REPUBLIC OF BULGARIA

FIFTH NATIONAL REPORT

UNDER THE

CONVENTION ON NUCLEAR SAFETY

Sofia, August 2010

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Introduction

The Republic of Bulgaria joined the Convention on Nuclear Safety (the Convention) in 1995. The Convention was ratified by an Act of the 37-th National Assembly on 14.09.1995, and entered into force on 24.10.1996. With its accession to the Convention, the country confirmed its national policy to maintain a high level of nuclear safety, ensuring the necessary transparency and implementing the highest safety standards.

As a Contracting Party, the Republic of Bulgaria took part in the four previous review meetings in 1999, 2002, 2005 and 2008, organised pursuant to Article 20 of the Convention. At each of them, in accordance with Article 5, Bulgaria presented its national reports on implementation of the obligations under the Convention.

The status of compliance with Convention requirements is successively presented in the previous four national reports where the measures of the competent authorities and organizations for the fulfilment of the obligations of the country are described as well. In accordance with the rules, adopted for the review process, answers are promptly provided to any questions raised to the previous four national reports.

This report is the National Report of Bulgaria (the fifth report) for the fifth meeting to review the implementation of the Convention, which will be held in April 2011. The report examines and evaluates the performance of the obligations of the country and reflects developments in this direction after the fourth review meeting. Assessment of obligations fulfilment is based also on the Bulgarian legislation and regulations and the status of nuclear facilities. Where necessary, reference is made to documents of the International Atomic Energy Agency (IAEA), containing internationally accepted requirements and safety standards (IAEA Safety Standards). Bulgaria is a member of the European Union (EU), thus the EU directives being transposed into national law are also taken into account in preparing the report.

National policy

Energy Policy of the Republic of Bulgaria is defined in the Energy Strategy, adopted by the National Assembly in 2002. Main directions on nuclear energy and nuclear safety as defined by the energy strategy are:

- Harmonization of national legislation on nuclear energy with the EU;
- Development of nuclear energy in accordance with current requirements of economy, reliability, nuclear safety and radiation protection;
- A clear and understandable legislation on nuclear safety and radiation protection, strict licensing regime, availability of adequate resources and technical support to the regulatory body;
- Operation of existing nuclear facilities subject to the requirements of a high level of safety and application of internationally recognized operating experience.

Nuclear energy is a major factor in the country energy mix in terms of high technology and production efficiency, competitive prices and maintaining a high level of nuclear safety and radiation protection. In recent years, the share of nuclear energy in Bulgaria was reaching 40-45% of the total electricity generation. At the same time, the use of nuclear energy for power generation is meeting the European energy policy objectives to ensure electricity supply at affordable prices and promote the combat against climate change.

A fundamental principle in the development of nuclear energy in the country is the national responsibility for ensuring the safety of nuclear facilities. In this context, the paramount duty of government is the development and implementation of adequate legislation on nuclear safety.

Standards and guidelines of the IAEA Safety Series is an internationally recognized framework that is used as a reference when developing national regulations on safety of nuclear facilities. Adopted in 2002, the Act on the Safe Use of Nuclear Energy (ASUNE) and the Act on Amendments and Supplements (AAS) to the ASUNE of 2010 and regulations thereto, consider and implement in the national legislation the international conventions and treaties, to which Bulgaria is a party, as well as the EU legislation and standards and the safety standards of the IAEA.

In 2008 a draft of a new Energy Strategy of Bulgaria until 2020 was developed, which is being under discussion during the last two years. Priorities of the new energy strategy are: sustainable development, competitiveness and competitive energy markets, energy security. The draft of the new strategy provides for the retention of the share of electricity produced from nuclear energy. This strategy will be implemented by lifetime extension of existing nuclear units and construction of new nuclear facilities.

By the draft energy strategy nuclear energy is regarded as one of the foundations for structural reorganisation of the national economy and as an important component of the energy industry in Bulgaria. The sector holds a great potential for gradual replacement of a significant proportion of the conventional generating capacities using organic fuel that will probably as a whole lead to a change in the energy raw material orientation of the country. As proposed in the project, the main task for the development of nuclear energy is the modernization and lifetime extension of the operations of the existing nuclear facilities, construction of new nuclear capacity and a corresponding increase in the share of nuclear energy in the overall structure of electricity generation to 50% by 2030.

National nuclear program

Nuclear profile

Bulgarian nuclear energy program was launched in 1974 with the commissioning of the first nuclear power unit of Kozloduy Nuclear Power Plant (NPP). Nuclear power in the country is concentrated at the Kozloduy site. By 2002, the total installed capacity of Kozloduy NPP was 3760 MWe, respectively 4 units with 440 MWe VVER-440 and 2 units with 1000 MWe VVER-1000. Due to the decommissioning of Unit 1-4, after 31.12.2006, the total installed capacity of the plant decreased to 2000 MWe.

After the closure of the four Kozloduy units, the share of nuclear power in the country energy mix has decreased from 45-48% in 2002 to 33.6% (15.3 billion kilowatt hours) in 2009. Bulgarian energy system continues to cover large part of the permanent deficit in the overall energy balance of the Balkan region, which contributes significantly to the economic stabilization in the region.

An interim pool type spent fuel storage facility and a newly built repository for dry spent fuel storage are located at the Kozloduy NPP site. Additionally, a facility for processing and storage of low-and intermediate level RAW is in operation on-site. The facility is operated by the State Enterprise “Radioactive Waste” (SERAW).

In order to fulfil the obligations of environmental protection and reduction of CO_2, SO_2, NO_x and emitted ash, Bulgaria plans to continue to rely on nuclear energy and to develop it according to the modern requirements for nuclear safety, radiation protection, cost effectiveness and reliability of operation.

The Republic of Bulgaria is planning the construction of a new nuclear energy capacity on the Belene site. Belene is planned to include two nuclear power units, equipped with VVER-1000/ A 92 design reactors. Nuclear Regulatory Agency (NRA) has approved the selected site in 2007. Currently the application for approval of technical design is being reviewed. The expert review

of the initial version of the new NPP technical design was completed in September 2009, including the Interim Safety Analyses Report (ISAR) and Probabilistic Safety Analysis (PSA). After the comments and findings have been considered, and the new version of the documentation package have been received by the NRA, in June 2010 started the follow-up review and assessment of the design.

In addition to NPPs, Bulgaria has also a nuclear research reactor IRT-2000, situated in Sofia on the territory of the Bulgarian Academy of Sciences (BAS). The reactor was stopped in 1989 and currently, in fulfilment of a Decree of Council of Ministers (DCM) is under reconstruction. Objective is to reconstruct it into a research reactor with low power 200 kW, which to use low enriched fuel.

Institutional framework

The Republic of Bulgaria has the necessary institutions for establishment and implementation of the national policy on safe use of nuclear energy and to carry out the state regulation and control. Responsibilities and duties are clearly defined and distributed among the respective authorities as follows:

- Nuclear Regulatory Agency – the regulatory body on the matters of nuclear safety and radiation protection and the safe management of Radioactive Waste (RAW) and Spent Nuclear Fuel (SNF). NRA establishes regulatory requirements on nuclear safety and radiation protection, issues licenses and permits, carry out regulatory control and impose enforcement measures to ensure compliance with the regulatory requirements, etc.;
- Ministry of Economy, Energy and Tourism (MEET) implements the state policy on energy development and implementation of the energy policy. Ministry drafts and implements the national strategy for energy development and the national strategy for spent fuel and radioactive waste management;
- State Energy and Water Regulatory Commission - implements the state policy of control of prices of generated electricity and issues licenses for the generation of electrical and thermal power;
- Ministry of Health implements the state policy of protecting public health and establishes mandatory health regulations, requirements and rules on all matters of hygiene, epidemiology and radiation protection. Through its specialized units, the ministry carry out specific functions in the area of health protection in the use of nuclear energy and ionizing radiation. Such specialized units are the National Centre of Radiobiology and Radiation Protection, as well as the departments “Radiation Control” at the Regional Inspectorates for Protection and Control of Public Health;
- Ministry of Environment and Water (MEW) directs, coordinates and supervises the development and implementation of state policy on environmental protection, conservation and use of water and the earth. The Ministry manages the National system for environmental monitoring and is the competent decision making body in respect of the Environmental Impact Assessment;
- Ministry of Interior ensures the security of nuclear facilities and related sites, being identified as particularly important in terms of physical protection. The Ministry, through the General Directorate for Civil Protection coordinates activities to protect the population and national economy in the case of a disaster, including the conduct of risk assessment, preventive measures, rescue and emergency repair work and for providing international assistance.

The Minister of Transport and Communications and the Minister of Defence also perform specialized functions in the use of nuclear energy and ionizing radiation.

According to Article 5 of the ASUNE, coordination between different authorities is within the responsibilities of the NRA Chairman.

Legislative framework

The fundamental Law to ensure the safety of facilities and activities is the Act on the Safe Use of Nuclear Energy (in force since July 2002). The Act regulates the public relationship related to the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel, as well as the rights and obligations of those involved in these activities to ensure nuclear safety and radiation protection. ASUNE is based on the fundamental principles of:

- independence and competence of the regulatory body;
- establishment of clear and predictable regulatory environment by specification of mandatory requirements for nuclear safety, radiation and physical protection, emergency planning and preparedness;
- implementation of a strict licensing regime, based on a thorough review and assessment of all aspects of safety;
- conduct of regulatory inspections and imposition of enforcement measures.

Detailed requirements for nuclear safety and radiation protection are specified in the regulations for implementing the ASUNE (over 20 regulations) that are listed and described in Annex 1.

The Law on Environmental Protection, Law on Health, Disasters Protection Act and other laws and regulations are also related to the safe use of nuclear energy. In particular, their requirements and the relationships between them are presented in the report under Article 7.

Priority to safety

Assuming that the use of nuclear energy for peaceful purposes contributes to economic and social development of the country and raise living standards, Bulgaria reaffirms that during the use of nuclear energy, the protection of the health of individuals, the population as a whole, including future generations, and the environment have and will have first and highest priority. In the development of nuclear energy, Bulgaria will continue to adhere to the following principles:

- Maintaining the highest standards of safety;
- Presentation to the public a clear and timely information about the safety of nuclear facilities;
- Consideration of public opinion in formulating energy policy;
- Development of safety culture of management and operating staff;
- International cooperation in research, design, application and operational areas of nuclear energy.

The streamlines in the field of nuclear energy and nuclear safety are defined by the Energy Strategy of Bulgaria from 2002:

- Harmonization of national legislation with EU on nuclear energy;
- Development of nuclear energy in accordance with modern standards for safety, economy and reliability, nuclear safety and radiation protection;
- A clear understandable legislation on nuclear safety and radiation protection, strict licensing regime, availability of adequate resources and technical support to the regulatory body

- Operation of existing nuclear facilities subject to the requirements of a high level of safety and application of internationally recognized operating experience.

Characteristics of the report

The fifth national report gives an overview of developments in the field of ensuring nuclear safety in the period after the fourth review meeting of national reports. Information is submitted to implement the priorities of the country and the implementation of the recommendations. The report reflects in detail the carried out during the reporting period safety assessments and analysis, as well as the implemented programs for reconstruction and modernization of operating nuclear power units. Methods used to evaluate the safety and results and major conclusions are also described. The safety during operation of NPPs has been considered, and where appropriate representative indicators have been used. The report includes the regulatory practices in updating the legislative framework, licensing, establishment of regulatory guides, assessment and analysis of safety, and inspection activities. The main activities and changes that have been completed or are in progress after the fourth review meeting have been presented.

Structure

The national report is structured in conformity with the Guidelines on the national reports under the Convention on Nuclear Safety (INFCIRC/572/Rev.3). Section B “Summary” presents shortly the successive efforts of the country to achieve the objectives of the Convention.

Section C provides information on the implementation of the Convention by applying the article by article review approach. An attempt has been made to ensure that the format and content of the fifth national report ensure it is a stand-alone document, which does not require knowledge of previous reports, while clearly and correctly highlights the developments in the field after the fourth review meeting. Particular attention in the report is devoted to the striving of the regulator and licensees for continuous safety improvement.

Annexes to the report:

Annex 1: List of secondary legislation

Annex 2: Emergency technical facilities, systems and means to ensure the emergency preparedness in Kozloduy NPP

A. Summary

During the discussions of the fourth national report, held in Vienna in April 2008, the Parties have agreed with and supported the adopted priorities in the policy of the Republic of Bulgaria:

- Strong and consistent policy aimed at maintaining a high level of nuclear safety;
- Establishing a strong and independent regulatory body;
- Harmonization of legal and regulatory framework with international best practices;
- International cooperation in all areas related to research, design and operation of nuclear facilities;
- Special attention to the human factors for achieving high safety culture.

As a result of the discussions following the presentation of the fourth national report, several measures to improve safety in Bulgaria were identified, namely:

- The program of the regulatory body to develop regulatory guides;
- Implementing the National Plan for harmonization of the legislation and practices at European level, taking into account the reference levels established by the West European Nuclear Regulators Association (WENRA);
- Development of regulatory practices in the implementation of risk-informed approach to decision making;
- Ensuring international involvement in the review and assessment of the design for the new NPP;
- Optimization of maintenance and testing programs using risk informed approaches and methods;
- Conducting periodic safety review of Units 5 and 6 of Kozloduy NPP in respect of renewal of operating licenses;
- Considering the results of Kozloduy NPP Units 5 and 6 modernization in the process of updating both PSA and the Severe Accidents Management Guidelines (SAMGs);
- Developing a program to reduce liquid discharges.

This fifth national report gives an overview of the planned measures to improve safety and outlines future plans in this direction. The status of implementation of the above measures is described in detail in appropriate places in the texts of Articles 7, 8, 14, 15, 17, 18 and 19. This summary presents the main results in the last three years.

The main activities and changes related to nuclear safety in Bulgaria, which have been met or are in progress after the fourth review meeting, are as follows:

Legislation

Act of Amendment and Supplement of ASUNE

In implementation of the NRA policy for updating of legal requirements in accordance with the development of international standards and EU legislation, a bill to amend and supplement the ASUNE has been developed in the period 2007-2009. The bill takes into account the changes in international conventions and treaties, the new European Union legislation, and new or modified documents of the International Atomic Energy Agency, as well as experience in applying the law in practice. The main changes affecting the safety of nuclear installations are:

- Considering the amendment of the Convention on the Physical Protection of Nuclear Material;
- Considering the ratified agreement between EURATOM and countries members of the European Commission Urgent Radiological Information Exchange (ECURIE);
- Transposition of Council Directive 2009/71/EURATOM establishing a Community framework for nuclear safety of nuclear installations;
- Introduction of the fundamental safety principles, specified by the IAEA document IAEA SF-1 "Safety Fundamentals";
- Introduction of a license for decommissioning, to replace the issuance of a series of permits and to ensure the long-term responsibility of the licensee;
- Eliminating shortcomings related to the settlement of transfer of responsibility for safety in the transfer of ownership or bankruptcy, etc.

In April 2010 the bill was submitted for consideration by the 41 National Assembly. In June 2010 it was adopted unanimously on first reading and in July was finally adopted on second reading. Adoption of the law will require revision of most of the regulations for its implementation. This is expected to be one of the main NRA challenges over the next few years.

