core and only one group of control fuel assemblies is partially inserted into the reactor core. This group is used to control the power of the rector and to compensate for rapid changes in the reactor activity (temperature and power effects).

A defined concentration of boric acid is created in the primary circuit coolant so that slow changes in reactivity are compensated (fuel burn up, xenon and samarium poisoning) and sub criticality of the cold reactor is maintained.

3.4 Reactor Core, Type WWER-1000/V-320

Equivalent diameter of reactor core	- 3160 mm
Reactor core height	- 3530 mm
Number of fuel assemblies	- 163
Number of rods in an assembly	- 312
Mass of fuel (UO_2)	- 74.2t
Average fuel burn up after a three-year cycle	– 40.1 MW.d/kg U

The average time for reactor operation between two refueling cycles is 7000 effective hours. Refueling is performed during shutdown with a deeply sub critical and cooled down reactor.

Reactor Control and Operation

Control and operation of reactors, type WWER-440 and WWER-1000 is analogous and is performed by the following systems:

- System for group and individual control;
- System for control of the position of the control rods of the reactor;
- System for automatic power control;

Alarm and Emergency Protection Systems.

The devices for control of the neutron flux of the reactor provides:

- Measuring and control of the density of the neutron flux of the reactor from 10^{-8} to 115% of the nominal thermal power of the reactor.
- Measuring and control of the relative speed of density changes in the neutron flux (period of the reactor) from level 10^{-6} to 115% of the nominal thermal power of the reactor;
- Emergency and alarm signals within the scheme for emergency protection of the reactor;
- Signals for all-range changes to the displaying and registering devices in the Main Control Room.

Devices for thermal control of the rector and the primary circuit measurements:

- Coolant temperature at the outlet of a given number of fuel assemblies;
- Coolant temperature at the outlet of the mixing chamber above the reactor core;
- Pressure fall in the reactor core;
- Coolant pressure in the reactor core;
- Difference in coolant temperature in the hot and cold piping of each circulation loop;
- Pressure and level in the pressurizer;
- Coolant temperature at the I/O of the steam generators;
- Pressure at the outlet of each main circulation pump;
- Feed water temperature to the steam generator;
- Water pressure in the feed water system to the primary circuit;
- Temperature of reactor structure elements, etc.

Systems for early detection of primary circuit leaks (type ALUS) installed in Units 1 through 4

The reactor control and protection system provides the following modes:

- Start-up and shut down of the reactor to power 3-5% of the nominal in manual control mode;
- Automatic power regulation within the range 3-5% to 100 % of the nominal;
- Compensation of reactivity changes;
- Accident protection, which brings the reactor to sub-criticality in 8.5 – 15 sec. for WWER-440 (1.7 – 4 sec. for WWER-1000).

Cooling Circuits (Primary and Secondary)

The technological schemes of the Units with WWER reactors are two-circuit ones. The primary circuit is designed to receive the heat developed in the reactor core through the steam generators to the secondary circuit. It consists of the main circulation loops and auxiliary systems.

During power operation, the primary circuits contains radioactivity from the following sources:

- Coolant activity resulting from interaction between the fast neutron flux and oxygen isotopes in the coolant;
- Fission product activity, introduced into the coolant through micro defects in the cladding of the fuel elements;
- Corrosion activity, resulting from activation of structural materials in the reactor core.

The secondary circuit is designed to generate non-radioactive steam and transfer it to the turbine generators to generate electric power. It includes the steam generators, the turbine generators, and the auxiliary equipment in the machine room.

The Danube River is used as the ultimate heat sink for all of the reactor systems. The water is transferred with the help of two bank pump stations from the cool channel with a total flow of 160 m^3/s and length 7.5 km. The hot outlet channel is in parallel to it and returns the water back into the Danube.

4. Environmental Protection

4.1 Radioactive Substances Emitted into the Environment

The yearly activity of the gaseous-aerosol emissions, released by Kozloduy NPP plc. into the atmosphere, is shown in Table 4.

Table 4. ***Gaseous and aerosol activity, released in the period 1998 –2000 Compared to design norms***

	Radioactive Noble Gases [TB_q]	**Long Life Activity [GB_q]**	**IODINE –131 [GB_q]**
Acceptable average daily values	70	2	1.4
Design Norms for Units 1-6 for 3760 MWh	25550	730	510
Total emitted activity by Kozloduy NPP in 1998	233.5	1.16	5.42
Comparison with the design norms %	0.90%	0.16%	1.06%
Total emitted activity by Kozloduy NPP in 1999	259.6	1.05	2.93
Comparison with the design norms %	1.02%	0.14%	0.57%
Total emitted activity by Kozloduy NPP in 2000	251.8	1.19	3.26
Comparison with the design norms %	0.98%	0.16%	0.64%

4.2 Protective Cover of the Reactor Installation

The reactor vessel (RV) equipment No V-230 is located in a structure, which has a system of hermetic chambers, bearing pressure up to 0.2 MPa (abs). The RV is located in a pre-stress reinforced concrete structure with steel casing and a cylindrical shape, covered by a spherical dome, which can bear pressure up to 0.5 MPa. C. The protective casing is tensed through a rope system, which allows it to bear extreme external and internal pressures. The steel casing and the concrete screens at the internal side of the protective casing, protect it from reactive jets and flying objects in case of a high-energy pipe break.

4.3 Safety Systems

The Safety Systems (SS) at Units 1 and 2 are automatic, two-channel systems with 100% redundancy. Each unit has 3 Diesel Generators (DG) installed, each capable of supplying the emergency power required for the unit.

Depending on their role the SS are divided as follows:

- Protective Systems, including, the Reactor Emergency Protection System;
  - Emergency High Pressure Boron Injection System;
  - Primary Circuit Overpressure Protection System;
  - Secondary Circuit Overpressure Protection System;
  - Complementary Emergency Feedwater System to the SG;
  - Fast acting isolation and cut-off valves of the main steam pipe lines.
- Localising Systems, including:
  - Spray system;
  - System of hermetic compartments (confinement).
- Supply Systems, including:
  - Systems for Reliable Power Supply;

- System for Ventilation of the SS Rooms;
- Emergency Lighting System;
- Service Water System.

- Control Systems, including:
  - System for forming signals for emergency protection, based on neutron, physical and technological parameters;
  - Automatic stepped starting of the DGs;
  - Automatic regulator of reactor power;
  - Automatic Main Circulation Pump control;
  - System for forming control signals for the Safety Systems.

During the designing of the SS for Units 3 and 4, the principle of single failure was applied. The safety systems consist of three independent channels, each one of which can perform the system design functions by itself and ensure the safety of the Unit at all operation modes for each one of the envisaged design basis events (capacity 3 x 100%). Unlike Units 1 and 2, in Units 3 and 4 there is a low-pressure system for emergency core cooling.

In the design of the SS for Units 5 and 6, again, is applied the principle of the single failure. Each safety system consists of three independent channels, separated functionally and territorially, each one of them being able to ensure the design functions of the system and ensure the Unit's safety at all operation modes and following the maximum design basis accident.

A system for emergency cooling of the reactor core is installed at Units 5 and 6. This system consists of four hydro accumulators, filled with boric acid solution, with a useful volume 50 m^3, which capable of direct injection into the reactor core when primary circuit pressure is less than the pressure in hydro accumulators.

Spent Fuel Storage Facility at Kozloduy NPP

After preliminary storage of about 3 to 5 years in the fuel assembly preliminary storage pools, located next to the reactors, the fuel assemblies are transported, using internal plant transport container and a specialized auto platform, to the Spent Fuel Storage Facility.

Storage is in a pool; with a design capability for storing fuel assemblies from both, WWER-440 and WWER-1000 type reactors. The spent fuel storage is done under a protection layer of demineralised water, in transportation baskets. Their location warrantees, that the nuclear safety requirements are met with enough sub-criticality. The volume of the Spent Fuel Storage Facility, according to its design, is 168 baskets, 30 assemblies each from the reactors of Units 1 through 4. The fuel is stored in 4 sectors. The acceptable filling is ¾ of the capacity of each one of them.

Radwaste Treatment and Storage Facilities at Kozloduy NPP

Radioactive waste is stored and treated with the help of systems and facilities, constructed together with the Units, at present.

The main method for treatment of the solid radwaste is its volume reduction by pressing it into 200-liter steel barrels. The pressing is performed in two stages: a) preliminary pressing of the waste in the barrels, and b) compaction of the barrels themselves using a press.

The liquid radwaste is collected through a special systems and after precipitation and mechanical filtering it is treated in a two-stage evaporating facilities, as a result of which distillate and concentrate are received with a solids concentration greater then 300 g/l.
The distillate is then transferred through ion-exchange filters and after a check of the radiochemical and chemical parameters is reused in the reactors systems. The concentrate is kept in reservoirs, located in special rooms in the reactor facilities.

The Radwaste Treatment and Storage Facility Complex is being commission for operation with the accumulated waste from existing storage facilities. Waste in this facility will be prepared for transportation to a long-term storage facility where it will be treated, processed into a state, which will allow it to be incorporated into solid matrix for long-term storage.
Westinghouse provides the technology and the basic facilities under a contract. The technology envisages cementing the liquid radwaste, pressing of the solid radwaste, and their accommodation in reinforced concrete containers.

The containers, after being filled and sealed are stored in aboveground halls to isolate the containers from the direct atmospheric influence, and to be able to localize any radioactive products in case of an accident.

Belene NPP

The site is located in the Svishtov-Belene plain on the bank of the Danube – 571 km and opposite the biggest island in the Danube – Belene (Persin) island and is 7.5 km from the border with Romania.

A Technical Project was developed by AEP – Kiev and Energoproject – Sofia, for the construction of the NPP in 1987, which envisages the construction of four Units with reactors, type WWER-1000/V320. The basic construction was commenced in 1987. Large-scale construction was performed during the period 1988-1990. After 1991, the construction was practically frozen.

In the period 01.07 – 20.07.1990, a PREOSART Mission with representatives from Cuba and Romania was held, for IAEA expert review of the construction. The conclusion was that the project organization is an integrated and centralized formation, valid for the member countries, in the Economic Mutual Aid Union (EMAU). It operated, based on an approved unified project for WWER-1000, aiming at high level of reliability and safety, minimum expenses and optimum construction schedules. The mission gave a positive assessment for the management, construction, and the preparation for commissioning. Their major recommendation was to develop a Quality Assurance Program.

In 1990, a two-month mission was held, by IAEA again, for the assessment of the project from a safety point of view. The mission reviewed the reactor core and safety systems designs and the safety analyses. The assessment of the mission was that as far as the reviewed parts were concerned, Belene project is similar to the modern PWR type reactors. No substantial safety deficiencies were found. The recommendations were concerning possible improvements.
With some documents, developed in 1996 and 1997, based on the operational experience from Kozloduy NPP and other NPPs with WWER, technical solutions were suggested for Belene

NPP, leading to enhancing of nuclear safety and improvement of maintenance and reliable operation.

In relation to the effective legislative order in the Republic of Bulgaria, all activities, performed to date and all procedures were reviewed. Because of this the following were developed:

- Studies and activities, enhancing safety at Belene NPP, following IAEA program;
- Engineering review and implementation possibilities, January 1996;
- Documents for permit request for choice of site and construction, August 1997.

After the construction of the NPP was frozen, programmed preservation activities for the basic structures and preservation of the equipment stored on site were performed. Control of the status of the building structures is exercised and if any defects are found, they are eliminated. For a big part of the basic equipment, the companies, which produced it, were consulted.

Still a final decision, concerning a future construction of Belene has not been made.

Annex 3

IMPLEMENTATION STATUS OF THE MEASURES FROM THE RECONSTRUCTION AND MODERNIZATION COMPLEX PROGRAM FOR UNITS 1-4

KEY for **Status:**
I – Completely implemented Measure;
O – Ongoing Measure (the year for completion is stated);
D – Measure dropped because of early decommissioning;
OD – Ongoing within the decommissioning project

№	Measure	Title	Unit	Comments	Status 1,2 U	Status 3,4 U
1	M.1.1	Replace the Automatic Control of Neutron Parameters in "Source Range".	1-2	The Measure is implemented	I	-
2	M.1.2	Operative Control System of Energy Release along the Height Reactor Core.	1-2-3-4	The Measure is implemented	I	I
3	M.1.3	Optimize the Table of the Permissible Reactor Modes.	1-2-3-4	The Measure is being implemented at Units 1-4 under a contract with ACE-Russia, Main Contractor OKB "Hydropress". The necessary calculations have been completed. Comments are being resolved. To be completed in 2001.	O 2001	O 2001
4	M.2.1	Tightness Control of the Fuel Rods Cover, based on Benchmark Isotopes	1-2-3-4	The activities, planned on the Measure have been completed. In addition within the help from IAEA, under project BUL/4/006 the procurement of "sipping test" system is organized, which could be used at Units 1-6.	I	I
5	M.2.2	Ensure Fuel Cooling at LOCA	1-2-3-4	Analyses have been carried out for LOCA Dy 100 and Dy 200. The licensing comments are being resolved. International expertise is being carried out The realistic analyses of LOCA Dy 500 have been carried out, according to methodology, approved by SNEUI.	O 2001	O 2001
6	M.2.3	Justify Strength of the Internal Reactor Core Devices	1-2-3-4	The Measure is being implemented at Units 1-4. Contractor has been chosen through international bidding.	O 2002	O 2002

7	M.2.4	Ensure Feedwater to the Steam Generators -Units 1 and 2 from the Safety Injection System.	1-2	The Measure is implemented	I	-
8	M.2.5	Ensure Reliable Electric Supply to Pumps 1 and 2 of the Additional Pure Condensate Tank.	1-2	The Measure is implemented.	I	-
9	M.2.6	Repair Additional Tanks 1 and 2 for Pure Condensate.	1-2	The Measure is implemented in the necessary scope considering the earlier decommissioning of Units 1 and 2.	I	-
10	M.2.7	Improve Conditions for Fuel Operation and Control of Its Integrity.	1-2-3-4	The Measure is implemented together with the fuel producer and the respective competent authorities.	I	I
11	M.2.8	Containment Venting System	1-2-3-4	The Activities for an additional system have been planned for implementation only at Units 3 and 4, as an element of beyond design basis and severe accident management. Design basis accidents do not require such a system. System design procedure has been commenced.	D	O 2002
12	M.2.9	Remote Control of Valves Connected to the Emergency Boric Acid Tank.	1-2-3-4	The Activities have been planned for implementation only at Units 3 and 4. Analysis has been carried out for the necessary Measures and technical solution for their implementation was prepared.	D	O 2002
13	M.2.10	Installation of Additional Check Valves on the Make-Up Water to the Steam Generators in the SG Box.	1-2-3-4	The Activities have been planned for implementation only at Units 3 and 4. Procurement and design procedures have been commenced.	D	O 2002
14	M.2.11	Commence Measuring of the Level in the Reactor.	1-2-3-4	The Activities for an additional system have been planned for implementation only at Units 3 and 4, as an element of beyond design basis and severe accident management. Design basis accidents do not require such a system. System design procedure has been commenced.	D	O 2002

15	M.2.12	Installation a Flow Restrictor at Tightness Loss at Primary Circuit SG Collectors.	3-4	The Measure is being implemented by KNPP during outage-2001 and outage-2002 based on documentation by the general constructor of the reactor building.	-	O 2002
16	M.3.1	Define Possibility for Reactor Vessel Destruction.	1-2-3-4	Analysis has been carried out for Unit 2, applicable also for Unit 1. Based on this and considering SNEUI comments, additional study has been commenced for Units.	I	O 2002
17	M.3.2	Determine Residual Life Time of Reactor Vessels.	1-2-3-4	The necessary scope has been covered for Units 1 and 2. Within the RLT activities additional accelerated irradiation of Unit 1 samples, aiming at specifying data for Unit 3 reactor vessel residual operational life.	I	O 2002
18	M.3.3	Expand the Program for Metal Control.	1-2-3-4	The Measure is implemented.	I	I
19	M.4.1	Additional Calculation Based Justification of SG Strength.	1-2-3-4	The Measure is planned for implementation only at Units 3 and 4.	D	O 2002
20	M.4.2	Statistics-Dynamic Strength Analysis of Primary Circuit and Supports, Resulting from It	1-2-3-4	Implementation based recommended analyses for additional supports are carried out for all units in the necessary scope. Additional studies for Units 3 and 4 are planned considering depending failures.	I	O 2002
21	M.4.3	Operational Reliability Analysis of Primary Circuit Piping with Diameter Dy 200 and Dy 500.	1-2-3-4	The Measure has been completed for Units 1 and 2. Additional studies have been commenced, concerning only Units 3 and 4.	I	O 2002
22	M.4.4	Replace SG Blow Down Pipes with Ones, Manufactured from Stainless Material.	1-2-3-4	The Measure in the necessary scope has been completed for Units 1 and 2, considering the earlier decommissioning. For 3 and 4 it is to be implemented during the current outages of the Units.	I	O 2002

23	M.4.5	Rehabilitation of Water Treatment of SG Blow Down System.	1-2-3-4	Having in mind the earlier decommissioning and lack of need, the complete implementation of the Measure for Units 1 and 2 was stopped. To be implemented during the current outages for Units 3 and 4.	D	O 2002
24	M.4.6	Use More than One System to Detect Leakages.	1-2-3-4	A new system for early leak detection, through collecting and measuring the condensate, deposited at the heat exchangers of system R-1 form the moisture in the SG box has been implemented at Units 1 and 2. In addition, a moisture detection system for Primary Circuit piping and equipment of Unites 3 and 4 is planned. Procurement procedure has been initiated.	I	O 2002
25	M.4.7	Analyze the Consequences of a High Energy Line Break in the Machine Room.	1-2-3-4	The Measure is planned for implementation only at Units 3 and 4.	D	O 2002
26	M.4.8	Temperature Measurements of Dy 200 for Each Unit.	1-2-3-4	Measure has been implemented at all Units	I	I
27	M.5.1	Improve Containment Seals.	1-2-3-4	At Units 1 and 2 during all outages, a complex of additional measures is implemented, for maintaining and further gradual decrease of non-density. The Slovak company VUES has been retained for Units 3 and 4 in connection to the box sealing-related activities c, so that during the current outages, results comparable to Bohunitse are to be achieved.	I	O 2002
28	M.5.2	Determine the Parameters inside the Containment at Primary Circuit Large Diameter Line Breaks.	1-2-3-4	Licensing analyses have been carried out for LOCA Dy 100 and Dy 200 for all Units at the present status of the system. Technical measures for Units 1 and 2 have not been planned. Such an assessment for Units 3 and 4 is being made within the justification for reconstruction of Localizing Systems – See M.5.3.	I	O 2001