Harmonization of safety requirements

For harmonization of approaches to safety in European countries, WENRA has established two working groups - one for the safety of nuclear power plants (Reactor Harmonisation Working Group), and the other for decommissioning and safe management of radioactive waste and spent fuel (Working Group on Waste and Decommissioning).

Reactor Harmonisation Working Group has approved safety reference levels for existing reactors and national action plans for harmonization. The plans are to have the reference levels transposed by the end of 2010. Since 2008 the working group is focusing on developing safety targets for new reactors. The final report of the group will be presented at the WENRA meeting in November 2010. It is expected that in the autumn of 2010 the Working Group will begin work on the problems of long-term operation of existing reactor installations, as well on the standards, which shall be used when assessing their safety.

Working Group on Waste and Decommissioning continues its work on the preparation of positions on the compliance with the reference levels for harmonization. The report for storage of radioactive waste and spent nuclear fuel and the national action plans were completed with implementation period - the end of 2012. Completion of the final report on decommissioning is expected by the end of 2010, while the implementation of national plans by the end of 2013.

Regulatory guides

NRA continued the implementation of its ambitious program to develop regulatory guides (RGs). In the process of annual review and update of planned activities, the program evolved, as the total number of planned guides was reduced to nineteen by means of combining two or more guides in one and by postponing in time the guide with a very low priority.

In the period after the fourth review meeting the NRA has adopted and issued eighth regulatory guides (published at the NRA website). Another 11 guides are at different stages of development as follows:

- 4 guides have been developed and approved internally, they are under discussion with authorities concerned, licensees and the public;
- 5 guides were developed by the authors and are presented for internal NRA discussions;

- 2 guides are in the process of developing the first draft, having established terms of reference, structure and content.

Published regulatory guides and new drafts could be found on the NRA website www.bnsa.bas.bg.

Regulatory body

Over the past three years, there have been no significant changes in the NRA functions, respectively there are no changes in the organizational structure. According to the Rules of procedure, NRA has 114 permanent positions and the Agency has the legal opportunity to employ additional staff on a temporary contract (up to 10%). As of August 2010, the main human potential of NRA is 95 employees - actually employed staff. Following a series of public discussions about the possibility of increasing the retirement age and reducing the payment and privileges of civil servants, there is an increasing trend of retirement or leaving the Agency. In terms of financial constraints, as a result of the crisis, the NRA is not in a position to provide the necessary funds for the appointment of new staff.

The requested by NRA funds for 2010 were significantly reduced in the process of negotiating the budget with the Ministry of Finance. During the year, with amendments to the state budget, the NRA funding was reduced by 20% more. In respect of budget reduction, NRA has reconsidered its plans and priorities for the year, and as a result international activities were limited to the minimum and inspection program was optimized.

After the fourth review meeting of national reports, significant human and material resources have been devoted to the further development of the Quality Management System (QMS) with approximately 40 documents being developed or reviewed. NRA QMS is an open and constantly evolving system that promptly reflects changes in international standards. NRA takes all appropriate actions to reflect in the QMS the concept of integrated management system as specified by the new IAEA documents.

NRA continues its efforts for the moderate development of the approach of integrated decision making, taking into account the positive experience of application of this method by other European regulators. NRA intentions are not to go forward to the complete implementation of the integrated approach. Efforts are focused in two main areas, namely to improve PSA models and to improve the legal requirements. In this respect, NRA has developed two regulatory guides - for PSA development and PSA applications. Level 1 and Level 2 PSA are being updated for the Kozloduy NPP units. The fulfilment of these conditions will allow the operator to put in practice some of the applications of the integrated approach, such as optimization of maintenance and repair activities.

Kozloduy NPP

Units 1-4

Units 1 to 4 of Kozloduy NPP are shut-down for decommissioning, while Units 1 and 2 are fully exempted from SNF. In late 2008, the Council of Ministers adopted a decision declaring the buildings and equipment of Units 1 and 2 as facilities for radioactive waste management to be decommissioned. Activities to prepare the units for decommissioning continue. The administrative and operational decommissioning activities will be carried out by SERAW and could start after receiving a license from the NRA. One of the related activities is the construction of a dry spent fuel storage facility, which is expected to be commissioned in the near future.

Units 5 and 6

The last 2 of total of 212 measures of the Modernization Program of Units 5 and 6 have been completed in 2008 and the programme full implementation has been reported. With the implemented modernization, the units are brought in conformity with the international requirements for safety and reliability.

Phased replacement of fuel assemblies with a new type of TVSA was carried out during the Planned Annual Outages (PAO) in 2008.

Based on a periodical safety review, the operating licenses of Units 5 and 6 were renewed. Licences have validity periods of 8 and 10 years respectively. With respect to the expiration of the 30-year design lifetime of the main equipment, a program for units' preparation for design lifetime extension is being developed. As defined by the licenses, terms of documentation preparation are respectively 2013 for unit 5 and 2015 for unit 6. In addition, Terms of Reference (TOR) is being developed for complex investigation and evaluation of the rest lifetime of the systems and equipment of the two units.

New power capacity

In the period following the fourth review meeting of national reports, NRA has approved the selected site for the new Belene NPP and issued the necessary authorization for the design activities. The submitted to NRA design technical documentation is subject to detailed review and assessment with the active participation of both Bulgarian and international experts. The expertise of the initial revision of the technical design of the new Belene NPP (including ISAR and PSA) ended in September 2009. After the findings and comments to the design have been considered and a new revision submitted, in June 2010 NRA initiated follow-up review and assessment of the design documentation.

Future challenges

Bulgaria faces several challenges in the short and long term, the most important of which are:

- Review of secondary legislation after the adoption of ASUNE changes by the National Assembly;
- Improve the regulatory practices, through the implementation of the regulatory guides development and updating program;
- Approval of the design and authorization of the construction of Belene NPP, and actual construction of the plant;
- Complex investigation and evaluation of the rest lifetime of Structures, Systems and Components (SSC) of Safety Systems (SS) on Kozloduy NPP Units 5 and 6;
- Commissioning and licensing of the dry spent fuel storage facility at Kozloduy NPP and related re-licensing of the wet Spent Fuel Storage Facility (SFSF);
- Construction of a national repository for low and intermediate level radioactive waste;
- Issuance of licenses for the decommissioning of units 1-4 of Kozloduy NPP (after entry into force of ASUNE changes);
- Approval of the technical design for reconstruction of the research reactor IRT-2000 and its implementation.

In conclusion, it should be noted that the Republic of Bulgaria fulfils its obligations under the Convention.

B. Reporting article by article

Article 6 Existing Nuclear Installations

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

Brief information about the nuclear facilities in Bulgaria

In Bulgaria there is one operating nuclear power plant - Kozloduy NPP with six nuclear units. Units 1 to 4 are with VVER 440/V230 reactors. First and second units are put into operation in 1974 and 1975 and are finally shut down for decommissioning at the end of 2002. Third and fourth units are put into operation respectively in 1980 and 1982 and are finally shut down for decommissioning in late 2006. Currently, Units 1 to 4 have operating licenses, under which they can not be used for energy production. Operations are limited to storage of irradiated and spent nuclear fuel in the near-reactor fuel pools and preparation for decommissioning.

In late 2008, the Council of Ministers adopted a decision (№ 839 from 20.12.2008) declaring the buildings and equipment of Units 1 and 2 as facilities for radioactive waste management, which are subject to decommissioning. It is planned that the administrative and operational activities during the decommissioning process of units 1 and 2 should be carried out by the State Enterprise Radioactive Waste after receiving a license, according to the ASUNE terms and conditions of.

The remaining two units - 5 and 6 are of VVER1000/V320 reactor type and are put into operation in 1987 and 1991 respectively. Since October 2009, Units 5 and 6 have received renewed operating licenses. Licenses are valid till November 2017 for unit 5 and October 2019 for unit 6.

Overview of important safety issues for Units 5 and 6

One of the significant safety issues during the past period was the carried out periodic safety review. The review was completed in 2009 and conducted in accordance with the conditions of the operating licenses of the two units. In conducting the periodic safety reassessment, the safety factors contained in the IAEA publication NS-G-2.10 have also been considered. In the process of licenses renewal, NRA reviewed and assessed a significant amount of documents, including the updated Safety Analyses Report (SAR), reflecting the state of the units, following the completed modernization.

The last 2 of total of 212 measures of the Modernization Program (MP) of Units 5 and 6 have been completed in 2008 and the programme complete implementation has been declared. Phased replacement of fuel assemblies with a new type of TVSA was completed during the planned annual outages (PAO-2008) of the units.

At the request of the NRA and the Kozloduy NPP, a follow-up IAEA expert mission was conducted in the period 10 to 20 November 2008 to assess the extent of resolution of safety

issues set by the IAEA - "Safety issues and their ranking for VVER-1000 model 320 NPPs". The purpose of the follow-up peer review was to make an independent assessment of the design changes implemented during the modernization and the level of resolving of identified issues. In the process of review, 61 safety related issues were addressed. For all respective issues, the final conclusion of the IAEA experts is that the problems are resolved satisfactorily and the questions are closed. It should be noted that for 9 of the issues continue the implementation of appropriate measures for issue closure.

On an invitation by the Kozloduy NPP management to the Moscow centre, in the period of 15 to 26 June 2009, the World Association of Nuclear Operators (WANO) carried out a peer review of Units 5 and 6. The main task of the peer review was to identify areas for improvement of the operational safety of the units and to identify best practices in the Kozloduy NPP, which may be of benefit to other NPPs.

With respect to the expiration of the design lifetime of the main equipment of Units 5 and 6 (defined by the general designer as 30 years), a program for units preparation for design lifetime extension is being developed. Deadlines for program implementation are defined as 2013 for unit 5 and 2015 for unit 6. A time-schedule has been developed for implementation of the activities to prepare and implement the lifetime extension program. Three main stages of project implementation have been formulated:

- Conduct a comprehensive survey of the physical conditions of the main equipment, the scope being agreed with the NRA;
- Develop a lifetime extension program and submit it to NRA in accordance with the agreed time-schedule;
- Implement the lifetime extension program (investment projects) till 2017 for unit 5 and till 2019 for unit 6.

A draft is under development of the TOR for the complex investigation and evaluation of the rest lifetime of the systems and equipment of the two units.

Over the past three years, there have been no safety significant events, according to the International Nuclear and Radiological Events Scale (INES).

Nuclear facilities finally shut down for decommissioning

This category of nuclear facilities includes units 1 to 4 of the Kozloduy NPP. At present, no spent or irradiated nuclear fuel is stored in the Spent Fuel Pools (SFP) of units 1 and 2 (SFP-1 and SFP-2). For Units 3 and 4 it should be noted the presence of irradiated assemblies, stored at the lower racks in the near-reactor pools of the two units (SFP-3 and SFP-4).

In June 2006, Kozloduy NPP adopted an updated strategy for the decommissioning of Unit 1-4. In line with this strategy, decommissioning should be carried out in two stages. The first phase will begin after the release of the SFPs from nuclear fuel. It includes a period for preparation and safe storage of the primary circuit and dismantling of non radioactive equipment in the turbine hall and the auxiliary buildings. Second phase will include dismantling of the equipment in reactor compartments, the reactors and the RAW processing equipment and facilities.

Facilities associated with the safe storage of SNF and RAW

A facility for storage of the spent nuclear fuel from VVER-1000 and VVER-440 reactors is located at the Kozloduy NPP site. The facility is wet type and is operated in accordance with the operating license, issued by the NRA. Management of spent nuclear fuel and radioactive waste is

carried out in conformity with the strategy adopted by the Council of Ministers in December 2004.

As important may be considered the information on the ongoing activities related to construction of a new facility of dry type for storing the spent nuclear fuel. The facility is located at the plant site and its capacity is consistent with the expected amount of spent nuclear fuel from the operation of the units with reactors VVER-440. At present, the activities are is construction stage, according to the construction permit, issued by NRA on 17 June 2008.

Statement by the Member State on the status of nuclear facilities

Actions undertaken and planned by the Republic of Bulgaria are in conformity with the requirements of Article 6 of the Convention. Suspension of the operation Kozloduy NPP units 1-4 is a political decision concerning the country's accession to the European Union. Measures to safe decommissioning are planned and are being implemented for these power units. A large-scale modernization program has been implemented at the operating units, which eliminates the internationally identified VVER-1000 safety issues. Actions are planned for lifetime extension, in accordance with the internationally recognized operational experience.

Article 7 Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.
2. The legislative and regulatory framework shall provide for:
(i) the establishment of applicable national safety requirements and regulations;
(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence:
(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;
(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

Article 7 (1) Establishing and maintaining a legislative and regulatory framework

Act on the Safe Use of Nuclear Energy

The fundamental Act in the field of safety of nuclear installations is the Act on the Safe Use of Nuclear Energy, in force since July 2002. ASUNE regulates the public relations related to the state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent nuclear fuel.

According ASUNE state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent nuclear fuel is carried out by the NRA Chairman, who is an independent specialized authority of the executive power and has the competence as specified by the Law.

Chapter One "General Provisions" of the law defines the scope of regulated matter and establishes the fundamental principles of nuclear safety and radiation protection, as being defined in the international documents. As main principles for the use of nuclear energy have been brought out: independence of the regulatory body; full responsibility for safety of the operating organizations (licensee); establishing and maintaining an effective safety management system; application of defence in depth concept; optimization of protection; limitation of exposure (ALARA), etc. Chapter Two "State regulation" defines the statute, functions and financing of the regulatory body.

Chapter Three "Authorisation" of ASUNE specifies the authorisation process for use of nuclear energy and ionising radiation, including radioactive waste management and spent fuel management and the fees for carrying out of the regulatory functions. Chapter Three specifies also the requirements on: ensuring funds for the decommissioning of the nuclear facilities by the establishment of a special fund managed by the Ministry of Energy and Energy Resources, requirements to the personnel carrying out activities at nuclear facilities and with sources of ionising radiation, as well as requirements on accounting and control of nuclear material, radioactive substances and other sources of ionising radiation.

Chapter Four "Radioactive Waste Management and Spent Fuel Management" specifies general requirements to the persons managing radioactive waste and spent fuel and regulates the relationships related to the overall strategy for spent fuel management. Chapter Four, Section II establishes the State Enterprise "Radioactive Waste" with main activity - radioactive waste management; construction, operation, rehabilitation and reconstruction of facilities for radioactive waste management; transport of radioactive waste off-site of the nuclear facility.

Statute and company management are specified. Section Three of Chapter Four (in force since 1 January 2003), regulates the financial arrangements for the management of radioactive waste by creating a special Fund Radioactive Waste to the Minister of Economy, Energy and Tourism and Energy Resources.

Supervisory powers of the NRA Chairman, as well as the rights and responsibilities of the inspectors are regulated in Chapter Five "Control over the use of nuclear energy and ionizing radiation and the management of radioactive waste and spent fuel". Chapter Six specifies the regime and procedures for the establishment of special areas around nuclear facilities and other sites with sources of ionizing radiation. By Chapter Seven the ASUNE establishes the requirements on physical protection; by Chapter Eight - the emergency planning and preparedness arrangements; Chapter Nine sets requirements towards the implementation of safeguards; Chapter Ten - on Civil Liability for Nuclear Damage; and Chapter Eleven contains enforcement provisions. Transitional and final provisions of the ASUNE define transitional conditions, related to the fulfilment of the existing requirements till the entry into force of the law, as well as provisions for amendment and supplement of other legal acts.

Act amending and supplementing ASUNE

In its policy statement, the NRA stated that "the NRA will update the legal requirements in accordance with the development of international standards and EU legislation and will develop regulatory guides and directions in areas where this is necessary. In implementation of this policy, it was decided to prepare a draft law on amendment and supplement to the ASUNE, taking into account the experience gained in law enforcement, the adoption of new EU directives on nuclear safety and radiation protection and the changes in the Convention on Physical Protection of Nuclear Material. In addition, in 2002 when adopted, the ASUNE was in compliance with the international treaties signed by the Republic of Bulgaria as: the Convention on Nuclear Safety; the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency; the Convention on Early Notification of a Nuclear Accident; the Convention on the Physical Protection of Nuclear Material; the Vienna Convention on Civil Liability for Nuclear Damage; the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; the Non-Proliferation Treaty of Nuclear Weapons and more. The ASUNE was in conformity with the existing European legislation as well. Since 2002, a number of European and international instruments entered into force, which required the implementation of measures at national level in order to transpose and comply with these acts.

To prepare the required changes to the Act, the NRA established a working group with the task to draft the necessary amendments to the law. The working group was also entrusted to review the new European Union legislation and the new or modified documents of the IAEA. The Group was also given the task to analyze the experience of implementing ASUNE and to propose appropriate changes, if any are needed.

Under the Bulgarian legislation, before putting forward a bill to be adopted by the competent authority, the author shall publish the draft on its website together with the respective justification of changes. All interested parties are given at least 14 days for comments and suggestions on the draft. In the process of development and discussion of the bill, NRA held meetings with representatives of licensees and interested authorities to take account of their proposals and reach consensus on all major issues.

In early 2009, coordination procedure was carried out with interested ministries and other authorities, following Article 58 of the Rules of Procedure of the Council of Ministers and its Administration (RPCMA). By Resolution № 304 of 24.04.2009 the Council of Ministers approved the bill, which on 28.04.2009 was submitted by the Prime Minister to the 40 National Assembly and was discussed in the Parliamentary Commission on European Affairs. After the parliamentary elections in mid-year and the constitution of the 41 National Assembly (Parliament), all bills introduced in the previous Parliament were returned to conduct a new

coordination procedure, including AAS of ASUNE. Meanwhile, Council Directive 2009/71/EVRATOM of 25 June 2009 entered into force, establishing a Community framework for nuclear safety of nuclear installations. In order to fully and accurately transpose Directive 2009/71/EVRATOM, the WG on the Act proposed further changes. Certain provisions have been refined and expanded, while in other cases, new provisions were proposed. Ultimately, in December 2009 the bill was re-submitted for consultation with all ministries and departments involved in the regulated subject. After all comments and proposals were considered, in April 2010 the bill was submitted for consideration and approval to the 41 National Assembly. In June 2010, the bill was adopted unanimously on first reading and it is expected to be finally adopted by the end of the year.

Amendments and supplements to the ASUNE, concerning the safety of nuclear installations, are as follows:

Changes of the Convention on Physical Protection

The amendments to the Convention on Physical Protection of Nuclear Material (CPPNM) were ratified by the Republic of Bulgaria (Official OJ. 16 on 02/21/2006). As required by the Convention, the NRA is determined as the competent authority, contact point and coordinator under the CPPNM. Providing physical protection is included as one of the main directions of the Act, together with nuclear safety and radiation protection. A number of specific obligations of the Republic of Bulgaria under the CPPNM and the Safeguards Agreement under the Non-Proliferation Treaty (NPT) have been reflected.

Agreement for the early exchange of information in radiological emergency

The Agreement between EURATOM and non-member States of the European Union on the participation of the latter in the Community arrangements for the early exchange of information in the event of radiological emergency (ECURIE) was signed by Bulgaria in 2003 and ratified by law in 2005 (SG. 34 of 4/19/2005). Pursuant to the Agreement, the NRA Chairman is designated as a competent authority and contact point under the Agreement.

Directive 2009/71/EVRATOM

Since 2007 Bulgaria is a member of the EU. One of the main priorities of the country is harmonization with the EU legislation and implementation of established European good practices. The AAS of ASUNE transposes the requirements of Council Directive 2009/71/Evratom establishing a Community framework for nuclear safety of nuclear installations, published on 02.07.2009 in the Official Journal of the EU. The directive is based on the Convention on Nuclear Safety and obliges the member countries, including Bulgaria, to conduct periodic self-assessments of the national framework and to organize international peer review in order to constantly improve nuclear safety. In this respect, the NRA has requested the implementation of an IAEA mission to review the regulatory activities in the country (IAEA IRRS), planned for mid 2012.

Fundamental documents of the IAEA

The Bill introduces the fundamental safety principles, established by the reissued in 2006 IAEA fundamental document in the safe use of nuclear energy - IAEA SF-1 “Safety Fundamentals”.

Decommissioning

A license for decommissioning is introduced to replace the issuance to the licensees of a series of permits. The aim is to avoid dual authorisation (license and permits) and to secure licensee responsibility for the safety of the facility throughout the whole process of decommissioning, lasting decades. License for decommissioning will be issued for up to 10 years and will be renewed on the basis of a safety reassessment. The proposed changes give the legal possibility of nuclear facility decommissioning by a specialized organization that is different from the operator.

Transfer of responsibilities between licensees

The Bill reflects a number of disadvantages associated with the settlement of the transfer of responsibility for safety in the case of transfer of ownership or bankruptcy, both in the process of construction of a new nuclear facility, and at the other stages of the life cycle of the facility. Succession of responsibilities and the rights is ensured.

A legal analysis performed by the NRA shows that after the entry into force of the amendments to the ASUNE, most of the regulations for the implementation the Act should undergo revision. One of the main NRA challenges in the near future is the review of the existing regulations for conformity with the changes in the Act and the development and implementation of a program to revise those regulations. This process is expected to take about two years from the date of entry into force of the amendments to the ASUNE.

Interfacing national legislation

According to the ASUNE, in addition to the NRA Chairman, other state authorities also carry out specialized control over the facilities and activities associated with the use of nuclear energy and ionizing radiation. In this respect, the law explicitly mentions as specialised authorities the Ministers of Health, Environment and Water, Interior, Defence, Agriculture and Food, Transport, Education, Youth and Science and the Chairman of the State Agency for National Security. Those authorities exercise control in accordance with their respective powers. Such powers are conferred mainly by the following laws:

Law on Environmental Protection

The Law on Environmental Protection regulates the protection of environment for the present and future generations and protection of human health. It also covers: preservation of the biological diversity in compliance with the natural bio-geographic characteristic of the country; protection and use of the environmental components; control and management of factors, damaging the environment; exercising control over the environment and sources of pollution; prevention and restriction of pollution; operation and maintenance of the National System for Environmental Monitoring; strategies, programmes and plans for environmental protection; collection and access to environmental information; organisation of the activities for environmental protection; rights and obligations of the state, municipalities, legal entities and individuals for environmental protection.

The Law on Environmental Protection, in force since September 2002 (replacing the Law of 1991) requires an Environmental Impact Assessment (EIA) to be conducting for: construction; activities and technologies related to installations for processing of irradiated nuclear fuel and installations for:

- Production or enrichment of nuclear fuel;
- Processing of irradiated nuclear fuel or high-level waste;
- Final disposal of irradiated nuclear fuel;
- Final disposal of radioactive waste;
- Storage, for not longer than 10 years, of irradiated nuclear fuel or radioactive waste at a site, different from the one where they have been generated;
- Storage of radioactive waste at sites other than the production ones;
- Installations for processing and storage of radioactive waste.

In the case of a construction of a new NPP, the approved by the Minister of Environment and Water EIA is a precondition for the issuance of a site approval order under the ASUNE. In the case of significant changes in the facility purpose or in case of decommissioning, the Law on

Environmental Protection requires the performance of a separate EIA. The presence of a issued by the Minister of Environment and Water positive decision on the EIA is a pre-condition for issuing by the NRA Chairman of a decommissioning permit (license), under the ASUNE.

Energy Act

The Energy Act regulates the public relations in the energy industry related to state control, regulation and efficient use of energy and energy resources, as well as the rights and obligations of physical and legal persons in the course of: production, import, export, transmission, distribution, and sale of electrical and thermal power and gas; increase of energy efficiency; and promotion of the use of renewable energy sources. Pursuant to the Act, the Council of Ministers shall define the state policy in the energy sector. The Minister of Economy, Energy and Tourism shall implement the national state policy. The National Energy Strategy shall be adopted by the Council of Ministers on a motion by the Minister of Economy, Energy and Tourism. The National Assembly shall approve this strategy.

The Energy Act requires that the operation of nuclear power plants shall be done on the basis of a license for generation of electrical or thermal power, which shall be issued by the Minister of Economy, Energy and Tourism. To be used for its intended purpose, a NPP shall have both licenses - a license for generation of electrical or thermal power and an operating license, issued under the ASUNE. Accordingly, the NPP operating license shall be automatically terminated upon termination of the license for generation of electrical or thermal power, issued under the Energy Act.

Law on Spatial Planning

The Law on Spatial Planning (LSP) regulates the public relations in respect to spatial planning, design and construction investments in Bulgaria, and specifies the respective property restrictions for development purposes. This Law requires the issuance of a series of permits that are associated with the authorisation of construction sites. Such permits shall be issued also in the cases of construction of a new nuclear facility or a site with sources.

It is an essential requirement that both laws (the LSP and the ASUNE) shall be complied with simultaneously for site selection, design, construction, and commissioning of NPPs and their reconstruction, major repairs and upgrades. Interfacing of the decisions, issued under both laws is the following:

- Authorization for siting (site selection permit), issued under the ASUNE is a precondition for issuance by the Minister of Regional Development of a permit for elaboration of detailed development plan, under LSP;
- Site approval order and design approval order under the ASUNE are a precondition for approval by the Minister for Regional Development of the detailed development plan and the technical investment project respectively;
- Construction permit issued under ASUNE is a precondition for the issuance by the Minister of Regional Development of a construction permit under the LSP.
- Authorization for use (after construction) under the LSP is a precondition for issuing of a commissioning permit, under the ASUNE.

Health Act

The Health Act regulates the public relations for the protection of life and health of the population. Section VI of the Act “Protection from the effects of ionizing radiation” establishes the requirements and criteria to protect people from harmful effects of ionizing radiation. Ministry of Health shall establish and maintain a register of persons who work or have worked in an environment of ionizing radiation and shall control the occupational exposure.

In some cases, there is a legislative requirement on the application of the conciliation procedure between the two authorities in the issuance of certain licenses. For example, a license for operation of sites with sources for medical purposes is issued by the NRA Chairman after administrative coordination with the Minister of Health, through the National Centre of Radiobiology and Radiation Protection. The license will enter into force only when the physical or legal person obtains the necessary permits to provide medical or dental care, as specified by the law on public health. Administrative coordination is done with the obligation that the sources of ionizing radiation can be used for medical purposes.

Disaster Protection Act

The Disaster Protection Act ensures the protection of public life and health, environment and property in case of disasters. According to the terminology of the law, the term "Disaster protection", among others, includes taking of appropriate actions in the case of nuclear or radiological emergency. The ASUNE requires that the organization to develop, maintain and coordinate the implementation of the external emergency plans shall be carried out by the specialized state bodies on Civil Protection and for protection of the population from disasters and catastrophes, created by the Disaster Protection Act, Law on the Ministry of Interior (LMI) or other normative acts. The external emergency plan shall be adopted by a decision of the Council of Ministers upon an initiative of the bodies responsible for its development.

Law on the Ministry of Interior

The Law on the Ministry of Interior regulates the principles, objectives, activities, structure and management of the Ministry of Interior. With the amendments made to the LMI in the end of 2009, among the main activities of the Ministry of Interior are protection against disasters, mitigation and recovery, provision of resources, undertaking of rescue activities, improvements in safety and health of employees, and coordination of the joint rescue system under the Law on Disaster Protection. General Directorate Civil Protection is the national specialized structure of the Ministry of Interior responsible to carry out the activities on protection from disasters. Its structure and activities are specified by the Rules for Application of the LMI.

In terms of physical protection of facilities, the responsibility is also distributed among various authorities. ASUNE provides that the terms and conditions to ensure the physical protection of nuclear facilities, nuclear material and radioactive substances during their use, storage and transport shall be specified by an Regulation adopted by the Council of Ministers on a motion by the Minister of Interior, Minister of Defence, NRA Chairman and Chairman of the State Agency for National Security.

Some nuclear facilities, as well as the associated facilities that are technologically bound or serve them, could be declared as extremely important in terms of physical protection. This is done by a decision of the Council of Ministers on a motion by the Minister of Interior, NRA Chairman and the Chairman of State Agency for National Security. Security of extremely important sites is provided by the Ministry of Interior.

International conventions and treaties

The Constitution is the supreme law of the country and no other law shall be contradictory. The provisions of the Constitution have direct effect. According to Article 5, Paragraph 4 of the Constitution, international treaties ratified by the constitutionally established procedure, promulgated and entered into force for Bulgaria are part of the country legal system and prevail over any conflicting provision of national law which contradict them.

In addition to the Convention on Nuclear Safety, in the field of nuclear safety Bulgaria is a party to the Convention on Early Notification of a Nuclear Accident, Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Joint Convention on the Safety of Spent

Fuel Management and on the Safety of Radioactive Waste Management, Convention on the Physical Protection of Nuclear Material and the Additional protocol.

In 2009, there were changes in the system for the implementation of safeguards under the Non-Proliferation Treaty. Following Bulgaria obligations under the European Union Accession Treaty, a tripartite agreement for the implementation of the safeguards between the EU and EURATOM, the Republic of Bulgaria and the IAEA entered into force on 1 of May 2009 (INFCIRC/193). After that date, the mechanisms applied for international exchange of information concerning the Safeguards have changed. This is because of the Bulgaria's obligation to provide information for monitoring and reporting of nuclear material to the European Commission.

As required by the Additional Protocol to the new agreement, the preparation and presentation to the IAEA of the information regarding the activities of the country in the nuclear fuel cycle is done by the Community, the Member State and by the Community and the Member State together. In accordance with new responsibilities coming from the ratification of the Agreement and Additional Protocol, latest declaration to the IAEA under INFCIRC/178 was sent in July 2009. The initial declaration under INFCIRC/193 was also prepared and sent to the IAEA. In compliance with the requirements of the new agreement, three new areas of material balance are being formed - two sites for small quantities of nuclear material throughout the country and one for the RAW storage facility in Novi Han. NRA drafted and sent to the European Commission (EC) the main technical characteristics and the first three statements of material balance areas for the sites with small quantities of nuclear material.

Article 7 (2) (i) National safety requirements and regulations

Secondary legislation

In the period after the entry into force of the ASUNE, all secondary legislation for its enforcement (the Regulations) were developed and adopted till the middle of 2005 (Annex 1). The Act and the Regulations for its implementation create the system of national requirements for safety of nuclear facilities and establish a unified and comprehensive regulatory framework, which is in line with the latest developments in the field of nuclear law, the international best practices (the IAEA documents), the best practices of the EU countries in this area, as well as the experience of the leading countries in the field of nuclear safety and radiation protection. The main regulations in the field of nuclear safety are:

- Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy
- Regulation on Ensuring the Safety of Nuclear Power Plants;
- Regulation on Safety During Decommissioning of Nuclear Facilities;
- Regulation on the Safety of Radioactive Waste Management;
- Regulation on Ensuring the Safety of Spent Nuclear Fuel;
- Regulation on Emergency Planning and Emergency Preparedness in case of Nuclear or Radiological Emergency;
- Regulation on the Conditions and the Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation;
- Regulation on Ensuring the Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances.