29	M.5.3	Upgrade the Localizing Systems through installing Additional Devices.	1-2-3-4	The Measure is planned for implementation only at Units 3 and 4 during the current outages.	D	O 2002
30	M.5.4	Lock Equipment to "Main Circulation Pumps Deck ".	1-2-3-4	The Measure has been implemented.	I	I
31	M.5.5	Enhance Reliability of Sprinkler System.	1-2	The Measure has been recommended bases on PSA, Level 1. Since there are no comments, concerning the Safety Systems from the Deterministic Safety Analysis, the Measure is not planned for implementation in the short term for operation of Units 1 and 2 left.	D	-
32	M.6.1	Update PSA, Level 1.	1-2-3-4	Updating has been made, considering the additional Steam Generator Emergency Feedwater System. (For Unit 1 and 2– qualitative assessment). A second updating is being made for Units 3 and 4 within the technical safety justification (SAR).	I	I
33	M.6.2	Analyze the Hazard of High Irradiation.	1-2-3-4	This activity is in fact a Probabilistic Safety Analysis, Level 2 and is planned for implementation only at Units 3 and 4.	D	O 2002
34	M.6.3	Assess Impact on Environment.	1-2-3-4	Implemented, including Units 1, 2, 3, 4, 5, & 6.	I	I
35	M.6.4	Develop Technical Safety Justification to Meet Modern Requirements.	1-2-3-4	A General Report for the safety of Units 1, 2, 3, & 4 has been developed. In addition, a SAR in compliance with a TOR, approved by BNSA, is being developed for Units 3 and 4 by a consortium of Bulgarian companies.	I	O 2002

36	M.6.5	Upgrade Safety Systems based on Probabilistic Safety Assessment, Level 1.	1-2-3-4	A PSA, Level 1 for Units 1-4, and the recommended Measures have been implemented. In addition, assessment of passive failure of emergency boric acid tank for Primary circuit has been recommended.	I	I
37	M.6.6	Residual Life Control and Management Program.	1-2-3-4	The implementation of the Measure for Units 3 and 4 is ongoing.	D	O 2002
38	M.7.1	Analyze UPS Failures.	1-2-3-4	The study was completed. Recommended Measures have been implemented during outage-2000 for Units 1-2-3-4.	I	I
39	M.7.2	Minimize DG Protections.	3-4	The Measures implemented during the outage 98/99.	-	I
40	M.7.3	Complete Physical Separation of Reversible Motor-Generators.	1-2	The Measure has been implemented.	I	-
41	M.7.4	Install Generator Breakers.	1-2	The Measure was dropped out because of the limited term of operation of Units 1 and 2.	D	-
42	M.7.5	Replace Breakers and Cathode Outlets in Metal Clad Switchgear.	1-2-3-4	The Measure has been implemented in its full scope, concerning the facilities at Units 1-4.	I	I
43	M.7.6	Replace the Complex Distribution Facility 6 kV, 0.4 kV Direct Current Actuator.	1-2-3-4	A Complete implementation is planned for Units 3 and 4. Within the project for decommissioning assessment will be made for the systems, which remain in operation and the need and scope of breakers replacement will be defined.	OD	O 2002
44	M.7.7	Replace the Generator Bearing Seals.	1-2-3-4	The Measure is about to be completed – the systematic replacement of the generator bearings of Units 1-6 was completed. The preparation for the last two at unit 4 is ongoing.	I	O 2001
45	M.7.8	System for Filing Transient Processes in the Electric Power Supply System Local Consumers.	1-2-3-4	Implementation dropped for Units 1 and 2 due to short term of operation left. The system has only informational functions and is not directly related to safety. The Measure has been implemented in Units 3-4	D	I

46	M.7.9	Replace the Generator Excitation System.	3-4	The Measure is at a stage of completion	-	I
47	M.7.10	Dismantling of Demineralized Water Reserve Container.	3-4	The Measure is being implemented now and will be completed during the next outages of Units 3 and 4.	-	O 2002
48	M.7.11	Reserve the DG Cooling in the DG Station.	1-2-3-4	The Measure has been implemented.	I	I
49	M.7.12	Establish Regular Connection for Hydrogen Supply from P-5,6.	1-2-3-4	The Measure is in a final stage of implementation. The system is for Units 1 thru 4.	O 2001	
50	M.7.13	Install an Accumulator Battery per Unit.	1-2	The Measure was dropped out due to the short term of operation left for Units 1 and 2. The implementation was redirected to Units 3 and 4.	D	O 2002
51	M.7.14	Replace the Accumulator Battery at a DG Station.	1-2-3-4	The Measure has been implemented.	I	I
52	M.7.15	Replace the Automatic DG Excitation Regulation	1-2-3-4	The Measure has been implemented.	I	I
53	M.7.16	Automatic Regulation of Distillate and Gas Temperature in the Generators.	1-2-3-4	The Measure was dropped out for Units 1 and 2. It is not directly related to safety enhancement. Preparation to be implemented at Units 3 and 4 during the next outage is ongoing.	D	O 2002
54	M.7.17	Install Additional Auxiliary Transformer 4 Thermocouple	3-4	This issue was resolved because of additional power supply possibilities, provided after the installation of generator breakers at Units 3 and 4.	-	I
55	M.7.18	Replace Safety Valves of the Preheating System.	1-2-3-4	Dropped out for Units 1 and 2 because of the short term of operation left and the satisfying status of the existing valves.	D	O 2002

56	M.7.19	Replace the DG Automation Control System with a Modern one with in-built diagnostic devices.	1-2-3-4	The necessary scope of modernization of the DG Control System at Units 1 and 2 should be assessed, depending on the functions and requirements to the systems, remaining in operation after the decommissioning of the Units. For Units 3 and 4, the preparation for the implementation during the following outage is ongoing.	OD	O 2002
57	M.7.20	Replace Automation of Sequencer at Units 3 and 4.	3-4	Preparation for the implementation during the following outage is ongoing.	-	O 2002
58	M.7.21	Reassess the Protection Levels in the House Power Supply System.	3.4	The Measure is at a stage of a TOR preparation and is interfaced with the breaker replacement in the Complex Distribution System - See M.7.6. Parallel implementation with M.7.6.	-	2002
59	M.8.1	Justify Operation with a Reduced Number of Emergency Protection Channels.	1-2-3-4	The Study is completed, resulting in recommendation of technical Measures Implemented at Units 1, 2, 3, 4	I	I
60	M.8.2	Modernize the Auxiliary Control Panel.	1-2	The Measure is implemented in the necessary scope at both Units.	I	-
61	M.8.3	Implement a Control System for the Safety Parameters.	1-2	The Measure is implemented in the necessary scope at both Units.	I	-
62	M.8.4	Modernize the System for Operator Support.	1-2-3-4	The necessary scope has been implemented at Units 1 and 2, taking into account the earlier decommissioning. Preparation for implementation at Units 3 and 4 during the following outage is ongoing.	I	O 2002
63	M.8.5	Steam Generator Level Control System.	1-2-3-4	A Compensatory Measures have been implemented at Units 1 and 2 - expanded valve and control system check. Preparation for implementation of the new system during the following outage of Units 3 and 4 is ongoing.	I	O 2002

64	M.8.6	Modernize Generator Temperature Mode Control	1-2-3-4	The Measure has been implemented.	I	I
65	M.8.7	Modernize Generator Gas Control Devices.	1-2-3-4	The Measure has been implemented.	I	I
66	M.8.8	"Cold" Channel Level Control Information System.	1-2-3-4	The Measure has been implemented.	I	I
67	M.8.9	Replace the Operative Connections System.	1-2-3-4	The Measure has been implemented.	I	I
68	M.8.10	Turbine Generator Vibration Control System	1-2-3-4	The Measure has been implemented.	I	I
69	M.8.11	Dividing the Control Diagram of the High Rate Reduction Device for Releasing Steam in the Atmosphere at Units 1 and 2.	1-2	The Measure has been implemented.	I	-
70	M.8.12	Assess Applicability of Safety Parameters Control System for Post- Accident Parameter Control.	1-2-3-4	The Measure is planned for implementation only at Units 3 and 4. Procedure for implementation has been initiated.	D	O 2002
71	M.8.13	Replace Safety Systems I & C Devices at Units 3 and 4.	3-4	The Measure is being gradually implemented during the successive outages of the Units	-	O 2002
72	M.8.14	Modernization the Emergency Protection Control System.	1-2-3-4	A probabilistic analysis of the reliability has been carried out at all Units. The recommended Measures have been implemented. Additional activities for Units 1 and 2 are not planned due to their forthcoming decommissioning. A preparation for analysis, which should determine the modernization options for Units 3 and 4, is ongoing.	D	O 2002/ 2003

73	M.9.1	Modernize the Radiation Control System in the Restricted Zone.	1-2-3-4	A complex implementation of the system, covering Units 1 through 4. Contractor was chosen after a bidding procedure and the implementation is about to be initiated. Study of the evenness of distribution of the gaseous-aerosol releases through air ducts will simultaneously be carried out.	I 2002	
74	M.9.2	Reconstruction of Health Physics and Personal Radiation Protection to the Restricted Zone.	1-2-3-4	The activities on the new organization and interior design, including modernization of the radiation contamination control devices for the body, have been completed. Replacement of the radiation contamination control devices for the body is planned in addition.	I	
75	M.9.3	Evaluate the Equivalent Dose of Neutron Irradiation.	1-2-3-4	The Measure has been implemented.	I	I
76	M.9.4	Study the Conditions for Liquid Radioactive Waste Treatment.	1-2-3-4	It is being implemented within the activities for commissioning of the Radwaste Conditioning Complex.	O 2001	
77	M.9.5	Rehabilitation of Ditch Water Treatment System.	1-2-3-4	A Detailed Design is being developed for the chosen modernization option. The procurement of the necessary equipment is ongoing.	O 2002	O 2002
78	M.9.6	Ventilation System Modernization in the Restricted Zone.	1-2-3-4	Replacement of the filters of ventilation systems B-1C, B-2, B-3 and B-4, planned for all the Units has been completed. No additional activities have been planned for Units 1 and 2. A new filter system with aerosol and iodine filters is being installed at Systems B-1 of Units 3 and 4.	I	O 2001
79	M.10.1	Ensure Safety Evacuation of Personnel in Case of a Fire.	1-2-3-4	A study, common for all Units 1-2-3-4 is ongoing. The implementation of eventual Measures will be commenced, after the acceptance of the study.	O 2002	

80	M.10.2	Upgrade the Main Control Room Ventilation System in Case of a Fire	1-2-3-4	The Measure has been implemented.	I	I
81	M.10.3	Automatic Control of Oil Drainage Pumps in the Machine Room	1-2-3-4	The Measure has been implemented.	I	I
82	M.10.4	Modernize the Fire Alarm Systems at Units 3 and 4.	3-4	The Measure has been implemented.	-	I
83	M.10.5	Probabilistic Analysis of Fire Hazard and Implement Measures Resulting from it.	3-4	A TOR has been developed to Carry out the Analysis. A procedure for its assignment is ongoing.	-	O 2002
84	M.10.6	Analyze Hazard of Activating Systems in Case of a Fire in the Control Room and Implementing Measures, if Necessary.	3-4	A TOR has been developed to Carry out the Analysis. A procedure for its assignment is ongoing.	-	O 2002
85	M.11.1	Seismic Stabilization of Machine Room, Diesel Generator Station, and Central Pump Station.	1-2-3-4	The necessary scope for Units 1 and 2 will be defined as a part of the Decommissioning Project. The total implementation of the Measure for Units 3 and 4 is ongoing	OD	O 2001
86	M.11.2	Calculate the Stability of the Storage Racks in the temporary Storage Pool for the Fuel Assemblies at Seismic Event	1-2-3-4	The Measure has been implemented	I	I
87	M.12.1	Additional Equipment at the Fresh Fuel Center.	1-2-3-4	The Measure has been implemented.	I	I
88	M.12.2	Enhance Safety at Fuel Storage and Shipment and Refueling.	1-2-3-4	In fact, the Measure is a probabilistic Safety Analysis at reactor shut down. The study is only being carried out for Units 3 and 4.	D	O 2001

89	M.12.3	Modernize Control of the Refueling Machine.	1-2-3-4	The necessary scope of improvements has been completed for all Units. Additional improvements are being planned for Units 3 and 4. A TOR is being developed.	I	O 2003
90	M.12.4	Separate an Internal Zone at Units 1 through 4.	1-2-3-4	The Measure has been implemented.	I	I
91	M.13.1	Rank Equipment for Work in Emergency.	1-2-3-4	Qualification Tests have been carried out on prototypes of the existing equipment within a PHARE financed project. Partial replacement of equipment, I & C and relays is ongoing. The necessary replacement of other equipment is covered by other Measures, concerning mainly Units 3 and 4.	I	O 2002
92	M.13.2	Classify Piping and categorize welds.	1-2-3-4	A study was carried out in 2000 for Units 1 and 2, and 3 and 4.	I	I
93	M.13.3	Improve Operational Documentation.	1-2-3-4	The Measure was implemented as regards to the technological regulations, operational and maintenance manuals, procedures and technologies.	I	I
94	M.13.4	Develop Emergency Instructions and Introduce Symptom-Oriented Accident Instructions.	1-2-3-4	A project for developing symptom-oriented accident procedures is ongoing for Units 3 and 4.	D	O 2002
95	M.13.5	Prevention of Non-Allowed Access to the Boron Facility.	1-2-3-4	The Measure has been implemented.	I	I
96	M.13.6	Change the Scheme for Taking Samples During Refueling	1-2-3-4	The Measure has been implemented.	I	I

97	M.13.7	Project for a Decommissioning Program.	1-2	A Conceptual Design has been developed for Units 1 and 2 within a PHARE – financed program. A new project for Technical Project development is ongoing, financed again by PHARE.	O 2002	-
98	M.13.8	System for Automatic Control of Secondary Circuit Water Treatment	1-2-3-4	The Measure has been implemented.	I	I
99	M.13.9	Expand the Installation for demineralized water production. .	1-2-3-4	The installations are common to all Units, 1-2-3-4. The Measure is about to be assigned for implementation of the developed projects.	O 2002	
100	M.13.10	Replacement of Nitrogen, Oxygen Station.	1-2-3-4	The installation is common for Units 1-2-3-4. Measure has been implemented.	I	
101	M.13.11	Condenser Cleaning Installations	1-2-3-4	A Compensatory Measures have been taken and improvements of the existing building have been done at Units 1 and 2. The installation of new systems at Units 3 and 4 is ongoing.	I	O 2002
102	M.13.12	Use Simulator for personnel Training.	1-2-3-4	A multifunctional simulator "EVVEREST" has been built. Its updating is ongoing considering the modifications, done at the Units. A contract was signed for the development of a full-size simulator, the prototype of which will be Unit 3.	I	O 2002
103	M.13.13	Modernize the Air Conditioning Systems	1-2-3-4	The priority rooms at Units 1 and 2 have been equipped with conditioners. The Measure will be completed for Units 3 and 4 during the following outage.	I	O 2002
104	M.13.14	Replace the Heat Exchange Pipes of Turbine Condensers. .	1-2-3-4	The necessary Scope of technical measures is being implemented at Units 1 and 2, considering the short operational term left. A stage-by-stage replacement is ongoing at Units 3 and 4, which will be completed during the following outage.	I	O 2002

105	M.13.15	Reconstruct the Turbine.	1-2-3-4	The Measure has been implemented for Units 1 and 2. The reconstruction only of Unit 4 TG is left.	I	O 2003
106	M.13.16	Develop Strategy for Severe Accidents Management.	3-4	The Measure is interfaced with the completion of the major Units modifications. A TOR for studies and analyses to be carried out is being developed.	-	O 2003

Annex 4

INFORMATION FOR THE ACTIVITIES RELATED TO THE DECOMMISSIONING OF UNITS 1 & 2 THAT ARE PLANNED AND IMPLEMENTED BY KOZLODUY NPP PLC

In compliance with the Agreement of 29 November 1999 between the Bulgarian Government and the European Commission, Kozloduy NPP units 1 and 2 have to terminate finally their operation before 2003. By the ratification of this document, the framework of this process has been laid and the responsibilities for the financial and technical support of the activities for decommissioning of units 1 and 2 have been bilaterally specified.

Taking into consideration the priorities of Partnership for Accession approved by the European Council in December 1999, our country developed and approved the following documents:

1. A Strategic Plan for implementation of the Agreement of 29 November 1999 regarding the future of Kozloduy NPP, adopted by the Council of Ministers of the Republic of Bulgaria by Protocol № 30 of July 13, 2000;
2. Working plan for the activities to be implemented by the end of 2002 that will lead to the final termination of the operation of Kozloduy NPP units 1 and 2, adopted by the joint working group Republic of Bulgaria – European Commission;
3. Framework Agreement between the Republic of Bulgaria and the European Bank for Reconstruction and Development (EBRD) regarding the activities of the Kozloduy International Fund for assistance in decommissioning of nuclear facilities in Bulgaria signed on 15 June 2001 in London.

Practically, since 1999 an intensive process has begun for the upgrading and development of the legislative, normative, and document-strategic basis including the internal Kozloduy NPP policy for preparation and assurance of safety in decommissioning of nuclear facilities in the country. This process with the leading role of the SAEER and with the active participation of experts from the MF, MEW, MH, MRDU, BAS, Kozloduy NPP and other organizations, was financially assisted and technically supported by the Bulgarian and international side, namely the European Union and IAEA.

The provision for safe decommissioning of units 1 and 2 is one of the important priorities of the operating organization, which maintains the effective protection of the personnel, of the public and of the environment from the harmful impact of ionizing radiation through enhancement of the safety culture and the implementation of organizational and technical measures.

The policy of Kozloduy NPP management to ensure the safe decommissioning of units 1 and 2 is developed in accordance with the requirements of the Convention on Nuclear Safety, the Law on the Use of Atomic Energy for Peaceful Purposes, the National Strategy for Development of the Energy Sector and the Energy Efficiency till 2010, the Strategic Plan for fulfillment of the Agreement of November 29, 1999 between the Bulgarian Government and the European Commission about Kozloduy NPP and is in line with the principles laid down in the IAEA reports INSAG-3: Basic Safety Principles, INSAG-4: Safety Culture and TECDOC-1133: Decommissioning of Nuclear Power Plants of WWER Type.

For assessment of the status of the safety in decommissioning of units 1 and 2 and its permanent enhancement there will be performed periodically:

- Internal re-assessments of the existing practices and facilities;
- Considering the level of safety during decommissioning of units 1 and 2;
- Taking measures for the protection of the environment, the public health, and the personnel from the harmful impact of ionizing radiation.

In Kozloduy NPP a specialized structural unit has been set up for the safe decommissioning of units 1 and 2 with an officially approved organizational structure for administrative management. The tasks, rights, responsibilities and the interfaces of the staff for the safe decommissioning of units 1 and 2 have been documented.

The strategy adopted by the Bulgarian side for decommissioning of Kozloduy NPP units 1 and 2 is in compliance with the AUAEPP, Regulation No.10 of the CUAEPP and with the developed in 2000 conceptual technical design by Belgatom – EWN under the PHARE program and it consists in the safe storage of the radioactive facilities in the units for a period of 35 years and after that final dismantling, decontamination and demolition of the facilities.

According to the adopted strategy, the major milestones during the process of decommissioning are the following:

- Safe shutdown of the units;
- Preparation for the safe storage of the radioactive objects on the units;
- Safe storage of the radioactive objects on the units;
- Termination of the safe storage of the units (dismantling of facilities, post-dismantling decontamination, demolition of the building structures and facilities).