Guides issued by the regulatory authority

The basic requirements on nuclear safety, radiation protection and physical protection of nuclear facilities are set in the ASUNE. To ensure the safety of facilities and activities, the NRA has developed and the Council of Ministers adopted a set of Regulations, which specify in detail the safety requirements to licensees and applicants. The ASUNE and the Regulations for its implementation entrust the NRA Chairman with the responsibilities to enforce the Law and to interpret the provisions and issue guidance for fulfilment of the legal requirements. One of the available instruments to accomplish that is the issuance of Regulatory Guides (RGs).

In many cases, the regulations define only the fundamental requirements and allow a wide range of freedom in determining design solutions and taking safety decisions. Therefore, in some cases, the requirements of the regulations are further explained by the RGs in order to help licensees to better understand regulatory requirements and criteria, by which the NRA will assess the adequacy of their safety assessments.

Regulatory guides are not mandatory in nature and criteria set out in the guides are not necessarily binding. They represent a useful tool for achieving a common approach to design and safety justifications of more than one licensee, operating similar type of facility or performing similar activities. Following the decision to restart the construction of a new nuclear capacity in the country, NRA decided to issue a set of RGs in the area of safety of nuclear facilities in order to implement the principle of equality between different licensees.

Regulatory guides define and recommend ways to fulfil legal and regulatory requirements, and explain the details, which are expected to be included in the documents submitted by licensees for the safety of facilities and activities. The NRA position is that the RGs should be followed by applicants and licensees, although they are not mandatory and their violation will not lead to sanctions or fines. It is in the benefit of the licensee to strictly follow the guides, which will allow the NRA staff to better understand the safety justifications and will reduce the time for review and assessment and in such a way reduce the authorisation time. Of course, licensees are allowed to apply other approaches and criteria when they consider that this will lead to a high level of safety. In these cases, they shall convince the regulator that all requirements of the regulations were considered and strictly followed, and that safety justification has been prepared properly and correctly.

NRA has established a comprehensive program for development of RGs, which is maintained and updated in accordance with the established priorities, the available resources, and the NRA expert capabilities. Regulatory guides included in the program have been selected by analysis of all proposals made by the various NRA departments. The program is reviewed annually and is updated based on the new proposals for RGs, changes in priorities, changes in the legislative framework, and others.

In 2008, when the fourth review meeting to the Convention was held, the program included development of about 35 regulatory guides concerning both the safety of nuclear installations and the safety of facilities and activities with sources of ionizing radiation. In the process of annual review and update of the activities planned, the program evolved and the total number of planned guides was reduced to nineteen. This was achieved by means of combining two or more guides in one and by postponing the guides with a very low priority in time. For clarity are given the following examples:

- Planned guide on the Operating Experience Feedback was included as a separate chapter in the Guide on Operation of Nuclear Facilities;
- Guide on qualification of SSC and guide on classification of SSC have been merged into one;
- Guides on PSA Level 1 and PSA Level 2 were also combined in one;

- Guide on the design of nuclear facilities has been postponed to a later stage, because the Belene design is in an advanced stage of review and assessment by the NRA and no other application for design approval is expected in the near future; etc.

In the period after the fourth review meeting, the NRA has adopted and issued eighth regulatory guides, while another 11 are at different stages of development as follows:

- 4 guides have been developed and approved internally, they are under discussion with interested authorities, licensees and the public;
- 5 guidelines were developed by the authors and are submitted for internal discussion within the NRA;
- 2 guides are in development of the First Draft, having approved terms of reference, structure and contents.

In order to ensure widespread and easy access, RGs are being published in printed form and in electronic form on the NRA webpage www.bnsa.bas.bg and the internal network. Guides are distributed to all interested organizations with a formal letter.

Establishing and revising regulatory requirements

Development and adoption of laws

The national practice on development and adoption of laws has its legal framework, specified by: the Constitution of the Republic of Bulgaria, Law on Normative Acts and the Decree for its implementation, the Rules of procedure of the Council of Ministers and its Administration, and Decree № 33 of the Council of Ministers (of 2002) for Organization and Coordination of the Preparation of Bulgaria for Accession to the European Union, etc. Under the Constitution, the right of legislative initiative have the Council of Ministers and Members of Parliament.

NRA submits bills to the Council of Ministers for consideration through a coordinating Deputy Prime Minister. Bills shall be coordinated in advance with all ministries and state authorities concerned. All comments and suggestions shall be reflected and a table for compliance shall be prepared. The Council of Ministers adopts the bill by a Decree and submits it for consideration and vote to the Parliament. After its adoption by the Parliament, the law is published in the Official Journal. The procedure for developing a draft law also applies to the development of amendments to existing laws.

Regulations

According to Article 5, item 14 of the ASUNE, NRA Chairman develops and proposes for adoption by the Council of Ministers of the regulations implementing the law. Regulations are secondary legislative acts which content should comply with the law. The procedure for developing and adopting regulations and their structure are established by the Law on Normative Acts, Decree № 883 on implementation of the Law on Normative Acts, and the Rules of procedure of the Council of Ministers and its Administration. Draft regulations shall be coordinated with all ministries and authorities concerned. All comments and suggestions shall be reflected and a table of compliance shall be prepared. The Council of Ministers adopts regulations by a Decree. After their adoption by the Council of Ministers, the regulations are published in the Official Journal.

Activities for harmonization of safety requirements

WENRA was established in 1999 as a non-profit organization. Members are the Chairman and top managers of nuclear regulatory authorities of the European countries, which operate nuclear power plants. Nuclear Regulatory Agency is member of WENRA since March 2003 and actively participates in the process of harmonization. For harmonization of approaches to safety in European countries, WENRA has created two working groups - one for the safety of nuclear

power plants (Reactor Harmonisation Working Group), and the other for safe decommissioning and management of radioactive waste and spent fuel (Working Group on Waste and Decommissioning). The purpose is to constantly improve safety and reduce differences between countries.

Involvement of NRA experts in the activities of the working groups started immediately after the NRA adoption as a WENRA member (March 2003). NRA members in the working groups take active part in meetings and activities on development of safety reference levels and in assessment and comparison of national requirements and practices. Actions are being implemented for harmonization of new regulatory requirements with the safety reference levels, in accordance with the commitments made by the WENRA member countries.

The working groups: analyze the current situation and different approaches to safety; compare the different national regulatory approaches with the safety standards of the IAEA; determine the differences and propose ways for their possible elimination, without adversely affect the achieved level of safety. The proposals are based on the best practices and the current requirements for existing NPPs and facilities for radioactive waste management. Developed common "reference levels" are intended to achieve a common approach to nuclear safety in Europe.

Working Group on Safety of Nuclear Power Plants

The Task Force for the Safety of NPPs has prepared revised safety reference levels for existing reactors and national action plans for harmonization. Plans are to transpose the reference levels by the end of 2010, but there is a possibility for extension until the end of 2011. The Working Group will prepare a report on the implementation of the commitments, which will be publicly available.

In 2008, the Working Group has begun work on developing reference levels for new reactors. Pilot study was made on a general concept for the safety of new reactors. The concept uses as a platform the developed reference levels for existing reactors and sets safety targets, rather than reference levels. Safety targets for the new reactors are based on IAEA Safety Fundamentals and other international documents, and are formulated based on the expected safety improvements in comparison to existing reactors. The final report of the WG will be presented at the WENRA meeting in November 2010. Working Group continues its work on this topic by carrying out validation of 10 selected safety targets, while a basis for the review will be feedback from review and assessment of new designs.

It is expected that after the WENRA meeting in the autumn of 2010, the Working Group will begin work on the issues of long-term operation of existing reactors, as well as the standards which shall be applied to assessing their safety. Detailed formulation of the task is being worked out.

Working Group on Waste and Decommissioning

Working Group on Waste and Decommissioning continues its work on the preparation of positions for compliance with the reference levels for harmonization. The report for storage of radioactive waste and spent nuclear fuel has been completed, as final comments from Member States are expected. The report will be corrected and posted on the website of WENRA by the middle of the year. National action plans for harmonization with the reference levels have been developed with the deadline for implementation being the end of 2012.

Final completion of the report on decommissioning is expected by the end of 2010. The deadline for implementation of national action plans is set for the end of 2013. The TOR for the preparation of a report on the development of reference levels for facilities for disposal of radioactive waste was approved. It is expected that the first version of the report will be ready by mid-2011 and the results of validation by the end of 2012. Implementation of national action plans is planned to be completed by 2015.

More detailed information on the reference levels and actions taken by Bulgaria can be found on the websites of WENRA and the NRA.

Article 7 (2) (ii) System of Licensing

To ensure the safety of facilities and activities, the ASUNE establishes an authorisation regime of issuing licenses and permits. Licensing process is conducted under the conditions of transparency and equality and is based on the fundamental legal principles:

- Responsibility for ensuring nuclear safety and radiation protection lies in full by the persons responsible for facilities and activities and may not be transferred to others;
- Persons responsible for facilities and activities shall establish and maintain an effective safety management system;
- The expected economic, social and other benefits shall outweigh the possible adverse effects of activities;
- Measures to ensure nuclear safety and radiation protection shall be optimized so as to ensure achieving the highest possible reasonably achievable level of protection;
- Exposure of personnel and the population shall be limited and maintained as low as reasonably achievable level;
- The concept of defence in depth shall be applied, having implemented all reasonable practicable measures to prevent accidents and limit their consequences;
- An effective system for emergency preparedness and response in case of a nuclear or radiological emergency shall be established and maintained;
- Protective measures to reduce current and uncontrolled exposure shall be justified and optimized;
- The competent authority which carried out the state regulation of the safe use of nuclear energy and ionizing radiation shall be provided with the human and financial resources, which are sufficient to carry out its responsibilities in full.

Chapter Three of the ASUNE determine the scope of activities, facilities and materials subject to authorisation. License is issued to operate a nuclear facility (unit of a nuclear power plant, facility for spent fuel, facility for radioactive waste management, research reactor). The maximum term of the license is 10 years. Thus the operator can plan long-term activities and to devote more resources to safety improvements. An option is given to renew the license on the basis of a periodic safety review. The law places very precise and clear requirements to the operator in respect of the conditions and criteria to be met in order to obtain a license, by which the subjective decision-making by the regulatory authority is avoided. The conditions, under which the licensee may request license amendment and the grounds for suspension or revocation of licenses, have been precisely specified.

For one-time activities, related to nuclear safety and radiation protection, the law provides for issuing of a permit. Those are the following cases:

- Siting of a nuclear facility;
- Design of a nuclear facility;
- Construction of a nuclear facility;
- Commissioning of a nuclear facility;
- Making changes, leading to modification of:

  - * Structures, systems and equipment related to nuclear safety and radiation protection;
  - * The conditions and limits for safe operation on the basis of which is authorized to operate;
  - * Internal rules for the activity, including instructions, programs, technical regulations annexed to the operating license;
- Decommissioning;
- Transport of nuclear material;
- Business transactions with nuclear facilities;
- Import and export of nuclear material;
- Transit of nuclear material.

License or permit, its modification or the refusal of the NRA Chairman to issue a decision may be appealed to the Supreme Administrative Court.

Terms and conditions for issuing licenses and permits are specified by the Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy, issued by the Council of Ministers, with effect from 22.05.2004. In accordance with this Regulation, an applicant for a license or permit shall submit the respective documents which prove the compliance with the requirements on nuclear safety and radiation protection. These requirements are defined mainly in the Regulations for implementation of the ASUNE (Annex 1).

The ASUNE establishes special procedures for building nuclear power plants. A nuclear power plant is built upon a Decision of the Council of Ministers on a motion by the Minister of Economy, Energy and Tourism. The proposal shall be accompanied by the results of public consultation concerning the assessment of nuclear safety and radiation protection and the safe management of radioactive waste and spent fuel, resulting from the activity of the NPP.

Public participation in the regulatory process is provided by the Law on Normative Acts, which requires publication of all bills at least one month prior to their adoption, as well as by the Access to Public Information Act. In addition, the Law on Environmental Protection requires public consultation on the results of the environmental impact assessment report for a nuclear facility.

Article 7 (2) (iii) System of regulatory inspection and assessment

Regulatory inspections

The Act on the Safe Use of Nuclear Energy assigns to the NRA Chairman the responsibility to carry out regulatory control over the nuclear safety and radiation protection in the use of nuclear energy and ionizing radiation and in the radioactive waste and spent fuel management. This control is:

- Preventive control by issuing licenses and permits for activities and individual licenses;
- Monitoring the implementation of the terms of licenses and permits for activities and individual licenses;
- Following up on implementation of recommendations and instructions given by the control authorities.

In fulfilment of its control powers, the NRA Chairman:

- Perform periodic and special inspections through designated authorized officials;

- Inform other specialized control authorities to take measures within their competence;
- Alert the prosecuting authorities with evidence of a crime;
- Amend or revoke licenses or permits issued or individual licenses;
- Impose enforcement administrative measures and administrative sanctions provided by the ASUNE.

NRA Chairman has the powers to request from individuals: information about their activities; the necessary documents in respect to the regulatory oversight, and if necessary request the assistance of specialized control bodies.

The overall objective of regulatory inspections and the application of enforcement measures is to ensure implementation by the operator of all activities in a safe manner and in accordance with the requirements, rules and regulations on nuclear safety and radiation protection. In pursuance of this objective, the NRA annual plan includes the areas of regulatory controls identified by the ASUNE and the conditions of the licenses and permits. Inspection activities are planned by taking into account operating status of nuclear facilities, the results of previous inspections, and planned modifications, in such a way ensuring coordination with the activities planned by the operators. Financing of inspection activities is secured through the NRA budget.

The NRA is trying to apply in its activities a non-prescriptive approach, therefore of particular importance are the systematic contacts with licensees (in the case of NPPs - daily), in which issues are discussed in an open dialogue. The aim is to assist licensees to implement the requirements of the Law and Regulations, so that the planned measures to be acceptable to both parties. Enforcement and administrative penalties are imposed only if all other possibilities have been unsuccessful. Discussions take place in a routine basis both at the NPP site and at the NRA headquarters, at the initiative of one of the two parties.

The types of inspections and areas of supervision are carried out within the ASUNE framework and are specified in detail in a NRA internal document “Procedure for the NRA inspection activities”. They are:

- Routine inspections;
- Thematic inspections;
- General inspection;
- Reactive (extraordinary) inspections.

Routine inspections are carried out mainly by the inspectors on site and include control of limits and conditions for safe operation, the state of systems important for safety, maintenance, and housekeeping. In essence, thematic inspections and general inspections are planned inspections, while reactive inspections are carried out on a case by case basis as necessary. Thematic inspections are carried out in different areas of oversight. 3-5 inspectors are involved with the competence closed to the inspected area. General inspections cover various technical and organizational areas and in general take place before the execution of an important stage in the lifecycle of the facility or to verify the compliance with license conditions. Normally, those inspections include 6-8 inspectors with different technical profile, covering the entire spectrum of the inspected area in terms of the stage of the facility, the purpose of the inspection, and the type of facility. Extraordinary inspections are conducted in the presence of circumstances that affect safety and are usually associated with investigation of operating events and failures of equipment and systems important to safety.