To ensure the safety of the nuclear facilities during their preparation for decommissioning the necessary financial means are provided from the following sources: Kozloduy NPP Investment Program, The Fund for Decommissioning of Nuclear Facilities, funding by the EU under the PHARE Program and other donors (EBRD – Kozloduy International Fund).

More important activities for implementation for the safe decommissioning of units 1 and 2 and the means for their realization are the following:

- Project management for the safe decommissioning of units 1 and 2:
  - Setting up a team for the project management;
  - Training and re-qualification of personnel;
  - Project management support.
- Preparation and detail design of the safe decommissioning of units 1 and 2;
- Licensing of the processes on the safe decommissioning of units 1 and 2;
- Preparation of the site for the safe decommissioning of units 1 and 2 taking into consideration the fact that the site has been designed as common for the power plant and the reliability of a great part of the systems is defined by the availability of links and the mutual redundancy between the separate units;
  - Preparation of the surveillance area;
  - Decontamination and processing of its wastes;
  - Rehabilitation of the auxiliary building;
  - Preparation for safe storage.

- Erection of new installations and modification of the existing ones necessary for the safe decommissioning of units 1 and 2:
  - Ventilation and heating;
  - Electric supply and lighting;
  - Systems for radiation control and management;
  - Adaptation of the systems for fire alarm and fire extinguishing;
- Management of the spent nuclear fuel (SNF) and radioactive waste (RAW):
  - Optimization of the last fuel cycles;
  - Disposal of SNF from the units;
  - Erection of additional facilities for SNF storage;
  - Processing, conditioning and safe storage of the RAW;
- Implementation of a program for mitigation of the social consequences of decommissioning of units 1 and 2
- Creation of normal working conditions in the rooms, provision of protective and preventive means;
- Performance of staff health prophylactics.

Within the framework of the programs for decommissioning the necessary organizational measures are being taken to ensure that the contamination of the environment, the irradiation doses of the plant staff and the public are maintained as low as reasonably achievable, including during the safe decommissioning of units 1 and 2. The contamination of the environment, the irradiation doses of the plant staff and the public should not exceed the norms stipulated by the national legislation and the international norms.

At present the following activities have been performed:

- **Conceptual technical design for decommissioning of units 1 and 2 has been drawn – Belgatom-EWN under the PHARE program.**
- A Technical Design for decommissioning is being developed. In the beginning of the year the implementation of a contract (BG9809-02-03) under the PHARE program started – Decommissioning of Kozloduy NPP Units 1 and 2 Project. The time for performance of the activities under the contract is 12 months. Eight working meetings have been held with the contractors – the consortium BELGATOM – Belgium and EWN – Germany and ENPRO-Consult-Ltd. (a subcontractor from the Bulgarian side). The tasks, which are our responsibility, are carried out within the 15 days time fixed in the contract, the relationships with the contractors are extremely correct and This makes us believe that the Technical Design for decommissioning of units 1 and 2, businesslike and up to now, there is no delay in the project implementation schedule. The Safety Analysis Report and the Assessment of the Impact on the Environment (AIE) shall be performed on time. The design activities implemented to date are:
  - Classification of systems after final shutdown;
  - Data sheets executed for each system;
  - Cost - benefit analysis performed for different decontamination options;
  - Clarified input data for AIE, SAR, and QA Program.

According to the previously approved schedule on June 13-14, 2001, the first working meeting took place. At this meeting, the Interim Report (Milestone 1) for the activities performed for the technical design for decommissioning of Kozloduy NPP units 1 and 2 was discussed.

A specialized technical council of Decommissioning Production Division reviewed the report and found that the notes and comments to the preliminary revision submitted to the contractors had been fully taken into account, and accepted the Interim Report (Milestone 1).

- In the framework of IAEA technical assistance for 2001 – 2003, a Project for Planning and Management of Decommissioning, BUL / 4 / 008, is in the process of execution. Two working meetings with IAEA representatives and the Project developer EWN-CORE (the former Greifswald NPP) took place. At these meetings the plans for work, the terms of delivery of hardware and software under the Project, the database configuration and the technical specifications were discussed and accepted. In July a new meeting took place, this time in Graifswald – Germany, to make familiar on site with their experience in decommissioning of units with WWER type reactors and the developed by them documents and databases.
- The following basic documents necessary for the implementation of the activity the Decommissioning Production Division have been developed:
  - Kozloduy NPP policy for the safe decommissioning of units 1 and 2;
  - Statute and Rules of Activity of Decommissioning Production Division;
  - Plan – program for the work and activities of the Decommissioning Production Division in 2001 with specific time limits, contractors, funding sources and responsible persons;
  - Schedule for the activities that the Decommissioning Production Division will implement or control their implementation, for each year till 2006;
  - Proposal for financing of the activities, which the Decommissioning Production Division will execute in 2001, by the Decommissioning of Nuclear Facilities Fund (DNFF) and a report for the planned costs of DNFF for 2001 with a short justification of the necessity of the predicted expenses. The latter were approved by Decision No. 213 of 13 April 2001 of the Council of Ministers of the Republic of Bulgaria. Based on the Decision, the Managing board of the Fund disbursed sums for financing of the following activities:
    - Selection of an engineering organization to exercise control and coordination of the activities of the first stage of decommissioning of Kozloduy NPP units 1 and 2;
    - Order a study: Analysis of the reliability of Kozloduy NPP external electric supply circuit (Open switchyard 110, 220 and 400 KV) and the electricity distribution in Northwestern Bulgaria taking into account the decommissioning of units 1 and 2;
    - Order activities on management and efficiency of the nuclear fuel cycle:

      -Analysis of different options for the final termination of the operation of units 1 and 2 from the viewpoint of the economical utilization of the nuclear fuel from the last refueling of the cores;

      -Technical – economical justification of the opportunity to use the spent fuel of units 1 and 2 for the need s of units 3 and 4;

-Safety analysis of transportation of irradiated units 1&2 nuclear fuel to units 3 and 4.

- Purchase of equipment for assessment of the radiological status of facilities, production rooms and alpha – spectrometry of units 1 and 2;
- Purchase of necessary equipment for decontamination of the facilities and the production rooms of units 1 and 2;

For all listed activities, the necessary documents for selection of contractor in compliance with the Public Procurement Law have been prepared.

Analyzing our activity, we may state that there are no critical tasks, which could negatively influence the processes of preparation for safe decommissioning of units 1 and 2.

In conclusion, to the above we may underline that the process of decommissioning is multilateral and for it international and internal programs have been developed and approved and the activities, the responsibilities and the financial sources have been specified.

Annex 5

A LIST OF THE MEASURES FROM THE MAIN CONTRACT OF THE MODERNIZATION PROGRAM FOR UNITS 5 AND 6 August 2001

Status KEY:
O – Ongoing;
D – Dropped out

№	Title	Comment	Status 5 U.	6 U
1.	Ensure Operability of Boron Regulation System at All Conditions	Included in Measure № 71 (additional DG)	D	D
2.	Install a Steam-Gas Mixture Detector in Reactor Vessel		O 2005	O 2005
3.	Replacement of Thermal Insulation in Containment		O 2005	O 2005
4.	Replace Electric Power Supply for Auxiliary Feedwater and Demineralized Water Pumps	Included in Measure № 71 (Additional Diesel Generators)	O	O
5.	Enhance Reliability of SG Safety Valves		O 2003	O 2003
6.	Heating of Water for HP & MP Safety Injection System (>55^{o} C)		O 2005	O 2005
7.	Ensure Detection of Loose Parts		O 2003	O 2003
8.	System for Quick Detection and Localization of Leakage		O 2005	O 2005
9.	Ensure Detection of Small Primary Circuit Leakages	Included in Measure № 8	O	O
10.	Reduce Impact of Thermal Cycles on Coolant System Piping		O 2003	O 2003

11.	Install Hydrogen Detection and Recombination System		O 2003	O 2003
12.	Modernize the Intermediate Cooling System Aiming at Elimination of Leakage between Systems		O 2005	O 2005
13.	Install Equipment for Measuring Activity of Gas Releases		O 2003	O 2003
14.	Containment Test Procedure Improvement		O 2002	O 2002
15.	Critical Parameter Monitoring System for Accident and Post Accident Conditions		O 2005	O 2005
16.	Implement a Safety Parameter Display System		O 2003	O 2004
17.	Replacement of "Titan" Information System		O 2003	O 2004
18.	Replacement of the Internal Reactor Control System		O 2003	O 2004
19.	Replacement and Upgrading of UKTS		O 2005	O 2005
20.	Replace Pressure Drop Sensors “Sapphire”		O 2004	O 2004
21.	Enhance Reliability of Relay Protections and Automatics of Main Distribution System		O 2005	O 2005
22.	Improve Reliability of 6 κV Breakers.		O 2005	O 2005
23.	Fire Propagation through Air Ducts (Fire Dampers)		O 2004	O 2004
24.	Modify the Gas Fire Extinguishing System		O 2005	O 2005
25.	Limit Effect of Feed Water and Steam Piping Line Breaks in the Reactor Building		O 2005	O 2005

26.	Analysis of Consequences of Internal Flooding		O 2003	O 2003
27.	Study the Seismic Stability of Buildings with 0.2 g		O 2004	O 2004
28.	Study Shutdown Subcriticality Margin		O 2004	O 2004
29.	Rank Equipment and Systems According to its Importance to Safety, OPB-88, and NUSS.		O 2003	O 2003
30.	Analysis of Safety Documentation Available in Kozloduy NPP		O 2003	O 2003
31.	Qualification of Computer Codes for Accident Analysis		O 2003	O 2003
32.	Develop a Program for Studying Rector Samples and Determining Critical Brittleness Temperature		O 2006	O 2006
33.	Study Irradiation Resistance of Reactor Vessel for a New Refueling Cycle		O 2003	O 2003
34.	Analysis of Primary Circuit Piping Subjected to Specific Thermal Loads		O 2003	O 2003
35.	Install Automatic System for Cold Embrittlement Protection		O 2005	O 2005
36.	Mechanical Analysis of Pressurizer Vent Line	Included in Measure №53	D	D-
37.	Study and Install a Valve Upstream of SD-A Facility		O 2005	O 2005
38.	Improve Stability of Main Steam and Feedwater Piping of the Outside Wall of Room A820		O 2005	O 2005
39.	Mechanical Analysis of Penetrations, Room 820	Included in Measure №25	D	D

40.	Additional Protection Functions for 6 & 0.4 кV Motors.		O 2002	O 2002
41.	Study Upgrading or Replacement of 6 & 0.4 кV Equipment.		O 2002	O 2002
42.	List of Analysis for Design and Beyond Design Basis Accidents		O 2002	O 2002
43.	Bring the SAR into Conformity with International Practice		O 2005	O 2005
44.	Develop an Updated SAR in conformity with PNAE G-01-36-95		O 2006	O 2006
45.	Analyze Accidents with the Help of Validated Computer Programs	Included in Measure №31	D	D
46.	Analyze the Emergency Feedwater System and the Specifics of the Operating Modes of SG Feedwater System		O 2004	O 2004
47.	Study Processes, Which may Lead to Incontrollable Accident, Resulting from a Failure of Control Safety Systems		O 2004	O 2004
48.	Analyze Additional Accident Scenarios (Accidents without Large Leakage)		O 2004	O 2004
49.	Analyze Additional Accident Scenarios (including Additional Beyond Design Basis Accidents with Large Leakage)		O 2004	O 2004
50.	Study the Core Cooling after Maximum Design Basis Accident		O 2005	O 2005
51.	Analyze Total Loss of SG Feedwater and Emergency Feedwater in Case of Break in the Steam or Feedwater piping		O 2004	O 2004
52.	Study Radiological Consequences in HX Depressurization		O 2003	O 2003
53.	Study "Feed and Bleed" Mode		O 2004	O 2004

54.	Study Dilution of Boron in Primary Circuit (Brink in Hex's and TQ)		O 2004	O 2004
55.	Event Identification and Analysis of Primary Circuit Dilution Mode		O 2005	O 2005
56.	Substantiate Accidents of Impossibility of Critical Mass Formation		O 2005	O 2005
57.	Analyze Total Loss of Electricity Power Supply		O 2004	O 2004
58.	Analyze Total Loss of Heat Sink (VC, VB)		O 2004	O 2004
59.	Analyze Total Loss of SG Feedwater and Emergency Feedwater	Included in Measure №53	D	D
60.	Analyze the Case of ATWS		O 2004	O 2004
61.	Install Filtering Ventilation		O 2004	O 2005
62.	Analyze Consequences of a Break in Suction Pipe from the Emergency Cooling System		O 2002	O 2002
63.	Assess Capability of System Design to Manage Beyond Design Basis Accident		O 2005	O 2005
64.	Study the Risk of Shutdown Accidents		O 2005	O 2005
65.	Improvement of the Reliability of the Diesel Generators and their Protections		O 2005	O 2005
66.	Ensure Uninterruptible Control of TG Stator Windings		O 2003	O 2004
67.	Ensure Uninterruptible Control of 6 kV Pumps		O 2005	O 2005

68.	Control of Windings' Temperatures of Transformers		O 2005	O 2005
69.	Replace Power Breakers KAG-24		O 2003	O 2004
70.	Enhance Reliability of Generator Excitation		O 2003	O 2004
71.	Install One Additional Diesel Generator for Each Unit		O 2003	O 2004
72.	Extend Remaining Life of SG Blow Down Piping		O 2004	O 2004
73.	Decrease the Level of Vibrations and Eliminate Hydraulic Shocks in the Secondary Condensate Systems of High Pressure Heater and Steam Superheaters	Included in Measure №74	D	D
74.	Extend Residual Life of Secondary Circuit Piping in Two-Phase Medium		O 2002	O 2002
75.	Increase Reliability of Circulation Water Filter of Condensers U6 (Unit 6)	The Filters for Units 5 and 6 are different		O 2005
76.	Visual and TV Equipment Inspection Facilities Procurement		O 2003	O 2003
77.	Enhance Facilities for Isolation of Primary Circuit SG		O 2003	O 2003
78.	Develop Methodology and Techniques for Replacement of Small Diameter Piping Sections	After implementation and depending on the results, Measure can be used also for Unit 5		O 2002
79.	Design and Implementation of Systems for Monitoring of Radio Nuclide Releases Through Air Ducts		O 2003	O 2003
80.	Develop Training Programs for Reducing Received Doses		O 2003	O 2003

81.	Provide Alpha, Beta and Gamma Radiometers		O 2003	O 2003
82.	Develop a Radiation Monitoring System for Severe Accidents		O 2003	O 2003
83.	Modernize Radiation Control System		O 2004	O 2005
84.	On-line Monitoring and Maintenance of Primary Circuit Water Chemistry		O 2004	O 2004
85.	Implement Information System for Secondary Circuit Water Chemistry		O 2003	O 2003
86.	Modify Water Treatment and Reagent Inventories		O 2003	O 2003
87.	Develop Design for Replacement of Steam Generators at Units 5 & 6 of Kozloduy NPP		O 2004	O 2004

Annex 6

A LIST OF THE MEASURES FROM THE MODERNIZATION PROGRAM FOR UNITS 5 AND 6 WHICH WERE IMPLEMENTED IN THE PERIOD 1998-2001

№	Title	Year of Implementation
1.	Enhance Reliability of Radiation Monitoring System Electric Supply	1998
2.	Study the Loads of Consumers, Supplied from Batteries.	1998
3.	Reconstruction of the First Stage of High Pressure Cylinder.	1998
4.	Improve the Functioning of Level Controllers of High Pressure Feedwater Heaters.	1998
5.	Replace the Valve of Steam Extractor 3.	1998
6.	Replace the Cast Iron Valves in the Machine Room.	1998
7.	Study and Identify Measures to Decrease Vibrations of the Demineralized Water System Pumps.	1998
8.	Decrease Pump and Piping Vibrations of TG Rotor Feedwater System.	1998
9.	Develop Information System	1998
10.	Develop Special Tools for Seal Repair of the technological Channels at the Reactor Top.	1998
11.	Develop Means for Transportation, Loading-Unloading Activities and Circulation Pump Testing.	1998
12.	Develop, Manufacture, and Install Equipment for High Quality Installation of Reactor Seals.	1998
13.	Implement and Use a Meteorological Facility.	1998
14.	Develop Training Systems to Train Personnel on Principles of Dose Load Reduction at Repair Works.	1998
15.	Equip Metrological Laboratory, Having Possibility to Measure Ionizing Radiation.	1998
16.	Improve Light in the Operation Halls.	1998
17.	Install a system for Uninterrupted Control of SG Blow-Down Water	1998
18.	Replace Boron Meters with Another Type, to Ensure Constant High-Rate Precise Measurement, and Automatic Calibration.	1999
19.	Optimize the Refueling Scheme.	1999
20.	Improve Electrical Motors Control of Pressurizer Heaters.	1999
21.	Transition to a Three-Year Refueling Cycle.	1999
22.	Qualification of Cable Penetrations and Plan Replacements.	1999
23.	Group, Analyze, and Qualify HVAC Systems according to their Seismic Requirements and NPP Regulations.	1999
24.	Improve Reliability of Low Pressure Feedwater Heater Pipe Bundles.	1999
25.	Review the Technological Regulations for Operation of Units 5 and 6.	1999
26.	Develop or Purchase Equipment for Spent Fuel Transportation to the Spent Fuel Pool.	1999
27.	Carry Out for Fire Hazard Analysis. (Part Framatome)	2000

28.	Carry Out for Fire Hazard Analysis. (Part Siemens).	2000
29.	TX System Operation for 24 hr. Reliability of TX Pumps.	2000
30.	Use Normal Ventilation for Hydrogen Extraction.	2000
31.	Upgrade Electric Power Supply Systems.	2000
32.	Mechanical Analysis of Primary Circuit Piping Zone Subjected to Specific Loads.	2000
33.	Study of the Mechanical Behavior of Bimetal joints of Primary Circuit Equipment.	2000
34.	Study and Optimize Diesel Generator Protections.	2000
35.	Study the Possibilities for Hydrogen Generation and Accumulation Processes. Set Technical Requirements for Process Management and Coping with Explosion Hazards.	2000
36.	Improve the Reliability of Relay Protection and Automatics of the Main Distribution Circuit.	2000
37.	Modernize the Moisture Separator Heater.	2000
38.	Install a Pre-separation System to the Moisture Separator Heater.	2000
39.	Improve the Condensate Drainage from MSR 1st Stage	2000
40.	Install a WWER-1000-320 Simulator, adequate to Units 5 and 6.	2000
41.	Develop a Project for Spent Fuel Storage.	2000
42.	Implement a Project for Radioactive Waste Treatment.	2000
43.	Improve Control on Accumulators.	2000 5 Unit 2001 6 Unit
44.	Install State–of–the-Art Troubleshooting Facilities (Ground Faults) in the Direct Current Power Supply System.	2000 5 Unit 2001 6 Unit
45.	Replace the System for Uninterrupted Power Supply (UPS).	2000 5 Unit 2001 6 Unit
46.	Study the Necessity for Improvement or Replacement of 220 V Direct Current System.	2000 5 Unit 2001 6 Unit

Annex 7

LIST OF THE INTERNATIONAL TREATIES, ACTS, AND SECONDARY LEGISLATION APPLICABLE TO THE NUCLEAR FACILITIES

I. International Treaties

1. TREATY for Non-Proliferation of Nuclear Weapons.
2. AGREEMENT between the People's Republic of Bulgaria and the International Atomic Energy Agency for application of the safeguards in relation with the Treaty for non-proliferation of nuclear weapons (ratified on 1 July 1968, in force since 5 March 1972) and the COMPLEMENTARY PROTOCOL to it (in force since September 2000).
3. VIENNA CONVENTION on civil liability for nuclear damage;
4. CONVENTION on physical protection of nuclear material;
5. CONVENTION on operational notification in case of nuclear accident;
6. CONVENTION on assistance in case of nuclear accident or radiological emergency situation;
7. CONVENTION on nuclear safety;
8. CONVENTION on assessment of the impact on the environment in an international context,
9. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Greece on operational notification in case of nuclear accident and exchange of information for nuclear facilities;
10. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Romania on operational notification in case of nuclear accident and exchange of information for nuclear facilities;
11. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Republic of Turkey on operational notification in case of nuclear accident and exchange of information for nuclear facilities;
12. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Federal Regulatory Authority of Russia on Nuclear and Radiological Safety;
13. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry of Protection of the Environment and Nuclear Safety of the Ukraine in the domain of the state regulation and control on safety in the use of atomic energy for peaceful purposes;
14. AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation in the domain of peaceful use of nuclear energy;
15. AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Federal Ministry of the Environment, the Protection of Nature and the Reactor Safety of the Federal Republic of Germany.