NRA Chairman authorises certain officials of the administration of the Agency (inspectors) to carry out control under the ASUNE, in accordance with their powers of authority. Inspectors have the following rights:

- Free access to the controlled persons and sites, at any time, to check the status of nuclear safety, radiation protection and the technical status of the facilities;
- Require the necessary data, information, explanations, and other operational information, including measurements and tests in order to clarify the technical conditions and the operational status of the facility, including staff qualification, and any other safety related information ;
- Issue acts for administrative violations;
- Make proposals to the NRA Chairman for modification, suspension, termination or revocation of the permits, licenses or individual licenses issued;
- To issue improvement notices for ensuring nuclear safety and radiation protection.

Inspection results are recorded in an inspection protocol (protocol of findings), to which the evidences collected, explanations and results of monitoring, measuring and testing are attached. Improvement notices given by the inspectors are obligatory. The results of inspection and control activities of NRA and the specialized control authorities are published in the NRA annual report, which is submitted to the Council of Ministers, state authorities, non-governmental organizations and the public.

Specific requirements to inspectors' appointment are specified in the NRA Rules of Procedure, the main being:

- Have not been convicted of a premeditated crime of general nature or imprisoned;
- Do not have commercial or other relationships with companies and organizations that carry out activities under the ASUNE;
- Have professional experience not less than 5 years in the field of state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent fuel.

Review and assessment of safety

NRA carries out safety review and assessment both in the process of issuing licenses or permits and periodically during the implementation of the activity. The process of review and assessment of documents supporting applications for licenses and permits can be summarized in the following steps:

- Reception and registration of the application and its attached documentation;
- Determine program and a team of experts to review and evaluate the documentation and in some cases specify methodological instructions for the task;
- Review and assess the applications and respective attachments for compliance with the requirements in force, and where appropriate - to the relevant documents to the IAEA or other regulatory authorities. If necessary, the applicant is required to submit additional information for the assessment;
- Results of expert evaluation are summarized and documented, as on the basis of the conclusions a proposal is made to issue the act or for motivated refusal;
- The final decision to issue the act or motivated refusal is within the responsibility of the NRA Chairman.

In cases where the documents contain information, which requires special knowledge, the NRA Chairman may contract additional review and assessment of selected documents to be done by external consultants. Experts from the respective departments prepare the TOR for the expertise and participate in the adoption procedure.

When it is identified non-compliance of the documentation submitted with the safety requirements, detailed notes are sent to the applicant for issue resolution. In such cases, it is a well established practice to organise meetings with representatives of the applicant in order to discuss and clarify questions and comments.

Periodic review of compliance with nuclear safety and radiation protection is carried out through review and assessment of licensee reports, reports on operating events, and through on-site inspections for compliance with the requirements for safe operation.

Analysis and evaluation of operational events

Under the current legislation (Article 19, Paragraph 1, p. 8 of the ASUNE), the requirements for providing information by the licensee to the NRA, including requirements for mandatory notification to the Agency in case of an event, incident or accident are defined by a Regulation. In this Regulation, the cases are specify where the licensee shall notify the regulatory body for violations of the requirements on nuclear safety and radiation protection, related to the management of nuclear material, the operation of nuclear facilities and management or use of radioactive substances or other sources of ionizing radiation. The Regulation also establishes procedures and sets time limits for notifying the regulatory body, which are respectively 24 hours or 1 hour from the time of the event, depending on the radiological consequences.

For each event, a written report shall be submitted within 30 days. All reports of operational events are reviewed and evaluated by the NRA inspectors, as for that purpose a special working group has been established. When necessary, additional information is requested or additional analysis and expertise are conducted in order to clarify the root causes of the specific event. In some cases, the NRA inspectors participate in the event investigation teams.

Use of risk-informed approach to decision making

Integrated (risk-informed) approach to decision making uses the results of risk assessment, along with other important information, to support decision making. As the there are various factors that should be considered, the use of structured process could facilitate the implementation of transparent, consistent and comprehensive integrated decision making. An integrated approach to decision making include the following factors:

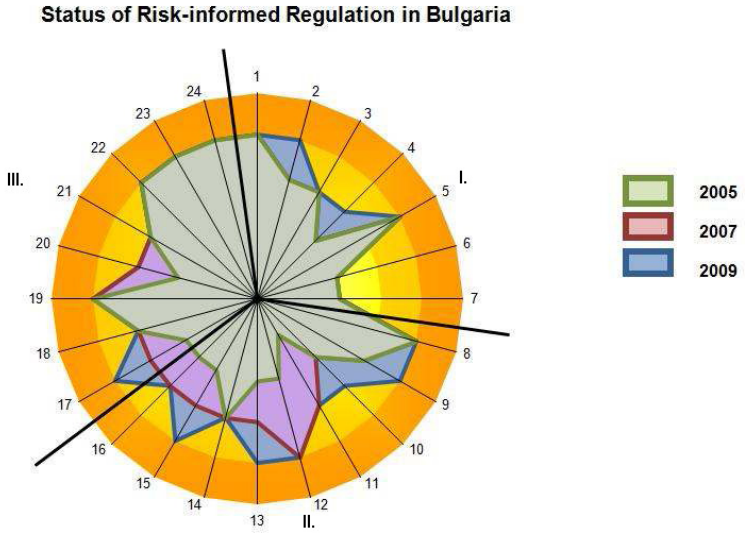
- Mandatory requirements, which normally include all the requirements of laws, regulations and technical specifications, as one of the most important requirement is that the risk shall be reduced as much as reasonably achievable;
- Results of the deterministic analysis. Deterministic analyses indicate whether the requirements of defence in depth have been implemented or and whether sufficient safety margins are maintained;
- The results of probabilistic analysis, which give an assessment of the level of risk from the NPPs and other factors (such as sections of important functions, etc.). They can be used to identify the weaknesses in the design and operation;
- Other relevant factors, e.g. costs and benefits that are result of: modifications implementation, the rest lifetime of equipment, inspection results, operational experience, and radiation exposure of personnel, resulting from the implementation of the changes, etc.

Regulatory authorities, members in the Forum of Regulators of Countries Operating VVER Reactors (VVER Forum), turned attention to the importance of an integrated approach to decision making. Accordingly, the forum working group on regulatory use of PSA developed a system of indicators to evaluate possibilities for implementing risk-informed regulation. The purpose of developing this system of indicators is to provide a user friendly tool for identifying the status of risk-informed regulation and safety management (strengths and weaknesses) in

order to assist regulatory authorities to plan their goals to the future development of the integrated method.

The main objectives of the system of indicators to evaluate possibilities for implementing risk-informed regulation are:

- Provide a method of self-identification in the status of risk-informed regulation and safety management;
- To identify the key practical areas of risk-informed regulation;
- To prioritize areas for future development.



On the basis of international regulatory practice, three major areas were established, according to which possibilities for implementing the integrated approach could be identified, namely: the Area I "Availability of legal requirements", Area II "Availability of PSA models and practice", and Area III "Availability of PSA expert reviews". As shown on the figure, NRA has a balanced development in all three areas for 2005-2009:

- Area I - in addition to the legal requirements, NRA issued guides to the operator on PSA development and PSA applications, as well as on how to perform deterministic analysis;
- Area II - extension of the PSA study - PSA Level 1 and Level 2 for internal and external events and threats, for all operating states - at power, low-power and shut down state, and maintaining it up to date (allowing for the realization Living PSA);
- Area III - performing a detailed expert review of the PSA study and its quality, done by an international expert team; and the availability of technical support organization in the process of review and assessment of the PSA.

These conditions allow the operator to implement some of the applications of the integrated approach, such as optimization of maintenance and repair.

NRA policy in this area is the moderate development of an integrated approach to decision making, with due consideration of the positive experiences from the application of this method by other European regulators. The intentions are not to proceed to full implementation of the integrated approach. It should be noted that the change in regulatory decision making approach will require complete revision of the legislative and regulatory requirements.

Article 7 (2) (iv) Enforcement of applicable regulations

To prevent and discontinue administrative violations and to prevent and eliminate their consequences, NRA Chairman imposes sanctions (fines and penalties) and enforcement administrative measures. Chapter Eleven of the ASUNE sets different amounts of penalties, depending on the type of offence and the offender. The ascertainment of violations, issuance, appeal and enforcement of penal provisions are made in the order specified by the Law on Administrative Violations and Penalties.

Compulsory administrative measures shall be imposed for violations of the requirements for nuclear safety and radiation protection, physical protection and emergency preparedness, in which there is a danger for an accident. Compulsory administrative measures that may be imposed in these cases are:

- Suspension or restriction of the authorization activity;
- Suspension of an individual license;
- Order to the licensee to carry out investigations, inspections or tests, modification of established limits and conditions for operation; modifications of design and constructions, review and modification of training courses and conducting of additional training, including verification of personnel knowledge and skills.

Compulsory administrative measures are imposed by an order of the NRA Chairman, based on the finding of the NRA inspectors. The order imposing enforcement measures shall determine appropriate time for their implementation. The order for imposing compulsory administrative measures may be appealed before the Supreme Administrative Court under the Law for the Supreme Administrative Court. Appeal does not suspend execution, unless the court orders otherwise.

Violation of the conditions of the permit or license is an administrative offence for which the person who committed the offence receives a fine or penalty in an amount determined by the ASUNE. Breach or violation of permit or license condition may give sufficient grounds for revocation of the license or permit. Revocation of permit or license shall be made by a decision of the NRA Chairman, which determines the terms and conditions in which the person may apply for a new permit or license for that activity.

NRA applies enforcement administrative measures and prosecution solely when all other possibilities have been ineffective. Effectiveness of that policy have been confirmed by the few penalties and compulsory administrative measures imposed since the entry into force of the ASUNE in 2002 (until now - 16 penalties were imposed, most for use of sources, as in 2009 and early 2010 - none issued).

Article 8 Regulatory body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

Article 8 (1) Establishment of the regulatory body

Foundation

In 1957 Bulgaria ratified the Statute of the IAEA. By this act Bulgaria, along with other 80 countries, is one of the founding states of the international organization. In June 1957, by Resolution № 603, the Council of Ministers established a Committee for the Peaceful Use of Atomic Energy, which mandate was to monitor and promote the development of R&D activities in the use of nuclear energy. After commissioning of the first two units of Kozloduy NPP in 1975, by Decree № 31 of the Council of Ministers of 15 March 1975, the Committee was given also control functions. In 1985 was adopted the first Law for Use of Nuclear Energy for Peaceful Purposes. The Law created a Committee for the Use of Nuclear Energy for Peaceful Purposes and determined in detail the functions and tasks of the organisation. An Inspection on the Safe Use of Nuclear Energy was established.

The law was amended several times until 2002 when it was fully repealed by the new Act on the Safe Use of Nuclear Energy. The ASUNE is consistent with the current trends in the field of nuclear law, including legislative practice of the EU countries in this area. In developing the Act, the recommendations of IAEA experts were considered. By the Act, the Committee was transformed into Nuclear Regulatory Agency, which is politically and financially independent regulatory authority.

Legal basis and status of the regulatory body

The status and responsibilities of the Nuclear Regulatory Agency are set by the Act on Safe Use of Nuclear Energy, published in the Official Journal 63 of 28.06.2002. According to Article 4 Paragraph 1 of the ASUNE, state regulation of the safe use of nuclear energy and ionizing radiation and the safe management of radioactive waste and spent nuclear fuel is carried by the Chairman of the Nuclear Regulatory Agency. NRA is an independent specialized body of the executive power and its jurisdiction is defined by the ASUNE.

NRA Chairman is approved by the Council of Ministers and appointed by the Prime Minister for 5 years mandate. He/she may be appointed for one more term of office. In exercising its powers, the Chairman is assisted by two deputy-chairmen, who are approved by the Council of Ministers and appointed by the Prime Minister upon a proposal of the NRA Chairman.

NRA administration is a category A2, which is the same for the ministries. From early 2003, NRA is a primary administrator of budget funds, which means that negotiate directly with the Ministry of Finance its budget for the year. The NRA budget is included as a separate line in the State Budget Act.

Mandate, mission and objectives

Regulatory functions, performed by the NRA in the service of society, determine the organization's mission, namely: “Protection of individuals, the society, future generations and the environment from harmful effects of ionizing radiation”. To achieve its mission, NRA is guided by internationally accepted principles of nuclear safety and radiation protection and constantly strives to improve its effectiveness and efficiency through implementation of internationally recognized regulatory best practices.

In accordance with the long term objectives, plans, priorities and expected problems, NRA develops a Strategic Plan for its activity. The plan is submitted to the Government and published on the NRA website. It is the basis for preparing annual plans, which define the scope and the objectives of NRA activities for the respective year. The strategic plan is periodically updated as a result of a change in priorities and goals of the organization or as a follow up to the risk analysis.

For the implementation of the main tasks facing the organization, the NRA management has adopted and periodically updates the “Policy Statement”, which identifies priorities and expectations to staff.