II ACTS

1. ACT on withdrawal of reserves and declarations under international conventions regarding the mandatory jurisdiction of the International Court and the International Arbitrary Court;
2. ACT on the Use of Atomic Energy for Peaceful Purposes;
3. ACT on Protection of the Environment;

4. ACT on the Public Health;
5. ACT on the Support in Public Disasters;
6. ACT on the Healthy and Safe Conditions of Labor;
7. ACT on the Ministry of the Interior;
8. ACT on Concessions;
9. ACT on the Arrangement of the Territory;
10. ACT on the Energy and the Energy Efficiency of 1999;
11. ACT on Measurements of 1998.

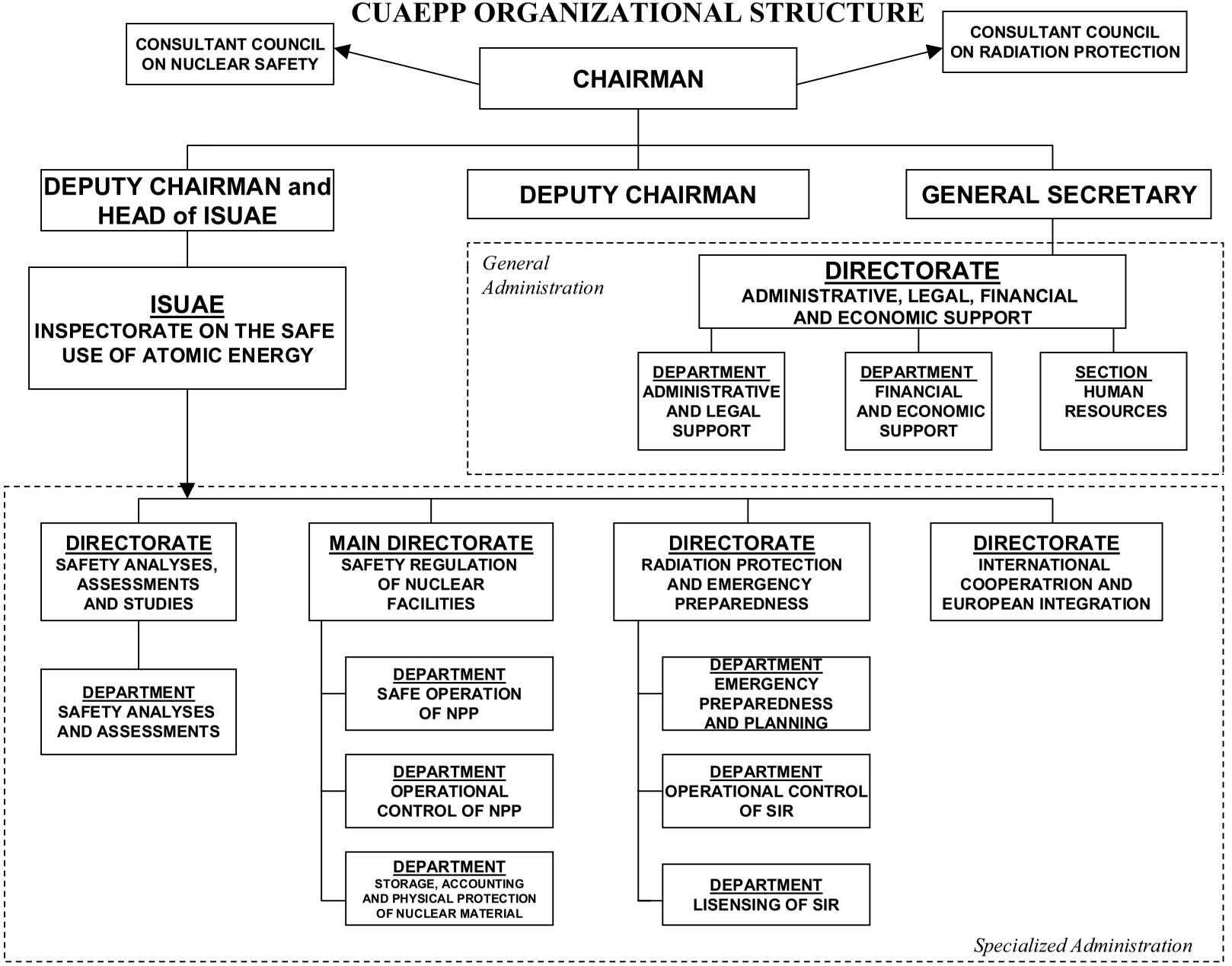
III Basic Secondary Legislation

1. RULES for application of the Law on the Use of Atomic Energy for Peaceful Purposes, adopted by the Council of Ministers.
2. REGULATION on exemption of small quantities of nuclear material from the application of the Vienna Convention on Civil Liability For Nuclear Damage, adopted by the Council of Ministers;
3. REGULATION on basic norms of radiological protection – 2000 (BNRP), in force since January 2000 and canceling the BNRP-92, adopted by Ordinance No. 252 of the Council of Ministers of 11.12.1992;
4. REGULATION on the order to define and apply sanctions for damage or for contamination of the environment over the permitted, adopted by the Council of Ministers;
5. REGULATION on setting up, operation and development of a National automated system for uninterrupted control of the radiological gamma background in the Republic of Bulgaria, adopted by the Council of Ministers;
6. REGULATION on definition of the amount of installments and the order to collect, spend and control the resources in the Decommissioning of Nuclear Facilities Fund and its management of 1999, adopted by the Council of Ministers and amended in 2000;
7. REGULATION on definition of the amount of installments and the order to collect, spend and control the resources in the Safety and Radioactive Waste Storage Fund and its management of 1999, adopted by the Council of Ministers and amended in 2000;
8. REGULATION on planning and preparedness for action in radiological accidents of 1999, adopted by the Council of Ministers;
9. REGULATION on the conditions and the order for registration and permission of foreign trade transactions of 2000, adopted by the Council of Ministers;
10. REGULATION No. 2 of CUAEPP of 1997 on the cases and the order for notification of the Committee on the Use of Atomic Energy for Peaceful Purposes for operational changes, events and emergency situations related to the nuclear and radiological safety;
11. REGULATION No. 3 of CUAEPP of 1997 on assurance of safety of nuclear power plants during design, construction and operation;
12. REGULATION No. 4 of CUAEPP on accounting, storage, transportation of nuclear material and application of the safeguards under the Treaty for Non-Proliferation of Nuclear Weapons, as amended in 2001 in connection with the ratified in September 2000 Complementary Protocol to the Agreement between the People's Republic of Bulgaria and the International Atomic Energy Agency for application of the safeguards in relation with the Treaty for Non-Proliferation of Nuclear Weapons.

13. REGULATION No. 5 of CUAEPP of 1988 on issuance of permissions for use of atomic energy;
14. REGULATION No. 6 of CUAEPP of 1989 on the criteria and the requirements to training, qualification and certification of personnel working in the area of atomic energy;
15. REGULATION No. 7 of CUAEPP of 1992 on collection, storage, processing, warehouses, transportation and burial of radioactive waste on the territory of the Republic of Bulgaria;
16. REGULATION No. 8 of CUAEPP of 1988 on physical protection of nuclear facilities and nuclear material;
17. REGULATION No. 10 of CUAEPP of 30.01.2001 on safety during decommissioning of nuclear facilities;
18. REGULATION No. 11 of CUAEPP of 2001 on safety during storage of spent nuclear fuel;
19. REGULATION No. 0-35 of the Minister of Public Health and the Minister of the Interior of 02.08.1974 on handling of radioactive substances and other sources of ionizing radiation;
20. REGULATION No. 46 of the Minister of Public Health and the Chairman of the Committee on the Use of Atomic Energy for Peaceful Purposes of 02.07.1976 on transportation of radioactive substances;
21. REGULATION No. 4 of the Minister of the Environment and Waters on the assessment of the impact on the environment of 22.07.1998.

Annex 8

CUAEPP ORGANIZATIONAL STRUCTURE



Annex 9

BASIC CONCLUSIONS OF THE IAEA EXPERT MISSION FOR INDEPENDENT ASSESSMENT OF THE ORGANIZATIONAL STRUCTURE OF KOZLODUY NPP plc, CONDUCTED IN FEBRUARY 2001

The organizational structure of Kozloduy NPP plc meets the objectives laid down in the preliminary version of the IAEA Safety Guide "Safety of Nuclear Power Plants: operational Organizational Structure". The legal requirements, the levels of responsibility, the authorities, and the communications are well established for all levels of the organizational structure. The discussions with the plant staff showed that the management presents well the responsibilities and the rights and they are understood accepted and applied throughout all levels of the organization.

The functions and the responsibilities are well understood by the present management team of Kozloduy NPP plc. During the whole review process, it was shown that everybody on the site is familiar with his/her functions and responsibilities. Despite the forthcoming shutdown of units 1 and 2 the endeavor to enhance safety is obvious.

The Directorate for Safety and Quality performs the communication with the regulatory authorities. The relevant access to information within the NPP organizational framework has been ensured. The regulatory bodies require a considerable amount of and detailed information for the everyday work, events and other documents related to the licensing process and it was noted that the order established by Kozloduy NPP to provide such information meets the requirements of the CUAEPP.

The processes used to control external assisting organizations are according to the requirements of the Preliminary version of IAEA for a Safety Guide on Operational Organizational Structure.

Considerable efforts are made at the plant to inform the public about the status of the plant safety. They include periodic broadcasts by the local television with representatives of the plant management and staff and periodic bulletins and interviews in the media.

The system for safety management is well considered and established by the organizational structure and the safety policy approved by the Executive Director of Kozloduy NPP plc. The interviews with the staff showed that the safety policy is well understood and is accepted. The system for safety management is implemented through performance of all safety-related activities by means of formal procedures and programs under stringent control by the Directorate for Safety and Quality.

At Kozloduy NPP plc management programs have been established, which cover all areas stipulated in IAEA safety standard for operational organizations.
The new organizational structure efficiently meets the requirements of the Modernization Program. Effective relationships of the Directorate for Reconstruction and Modernization have been established with the Directorate for Production; the Directorate for Safety and Quality; the Directorate for Economics and Finance. Other positive factors in this field are

the initiatives related to the development and extension of a program for rest lifetime of Kozloduy NPP units and the assignment of a Chief Engineer with the task to prepare units 1 and 2 for decommissioning.

The activities of communication, information, and liaisons at Kozloduy NPP plc are efficient and they ensure that the employees are familiar with the open issues before the plant. Effective management communication process have been put into practice – meetings of the Executive Director with the whole staff (3 of the last 9 months), Intranet pages of each Director providing the opportunity for personnel to ask questions, walk-downs of the work places by the managers, boxes for proposals and recommendations located at different places throughout the plant, and direct access to the whole management. Thus, an efficient management organization is ensured and openness and dialogue with the staff is encouraged.

A number of good practices have been identified in the report:
Obvious commitment and concern by the Board of Directors and the highest plant management level;
The wide understanding of the functions and responsibilities at the plant is commendable as well as the focusing of attention to the general message for safe production;
Full understanding at all levels in the organization of the management commitment to safe production;
Obvious presence of the management at work places and the positive understanding of all staff interviewed of the issues and challenges before the organization.

For enhancement of the level of the safety culture the IAEA, experts made the following suggestions:

1. In relation to the organizational structure:
   - to continue to carry out the activities to stop non familiar activities and functions;
   - to optimize levels of management by non interruptible improvement of the safety and investigation of the functional connections in and between the units;
2. In relation to the safety management – to decrease the prescriptive approach to the safety assurance and striving for more higher levels of the responsibility of the personnel for non interruptible increasement of the high level of the safety culture.
3. In relation to the supplementary functions – after the period of stability and after the complete development of the programs and when the units of the plant take more responsibilities for finding and identification of the personal faults to revise the structure of the Quality assurance system which has to be considered as not authoritarian unit and as present control function and as advisor and as stimulating non interruptible improvements.

This review summarized that the existing organization at Kozloduy NPP plc meets the contemporary requirements provided in IAEA documents. The team assessed the considerable progress made by Kozloduy NPP plc in the transition to Sole Proprietorship Company focused on safe production.

"NPP KOZLODUY" EAD, Kozloduy

RECONSTRUCTION AND MODERNIZATION DIVISION

QUALITY ASSURANCE PROGRAM
FOR THE MODERNIZATION PROGRAM
OF UNITS 5 & 6 OF KNPP

Reference № MK-DQA-KNPP-002

(ДРМ.УК.ПМ.002/01)

PLANT: UNITS 5 & 6

SYSTEM: QA

ORAGANIZATIONAL UNIT: R&M DIVISION

Kozloduy

2001

DEVELOPMENT, REVIEW AND COORDINATION OF DOCUMENTS

	Prepared: / titles, family name, signature, date/	**Reviewed:** / titles, family name, signature, date/	**Agreed:** / titles, family name, signature, date/
1.	Manager of Technical Advisor of SAEER for Units 5 & 6, Empresarios Agrupados and British Energy, Jesus F.Almarza	QA Section Head Quality Department, Emilia Vassileva	Safety & Quality Director Nikolai Todorov
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1. INTRODUCTION

1.1. Kozloduy NPP Plc. (KNPP) is in process to implement a Modernisation Programme (MP) affecting the Units 5 & 6 Kozloduy NPP (KNPP). The main objective of this Programme is to increase the Safety Level according to the international criteria and following the INSAG – 3 guidelines of IAEA.

1.2. The Programme was planned to be carried out in two phases:

- Basic Engineering Phase (BEP);
- Main Contracts (Implementation of Modernisation –IM);

1.3. This Quality Assurance Program (QAP) applies to the Main Contract - Implementation of Modernisation and it is the controlling document for all Quality aspects of the programme.

1.4. This QAP should be read together with the Project Management Manual, which describes the responsibilities and interfaces of the main participants.

1.5. The work will be carried out by KNPP with the assistance of the Main Contractors:

1) Westinghouse Project UK Ltd. (Westinghouse)

- Westinghouse Electric Company LLC (WEC) – Export Part
- Westinghouse Energy Systems LLL (WES) – Local Part

Main Contract with Westinghouse, Contract AEZ 734/99, signed on 02-Jun-99 ("Main Contract"), made by and between NEK EAD (NEK) and Westinghouse Industry Products International Co., LLC. (WIPICO), and amended on 29-Nov-00 between NEK, Kozloduy Nuclear Power Plant EAD (KNPP) and WIPICO whereby NEK rights and obligations under the Contract are transferred to KNPP. See details in **Annex1**.

The Contract **become** effective on 08-Jun-01

2) European Consortium Kozloduy (ECK) that is a consortium of three companies:

- Framatome ANP GmbH (who are providing Project Management for the Consortium)
- Framatome ANP SAS
- Atomenergoexport AO

Main Contract with ECK, Contract AEZ 765/99, signed on 08-Jul-99г. ("Main Contract") made by and between NEK EAD (NEK) and European Consortium Kozloduy (ECK, constituted by Siemens Aktiengesellschaft, Framatome Societe Anonyme and AO Атоменергоекспорт), and modified on 05-Jul-00 between NEK, "Kozloduy Nuclear Power Plant"

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EAD (KNPP) and ECK – three party agreement whereby NEK rights and obligations under the Main Contract are transferred to KNPP. See details in **Annex 1**

The Contract become effective on 01-Jun-01

1.6. These Contractors and sub-Contractors may, in turn, place subcontracts with other organisations.

1.7. The Quality Programmes and Quality Plans developed by the Main Contractors shall be reviewed and accepted by KNPP prior to implementation. These Quality Programmes will contain the applicable requirements of this Quality Assurance Manual and identify procedures to be utilised for the Project.

1.8. The Main Contractors will request from their Subcontractors the respective Quality Programmes. Those will be reviewed, approved and submitted to KNPP for Client's review. The Main Contractors will ensure that those QA Program will be approved prior to implementation and that contain appropriate quality requirements.

1.9. The work has been defined and broken down into a number of "Measures" which has been allocated to KNPP or to one or other of the Main Contractors.

1.10. The safety classification of the Measures is to be defined following the current KNNP procedures. This classification has to update and revised on an ongoing basis to assure compliance with National and International safety requirements.

2. MAIN STANDARD

2.1. The Main Quality Assurance Standard for this Project is the ISO 9001:1994, Model for quality assurance in design, development, production, installation and servicing.

2.2. Other references for this QA Program are listed in Section 5.

3. QUALITY SYSTEM REQUIREMENTS

3.1. Management Responsibility

3.1.1. Quality Policy

3.1.1.1. The objective of the Implementation of the Units 5& 6 MP is to perform in time the Measures included in the programme and within the estimated budget and with minimum disruption to NPP operation. This programme will:

- Improve Nuclear and Radiation Safety,
- Improve reliability, operability and maintainability,

3.1.1.2. To achieve the above mentioned goals, the main following tasks shall be

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carried out in accordance with the standards and quality requirements set forth in the technical specifications with documented demonstration the the quality is maintained throughout all project phases. i.e. studies, analyses, design, procurement, manufacturing, transportation, installation, testing, and commissioning, as applicable:

- Follow-up the scope of contracts.
- Supply the Input Data to the Main Contractors.
- Review and approve the design and documentation.
- Co-ordinate the interfaces between Main Contractors and KNPP.
- Achieve the clearance from BNSA and other regulatory Bodies.
- Follow-up the time schedule and solve possible constrains that could arise.
- Follow-up the implementation and co-ordination of the Measures until a successful outcome.
- Follow-up the control of costs against budget.
- Apply for funds in accordance with the requirements of Loan Agreements and in accordance with the Project Disbursement Plan.

3.1.1.3. All participating organisations are required to apply their own Quality Programs and Procedures and to ensure their staffs understand the objective of the project and their role in achieving the Quality standards.