Authorities and Responsibilities

Authorities and responsibilities of the Nuclear Regulatory Agency are set primarily in Article 5 of the ASUNE. Under the Act, the NRA Chairman shall have the following authorities and responsibilities:

- Manage and represent the agency;
- Issue, amend, supplement, renew, suspend and revoke licenses and permits for the safe conduct of activities;
- Supervise compliance with the requirements and standards for safe use of nuclear energy and ionizing radiation, radioactive waste management and spent nuclear fuel and the conditions of the licenses and permits;
- Issue and revoke individual licenses for work in nuclear facilities or with sources of ionizing radiation;
- Impose compulsory administrative measures and administrative penalties as provided by the ASUNE;
- Contract expert reviews, studies and research, related to nuclear safety and radiation protection ;
- Interact with the executive authorities, which have been granted regulatory and supervisory functions in respect of the use of nuclear energy and ionizing radiation, and propose to the Council of Ministers measures to coordinate these activities;
- Carry out the international cooperation of the Republic of Bulgaria in the safe use of nuclear energy and ionizing radiation and in the management of radioactive waste and spent nuclear fuel;
- Provide the citizens, legal persons and public authorities with objective information on the state of nuclear safety and radiation protection;
- Submit annual reports to the Council of Ministers on the state of nuclear safety and radiation protection and the activity of the NRA;
- Organize and coordinate the preparation and submit to the Council of Ministers the reports under the Convention on Nuclear Safety and the Joint Convention on the

Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;

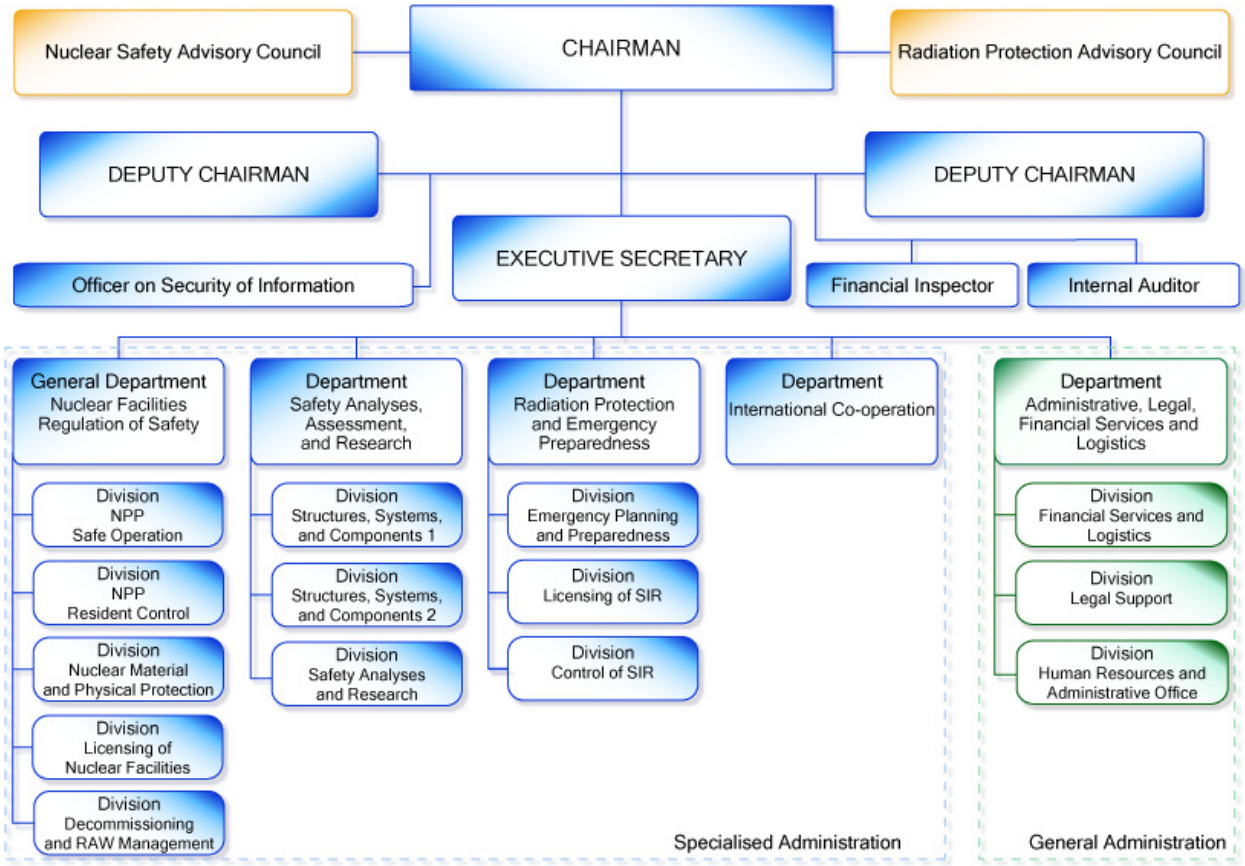
- Organize and coordinate the implementation of the obligations of Bulgaria under the Agreement between the Republic of Bulgaria and the International Atomic Energy Agency for the application of the safeguards, in connection with the NPT and the Additional Protocol;
- Perform the functions of a central authority and contact point for emergency notification and assistance under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency;
- Develop and propose for adoption to the Council of Ministers the Regulations for the implementation of the ASUNE.

The ASUNE identifies licensing activities, implementation of regulatory control, safety review and analysis, development of regulatory requirements, maintaining emergency preparedness and international co-operation of Bulgaria as the essential functions of the NRA. In addition, the Act states that the NRA Chairman may have other specific authorities, when conferred upon it by the legislation.

Organizational Structure

According to the ASUNE, the NRA Chairman is assisted by an Administration, which is organized in a Nuclear Regulatory Agency. The Agency is a legal person, funded by the state budget and has its headquarters in Sofia. The structure, operation and organization of work of the agency and its human resources are determined in the NRA Rules of Procedure, adopted by the Council of Ministers upon proposal of the NRA Chairman.

The NRA structure is consistent with the Administration Act, which sets out uniform requirements for the structure of the administrations in the country. The structure takes account of all activities of the regulatory authority under the powers vested to the Chairman by the national legislation. NRA Administration is headed by an Executive Secretary. NRA employees are divided into general and specialized administration. General Administration provides technical activities of the specialized administration and carries out administrative services to citizens and legal persons. Specialized Administration is organized into four directorates and assists the Chairman in carrying out its regulatory and supervisory functions relating to nuclear facilities, sources of ionizing radiation, nuclear material, radioactive waste, emergency preparedness and international cooperation. Specialized Administration includes a regional office at the Kozloduy NPP site. NRA organizational structure is shown on the figure.



Over the past three years there have been no significant changes in the NRA organizational structure.

Development and maintenance of human resources

The enormous responsibilities of the NRA staff in front of the society, determine the higher demands on their qualifications and experience, which are accurately and clearly defined for each particular position. Almost all employees of the Agency have a higher education (masters' degree) and long professional experience in the field of regulation, design, construction and operation of nuclear facilities and sites with SIR.

According to the Rules of procedure, NRA has 114 positions, as the Agency has the legal opportunity for appointments of additional staff (10%) on a labour contract. As of August 2010, the main NRA human potential is 95 employees (actually employed staff), of whom 77 had the status of civil servants. In the last three years, the Council of Ministers have adopted a number of resolutions for limiting the total number of state administration, and the fact that NRA has managed to maintain its staff can be counted as a success.

By the end of 2009, there was no change in the number of NRA compared with that in 2007, reported at the previous Convention report. In terms of financial constraints as a result of the crisis, NRA has temporarily stopped the recruitment of new employees.

Despite of the temporary difficulties, NRA employees are dedicated and highly motivated in their work and adhere to professional and human principles and values, which produce results of high effectiveness and quality.

Development and maintenance of competence

In recent years, the NRA employees' workload is constantly growing. This is due to the start-up of large infrastructure projects, such as the construction of a new nuclear power plant (Belene project) and the construction of a national repository for disposal of low and intermediate level waste.

NRA applies a consistent approach of targeted impact on employees in order to increase the effectiveness of their work and to achieve the organizational strategic objectives. Efforts are focused primarily in the following areas:

- Improvement of the system for planning of activities and the necessary human resources;
- Further development of the succession system;
- Improvement of the system for development of professional skills and qualifications of employees and conduct an effective training policy;
- Effective and efficient use of leadership skills of senior staff;
- Encouraging the development of teamwork in the organization work and ensuring responsibility and accountability in planning and execution of tasks; and others.

One of the main cornerstones in the organization is the system for knowledge management. NRA makes periodic re-assessment of the risk of loss of knowledge due to retirement or leaving of key staff, or inefficient transfer of knowledge and skills within the organization. One of the challenges facing NRA in this direction is the increase in the average age and approaching the retirement age of employees in key positions. Analyses show that over the next five years nearly one third of employees in key positions will be replaced due to reach of retirement age. NRA seeks to ensure adequate succession plan and training of personnel, who will have the necessary knowledge and skills to replace any of the key positions. It should be noted that 34% of the staff are employees up to 40 years of age, allowing for continuity of knowledge and accumulated experience.

Employment at the NRA is done by holding competitions to fill vacancies, in accordance with the requirements set out in the legal documents: Law on Civil Service, Labour Code and the Regulation to Conduct Competitions for Civil Servants. The main requirements for candidates are to possess the necessary qualifications, professional experience and personal qualities that enable them to deal professionally with the job requirements and work dedicatedly to serve the public interests, while strictly and impartially implementing the legislation. Conducting competitions is one of the main tools for selecting the most suitable employees to fill the job positions. In recent years, an unfavourable trend exists in reducing the interest in public service, which is indicated by reducing the number of candidates per vacancy. The cause analysis shows that a major factor in reducing the number of candidates is the significantly lower levels of payment in public administration, compared to the corresponding positions in the private sector.

To fulfil its responsibilities and functions in front of the public, the NRA establishes and maintains a level of competence that secures regulatory decision-making. Staff training includes both training to enhance the administrative skills conducted by the Institute of Public Administration and European Integration, and specialized training to increase technical and regulatory knowledge and skills. Training of staff at the Institute is a tool to achieve better training for increasing administrative capacity. Each year, an annual plan is developed for training of the employees in administrative matters. It is obligatory that such training pass newly recruited staff and those appointed for the first time on a management position.

Education and training to improve expertise and skills take into account the specificity of individual positions and the future challenges facing the organisation. In order to implement a systematic approach at all stages, a Competency and Training Management System is being

developed at the NRA. Up to now, in accordance with the NRA organizational structure, competence matrix have been developed and adapted for the main positions. Developed and implemented is a Software Tool Kit for statistical data processing to allow determining the needs for periodic training and setting appropriate priorities.

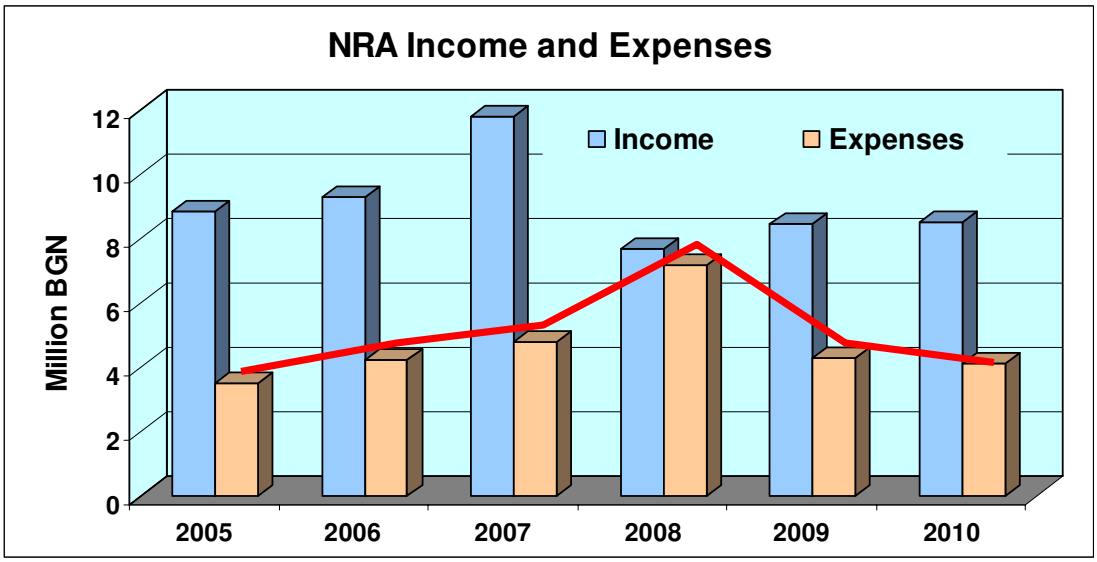
Particular attention is paid to the training of newly recruited staff, which undergo two types of training - general (courses with basic administrative knowledge and skills) and specific – which is specific for each particular case and includes selected training courses and on-the-job training having an experienced mentor. These officers are given specific tasks of increasing complexity, while errors are shown and their causes are analysed and finally additional training is carried out when necessary. According to Article 76 of the Law on Civil Service, a performance appraisal of the employees is carried out on an annual basis, by assessing the fulfilment of the requirements for the respective position.

Developments with respect to financial resources

The financial independence of the regulatory body is secured by the Act on the Safe Use of Nuclear Energy. Under the Act, the NRA activities are financed from the state budget and revenues from fees collected under the ASUNE. The NRA is a primary manager of budget funds, which means that it draws its own budget, which is directly negotiated with the Ministry of Finance. As a result, in recent years, there has been stability in the financing of the organisation.

As could be assumed, the international financial crisis did not miss Bulgaria. This seriously affected the NRA budget, as the requested by the NRA expected costs were reduced in the process of negotiation with the Ministry of Finance, and later on with the amendments to the State Budget Act, the NRA expenditures were reduced by 20%.

The diagram shows the trend in the NRA budget in recent years. The significant reduction in the budget, forced the NRA to revise its priorities and plans for the year and as a result: the appointment of new employees was terminated; international activities are limited to the practically achievable minimum; and the inspection program was optimized.



Regardless of financial difficulty in 2010 NRA still manages to cover all areas of regulatory oversight to ensure the preservation and growth of pay of employees. The main challenge is to maintain the number and motivation of employees.

Quality Management System

To meet its mission of protecting human health, the society, future generations and the environment from harmful effects of ionizing radiation, the Nuclear Regulatory Agency develops, implements, and continuously improves a quality management system.

The quality management system was developed based on the IAEA internationally accepted standards (before publishing GS-R-3 "The Management System for Facilities and Activities"), the international standard ISO 9001-2000 "Systems of quality management. Requirements", as well as the national requirements for establishing and maintaining a system of financial management and control. The IAEA requirements are fundamental for the implementation of the appropriate functions and tasks and are used to achieve the effectiveness of the regulatory body. Compliance of the QMS with ISO 9001 is a prerequisite for the quality of the performed activities and respectively to the efficiency of the regulatory body.

In establishing and implementing an effective QMS, the NRA:

- determine the approach to its diverse activities and the responsibilities of separate units and their personnel;
- provide for the necessary financial and human resources and good working conditions for the proper and timely execution of tasks;
- provide training to increase knowledge and skills of staff;
- support staff initiatives to improve the performance;
- periodically review organisational performance (self-assessments and audits) in order to plan measures for continuous improvement.

QMS documents are divided into four main levels, as follows:

- Level 1 - Documents determining policy and quality objectives, and how to achieve them;
- Level 2 - Procedures defining NRA policy and practices for implementation of activities;
- Level 3 - Work Instructions, giving detailed instructions on how to plan and implement activities;
- Level 4 - Guides to support the implementation of procedures and instructions or perform the tasks and related documents.

In accordance with their importance to fulfil the NRA mission and objectives, the activities are divided into main and support. As main activities are defined: Licensing and authorization; Inspection activity; Application of enforcement measures; Safety review and assessment; Development of laws, regulations and guides; International Cooperation; Emergency preparedness. As supporting activities are defined: Management activities; Administrative Support; Public Relations; and Staff training. Procedures (level 2), instructions (level 3), and where appropriate guides (level 4), are being developed for each main or support activity.

QMS developing and maintenance process requires significant human and material resources. Currently, the QMS includes about 60 documents from first, second, third and fourth level. Approximately 40 documents have been developed or reviewed in the period 2007-2010. NRA QMS is an open and constantly evolving system that promptly reflects changes in international standards. Following the adopted new IAEA safety standards, which reflect the concept of integrated management system, the NRA is taking the appropriate actions to comply with the new requirements.

Openness and transparency

NRA believes that the public access to safety related information and the intensified public control enhance the public confidence in the regulatory body. NRA implements a policy of openness and transparency in its relations with the public, media and all governmental and nongovernmental organizations.

Public relations in the area of nuclear regulation are related with two specific for this area factors. On the one hand, the public concerns about the sector requires that in any crisis situation, the media and the public are provided with accurate, detailed and easily accessible information. On the other hand, the continuous technological development of the industry and its economic significance for Bulgaria make it particularly interesting for the media. Finally, in its public communications, leading for the NRA is the overall benefit of the society.