3.1.2. Organization and Responsibilities

3.1.2.1. The organizational arrangements are described in detail in the Project Management Manual (Referenced in Table 2) which describes the responsibilities of the organizations and the people involved. A generaldiagram for implementation of MP of units 5&6 and main organizations is shown in **Annex 2**.

3.1.2.2. KNPP responsibilities

The basic responsibilities for the KNPP organization are as follows:

Executive Director: General management, overview and control of the Modernization Program, and on the quality policy and quality management.

Reconstruction and Modernization Division: Project management of 5&6 Units Modernization Activities, including Main Contract management, and management of works related to KNPP own Measures, overall responsibility on scope, time and cost of the MP. Co-ordination of MP activities among other KNPP Divisions, for review and acceptance of project deliverables. External communications with the Contractors. Interaction with Government Institutions and State Regulators, excluding BNSA. Filing, reproduction and distribution of the original documents.

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Resolution of deviations and non conformances.

Safety & Quality Division: Independent internal review, auditing and inspection of the safety and quality aspects related to the MP. Interaction with the Bulgarian Nuclear Safety Authority. Quality assurance auditing on the MP activities under Contractors' responsibility, and under KNPP own forces. Access control.

Production Division: Specification of the technical and planning requirements for the modifications under the MP.. Application of the Work Autorization system. Technical review and acceptance of design packages. Participation on Contractors' testing, organization, preparation and performance of system complex tests and commissioning of the Measures' implementation. Supervision of field activities..

Economic & Finance Division: General economic and financial management of the MP. Procurement of the necessary funding. Responsibility to interact with the lending institutions and to prepare the disbursement requests defining re-payment patterns. Financial control of the MP activities.

Legal Department: The Legal Department has the responsibility of assuring the Main Contract review and interpretation in order to support contract correspondence, variations orders and amendments. In addition, the Legal Department assist the E&F and R&M in the preparation of new contracts related to the Units 5&6 MP.

3.1.2.3. KNPP prepares the permits submission to BNSA, and other State Regulators (Health Authority, National Metrology and Standardization Authority, Boiler and Pressure Vessel Authority, District Fire Protection Authority, District Industrial Safety Authority, Environmental Authority, etc). ECK and Westinghouse will assist KNPP in answering any questions the regulators may ask

3.1.2.4. Persons involved in this project are responsible for identifying problems and, if they cannot correct the problem, referring it to their supervisor. Any problems that cannot be resolved by normal procedures must be referred to the M&I-Units 5&6 Department Manager in first instance and to R&M Director in second instance.

3.1.2.5. Consultants

As an Technical Advisor of The State Agency of Energy and Energy Resources (SAEER)the Consortium formed by Empresarios Agrupados from Spain, and British Energy from United Kingdom advise impelementation of the Units 5&6 MP. Empresarios Agrupados is acting as a leader.

KNPP has contracted the services of Parsons Energy and Chemicals from USA, for assistance in the project management, quality assurance, and technical review of the MP scope. To

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this effect, Parsons has formed an international multidisciplinary team based on the site, composed by American, European, Bulgarian and Russian personnel.

3.1.2.6. KNPP has placed contracts with Westinghouse and ECK (Main Contracts) who will perform the design work for the Measures allocated to them, and in agreement with the approved technical specifications.

Other Measures which are not included either in the Westinghouse scope or ECK scope will be (or have been) implemented by KNPP, by its own forces or by contracting international or Bulgarian Contractors.

3.1.2.7. The Main Contractors responsibilities are as follows:

1) Measures with supply and delivery of systems and components, turn-key:
- Prepare the detail design in accordance with the contract specifications,
- Procure the systems and components, and delivery to site,
- Install and test the systems and components,
- Perform quality assurance, surveillance and control functions.

2) Measures with supply and delivery of components, procurement-only
- Prepare tender specifications packages,
- Procure the systems and components, and delivery to site,
- Perform quality surveillance functions, upon KNPP's requests.

3) Measures resulting in studies:
- Prepare the studies in accordance with the contract specifications,
- Perform quality assurance, surveillance and control functions.

3.1.3. Management Review

3.1.3.1. The R&M Director will review operation of the Quality Programme associated with this project approximately six months after the start of the IM phase of the Project. QA Manager will assist in this review.

3.1.3.2. The results of the review will be documented and retained as Project Records.

3.2. Quality System & Planning

3.2.1. Quality System

3.2.1.1. The main goal of this QAP is to ensure that products and services for implementation of MP of KNPP Units 5&6 are provided in accordance with quality assurance requirements established by KNPP QAM and that the overall responsibilities of KNPP as an

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Operating organization are retained.

3.2.1.2. The Quality System Documents for this Project include this Quality Assurance Program and the following items:

1) KNPP documents

- .
- Quality Assurance Program for Safety of Units 5 & 6.
- KNPP procedures developed specifically for Quality Assurance and Project Management. These procedures are listed in Table 2.
- Other current KNPP procedures.

2) Main Contractors documents

- Westinghouse (WEC) Quality Management System Quality Manual
- ECK Quality Assurance Program, and
  - Framatome ANP GmbH Quality Management Manual, Project QA Program
  - Framatome ANP SAS QA Manual, Project QA Program
  - Atomenergoexport AO Project QA Program
- KNPP procedures developed for the QA and project management of Units 5&6 MP, as listed in Table 2.
- Project Manuals and/or Procedures prepared by the Contractors.
- Specific Quality Plans developed by Westinghouse and ECK and approved by KNPP for each Measure.
- SubContractors QA manuals, Project Programs, Project Plans, etc, together with Reports on the Contractors QA audits of the SubContractors.

3.2.1.3. All Project Team members shall receive from KNPP QA Department Project indoctrination on the KNPP Quality Program and Procedures that apply to their assigned tasks. This indoctrination shall be documented and retained as Project Quality Records.

3.2.1.4. Indoctrination shall include the following areas as applicable:

- this Quality Assurance Programme
- Project Organization, scope and deliverables
- Project Management Manual
- Site requirements such as safety, badging/access, radiation protection, site emergency plan, etc.
- Describe interface requirements with KNPP

3.2.1.5. Changes to this QAP shall receive the same level of review and control and

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shall be reviewed periodically every two years to ensure continual applicability.

3.2.2. Quality Planning

3.2.2.1. The Contractors shall prepare and present to KNPP for approval prior to initiation of work activities QA documents describing how they will meet the quality requirements for the Modernization Program.

3.2.2.2. The Contractors Quality Programmes shall meet the requirements as identified in ISO 9001 and this QAP.

3.2.2.3. Quality planning during implementation of each Measure shall be assured and performed in accordance with Quality Plans prepared by the Main Contractors in compliance to the ISO 10005

3.3. Contract Review

3.3.1. Main focus of the contract review to be performed by the Contractors in relation to the Units 5&6 MP is to ensure that the consistency of the contract requirements with the applicable standards and the quality assurance programs.

3.3.2. Before entering into any contract, KNPP will review the contract to ensure the requirements are adequately defined and sufficient resources are available to meet the contractual requirements.

3.3.3. The Contractors are responsible to keep and update the Contract Review function as per ISO 9001 according to their QA procedures. Results of the contract review function will be documented, and made available to KNPP through the auditing process.

3.3.4. The requirements for Contract Review are to be transferred by the Contractors to the Suppliers and SubContractors in accordance with the ISO standards.

3.3.5. Contract review requirements apply to contract changes (i.e. Variation orders, Amendments), which in all cases will be reviewed by the Contractors to ensure implementation feasibility, based on capability of their organizations to meet the new obligations, in relation to technology & know-how, technical skills, resources availability and financing. Results of these reviews will be documented by the Contractors and made available to KNPP through the auditing process.

3.3.6. Objective evidence is required that contract changes are to be subjected to the same review process, authority signing, and distribution than the original contract documents.

3.4. Design Control

3.4.1. General

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3.4.1.1. All design activities will be carried out in accordance with documented procedures that control and verify the design to ensure the requirements are met. The Contractor will prepare Quality Plans for the Design Process and will show hold points for KNPP Design Review, and review of the computer software Verification and Validation.

3.4.1.2. A graded approach to Quality should be adopted based on the risk significance of the Measure and shall include such considerations as whether the Measure is safety related or not according to specific KNPP procedures. This graded approach determination could affect:

- The level and detail of analysis of design
- The need for and level of design review and approval
- The degree of verification of design
- The controls applied to design change
- The detail of design records and their retention time
- The need for alternative calculations to be carried out
- The need to qualify or test the design output
- The need for qualification tests for design

3.4.1.3. The application of the graded approach will be included in the Contractor's Quality Plans. KNPP will review and approve the Contractors' processes for Design Control.

3.4.2. Design/Development and Implementation Planning

3.4.2.1. The Contractor will ensure that activities are clear and are assigned to qualified personnel and that sufficient resources are available to complete the activity.

3.4.2.2. Design Planning will include at least the following processes: activity identification, activity sequencing (logical ties and interfaces), activity estimates (duration, resources, constraints), plan and schedule development, and plan and schedule control. The Planning should be developed in enough detail to provide assurance that all project relevant activities are properly planned.

3.4.2.3. KNPP will revise the planning for consistency with the contract requirements as applicable.

3.4.2.4. KNPP considers the planning information from the Westinghouse and ECK Main Contracts, and/or individual Measures, and from the Plant outage plan.

3.4.2.5. The Design Planning stage should identify:

- The Codes and Standards to be used
- Contractor specific design practices

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- Contractor specific design procedures
- All computer software and models to be used

3.4.2.6. Contractors will verified and validate by testing any non standard computer codes and software used in the MP.

3.4.2.1. Computer software and models used for design shall be validated by the Contractor to confirm the adequacy and functions correctly under the set of conditions accordind to their intendent usage This validation shall be documented and retained as Project Quality Records. This validation shall be re-verified when the computer platform is changed or if the software version is revised.

3.4.2.7. Planning developed by any of the participants of the project will use the standard format agreed in contract documentation.

3.4.3. Organizational and Technical Interfaces

3.4.3.1. Because the MP involves several different organizations, KNPP will coordinate between the different Main Contractors those activities that interface between affected parties.

3.4.3.2. The Contractors control the interfaces between its own departments and identifying technical interfaces that are external to its organization.

3.4.3.3. In addition, ECK is will manage the interfaces among the Measures assigned to each partner, assuring consistent results and flawless process in design development and work execution.

3.4.3.4. Interface inputs and outputs will be addressed by the Main Contractors, in such a way that interfaces that cross the Main Contracts' scope can be managed by KNPP.

3.4.3.5. KNPP will manage the interfaces between the two Main Contractors, to assure that Contractors' interface outputs are consistent and valid.

3.4.4. Design Input and Design Output

Design Input

3.4.4.1. Contractors will ensure that the applicable Design Inputs, such as design bases, performance requirements, regulatory requirements, codes and standards shall be identified and documented, and their selection reviewed and approved by the Contractors' responsible design person. Deviations from original Input Data will be identified and justification will be provided by the Contractors on the adequacy of the selected Design Input.

3.4.4.2. Input Data needed by Main Contractors, i.e. Westinghouse and ECK, will be provided by KNPP. All Input Data requests and replies will be filed in the Units 5 & 6

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Modernization and Investment Department, providing a database of information for all involved parties.

3.4.4.3. KNPP will supply the Input Data in a controlled manner in accordance to specified procedure listed in Table 1, in its existing format and language.

3.4.4.4. Westinghouse and ECK will carry out necessary verification of the data, as applicable. Westinghouse and ECK will ensure that input data, and subsequent revisions, are controlled within their organizations to ensure that correct information is being used at all times. All deviations from the KNPP supplied information will be documented by the Contractor and submitted to KNPP for their records.

3.4.4.5. The Contractors must ensure control of the delivered Input Data, in such a way that their consequent changes are effectively and timely incorporated in the design process.

3.4.4.6. Preparation of Input Data by KNPP is described in the procedure listed in Table 1.

Design Analysis

3.4.4.7. Design analysis shall be performed in accordance with Contractors ' documented procedures.

3.4.4.8. Design analysis documents shall be sufficiently detailed as to purpose, method, assumptions, design input, references, and units that staff with the relevant qualifications in the subject can review and understand the analyses and verify the adequacy of the results without recourse to the Contractor.

3.4.4.9. Calculations shall be identifiable by subject (including structure, system, and component and by other data such that the calculations are retrievable.

3.4.4.10. Computer programs can be utilized for design analysis. Computer software shall be controlled by in accordance with Contractors' procedures.

3.4.4.11. Where mathematical models are used, they shall be subject to verification and validation to ensure their adequacy for the intended use.

3.4.4.12. Documentation of design analyses shall include:

- definition of the objective of the analysis
- Description of input data and their sources
- definition of the design assumptions and evidence that those have been verified
- Description of any calculations with computer software and models, including name of computer program, revision identification,inputs, outputs, records or references to other documents supporting the verification and validation, as well as applicable software and data specific to the analysis performed.

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- Review and approval records.

Design Output

3.4.4.13. The responsible design organization shall prescribe and document the design activities on a timely basis and to the level of detail necessary to permit the design process to be carried out in a correct manner, and to permit verification that the design meets requirements. Design documents shall be adequate to support facility design, construction and operation. Appropriate quality standards shall be identified and documented, and their selection reviewed and approved. Design methods, materials, parts, equipment, and processes that are essential to the function of the structure, system, or component shall be selected and reviewed for suitability of application. Applicable information derived from experience, as set forth in reports or other documentation, shall be made available to responsible design personnel.

3.4.4.14. Design Outputs documents for the Units 5&6 MP are described in the Technical Specifications for each Measure

3.4.4.15. The final design (approved design output documents and approved changes thereto) shall:

- Be relatable to the design input by documentation in sufficient detail to permit design verification, and
- Identify assemblies and/or components that are part of the item being designed. When such an assembly or component part is a commercial grade item that, prior its installation, is modified or selected by special inspection and/or testing to requirements that are more restrictive than the Supplier's published product description, the component part shall be represented as different from the commercial grade item in a manner traceable to a document definition of the difference.

3.4.4.16. During the implementation phase and in order to guarantee meeting the requirements of the design and agreed scope, the following activities should be performed by the Contractors and reviewed by KNPP for each Measure, insofar as they apply:

- Design Inputs
- Planning
- Review and approval of Design Outputs
- Manufacturing Inspection & Test Plan including Inspection Hold and Witness Points
- Successful performance of Factory Acceptance Test (FAT)
- Receiving Inspection and acceptance at the delivery of supplies at site
- Installation activities

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- Functional Test
- Commissioning

3.4.4.17. As part of the design output, the Contractors will demonstrate:

- How their design meets the design requirements
- How the acceptance criteria was developed
- Identify critical design characteristics and parameters

3.4.5. Design Review

3.4.5.1. The Main Contractors will arrange formal design reviews involving internal staff from all involved functions and steps during the entire process including: stocking-up with materials, final design, manufacturing, inspection, testing, packaging, transport, erection, commissioning. Results from the design review will be formally documented using the Contractors design review documentation procedure. Copies of the review documents shall be sent to KNPP for record retention.

3.4.5.2. Design review should cover also the interfaces between the Main Contractors, the interfaces between the Main Contractors and Kozloduy NPP, and the interfaces among ECK' s partners, that are under ECK responsibility.

3.4.6. Verification

3.4.6.1. The Main Contractors in accordance with their internal procedures will perform design verification. The Contractor will retain copies of the Verification records and a copy sent to KNPP for records retention purposes.

3.4.6.2. For activities carried out by KNPP, the verification will be carried out as described in the procedure listed in Table 1.

3.4.6.3. The Main Contractors will perform all computer software validation where appropriate. Validation shall be documented and retained by the Contractor. Copies of the review documents shall be sent to KNPP for record retention.

3.4.7. Design Changes

3.4.7.1. Design changes can be originated from the Contractors due to the need to adjust the preliminary design documents to plant conditions. In addition, design changes can be originated due to modifications in input data changes made after the freeze date Design Changes will be analyzed carefully in view of their impact on the MP (scope, cost, scheduling).

3.4.7.2. Design Change proposals will be formally identified by the initiating organization and circulating to all involved organizations. Such Design Changes must be formally documented, reviewed and approved by the Main Contractors and Kozloduy NPP prior to

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implementation.

3.4.7.3. Changes in the Measures' design or in any design criteria or functional requirement will not be implemented by Contractors without prior review and approval by KNPP.

3.4.7.4. This design change process will be documented by the Contractors in their QA Programs & Procedures (QA P&P).

3.4.7.5. KNPP will review and approve the Contractors' Design Change procedures.

3.4.7.6. After starting the Measures' installation, any design changes arising during the implementation, should follow the corresponding procedure indicated in Table 1.

3.5. Document and Data Control

3.5.1. KNPP will establish the requirements for documents to be prepared by Contractors and control of the related data, in accordance with KNPP internal requirements, which cover, as a minimum, the following tasks:

- Document identification and numbering,
- Document development, review and approval,
- Filing, reproduction and distribution of the original documents
- Document changes preparation, review and approval,
- Filing, reproduction and distribution of the document changes
- Traceability of changes to their original documents.

3.5.2. The Contractors will prepare design documents in accordance with KNPP requirements for identification and numbering, and these requirements will be documented in the Contractors QA P&P.

3.5.3. Contractors are responsible for preparing and controlling master lists showing the document title and the current revision and/or status of the document. Contractors' master lists must be available for KNPP in Kozloduy.

3.5.4. Contractors' should comply with this requirement that applies to all Project related documents including technical, financial, drawings, operational manuals, and maintenance manuals.

3.5.5. Contractors will implement the review process for design and licensing documents, input data, calculations, drawings, lists, etc. based on a verification in accordance with their procedures.

3.5.6. The verifier - who will be a person other than the author, with a similar or higher technical capacity - will ensure that the author has not committed any errors in operations, measurements, data compilation or capture, but without re-examining the input data or the hypotheses or the methods followed by the author.

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3.5.7. Contractors will instruct to documents' authors with respect to the scope, interfaces and requirements applicable to the document. The Contractors' supervisors will carry out the control of the preparation of the document. This process will be documented by the Contractors' QA P&P.

3.5.8. KNPP and Contractors will follow, as a minimum, the quality requirements described below:

- Identification of documents
- Definition of documents' objective and scope
- Definition of criteria and hypotheses that must be confirmed, and of the preliminary information supplied
- Definition of applicable standards, documents and data
- Definition of main technical issues of each document
- Indoctrination of personnel responsible for document control and data management,
- Responsibilities for reviewing and approving documents,
- Definition of filing, storing, and updating of documents,

3.5.9. KNPP Production Division will review the documents related to Measures with implementation requirements to ensure the functional, operation and testing adequacy with plant conditions, including work authorization system, safety requirements, and other KNPP procedures (access, work permits, etc).

3.6. Purchasing

3.6.1. Main Contracts

3.6.1.1. Most of the Contractors' Measures are defined as a "turn-key" approach, in which the Contractors are responsible for the procurement, manufacturing, and delivery to site for Measures involving supplies. The requirements for these supplies are set forth in the contract specifications, and the Contractors must ensure full compliance with technical and QA requirements.

3.6.1.2. The Contractors will document the purchasing processes in their QA P&P. Contractors will develop Quality Plans for the purchasing and supply of all important safety-related purchased items.

3.6.1.3. The Quality plans will indicate:

- the purchased items and the relevant quality requirements
- methods for evaluation, selection and control of suppliers
- requirements to procurement documents

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- evidence of compliance with regulatory requirements applicable to the purchased items. Definition of the regulatory requirements should account for regulations applied to KNPP and the obligatory requirements for the country-originator of purchased items.

3.6.1.4. KNPP will review the Contractors' purchasing process in accordance with the requirements set forth in the ISO standards and in the present QA Program.

3.6.1.5. The Main Contractors will select the SubContractors on the basis of their specialist technical knowledge, the quality of their staff, previous satisfactory experience and their ability to meet project requirements. If the SubContractor does not have an adequate Quality System then additional controls shall be identified and applied by the Contractor to the overall process performed by the subcontractor prior to process implementation. KNPP should receive the audit reports performed by the Main Contractors on the Subcontractors quality programs.

3.6.1.6. Results of the selection process will be submitted to KNPP for verification of conformance with the QA standards. SubContractors shall be approved by KNPP prior to use.

3.6.2. KNPP Purchasing

3.6.2.1. Material to be purchased during the implementation phase and not included in the Main Contracts will follow the KNPP Purchase General Procedure.

3.6.2.2. This material may comprise raw material, components, and systems called upon by KNPP own Measures, or by interface needs arising from Measures included into the Main Contracts. In this latter case, the material out of Contractors' scope boundaries is to be provided by KNPP to ensure proper Measure performance.

3.6.2.3. Engineering and/or installation subcontracts needed by KNPP to implement its own Measures and activities, will be subject to tendering process in accordance with the Bulgarian Public Procurement Law, the Plant internal procedures, and this QA Program.

3.7. Control of customer supplied product

3.7.1. KNPP supplied products

3.7.1.1. All equipement and materials supplied by KNPP for Contractors' use on the project or for related activities will be received, verified and identified, and conserve up to the time of their use in the project for which they were intended.

3.7.1.2. The control of data and documents supplied by KNPP for the execution of the project will be governed by the requirements of Section 3.4. and 3.5. This Section therefore applies only to the rest of the KNPP products.

3.7.1.3. Receipt Inspection and verification of equipement and materials will entail checking the quantities and main characteristics against the delivery documents provided by the

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KNPP.

3.7.1.4. A check will be made for any deterioration or damage during transport or handling, loss of document or any other anomaly.

3.7.1.5. A Receipt Inspection Report will be drawn-up for each equipement and materials.

3.7.1.6. Any damages to the supplies or any other anomalies will be reported to the KNPP.

3.7.1.7. A Non-conformity Report will be made for any non-conformity detected during reception. This report will be then sent to KNPP, so that the non-conformity equipement and materials can be repaired or replaced. The Report will be in accordance with the Section 3.13.

3.7.1.8. The non-conformity product will be separated from the others and identified as such until the non-conformity has been resolved. Controls shall be established to ensure the non-conformity equipement and materials is not issued or installed prior to disposition of the non-conformity.

3.7.1.9. Each equipement and materials will be identified according to a code established by KNPP.

3.7.1.10. Once the equipement and materials have been formally received and identified, Contractors will maintain them in areas provided for them until such time they are required in the project, in accordance with applicable requirements.

3.7.2. Contractors' supplied products

Contractors will document in their QA P&P the processes applicable for the maintenance of quality requirements of products that they supply to the Suppliers and/or SubContractors. These processes will be subject to review and approval by KNPP.

3.8. Product identification and traceability

3.8.1. Requirements that facilitate the physical location of a product and access to its characteristics and the history of its use and origin will be defined by the KNPP approved procedure.

3.8.2. Contractors will assure that identification and physical traceability of material, systems, and components are kept at all time throughout the different phases of manufacturing, fabrication, installation and testing.

3.8.3. The identification and traceability processes will be documented in the Contractors QA P&P. These documents shall be in conformance with KNPP requirements.

3.8.4. These processes will be subject to review and approval by KNPP.

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3.9. Process Control

3.9.1. The project activities that affect quality will be carried out in accordance with KNPP approved procedures.

3.9.2. The process control activities will be documented in the Contractors QA P&P.

3.9.3. All these activities will be planned, executed and controlled in accordance with the procedures established by the responsible persons for performing the activity.

3.9.4. Contractors personnel will follow for on-site activities KNPP rules in accordance with Plant approved procedures.

3.9.5. Contractors will define in the subcontracts the process control requirements established in codes and standards applicable to the supply, and will verify that they are fulfilled by their Suppliers and SubContractors.

3.9.6. Processes will be controlled by instructions, procedures, drawings, checklists, or other appropriate methods. The controls will be applied to the processes in a manner that is commensurate with their overall importance to the achievement of quality and contract requirements.

3.9.7. Procedures, equipment, and personnel involved in the control of fabrication, construction, testing, analysis and installation, or performance of services will be qualified in accordance with applicable contract requirements and standards.

3.9.8. Special processes shall be qualified by procedures meeting KNPP and specific contract requirements. Special processes are those whose results cannot be fully verified by subsequent inspection and testing and whose deficiencies may become apparent only after the product is in use. Examples of such processes include welding, heat treating and nondestructive examination.

3.9.9. Performance of nondestructive examination to verify conformance to specified requirements shall be done by qualified personnel. Qualifications shall meet the requirements of internationally recognized standards.

3.9.10. The responsible organization, i.e. Main Contractors, Suppliers and/or SubContractors as applicable, will establish written procedures for the control and administration of Non-Destructive Examination (NDE), and other special process personnel training, examination, and certification.

3.9.11. For special processes not covered by existing codes and standards or where quality requirements specified for an item exceed those of existing codes or standards, the necessary requirements for qualifications of personnel, procedures, or equipment will be specified or

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referenced in the project procedures or instructions.

3.9.12. Records will be maintained as appropriate by the responsible organization, i.e. Main Contractors, Suppliers and/or SubContractors as applicable, for the currently qualified personnel, procedures, and equipment of each special process.

3.10. Inspection and Testing

3.10.1. The Main Contractors will define and agreed with KNPP the inspection and testing activities to be carried out, in order to verify compliance with the requirements specified for the product.

3.10.2. Contractors must ensure that inspection requirements are defined for the following phases of the manufacturing, installation and testing, through the identification of witnessing and hold points in the manufacturing and inspections plans.

- Receiving inspection,
- In-process inspection,
- Final Inspection, i.e. Factory Acceptance Tests, or Site Acceptance Tests.

3.10.3. The inspection and testing processes will be documented in the Contractors QA P&P.

3.10.4. KNPP will supervise the fulfillment of the foregoing. The Inspection & Test Plans developed by the Main Contractors shall be provided to KNPP for review and approval prior to implementation.

3.10.5. KNPP will define in the manufacturing and inspection plans the Client's presence as appropriate to obtain first hand impression of the inspection and testing performance and results.

3.10.6. Vendor Inspections will be made in accordance with the procedure listed in Table 1.

3.10.7. Inspections will be carried out in accordance with procedures that cover the following points, as applicable:

- Reference to drawings, specifications or procedures
- Characteristics or properties to be inspected
- Persons responsible for carrying out the inspection, who shall be persons other than those who performed the inspected work. Personnel qualification requirements
- Inspections performed by independent organizations
- Explicit acceptance criteria extracted referenced to from specifications, drawings, supplier's instructions, and codes and standards

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- Description of the method of inspection and equipment to be used (accuracy required and calibration period) or reference to the appropriate procedure
- Frequency of inspection and sampling criteria
- Inspection Records including compliance certificates, test records, non-conformity records
- Requirements for documenting and the disposition of any non-conformities identified
- Verification that all inspection operations have been carried out and that they are acceptable
- Persons responsible for acceptance of the results

3.10.8. Tests shall be carried out in accordance with procedures that cover the following points, as applicable:

- Description of the testing method
- Measures to ensure that all prior testing requirements and conditions have been met before commencement of such tests
- Acceptance criteria and limits, in accordance with applicable codes, standards and additional requirements
- Type of instrumentation to be used, accuracy required and calibration period
- Environmental conditions required
- Test Records
- Persons responsible for acceptance of the results.

3.10.9. Contractors are responsible for the receiving inspection at site of the material, components and systems under their Measures' scopes. KNPP representatives shall be present in these inspections before the temporary storage of the goods in KNPP Warehouses.

3.11. Control of Inspection, measuring and test equipment

3.11.1. The requirements of the National Metrology and Standardization Authority will be followed by both KNPP and the Contractors, as defined by the contract documents.

3.11.2. Contractors must ensure that the measurements to be carried out are defined with necessary precision; that the adequate instruments, measuring and testing equipment, have been defined to ensure the required accuracy and precision; as well as properly calibrated instruments, measuring and testing equipment are used throughout all phase of manufacturing, fabrication, installation and testing of Measures related to Units 5&6 MP.

3.11.3. The control of inspection, measuring and test equipment processes shall be

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documented in the Contractors QA P&P.

3.11.4. KNPP shall verify that all the inspection, measuring and testing equipment (including the software used in tests) utilize to demonstrate that the product conforms with the specified requirements, be duly calibrated and controlled and that the calibrations are within the established validity period.

3.11.5. In cases where equipment supplied by KNPP is used, it must be delivered with the corresponding calibration certificates (or stickers) and operational instructions. When the work is completed, both the equipment, certificates and instructions shall be returned to KNPP.

3.11.6. When the equipment is subsequently required to demonstrate conformity of the product with the specified requirements, it will be checked whether its calibration is still valid. If it is not, it will be sent to an accredited laboratory for recalibration.

3.11.7. The inspection, measuring and testing equipment will be controlled in accordance with the following requirements:

- Identification of the inspection, measuring and testing equipment and of its state of calibration
- Existence of calibration records containing, for each item of equipment, information of the execution of calibration activities
- Existence of documents recording the handling or operation of the equipment or instrument, and their protection and maintenance

3.11.8. The control carried out before the using the equipment will consist on verifying that it is suitably calibrated, that its calibration period has not expired and that it functions satisfactorily. This information will be obtained by consulting the equipment's Technical Card.

3.11.9. If it is found that an equipment item it is not correctly calibrated at the time of its use, the validity of the inspection and test results obtained up to that moment will be evaluated and documented, proceeding accordingly.

3.11.10. Whenever the validity of an inspection, Measurements or test tally with the precision of the equipment used, the corresponding result report will include the equipment identification.

3.11.11. Metric tapes, steel rulers, levels, squares and other inspection, measuring and testing equipment do not require calibration unless their quality or precision is sufficiently doubtful as to require their comparison with other commercial tools of equivalent or greater precision.

3.11.12. Any non-conformity found in the equipment during its use shall be documented in a Non-conformity Report which will be given to the organisation unit responsible for the equipment so that it can be remedied. The disposition of non-conformities shall be in

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accordance with that indicated in Section 3.13.

3.11.13. KNPP is responsible to transfer the requirements for control of inspection, measuring and testing devices to new contracts to be let for the Units 5&6 MP, and to apply those requirements for Measures under direct KNPP implementation.

3.12. Inspection and Test Status

3.12.1. Contractors are responsible for defining in detail the requirements for identifying the product inspection and test status, in order to ensure that only products which have passed the stipulated inspections and tests are shipped, used or installed.

3.12.2. The inspection and test status process will be documented in the Contractors QA P&P.

3.12.3. KNPP will review the Contractors' procedures for this process.

3.12.4. KNPP, the Main Contractors and its SubContractors shall develop and implement written inspection and test status system in compliance with contract specifications, to ensure that items have passed required inspections and tests and are prepared for certification and turn-over.

3.12.5. The status of inspection and test activities will be identified either on the items or in documents traceable to the items where it is necessary to assure that required inspections and tests are performed. It also assures that items, which have not passed the required inspections and tests, are not inadvertently installed, used, or operated.

3.12.6. Status will be maintained through labels, indicators, such as physical location and tags, markings, shop travelers, stamps, inspection records, or other suitable means.

3.12.7. The authority for labeling the inspection and test status of equipment in accordance with it`s I&TS shall be specified in the Contractors' QA P&P for activities performed outside KNPP site. Organizations performing work on site shall follow KNPP procedures.

3.12.8. Records shall be maintained identifying the inspection authority responsible for the release of conforming products.

3.12.9. The Certificate of Conformance shall identify:

- The purchased material or equipment,
- Specific procurement requirements met by the material or equipment,
- Procurement specifications and/or drawings with a suitable certificate,
- Any approved changes or deviations applicable to the item,
- Identification of any procurement requirement not met, together with an explanation,
- Records of independent inspection or test if applicable.

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3.13. Control of non-conforming product

3.13.1. KNPP procedure listed in Table 1 will address the control and disposition of nonconforming items.

3.13.2. The Main Contractors will define for its Suppliers and SubContractors the requirements for the identification, documentation, evaluation, segregation (whenever possible) and disposition of non-conformity products, in order to ensure that such products are not inadvertently used or installed. It also will supervise the fulfillment of these requirements.

3.13.3. The control of nonconforming process will be documented in the Contractors QA P&P.

3.13.4. KNPP will review and approve the Contractors' procedures for this process.

3.13.5. Each organization participating in the Project will have a method for the detection and disposition of non-conforming items, and a tracking system for recording the non-conformances.

Any person has the authority and responsibility to identify and report non-conformities that may become evident during the execution of work.

3.13.6. Each non-conformity will be documented in a Non-conformity Report which briefly describes the non-conformity, the actions to be taken to remedy it, the name of the person responsible for carrying out the actions and the expected date of execution.

3.13.7. Nonconforming items will be uniquely identified, and when practical, will be placed in a clearly marked holding area until properly dispositioned. When segregation is impractical, other precautions defined in procedures will be used to preclude inadvertent use.

3.13.8. Further processing, delivery, installation, or use of a nonconforming item will be controlled pending an evaluation and an approved disposition by authorized personnel.

3.13.9. Nonconforming characteristics will be reviewed, and recommended dispositions of nonconforming items will be proposed and approved in accordance with documented project procedures. Dispositions of nonconformances that are other than rework to original specifications shall be referred to KNPP for approval.

3.13.10. Repaired and reworked product shall be re-inspected in accordance with documented procedures.

3.14. Corrective and Preventive action

3.14.1. Corrective action procedures will define the methods and responsibilities for the identification, processing, control, resolution, reporting and follow-up for conditions adverse to quality to assure implementation of adequate corrective action. These procedures shall assure that

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appropriate levels of management are informed of such deficiencies, including corrections, and that follow-up action is taken to verify implementation of corrective action.

3.14.2. The corrective action system shall include procedures for:

- Investigating the cause of the nonconforming condition and the corrective action needed to resolve and to prevent recurrence;
- Initiating preventive actions to deal with problems to a level corresponding to the risks encountered;
- Applying controls to ensure that corrective actions are taken and that they are effective;
- Implementing and recording changes in procedures resulting from corrective action;
- Establishing a system for tracking and trending corrective action requests and ensuring that actions taken are effective.

3.14.3. Errors or deficiencies in data such as input data, drawings, and documents in general which do not affect the manufacturing process (including scheduling dates) nor neither approved materials nor other significant characteristic of the supply, will normally be handle through correspondence.

3.14.4. A non-conformance report will be raised should there be a significant number of errors that appear to have arisen from the same cause or it supposes a significant error or deficiency which alters in some way the quality of the supplies. Alternatively, a non-conformance report will be raised should there be a significant failure in the Quality Programme of any participants.

3.14.5. Disposition of Non-conformances will be considered at the Management Review.

3.14.6. Main Contractors and those directly contracted by KNPP will perform corrective and preventive actions according with their quality systems. Non-conformances report, relating to this project will be available for the Head of the Modernization Projects Department.

3.14.7. The corrective and preventive action process will be documented in the Contractors QA P&P. KNPP will review and approve the Contractors' procedures for this process.

3.15. Handling, Storage, Packaging, Preservation and Delivery

3.15.1. The Contractors and SubContractors shall establish and maintain procedures for the handling, storage, packaging, protection and delivery of products, in order to prevent their damage or deterioration.

3.15.2. The handling, storage, packaging, preservation and delivery processes will be

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documented in the Contractors QA P&P.

3.15.3. KNPP will review and approve the Contractors' procedures for these processes.

3.15.4. When the handling, storage, packaging, preservation and delivery of products are within the scope of KNPP, the requirements applicable to such activities will be established in the KNPP documents.

3.15.5. Written instructions or procedures shall be developed and implemented by KNPP, the Main Contractors and their SubContractors and suppliers to ensure that handling, storage, packing, and delivery of product requirements are met.

3.15.6. Methods and means of handling that prevent damage or deterioration shall be established.

3.15.7. Secure storage areas or stock rooms to prevent damage or deterioration of product, pending use or delivery, shall be provided. Appropriate methods for authorizing receipt and the delivery to and from such storage areas shall be stipulated.

3.15.8. The condition of product in stock shall be assessed at appropriate intervals. A planned maintenance program for stored equipment shall be established when required.

3.15.9. Packing, preservation, and marking processes (including materials used) shall be controlled to the extent necessary to ensure conformance to specified requirements and shall identify, preserve and segregate all products from the time of receipt until responsibility for product ends.

3.15.10. When required for critical, sensitive, perishable, or high-value articles, specific procedures for handling, storing, packaging, shipping, and preservation will be used.

3.16. Control of Records

3.16.1. Each participating organization will provide a Project Quality Record Schedule to the Units 5 & 6 M&I Department. This Project Quality Record Schedule will identify:

- The name of the record
- Originating Organization including Subcontractors
- The type of record (e.g. document, drawing)
- Language;
- Compliance with regulatory requirements;
- The media, if the record is not a hard (paper) copy such as CD-ROM, diskette, etc.
- How long the record should be retained

3.16.2. On completion of the Project all permanent records defined on the record

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schedule and the record schedule will remain in the KNPP Archive for permanent storage.

3.16.3. A sample record schedule for this project in shown in Table 3, the actual record schedule will be maintained by KNPP Archive.

3.16.4. The following documents, among others, will be considered as quality records:

- Project Quality Programs, Project Management Manuals, quality procedures, instructions and plans, or equivalent documents
- Documents issued as a result of internal audits
- Successful tenders, contracts including modifications thereto and documents that demonstrate their revision
- Evaluation and qualification documents from supplies and SubContractors
- Purchase documents for supplies or services subcontracted for the project, including modifications thereto and documents that demonstrate their revision
- Design documents and corresponding input data, as well as modifications thereto
- Quality planning documents
- Design review, verification and validation documents including computer software validation reports
- Lists of project documents
- Product Receipt Inspection Reports
- Qualification of the production and personnel qualification processes of suppliers and SubContractors (list of qualified processes, inspection and testing personnel, welders, etc)
- Quality Plans
- Inspection & Test Plans
- Minutes or reports on inspections, procedures and test protocols on supplies for the project
- Lists of instruments, calibration results and cards
- Non-conformities, corrective and preventive actions, concessions
- Storage, handling and packaging instructions
- Shipping authorizations and supply dossiers
- Training records
- Documents on reports on personnel qualification and certification
- Quality records belonging to the Suppliers and SubContractors, and other documents

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received by KNPP

- Certificates of Conformance

3.16.5. Other kinds of documents which, for the project, can be considered as quality records will be indicated.

3.16.6. Quality records will be filed following a controlled system, both for those generated and those received. Records management shall be in accordance with the procedure listed in Table 1.