The mission of the regulatory body is not to advertise or promote nuclear technology, but to protect the public, workers and the environment, and to ensure the safety of nuclear installations and sources of ionizing radiation. The main communication task of NRA public relations officials is to support that mission by providing the audience with clear understanding of the issues, which is a prerequisite for maintaining the credibility of the regulatory body. Public awareness is a NRA priority not only in cases of real events, subject of media interest, but continuously. Public awareness is equally important in cases when rumours, not based on real data, have to be disproved.

The NRA has the complex task to guarantee timely information to the media for everything happening in the area and has to improve communication from the technical language of the expert to the everyday language of the public, especially when an important topic is concerned. The NRA is striving to communicate the right messages and information and to support their proper understanding by the media, including correct retransmission to the public. To ensure that, the NRA regularly organizes training seminars for journalists, which traditionally are attended by representatives of all national media, as well as the public relations officers of the authorities and organisations concerned.

Another tradition in recent years is the organization of visits to the NRA of students. They are acquainted with the natural phenomenon “radiation” and the risks and benefits associated with it, emergency arrangements, and authorities’ functions and responsibilities.

An example of the openness of the NRA is the practice to publish on its website all operational events reported by licensees, as well as all events with sources of ionizing radiation (in Bulgarian and in English). Any other information of interest to the media and the public is also posted at the website. If necessary, the Agency publishes press releases, which in addition to the usual communication official channels are distributed to a large list of journalists.

External technical support

NRA has the responsibilities of development of regulations and guides, review and assessment of safety, authorization, inspection and enforcement, as well as functions in respect of emergency preparedness, physical protection or public information. To perform those functions, NRA needs to come out with a series of regulatory decisions in different aspects of safety, which shall be appropriately justified, based on detailed review and assessment or inspections.

To perform their functions NRA is provided with resources in a manner consistent with the regulated activities and facilities, taking into account the extent and nature of potential hazards. As a country with limited nuclear program, Bulgaria is not able to establish and maintain a large regulatory body. Because of this, when certain specific knowledge is insufficient inside the organization, NRA seeks advice or help from external experts.

The expert knowledge in nuclear issues in the country is concentrated in limited number of organizations, such as national scientific institutes, universities, private companies and of course the operating organizations and the regulator. Additionally, there are individuals that are not part of any of the organizations mentioned above, who have the necessary knowledge and capabilities to make valuable contributions in specific areas of safety concern.

NRA has its own internal department for review and assessment of safety submissions. This department works in close cooperation with the licensing and inspections department as experts from both departments take part in the process of review and assessment, depending on the required competencies for the review. In addition, NRA is allocating a lot of efforts and resources in establishing a well structured, complete and effective system for technical support. The necessary information was collected and a complete database was established of companies and individuals with competencies in the field of safety of facilities and activities, covering the whole lifecycle of a nuclear installation. The database include company profile, age profile, available competencies, CVs of employees, expert work (contracts) done by the company in the nuclear field, and all data for individual independent experts.

Based on the data collected, analyses of companies and own competencies and capabilities and assessment of regulatory challenges in mid-term, in 2003 NRA signed framework contracts for cooperation and expert support with 13 Bulgarian engineering companies and scientific organizations. Currently this number is 20. The main goal of the contracts is to keep the regulator informed about changes in company competencies and capabilities and avoid conflict of interests. According to the framework contracts, Technical Support Organizations (TSOs) shall inform the NRA about any change in their staff composition (hiring new or loosing staff, retirements) that may lead to loss of knowledge and skills inside the company or acquiring new areas of professional competence that may be of technical support to the regulator. Additionally, at the beginning of each calendar year the TSOs shall update their company package (explained above), provided as attachment to the contract. Also, TSOs shall inform the NRA about any other information that may be of interest in assigning to them independent reviews related to licensing activities or safety assessments.

One of the main objectives of the framework contracts is to avoid conflict of interests. This means that the TSOs working for the NRA shall be effectively independent of the operator or the company working for the operator for the specific task. In general, as most of the TSOs are commercial companies, it is not possible to stop them working for the licensee on different projects. In small countries, with limited number of technically competent organization, all of those companies in different tasks and periods and with different frequency do some work for the operators of nuclear facilities. It is the NRA understanding, that effective independence in this case means “The TSO is not part of the operator structure or a daughter company and did not participated as a company or with experts in the analyses or development of the safety submissions”. According to the framework contracts, all TSOs are obliged to inform the NRA on any work they do for operators of nuclear facilities in the country. Additionally, operators should indicate in the safety submissions the companies being involved in the development or review of the documents.

In exceptional cases (SAR, new design), almost all of the local TSOs are involved, so the NRA forms a consortium of the remaining experts with the requited competencies and seeks advice from international organizations. The difficulties in those cases are mainly related to assure sufficient financial resources, as the foreign experts are several times more costly than the local ones. In those cases NRA uses the large expert capabilities of the IAEA and tries to finance some of the work on bilateral or multilateral basis. NRA experience in using TSOs shows that one of the future solutions in this respect, especially for small countries is to join the regulatory assessment resources at regional or international level.

NRA bears all the responsibility for making regulatory decisions and has allocated the necessary human and financial resources to secure the effective operations of the system for technical support and ensure:

- full time experts within the regulatory authority who are competent and capable to perform regulatory reviews and assessments;
- full time experts that are trained and capable to evaluate assessments performed by the TSOs;
- availability within the organisation and at the TSOs of necessary assessment tools and computer codes to do the assessment;
- sufficient financial resources to pay for the contracts;
- access to new developments in science and technology to NRA staff and TSOs;
- continuous improvement of own and TSO expertise, trough training and education programs, as well as participation in international research and exchange programmes, etc.

The NRA system for technical support has been evaluated and positively assessed by independent reviews (IAEA IRRT and Atomic Questions Group Peer Review missions, conducted in 2003).

Advisory Councils

Under the provisions of Article 9, Paragraph 1 of the ASUNE, the NRA Chairman shall create two advisory councils:

- Advisory Council on Nuclear Safety; and
- Advisory Council on Radiological Protection.

Advisory Council shall adopt rules for their work and their meetings are chaired by the NRA Chairman or by an authorized representative. Advisory Councils support the NRA Chairman by giving advice on the scientific aspects of nuclear safety and radiation protection. Their opinion is only advisory in nature, while the full responsibility for the regulatory decisions rests with the NRA. The main functions and tasks of the Advisory Councils are:

- Make proposals in the process of establishing of NRA priorities;
- Discuss and give opinion on existing regulations and new drafts;
- Discuss and give advice on programs and projects to improve the safety of nuclear facilities and sites with SIR;
- Propose implementation of investigations, research and other activities in connection with the safe use of nuclear energy and SIR;
- Assist the NRA Chairman in preparation of the national reports under the international conventions and treaties;
- Assist the dissemination and exchange of information and experience, including international ones;
- Review and give advice on the quality of the reports from contracted expert reviews or research studies;
- Carry out other activities as requested by the NRA Chairman.

Under the provisions of Article 9 of the ASUNE, the composition of the advisory councils shall be determined by an order of the NRA Chairman. The advisory councils include prominent

Bulgarian scientists and experts in the field of nuclear energy and ionizing radiation, radioactive waste management and spent fuel. Members of the Advisory Councils have rich academic, research, or operational experience, in various aspects of nuclear safety and radiation protection, nationally and internationally.

Article 8 (2) Status of the regulatory body

Place the regulatory body in the government structure

Under Article 4 of the ASUNE and Article 19, Paragraph 4 of the Law on Administration, the Chairman of the Nuclear Regulatory Agency is considered as the executive authority. As such, it annually submit to the Council of Ministers a report on the status of nuclear safety and radiation protection in nuclear energy and ionizing radiation, and radioactive waste and spent fuel management, as well as the activities of the Agency (responsibility according to Article 5, item 10 of the ASUNE).

Under RPCMA, there is a direct line of communication between the government and the authorities established by Law, as specified by Article 19, Paragraph 4 of the Law on Administration, the NRA Chairman being one of them. This line is expressed by the RPCMA requirement that any issues for consideration by the government may be submitted only by a member of the Council of Ministers.

As an independent regulatory body within the system of the executive power, the NRA Chairman reports directly to the Chairman of the Council of Ministers – the Prime Minister. By an order of the Prime Minister, since August 2009, the functions of coordination of NRA activities have been delegated to the Deputy Prime Minister and Minister of Finance.

In addition, the NRA Chairman shall inform the National Assembly on matters of nuclear safety and radiation protection, and take part in meetings of the Parliament and the Parliamentary Commissions, when invited to do so.

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.

Formulation in the legislation assigning the prime responsibility for safety to the licence holder

Responsibilities of licensees are specified by the Act on the Safe Use of Nuclear Energy, the Regulation on procedures for issuing licenses and permits for safe use of nuclear energy and the Regulation to ensure the safety of NPPs. Responsibilities of holders of licenses and permits are set by the legislation as follows:

- comply with nuclear safety and radiation protection requirements, standards and rules;
- maintain a high level of quality in all activities carried out;
- take actions for prevention of incidents and accidents and for mitigation of their consequences;
- carry out all measures and activities associated with the safe storage of the generated nuclear material, radioactive substances, spent nuclear fuel, and radioactive waste;
- Implement all necessary measures for the physical protection of the sites and the nuclear material;
- monitoring and measurement of the characteristics of the nuclear material and radioactive substances, and maintaining systems for their accounting and control, etc.;
- conduct review and assessment of nuclear safety and radiation protection and take actions to improve safety, by considering own and international experience and the developments in science and technology; use of systems, equipment, technologies and procedures consistent with these achievements and internationally recognized operating experience;
- ensuring the necessary financial and human resources, including systems for personnel qualification;
- maintain financial insurance for nuclear damage;
- monitoring of the radiological characteristics of the working places and the environment;
- provide the public, state bodies and public organisations with objective information regarding nuclear safety and radiation protection; etc.

These responsibilities are reflected in an appropriate manner in the licenses and permits issued by the NRA (depending on the type of the issued document). Each license defines: the scope of activities; the basic requirements for carrying out the activity; the obligations to maintain the necessary financial, human and other resources, as well as specific requirements referring to:

- nuclear safety, radiation protection, physical protection, quality assurance, emergency preparedness, management of radioactive waste and spent fuel, mitigation of deviations and accidents;

- providing information about: the operations, including fulfilment of license conditions; the procedure for notification in changes of the circumstances in which the license was issued; the procedure for license amendment or extension of validity;
- the obligations of the licensee in connection with the regulatory control carried out by the NRA, the applicable legislation, relationship with other permits or licenses; etc.

According to the Regulation on Ensuring the Safety of NPPs, "The operating organization bears the full responsibility of ensuring safety, including when other entities implement activities or provide services to the NPP, as well as in relation to the activities of the specialized regulatory authorities in the fields of nuclear energy and ionising radiation". The same Regulation requires the operating organizations to establish justified organizational structure for the safe and reliable operation, with clearly defined responsibilities, powers and lines of interaction of the staff, who carry out safety related activities. Also, there is a requirement towards any change in the organizational structure, which is important for safety – such changes shall be justified in advance, systematically planed, and be evaluated after their implementation.

For issuing a permit or a license, the applicant has to demonstrate that: the organizational structure will ensure the maintaining of a high level of safety; compliance has been ensured of facilities and activities with the rules and regulations on nuclear safety and radiation protection; a systems for maintaining a high level of safety culture and work arrangements are in place, which ensures that radiation doses to workers and the public will be kept as low as reasonably achievable; etc.

Discharging of the prime responsibility for safety by the licence holder

The discharges of responsibilities by the license holder are described by the Kozloduy NPP internal organizational documents. The internal document - Rules for the structure and operation of the Kozloduy NPP, specifies the overall organizational structure; management priorities; management bodies and their functions; principles to build the organizational structure; functions and tasks of different structural units; and lines of interaction.

Departments and power generating divisions: Power Generation 1 (PG-1) - Units 1-4 and Power Generation 2 (PG-2) - Units 5 and 6 have their own internal procedures, which are in conformity with the general Rules of the plant, mentioned above.

The procedure for making changes in the administrative and organizational structure of the company is specified by an administrative instruction "Management of organizational changes in Kozloduy NPP". The document defines the procedure for amendment of the organizational structure, sets criteria for assessing their impact on safety, responsibility for planning, execution and analysis of the effects of the amendments. Impact of changes on different groups of staff is also assessed.

Responsibilities of personnel are defined by job descriptions for each job position, while for the operating personnel in job instructions also.

Ensuring by the regulatory body that the licence holder discharges its prime responsibility for safety

Nuclear Regulatory Agency carry out control over the fulfilment of licensee obligations using various approaches, including control over modifications in internal documents, on the basis of which the license has been issued.

In case of changes in internal documents, it shall be demonstrated that the requirements, already described in section 9.1, have been fulfilled. Amendment of internal rules for the activity is done

by separate permits. Whenever there are changes in organizational structure, which are important for safety, to issue the permit for the modification NRA check and verify if those changes are justified in advance; whether they comply with the statutory requirements; and whether they have been planned and systematically assessed.

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.

Overview of measures and regulatory requirements

One of the fundamental principles, specified by the Act on the Safe Use of Nuclear Energy, states: "During the use of nuclear energy and ionizing radiation and radioactive waste management and spent fuel management, nuclear safety and radiation protection have priority over all other aspects of this activity". The application of this principle is further developed in the Law regarding the criteria to be met by applicants for receiving a license to operate a nuclear facility, such as:

- Have financial, technical, material resources and organizational structure to maintain a high level of safety for the entire lifetime of the facility;
- Have enough skilled and qualified personnel with appropriate education and training;
- Have adopted a program of measures, including internal rules, necessary for ensuring and maintaining the quality of all activities in the operation of the nuclear facilities;
- Have provided the conditions for maintaining a high level of safety culture.

Regulation on Ensuring the Safety of Nuclear Power Plants requires the Management Body of the operating organizations to adopt a document, defining the safety policy, which gives highest priority to safety over all other activities and assume a clear commitment to continuously improve safety, and which encourage staff to have critical attitude towards the activity in order to achieve the highest results. To implement the safety policy, operating organizations should develop a strategy that contains goals, objectives and methods that can be easily implemented and monitored.

The Regulation requires availability of sufficient staff with appropriate qualifications, who know and understand the design bases, safety analysis, design and operational documentation for all operating and emergency conditions. Changes in staff composition, which may influence safety, shall be planed and justified in advance and evaluated after implementation.

Measures taken by licensees to implement arrangements for priority of safety

Kozloduy NPP, as holder of licenses to operate nuclear facilities, has the overall responsibility for managing and securing their safety. Therefore, the Company gives highest priority to safety over all other activities and has declared its commitment to continuously improve safety and to stimulate staff for having responsible and critical attitude towards the job, complying with the principles of safety.

The Kozloduy NPP Declaration on the Company long-term intentions, maintaining the level of safety in accordance with applied standards and continuous improvement of safety culture are given the top priority. The main objective "safe, efficient and environmentally clean power generation, at guaranteed quality and reliability and in conformity with national and international requirements and issued licenses" is also formulated there. To achieve that objective, the Company will implement an integrated management system complying with the requirements of IAEA GS-R-3 "Management systems for facilities and activities".

Through this policy, the management of Kozloduy declare the intentions to maintain structure, organization and management systems, which will provide for the necessary financial and material resources, highly skilled, well trained and motivated staff to implement and control the activities on:

- Reliable and safe operation of nuclear facilities;
- Safe decommissioning;
- The safe management of SNF and RAW;
- Environmental protection, protection of personnel and the population;
- Reliability and availability of equipment.