3.16.7. The applicable design specifications, procurement documents, erection and testing procedures or other documents should specify the Quality records to be generated. Records generated as a result of application of regulatory documents should also be specified.

3.16.8. The record system ensures that, in order to be considered as such, quality records comply with the requirements, that they are registered and that filing is done in accordance with established instructions in order to facilitate speedy location an access.

3.16.9. Only documents that have been completed by the persons responsible for their issue, review, if required, and approval, and that bear their signature and the date, an that are in the correct format shall be considered as valid records.

3.16.10. All quality records will be safeguarded and kept in such a way that the required extent of control can be maintained to prevent damage or deterioration due to unsuitable environmental conditions, or other harmful agents.

3.16.11. Documents that give evidence of the quality of the design or supply for a project will have certain retention periods which will be determined in accordance with the conditions that have been established in the contracts.

3.16.12. Bulgarian Language will be used for the on-site related certificate and records.

3.16.13. The control of records process will be documented in the Contractors QA P&P.

3.16.14. KNPP will review and approve the Contractors' procedures for this process.

3.17. Internal Quality Audits

3.17.1. Every organization shall establish a system for planned periodic audits for the Project.

3.17.2. The purpose of audits will be to:

- Check the implementation and efficiency of the Quality System
- Verify fulfillment of the objectives and instruction to maintain and improve the

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Quality System

- Check conformity of the work in the project with the specified quality requirements
- Provide the person responsible for the different organization units and their staff with the means to contribute to the improvement of the Quality System
- Determine which Quality System elements are affecting the established quality objectives, so that they can be corrected
- Established the appropriate corrective or preventive actions for fulfillment of the quality objectives defined

3.17.3. An audit schedule will be established by each organization to assess the effectiveness of the global Quality System and the extend of compliance with it in all areas of the project.

3.17.4. KNPP will conduct audits of the Main Contractors at appropriate Project intervals in accordance to procedure listed in Table 2.

3.17.5. The Main Contractors will carry out internal audits of their organizations and of their SubContractors as appropriate. The Project QA Manager will be invited (as an observer) to audits specifically related to this Project and will be provided with a copy of the audit report.

3.17.6. The KNPP QA Manager will conduct a first audit of the MP Departments, Sections and Divisions with participation in the Project, after 6 months the start of the Project and report the results to the S&QDirector. The audit will be carried out using the procedures of Kozloduy NPP. Additional audits will be scheduled at appropriate intervals to ensure effective Quality Programme implementation.

3.17.7. The audit team will be composed of a qualified Audit Team Leader and, if necessary, additional qualified auditors. Technical Specialists may assist under the direction of the Audit Team Leader.

3.17.8. The Audit Team will be independent from the person directly responsible for the elements and activities to be audited.

3.17.9. Audits will be carried out in accordance with an established Audit Plan and Checklist, prepared beforehand by the audit team under the direction of the Audit Team Leader.

3.17.10. The questions included in the checklist will be addressed to appropriate personnel associated with the Project.

3.17.11. When the audit has been completed, a report will be drawn up that reflects the results obtained and any non-conformity detected on which action must be taken. These results will be provided to the Management responsible to address and resolve the identified issues.

3.17.12. The auditing process will be documented in the Contractors QA P&P.

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3.17.13. KNPP will review and approve the Contractors' procedures for this process.

3.18. Training

3.18.1. Personnel assigned to work on this Project will be primarily be chosen for their relevant technical or organizational knowledge. Supervisors will assign staff on the basis of their knowledge and, where appropriate, will provide additional training. Training records will be updated to show the training received.

3.18.2. The specific training necessary to efficiently performed the tasks assigned will be obtained as follows:

- Carrying out the actual work under the permanent guidance of supervisors
- Courses on work related subjects given by qualified experts
- Specialized bibliography, and technical information for consultation or reference available

3.18.3. In matters of quality, training will be obtained through the circulation of the Quality System requirements.

3.18.4. Project assigned personnel will receive appropriate Project indoctrination prior to the performance of Project related tasks including indoctrination on the Project Quality Assurance Programme and Project specified procedures relating to their job task assignments.

3.18.5. Training on the specific operational and maintenance (O&M) knowledge for the Measures involving equipment and systems supplies are included in the contract specifications. The training is oriented to allow KNPP staff to perform O&M tasks on the supplied components, once the warranty period is over. The Contractors' must ensure that the training scope, curricula, duration and methodology satisfy this requirement. A certification of learning is to be provided at the end ot the training period.

3.18.6. Contractors shall ensure that their staff working on site pass training according to KNPP rules.

3.18.7. The training process will be documented in the Contractors QA P&P. KNPP will review and approve the Contractors' procedures for this process.

3.19. After-sales Service

3.19.1. During the warranty period, Contractors are responsible for servicing and repairing the equipment and systems in case of mal-functioning. Contractors are also responsible for providing replacement parts to bring the equipment and systems to the original specified conditions.

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3.19.2. Contractors will transfer these requirements to the Original Equipment Manufacturers, as applicable.

3.19.3. When after-sales service is included in the contract, the procedures that control such service will be established. These procedures will also cover the need to verify that the service complies with the requirements specified in the contract and that it is reported accordingly.

3.19.4. The warranty and after-sales service processes will be documented in the Contractors QA P&P.

3.19.5. KNPP will review and approve the Contractors' procedures for these processes.

3.20. Statistical Techniques

3.20.1. Where required, procedures will be established for statistical techniques to Measure process capability and characteristics. These Measurements are used to benchmark the characteristics and develop solutions for improving the work processes.

3.20.2. Procedures shall be developed, when applicable, for sampling inspection and other statistical techniques.

3.20.3. Project Management, responsible Managers and Quality Assurance identify the need for statistical techniques and ensure correct application.

3.20.4. Sampling plans, when required, shall be defined and meet recognized sampling methods and sample sizes.

3.20.5. Sampling plans for inspection may be reduced when historical records, characteristics of the item, or the application of an item indicates that a reduction in inspection can be achieved without jeopardising quality. Sampling plans, when used, are documented in detail to show factors such as lot size, sample size, and accept/reject criteria.

3.20.6. The statistical techniques will be also used in other activities, such as probabilistic safety analysis, the analysis of non-conformities and corrective actions, etc.

3.20.7. The statistical techniques process will be documented in the Contractors QA P&P.

3.20.8. KNPP will review and approve the Contractors' procedures for this process.

4. DEFINITIONS AND ACRONYMS

4.1. Definitions

Audit — a planned and documented activity performed to determine by investigation,

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examination, or evaluation of objective evidence the adequacy of and compliance with established procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

Contractors - Companies or Organizations with which KNPP has signed contracts for the implementation of Measures within the KNPP Units 5 & 6 Modernization Program. Contractors are ECK, and Westinghouse, and their respective SubContractors.

Certificate of Conformance — a document signed or otherwise authenticated by an authorized individual certifying the degree to which items or services meet specified requirements.

Certification — the act of determining, verifying, and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with specified requirements.

Corrective action — measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

Design Change — any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto.

Design Input — those criteria, parameters, bases, or other design requirements upon which detailed final design is based.

Design Output — drawings, specifications, and other documents used to define technical requirements of structures, systems, components, and computer programs.

Deviation — a departure from specified requirements.

Document — any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results. A document is not considered to be a Quality Assurance Record until it satisfies the definition of a Quality Assurance Record as defined in this Supplement.

External Audit — an audit of those portions of another organization's quality assurance program not under the direct control or within the organizational structure of the auditing organization.

Measure - A particular modification or study to be carried out as part of the Units 5 & 6 Modernization Programme (see list on table 1)

Measuring and Test Equipment *(M & TE)* — devices or systems used to calibrate, measure, gage, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

Nonconformance — a deficiency in characteristic, documentation, or procedure that

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renders the quality of an item or activity unacceptable or indeterminate.

Objective Evidence — any documented statement of fact, other information, or record, either quantitative' or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests which can be verified.

Organizations – In this Program, organizations are represented by KNPP, Main Contractors, Subcontracts, Suppliers, State Regulators.

Quality Assurance (QA) — all those planned and sistematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

Quality Assurance Record — a completed document that furnishes evidence of the quality of items and/or activities affecting quality.

Special Process — a process, the results of which are highly dependent on the control of the process or the skill of the operators, or both, and in which the specified quality cannot be readily determined by inspection or test of the product.

Supplier — any individual or organization who furnishes items or services in accordance with a procurement document. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, consultant, and their subtier levels.

4.2. Acronyms

BNSA	Bulgarian Nuclear Safety Authority
KNPP	Kozloduy Nuclear Power Plant
QA P&P	Quality Assurance Program and Procedures
SAEER	State Agency of Energy and Energy Resources

5. REFERENCES

1) ISO 9002 : 1994 Model for quality assurance in production, installation and servicing

2) ISO 9003 : 1994 Model for Quality Assurance in final inspection and test

3) Supplemented by the following IAEA Standards:

4) 50-C-QA-1988 Code on the Safety of Nuclear Power Plants

5) 50-SG-QA1 –1984 Safety Guide. Establishing of the Quality Assurance Programme for a Nuclear Power Plant

6) 50-SG-QA2-1979 Safety Guide. Quality Assurance Records System for Nuclear Power Plants

7) 50-SG-QA3-1979 Safety Guide. Quality Assurance in the Procurement of Items and Services for Nuclear Power Plants

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8) 50-SG-QA6-1981. Safety Guide. Quality Assurance in the Design of Nuclear Power Plants

9) 50-SG-QA7-1983. Safety Guide. Quality Assurance Organization for Nuclear Power Plants.

10) 50-SG-QA8-1981. Safety Guide. Quality Assurance in the Manufacture of Items for Nuclear Power Plants

11) 50-SG-QA10-1982. Safety Guide. Quality Assurance Auditing for Nuclear Power Plants

12) Bulgarian National Laws and Regulatory Requirements will be applied

13) Other technical standards will be referenced in individual documents

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DETAIL OF CONTRACT DOCUMENTS

Main Contract with Westinghouse:

- Contract AEZ 734/99, signed 02-Jun-99 ("Main Contract"), between NEK EAD (NEK) and Westinghouse Industry Products International Co., LLC. (WIPICO),
- Amendment 1 to the Contract dated 22-Oct-99 between NEK and WIPICO for extension of the expiration date of the Contract,
- Amendment 2 to the Contract dated 29-Nov-00 between NEK, Kozloduy Nuclear Power Plant EAD (KNPP) and WIPICO whereby NEK rights and obligations under the Contract are transferred unto KNPP,
- Amendment 3 to the Contract dated 14-Feb-01 between KNPP and WIPICO for amendment of the Contract Terms and Conditions,
- Amendment 4 to the Contract dated 05-Mar-01 between KNPP, WIPICO и Westinghouse Project UK Ltd. (WPUL) - three party agreement whereby WIPICO rights and obligations under the Contract are transferred to WPUL,
- Amendment 5 to the Contract as of 05-Mar-01 between KNPP, WPUL и Westinghouse Energy Systems LLC (WES) - three party agreement for transfer of WPUL rights and obligations under the "Local Scope" of the Contract to WES.

Main Contract with ECK:

- Contract AEZ 765/99, signed 08-Jul-99г. ("Main Contract") between NEK EAD (NEK) and European Consortium Kozloduy (ECK, constituted by Siemens Aktiengesellschaft, Framatome Societe Anonyme and АО Атоменергоекспорт),
- Variation order No.001 to the Main Contract dated 05-Jul-00 between NEK, "Kozloduy Nuclear Power Plant" EAD (KNPP) and ECK – three party agreement whereby NEK rights and obligations under the Main Contract are transfered unto KNPP; Siemens Aktiengesellschaft rights and obligations under the Main Contract are transferred unto Siemens Nuclear Power GmbH; and the validity of the Main Contract has been extended;
- Variation order No.002 to the Main Contract dated 07-Aug-00 between KNPP and ECK for amendment of the Main Contract Conditions,
- Variation order No.003 to the Main Contract dated 28-Sep-00 between KNPP and ECK for amendment of the Main Contract Conditions and for extension of expiration period of the Main Contract,
- Variation order No.004 to the Main Contract dated 22-Dec-00 between KNPP

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and ECK for extension of expiration period of the Main Contract,

- Variation order No.005 to the Main Contract dated 30-Jan-01 between KNPP and ECK for amendment of the Main Contract Conditions and to transfer Framatome SA rights and obligations under the Main Contract to Framatome ANP SAS,
- Variation order No.006 to the Main Contract dated 20-Feb-01 between KNPP and ECK for extension of expiration period of the Main Contract,
- Variation order No.007 of 15-May-01 between KNPP and ECK for introducing in the Main Contract the fact Siemens Nuclear Power GmbH has been renamed Framatome ANP GmbH, and for amendment of the Main Contract Conditions.

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GENERAL DIAGRAM FOR IMPLEMENTATION OF UNITS 5 & 6 MODERNIZATION PROGRAM

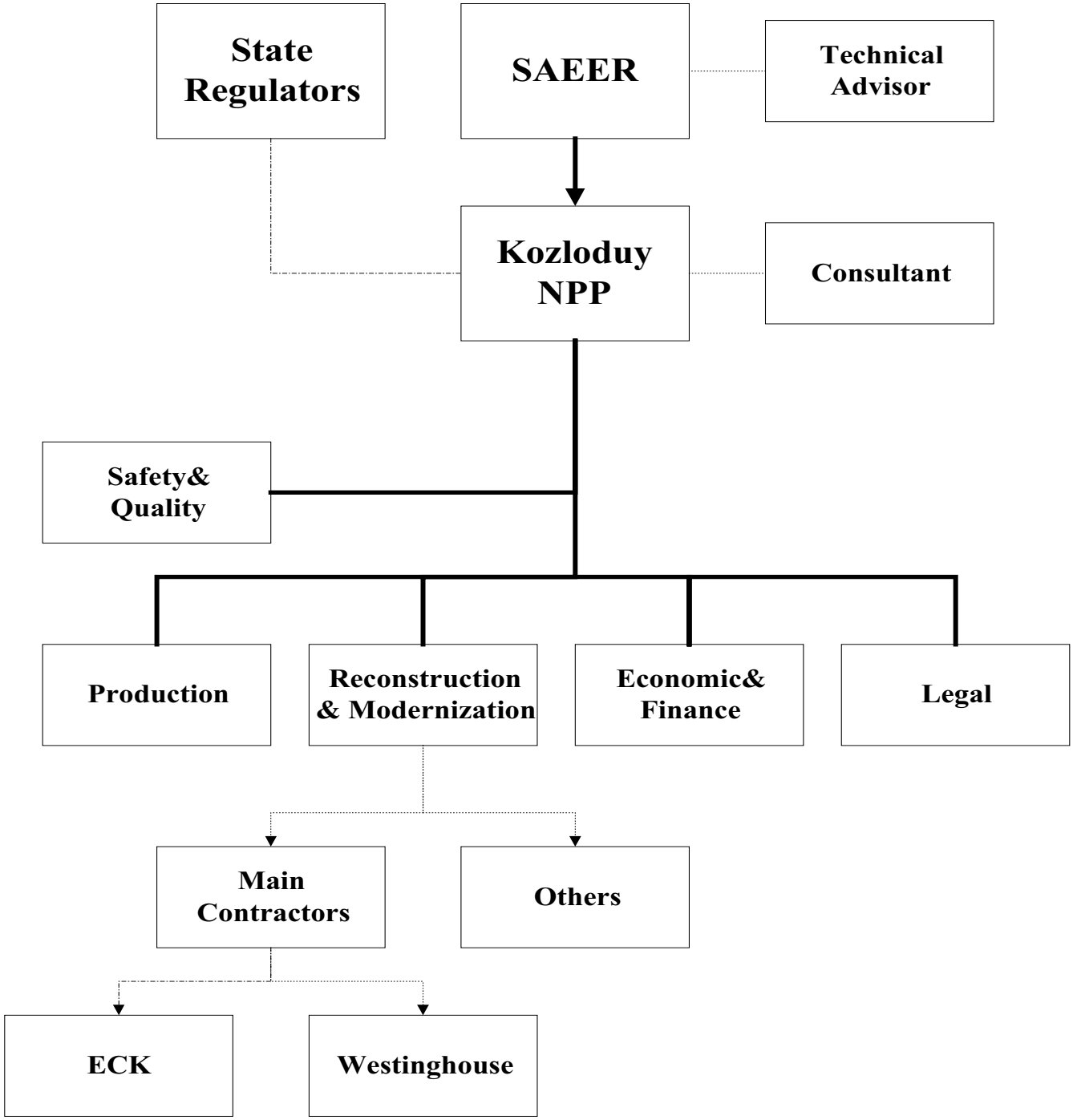

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Table 1. LIST OF PROCEDURES

Number	*Title*
Quality Assurance Procedures	
	Quality Assurance Manual
	Distribution and Control of Project Procedures
	Auditing
	Project Audit Programme
	Input Data Procedure
	Interfaces Procedure
	Design Verification
	Approval of the Design and Manufacture's documentation Procedure
	Design Change Control
	Purchasing
	Erection Procedure
	Testing and Commissioning Procedure
	Corrective Action Requests
	Stop Work
	Indoctrination and Certification of personnel performing Quality Related Activities
	Vendor Inspections
	Contractor/Vendor Non Conformities and Deviation Requests
	Records management
Project Procedures	
	Project Management Manual
	Project Planning System
	Project Correspondence and Documentation Identification System
	Reporting
	Licensing Procedure
	Contract Management Procedure
	Budgeting, Cost Control and Invoicing Procedure
	Financial Modeling Procedure
	Disbursement Plan Procedure

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Table 2. RECORD SCHEDULE

Title	*Type of Record*	*Retention Period*
Input Data Request	Document	Completion of Project
Replies to Input Data Request	Document	Completion of Project
Terms of Reference	Document	Permanent
Technical Project	Document	Permanent
Technical Specifications	Document	Permanent
Technical Reports	Document	Permanent
Verification Records	Document	Permanent
Validation Records	Document	Permanent
Quality Programmes and Plans	Document	Permanent
Records of Management Reviews	Document	Completion of Project
Audits Reports	Document	Completion of Project
Non-conformance Reports and Actions	Document	Completion of Project
Project Management Procedures and Manuals	Document	Completion of Project
Regulatory Agreements to Measures	Document	Completion of Project
Inspection Reports	Document	Permanent
Testing Reports	Document	Permanent

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Annex 11

STRUCTURE AND ORGANIZATION OF THE PERMANENT COMMISSION FOR CIVIL PROTECTION IN CASE OF CALAMITIES, ACCIDENTS AND CATASTROPHES

GENERAL INFORMATION

With Decree No 18 of the Council of Ministers, dated 23.01.1998, Regulatory Order for organisation and activities for preventing and liquidating the consequences of calamities, accidents and catastrophes (Promulgated in State Gazette, Issue 13/1998). With this Order, the organisation, the basic functions, and the assignments of the state authorities, local authorities and administration, and companies are regulated, for prevention, reducing and liquidating the consequences, resulting from calamities, accidents, and catastrophes in times of peace. For this purpose, the basic functions are defined as follows:

- Performance of prevention activities for non-allowance and reduction of detrimental consequences, resulting from calamities, accidents and catastrophes;
- Founding organisations, training managing authorities, forces and means for supporting them, keeping them in alert and carrying out rescue and urgent accident-rehabilitation works in case of calamities, accidents and catastrophes;
- Train population in behavior and action in case of calamities, accidents and catastrophes;
- Collect, process, exchange and distribute information for the existing potential hazards, for origination of calamities, accidents and catastrophes and their consequences, the ways, formations and means for their liquidation.

ORGANIZATION OF ACTIVITIES FOR CALAMITIES, ACCIDENTS, AND CATASTROPHES PREVENTION

The organisation, management, coordination, and control of the activities for prevention, reduction, and liquidation of the consequences at origination of calamities, accidents and catastrophes are executed by the Council of Ministers, Ministries, organisations and local authorities and administrations and the companies, according to their competence. The General Management is executed by the Council of Ministers. For meeting this assignment, a Permanent Commission for Civil Protection in Case of Calamities, Accidents, and Catastrophes was founded to the Council of Ministers, hereafter briefly called “Permanent Commission” (Fig. 12.1). The names of the Permanent Commission members are defined with an Order of the Prime Minister of the Republic of Bulgaria, and their members are Managers or Deputy Managers of Ministries and Organisations. If it turns out to be necessary, other officials are involved. The Permanent Commission activities are supported by Headquarters, managed by the Secretary of the permanent Commission to the Council of Ministers. Headquarter members are representatives of the State Agency “Civil Protection”, the Ministries and organisations, represented in it, and is defined with an Order by the Chairman of the Permanent Commission.

The Permanent Commission, within its competence, normally makes decisions with majorities, which afterwards, are obligatory for the Ministries, organisations, local authorities and administration, and companies.

The Permanent Commission performs the following basic assignments:

- Analyses the readiness of the country to prevent and liquidate the consequences of calamities, accidents and catastrophes, approves and organises the implementation of programs, plans and measures to improve the readiness;
- Organises the scientific studies on the issues for public and national economics protection in case of calamities, accidents and catastrophes;
- Organises and performs activities to prevent and reduce the detrimental consequences of calamities, accidents and catastrophes;
- Manages, coordinates and controls the preparation, organisation, alertness and execution of rescue and urgent accident-rehabilitation works at calamities, accidents and catastrophes;
- Develops and brings to attention and review by the Council of Ministers drafts of normative deeds for public and national economics protection in case of calamities, accidents and catastrophes;
- Accepts and applies a uniform methodology for filing the national economics sites, which bear potential hazards;
- Organises training for managing authorities, formations and public in types of behaviour and action in case of calamities, accidents and catastrophes;
- Organises bringing into alertness of permanent Commissions, headquarters and formations for checks;
- Collects information for calamities, accidents and catastrophes, which have occurred, informs the state authorities and the population about the situation, its forecasted development, possible consequences and the measures, taken for its liquidation and the types of behaviour and action;
- Informs through verbal notes, handed at “State Protocol” Department to the Foreign Affair Ministry, diplomatic representations, accredited in the Republic of Bulgaria, about the situation and recommends activities for the protection of the foreign citizens, residing in the country;
- Prepares a suggestion on behalf of the Council of Ministers to the President of the Republic of Bulgaria for partial military mobilisation in case of calamities, accidents and catastrophes;
- Prepares a suggestion to the Council of Ministers to include finance means in the State budget, which will be needed to meet the assignments for public and national economics protection in case of calamities, accidents and catastrophes;
- Makes decisions for spending and exercising control on the designated funds from the budget, donations, and other sources financing the preventive activities, scientific studies, organisation, preparation of authorities and formations for liquidating the consequences of calamities, accidents and catastrophes;
- Renders help and controls the activities of Ministries, organisations, local authorities and administration, and companies for public and national economy protection in case of calamities, accidents and catastrophes;
- Performs functions and tasks in the sphere of international activities, delegated by the Council of Ministers, concerning the public and national economy protection in case of calamities, accidents and catastrophes;
- Makes suggestions to the Council of Ministers for asking help from international organisations and other states and organises its use;
- Participates at determining the quantity and type of formations for rendering help at request to international organisations and other countries.

The Permanent Commission executes its managing function through the National Centre for Crisis Management, which is founded within the headquarters of the Commission, and includes representatives of the ministries and the central organisations.
A Science-Coordinating Council and expert teams are founded to the Permanent Commission as specialised volunteer authorities to support the prevention activities and scientific studies at protection of public and national economics, to assess the situation in case of calamities, accidents, and catastrophes and to define the ways and means for liquidation of the consequences. The members of the Science-Coordinating Council and the expert teams are appointed with an Order by the Chairman of the Permanent Commission.

The Science–Coordinating Council and the expert teams have the following basic assignments:

- Support the Permanent Commission at the execution of the activities for preventing and reducing the detrimental consequences of calamities, accidents and catastrophes;
- Organise, manage and control the development of long-term forecasts for occurring of calamities, accidents and catastrophes and other practically applicable measures for public and national economics protection;
- Prepare expert assessments of the situation and the consequences in case of calamities, accidents and catastrophes and suggestions for the way and means for their liquidation;
- Take part in the analysis of the country status in relation to actions for prevention and liquidation of consequences from calamities, accidents and catastrophes, and the development of projects, programs and measures to increase the readiness for public and national economics protection;
- Organise scientific-practical conferences, symposia, workshops, etc. on public and national economics protection in case of calamities, accidents, and catastrophes.

The organisation and activities of the Science-Coordinating Council and the expert teams are regulated with Statutes, approved by the Permanent Commission to the Council of Ministers.
In Ministries and organisations, specified by the Permanent Commission to the Council of Ministers, Permanent Internal Commissions are founded for Civil Protection in case of calamities, accidents, and catastrophes. Chairmen of those Commissions are the Managers (Deputy Managers) of the respective Ministries or organisations. In the companies, based on the judgement and with an Order of the chairman of the Regional Commission, the foundation of an organisation for liquidating the consequences in case of calamities, accidents, and catastrophes is assigned.
The members of the permanent internal Commissions are appointed with an Order of the respective Minister (Manager). Ministry Department Chiefs, organisations, and the authorities reporting to them, and those performing protection functions are included as members. Their operative work is supported by a headquarters, appointed following an Order by the Chairman of the Permanent Commission.
In the regions and the municipalities are respectively fronded permanent (regional and municipality) Commissions for Civil Protection in case of calamities, accidents, and catastrophes. Chairmen of these Commissions are the Regional Managers and Mayors. Their members are appointed following an Order of the Regional Manager or the Mayor. As members are appointed: Department Chiefs from the respective administration, chiefs of divisions or structures, subjected to the Ministries and organisations in the region, or municipality, having protection functions. Their operative work is supported by a headquarters, appointed with an Order by the Chairman of the Permanent Commission.

The Permanent Commissions develop the following documents:

- Yearly activity plan of the permanent Commission, which includes tasks and activities, ensuring meeting of their functions on public and national economics protection in case of calamities, accidents, and catastrophes;
- Plans for carrying out rescue and urgent accident-rehabilitation activities in case of calamities, accidents, and catastrophes, as follows:
- The Permanent Commission to the Council of Ministers develops and coordinates with the Ministries and Organisations a National Plan, which is approved by the Prime Minister of the Republic of Bulgaria;
- The Permanent Commissions to the Ministries and Organisations develop their plans for participation in rescue and urgent accident-rehabilitation activities in case of calamities, accidents, and catastrophes, which are coordinated with the Chairman of State Agency "Civil Protection", and approved by their Chief and are inseparable part (Attachment) to the National Plan;
- The Permanent Commissions to the regions and municipalities develop plans, which are approved with a decision of respectively the Regional or Municipality Commission; the regional plans are coordinated with the Chairmen of the State Agency "Civil Protection", and the municipality plans – with the Chairman of the Permanent Regional Commissions;
- The companies develop their plans, which are coordinated with the Chairmen of the Regional Commissions on the territory of which they are, and are approved by their managers;
- The Permanent Regional Commissions develop plans for collaboration with the military units on the territory of the county in case of calamities, accidents, and catastrophes and their participation in rescue and urgent accident-rehabilitation activities; the plans are coordinated with the military units commanders and are approved by the Chairmen of the respective Regional Commissions and the garrison commanders;
- The plans for carrying out rescue and urgent accident-rehabilitation works are brought into force by the Chairmen of the Permanent Commissions within the scope of their competence;
- In rescue and urgent accident-rehabilitation activities, in case of calamities, accidents, and catastrophes, participate;
- Formations of the State Agency "Civil Protection";
- Non-militarised formations with general appointment – at the regions and the sites of national economics, and with special appointment – at the Ministries, Organisations, Companies, and the Bulgarian "Red Cross";
- Regular professional formations of ministries, organisations, companies; the participation of companies from the military industrial complex is coordinated with the national security authorities;
- Divisions (sub-divisions) of the Bulgarian army, the Ministry of Interior, the Military Logistics Units to the Ministry of Transport, the Military units, assigned to the Mail and Communications Committee, the Military Engineering Units;
- Volunteer formations;
- International organisations and other countries' formations, including military ones.
- DECLARING A DISASTER
- Disaster on the territory of the whole country or a part of it is declared with a Decision of the Council of Ministers, following a suggestion by the Chairman of the Permanent Commission to the Council of Ministers. Disaster in a part of the territory of the country is declared;
- By the Chairman of the Permanent Regional Commission, following their decision, when the zone of the disaster covers territory of more than a town in the region;

- By the Chairman of the Permanent Municipality Commission, following their decision, when the zone of disaster covers the whole or a part of the territory of the town.

The announcing and bringing into alertness of the Managing Authorities and forces about calamities, accidents, and catastrophes is made following a decision by the Chairmen of the Commissions, in correspondence with their competence and the developed plans. The announcement is made by officials on duty, using special signals. After bringing into alertness, the Chairmen of the Permanent Commissions report right away to the Headquarters of the Permanent Commission to the Council of Ministers. Public is announced for the calamities, accidents, and catastrophes following the Decision of the Chairman of the respective permanent Commission through the officials on duty, with the signals, established by the State Agency "Civil Protection".
The Permanent Commissions organise, on a timely basis, collecting and summarising of information about the calamities, accidents, and catastrophes, the resulting consequences, measures for their liquidation, the activities of the Managing Authorities and the formations, and the public behavior and inform the Headquarters of the Permanent Commission to the Council of Ministers. The Chairmen of the Permanent Commissions are responsible for the timely information and its correctness.
After the completion of the rescue and the urgent accident-rehabilitation activities, the Permanent Commissions send to the Headquarters of the Permanent Commission to the Council of Ministers summarised report about the reasons, the character and the consequences of the calamities, accidents, and catastrophes and the measures that have been taken.
After the completion of the rescue and the urgent accident-rehabilitation activities, those who work in health hazard conditions, are obliged to undergo a medical check-up. Their health condition is determined with a conclusion by a medical consultative Commission or a labour-expert medical Commission. Those who have had their health damaged because of their participation in the rescue and urgent accident-rehabilitation activities are paid indemnities, following the order, regulated in the normative deeds.
In case of calamities, accidents and catastrophes, when the consequences, concerning the reasons for their initiation, or at liquidating the consequences, a justified assumption could be made, that a crime was committed. The Chairman of the Permanent Commission, managing the rescue and urgent accident-rehabilitation activities immediately informs the investigating authorities and the prosecution for commencing preliminary investigation.
For the needs of the Management of the Permanent Commissions are used the National Communication System and the communications of the organizations.
To keep in alert the communications, the Permanent Commission to the Council of Ministers, carries out planned yearly drills for reconnecting the assigned communication channels and information exchange.

FINANCING

The activities for public and national economics protection in case of calamities, accidents, and catastrophes are financed respectively by the national and municipality budgets, by incomes of own activities and donations.
The Permanent Commissions create a reserve of material means, necessary to perform the tasks for public and national economics protection in case of calamities, accidents, and catastrophes.

ORGANISATION AND CARRYING OUT OF PREVENTIVE ACTIVITIES

The preventive activities are planned and carried out, according to yearly plans, developed by the Permanent Commissions. The Permanent Commissions, within the scope of their competence, file the potentially hazardous sites from the national industry, based on uniform methodology, criteria, and complex risk assessment. The Chairmen of the Permanent Commissions appoint specialised teams for study and control on the potentially hazardous sites from the national industry. In them are included representatives of Ministries, organisations, regional and municipality authorities, state controlling and supervising authorities, scientific teams, experts and specialists, having in common with the studied problem. The Specialised Commissions for Study and Control of the potentially hazardous sites from the national industry are appointed with an Order of the Chairmen of the Permanent Commissions for each specific case. The Site Manager of the site, determined for a check is informed in a written format. The Site Managers are obliged to provide unrestricted access for the members of the Specialised Team for Study and Control of Potentially Hazardous Sites of the National Industry and to support them for meeting their obligations, concerning the purpose of the check.

Minutes of the Check are prepared about the results of the study and control and they are delivered to the Managers of the checked sited. The prescriptions from the minutes of the Specialised Teams for Study and Control of Potentially Hazardous Sites of the National Industry are obligatory for the checked sites.

The Specialised Teams for Study and Control of Potentially Hazardous Sites of the National Industry report their activities in front of the Permanent Commissions.

On request from the Chairmen of the Permanent Commissions, the Managers of the companies, organisations, and competent institutions provide information, concerning the risk factors and the results from the prevention activities.

Administrative penalty regulations are envisaged for breach commitment.

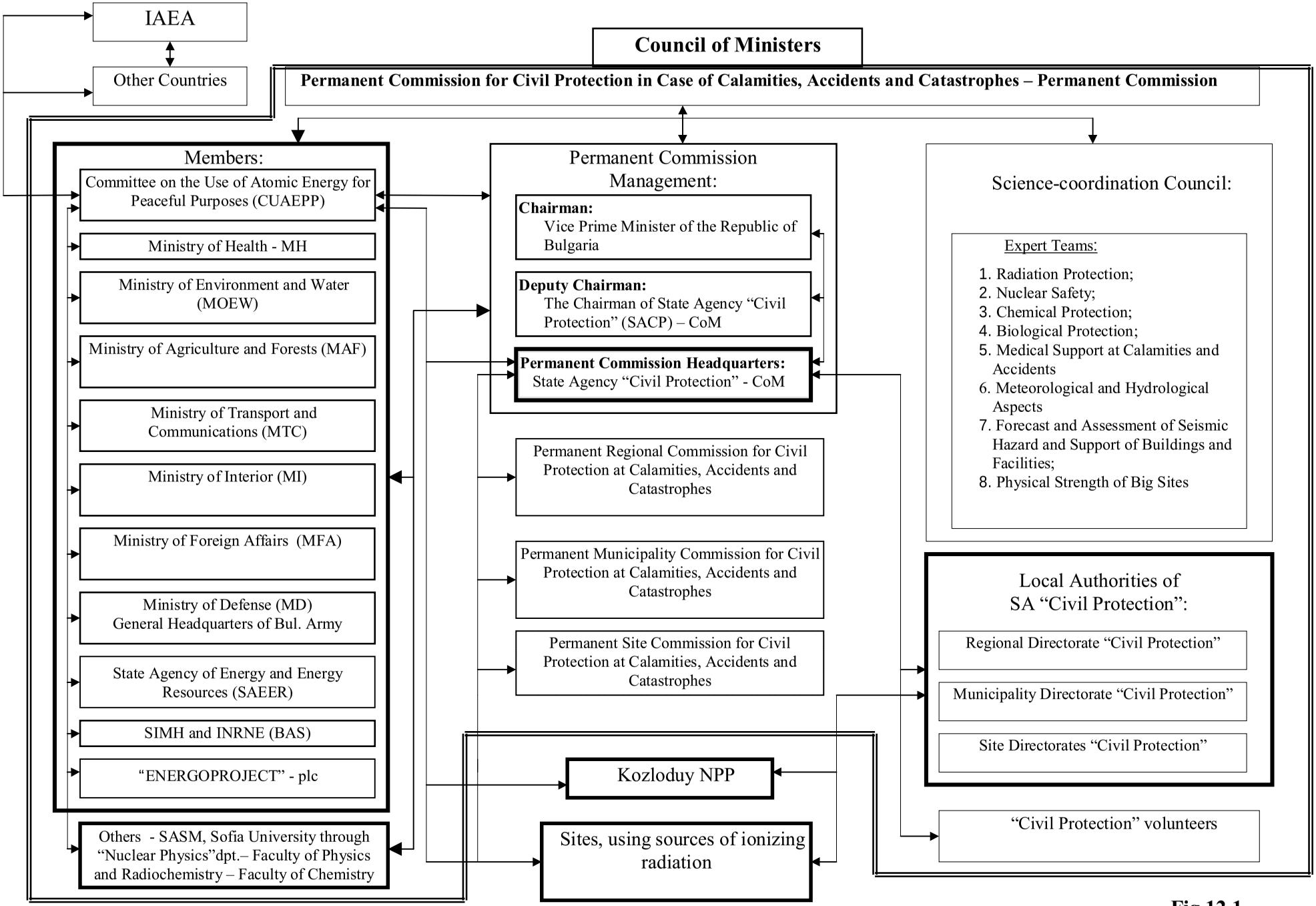
IAEA
Other Countries
Council of Ministers
Permanent Commission for Civil Protection in Case of Calamities, Accidents and Catastrophes – Permanent Commission
Members:
Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP)
Ministry of Health - MH
Ministry of Environment and Water (MOEW)
Ministry of Agriculture and Forests (MAF)
Ministry of Transport and Communications (MTC)
Ministry of Interior (MI)
Ministry of Foreign Affairs (MFA)
Ministry of Defense (MD)
General Headquarters of Bul. Army
State Agency of Energy and Energy Resources (SAEER)
SIMH and INRNE (BAS)
"ENERGOPROJECT" - plc
Others - SASM, Sofia University through "Nuclear Physics"dpt.– Faculty of Physics and Radiochemistry – Faculty of Chemistry
Permanent Commission Management:
Chairman:
Vice Prime Minister of the Republic of Bulgaria
Deputy Chairman:
The Chairman of State Agency "Civil Protection" (SACP) – CoM
Permanent Commission Headquarters:
State Agency "Civil Protection" - CoM
Permanent Regional Commission for Civil Protection at Calamities, Accidents and Catastrophes
Permanent Municipality Commission for Civil Protection at Calamities, Accidents and Catastrophes
Permanent Site Commission for Civil Protection at Calamities, Accidents and Catastrophes
Kozloduy NPP
Sites, using sources of ionizing radiation
Science-coordination Council:
Expert Teams:
1. Radiation Protection;
2. Nuclear Safety;
3. Chemical Protection;
4. Biological Protection;
5. Medical Support at Calamities and Accidents
6. Meteorological and Hydrological Aspects
7. Forecast and Assessment of Seismic Hazard and Support of Buildings and Facilities;
8. Physical Strength of Big Sites
Local Authorities of SA "Civil Protection":
Regional Directorate "Civil Protection"
Municipality Directorate "Civil Protection"
Site Directorates "Civil Protection"
"Civil Protection" volunteers

Fig.12.1.