All activities will be done in compliance with all safety requirements, through the implementation of procedures and management practices, necessary to continuously improving safety culture and continuous monitoring and evaluation of safety.

The specific objectives, tasks and ways to implement the safety policy are reflected in the Company's Business Plans and the annual production, investment and maintenance programs. Safety management is implemented through the planning of safety related activities, risk assessment before implementation, ensuring competent personnel for the activities, monitoring during implementation, analysis of the work done and taking of corrective measures if necessary. Organizational and operational procedures specify the planning process and respective responsibilities for:

- Definition of priorities for the implementation of operating and maintenance tasks;
- Admission of staff for maintenance and repair, as well as follow up acceptance of equipment by the operational staff;
- Decision-making, implementation and testing of modifications to SSC important to safety;
- Risk assessment of impact to personnel health and the safety of nuclear power plant, prior to implementation of assigned tasks.

Provision of competent staff is achieved through:

- Existing system of selection and qualification (presence of health criteria, Psycho-physiological status, level of education, career development, etc.);
- Implementation of the systematic approach to training (analysis of training needs, analysis of tasks, programs for initial training and retraining for every position, conducting tests and examinations to demonstrate staff knowledge, involvement of line managers in identifying and planning further training);
- Active involvement of the Kozloduy NPP staff in the discussion and implementation of large-scale modifications of the SSC, important for safety.

Monitoring of the implementation of activities is implemented by line managers or by specifically authorized employees (when controlling external contractors). Before the implementation of nuclear hazardous activities or tasks, involving staff from different structural units, implementation procedures, which determine the interactions, check-lists to verify the implementation and the results and how to complete the operation are developed. The system of admission to work explicitly requires the appointment of a responsible person for: adherence to the procedures in the workplace, the use of written procedures, quality of execution, and completion of activities.

Department of Safety and Quality is implementing internal control over the application of safety requirements. Head of that Department is directly subordinated to the executive director of

Kozloduy NPP and has extensive powers, including ceasing any activity which is carried out in contravention of nuclear safety and radiation protection or in detriment of safety. Subject to control is the overall activity of Kozloduy NPP, including the aspects of environmental protection and external radiation monitoring in the surveillance area, industrial safety, high-risk facilities, fire protection, and metrological control of measuring devices. The Department manages the work of the Safety and Quality Council, which is an advisory body to the Executive Director of the Kozloduy NPP. The Department is responsible for control and documentation of radiation exposure of Kozloduy NPP staff.

To meet the constantly changing requirements of the market and the public in respect of safety, quality, environmental and social responsibility, Kozloduy NPP perceived an attitude of continuous innovation and change. Innovations are being prompted on one hand by the Nuclear Regulatory Agency, and on the other hand from domestic and international control bodies. They are related to taking timely actions in response to new requirements laid down by international and national laws, regulations, and standards. In this regard, Kozloduy NPP developed a concept for transition to the Integrated Management System (IMS). This concept defines existing and required conditions for implementation of IMS and determines plant approach for its establishment and deployment. The next step is to identify the specific activities and resources for the transition to an integrated management system. In this respect, a program for transition to an integrated management system has been developed and is being implemented. Program activities are consistent with the recommendations of the IAEA Safety Guide GS-G-3.1 Application of the Management Systems for Facilities and Activities and GS-G-3.5 The Management Systems for Nuclear Installations.

The Program for Development of Safety Culture defines the annual planning and implementation of activities to promote safety culture, with the primary task of improving the system and methods for self-control and self-assessment in the performance of the functions. Based on these activities, through feedback from operational experience staff awareness is constantly improving, proactive staff actions to detect and eliminate human errors, organizational weaknesses, and problems in different operating areas are increasing.

Training in safety culture has been included in the initial training programs of all positions and has different duration for different positions. To ensure adequate training, a specific training module “Safety Culture” was developed, as well as other courses related to various aspects of safety culture (“Human Factors” course, “Effective performance of work and error prevention techniques” course, “System to improve human behaviour by event analysis”, etc.). Specific topics of these courses are included in the annual staff retraining programs and seminars with involvement of international organizations are held.

A system of indicators is used by the Kozloduy NPP, which is considered as part of the management tools for monitoring and controls. Managers at all levels can use the results of the system to take corrective measures and actions for solving or prevention of problems in specific processes or activities.

The system of indicators is being constructed as an open pyramidal system of five levels, allowing further developing and refining, as a result of the analysis and experience of its use, as well as changes in business environment. A qualitative assessment of the degree of implementation is carried out for levels one to four. Following tasks implementation the bottom parameters of the pyramid are reached, which are measurable and have quantitative values and evaluation criteria (“specific indicators”). Feedback goes from the bottom up for assessing the implementation of company objectives.

Independent safety assessments are carried out by the Nuclear Regulatory Agency and the specialized control bodies - the National Centre of Radiobiology and Radiation Protection, Regional Directorate “Labour Inspection”, Regional Directorate “Fire Safety and Public Protection”, etc.

Regulatory process for monitoring and oversight

Licensee safety management arrangements are subject of thematic inspections, conducted by the NRA at least once in every two years. Mechanisms of making safety relate decisions and management of key processes in NPP operation are reviewed during the inspections. Allocation of functions and operational subordinations are also within the scope of the inspection.

Safety culture aspects of staff are assessed in surveys, interviews and documentation review during all regulatory inspections. Safety indicators, which are periodically presented to the NRA, are also used as a source for assessing safety culture.

Preparation and training of staff are also subject to regulatory inspections. The NRA Qualification Examination Commission verifies the knowledge of the staff at the Main Control Room (MCR) and the senior management (see also information under Article 11).

Means used by the regulatory body to prioritize safety in its own activities

The priority to safety is an indisputable factor in the NRA regulatory activities. The Policy Statement of the NRA management states that nuclear safety and radiation protection have priority over economic and other societal needs. The means of achieving this objective are:

- establishing an effective, comprehensive and practically applicable legislative framework;
- taking regulatory decisions objectively and in full conformity with the law, without being susceptible to any influence or pressure;
- implement regulatory control functions in an independent, open and justified manner;
- work towards the continuous improvement of the qualification and technical competence of NRA employees and their motivation;
- increased use of national and international scientific and technical potential;
- maintain a fair and open dialogue with all controlled individuals and organisations;
- impose penalties, only after all other means for achieving safety have been exhausted.

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.

Article 11 (1) Financial resources

Principles for financing of safety improvements during facility lifetime

The main principles in the financing of measures to improve safety are:

- Priority in providing financial resources to ensure the safety of the nuclear installation throughout its design lifetime;
- Sufficiency of secured financial resources to implementation of the safety policy;
- Duly provision of financial resources for implementation of measures to improve safety in order to maintain consistency between the current state of the nuclear facility and the continuously increasing regulatory requirements;
- Establish and maintain adequate organizational structure, organizational relations and internal company relations in the financial and economic administrative units to ensure implementation of safety commitments.

To permanently maintain the NPP status in conformity with the current requirements on safety, reliability and efficiency, the Kozloduy NPP carry out, on an annual basis, a set of activities, financed by own and borrowed funds (loans).

For the period 1998-2009, the acquired investment costs are spent for long-term assets and for the continuous improvement of the operational safety and reliability of Units 5 and 6. For the period 1998-2009, within the framework of the annual investment programs, 1,349,918,000 BGN were spent, of which EUR 666,509,000 are own funds and EUR 683,409,000 are loans under the Units 5 and 6 Modernization Program.

Funding (thousands BGN)	**1998-2009**	**1998-2007**	**2008**	**2009**
Total	1 349 918	1 186 433	62 849	100 636
1. Own Funds	666 509	506 691	60 896	98 922
including for modernization of Units 5 and 6 (2000 – 2009)	178 016	174 347	2 535	1 134
2. Loans	683 409	679 742	1 953	1 714

Over the past two years, the main part of investment and maintenance costs are intended to finance activities for continuous improvement of operational safety and reliability of Units 5 and 6. Information about the cost of investment programs and repair costs for the improvement of operational safety for 2008 and 2009 are presented in the table.

Investment and maintenance costs of Units 5 and 6	**2008**	**2009**
Investment costs for financing safety programs	45 311	78 693
Repair costs of PG-2	50 959	57 498

Besides the cost of maintenance and repairs, significant resources are spent on safety improvement of operational units. In 2010 and 2011, Kozloduy NPP planes investments of 115 095 000 and 85 000 000 BGN respectively.

Principles for ensuring financial reserve

The main principles are:

- Prudence in ensuring financial resources for the subsequent decommissioning and management of spent fuel and radioactive waste. To finance the decommissioning activities, funds are being allocated to Fund "Decommissioning of Nuclear Facilities" and for management of radioactive waste to Fund "Radioactive Waste" on a monthly basis;
- Purposeful use of Funds "Decommissioning of Nuclear Facilities" and "Radioactive Waste". Funds are spent only for targeted funding, according to the annual program of decommissioning of nuclear facilities, to ensure the storage and disposal of radioactive waste, and for other activities specified by the Act on the Safe Use of Nuclear Energy.

Sources of financing the decommissioning activities of Units 1-4 of the Kozloduy NPP are:

- Revenue from the Kozloduy NPP;
- Targeted Funds: State Fund "Decommissioning of Nuclear Facilities" (DNF) and International Fund "Kozloduy".

The main sources and amounts of financial resources provided by Kozloduy NPP to maintain the safe operation of Unit 1-4 and for their preparation for decommissioning, in the period 1998 - 2009, are presented in the table.

Funding (thousands BGN)	2001-2009	2001-2007	2008	2009
Total	379 829	248 584	52 070	79175
1. Own investments	140 975	140 036	877	62
2. Borrowed funds	238 854	108 548	51 193	79 113
2.1. from Kozloduy fund	197 247	70 092	49 041	78 114
2.2. from fund DNF	41 607	38 456	2 152	999

The investments in 2010-2011 and the relevant sources of funding are shown in the following table.

Funding sources (thousands BGN)	2010	2011
External financing:	123 923	77 288
from Kozloduy fund	117 090	71 207
from fund DNF	6 833	6 081

Statement on the adequacy of financial provisions

Sufficiency of funds to improve safety

The Regulation for Licensing of Activities in the Energy Sector requires the NPP to prepare and submit to the State Energy and Water Regulatory Commission a five-year plan, which guarantees the proper use and allocation of funds, including those for safety.

As a result, the established system for budgeting and planning, development, approval, implementation and control of the activities to increase safety, guarantee that funds planned,

provided and spent for these activities are sufficient in amount and timeliness. In preparing the annual plans, priority is given to allocation of the necessary funds for improving the safety of Units 5 and 6.

The provided information shows that funds are spent consistently through the years and in amounts completely covering the safety improvement measures.

Sufficiency of funds for the decommissioning of Unit 1-4

Continue the work to implement the Updated Strategy for the Decommissioning of Kozloduy NPP Units 1-4.

Based on the concept of "continuous dismantling" of equipment during all decommissioning stages, the updated strategy achieve shortened decommissioning period, the optimal allocation in time of dismantling activities, uniform and more efficient use of financial and human resources, preservation of jobs, the optimal use of existing knowledge about the plant, effective use of existing infrastructure for waste treatment.

The updated strategy foresees, that all preparatory activities for the decommissioning of Units 1 and 2 be completed by the end of 2010.

Processes to assess the financial provisions

The procedures for identifying, collecting, spending and control of funds and the amount of contributions are determined by Regulations adopted by the Council of Ministers. Income and costs in the funds are collected, recorded and centralized in the system of single treasury account using a separate transit account opened by the Ministry of Economy, Energy and Tourism in the Bulgarian National Bank. It has a separate billing code in the system for authorizing electronic payments.

Funds are managed in a manner that ensures management of radioactive waste and implementation of licensee annual program on decommissioning.

Provision of the necessary resources to Fund "Decommissioning of Nuclear Facilities" and determining the weight factor, forming the amount of contributions to be made by Kozloduy NPP, is carried out by revising the estimated costs for:

- Decommissioning of nuclear facilities;
- Management, including its processing, of spent nuclear fuel, which remains on-site, after:
  - Earlier termination of units operation under governmental decisions arising from international agreements;
  - Final shut down of the last nuclear reactor;
- Management of highly active waste from processing of spent fuel.

Revision of the cost estimation is done every three years by the licensee, operator of the nuclear facility to be decommissioned, and is approved by the Minister of Economy, Energy and Tourism.

There is no change in the framework of financing RAW management activities, as described in the fourth national report. Detailed information on the current status of all activities related to the management of RAW is presented in the national report of the Republic of Bulgaria under the Joint Convention.

Article 11 (2) Human resources

Arrangements and regulatory requirements concerning staffing, qualification, training and retraining of staff for nuclear installations

In accordance with the ASUNE requirements, activities that affect the safety of nuclear facilities shall be carried out by professionally qualified personnel holding an Individual License (Certificates of Competence). Individual licenses are issued by the NRA Chairman to individuals at nuclear installations, who carry out activities related to securing or controlling nuclear safety and radiation protection.

The Regulation on the Terms and Procedures for Obtaining Professional Qualification and on the Procedures for Issuing of Licenses for Specialized Training and of Individual Licenses for Use of Nuclear Energy establishes procedures for examinations before the Qualification Examination Commission and specify the qualification requirements for education, training and experience for appointment of various positions in the operating organizations, the requirements for initial and support specialized training, and requirements relating to procedures for issuance of licenses for specialized training. Regulation on Ensuring the Safety of Nuclear Power Plants has the following requirements:

- Operation of Nuclear Power Plants is carried out in by sufficient number of qualified staff who know and understand the design bases, safety analysis, design and operational documents of the plant for all operating states and emergency situations;
- Adequacy of staff and their qualifications should be analyzed and confirmed in a systematic and documented manner;
- Change in staff number shall be plan and justified in advance and valuated after implementation;
- Preparation and training of staff should ensure sufficient knowledge about the characteristics and behaviour of the safety important SSC in all operational states and emergency conditions;
- NPP operational staff shall be prepared and trained for occupation of higher positions after duplication of the job for a reasonable period of time;
- Operational staff of the MCR shall pass a full-scope simulator training at least once a year, while the operating shifts - periodic emergency exercises;
- Maintenance personnel shall be trained on real models or components for the improvement of professional skills and to reduce the duration of activities with radiological risk;
- Pre job briefings of personnel involved shall be conducted before the implementation of responsible operations and operational tests.

Methods used for the analysis of competence requirements and training needs

In terms of qualification requirements, Kozloduy NPP staff is differentiated into 4 groups (A, B, C, D) in accordance with the functions and relationship with nuclear safety, radiation protection, and operated facilities and systems.

To ensure availability of qualified and competent personnel, a system of internal and external selection is used. This system provides:

- Verification of compliance with qualification requirements for the position;
- Verification of the health status of applicants and subsequent evaluation for fitness to work in an environment of ionizing radiation;

- Verification of the psycho-physiological characteristics of staff, in respect of issuing of individual licenses by NRA.

Requirements for appointment to any post in Kozloduy NPP and the main functions and duties, rights and responsibilities are defined in the job descriptions for the workplace.

Personnel engaged in activities related to ensuring and control of nuclear safety and radiation protection is licensed by the Nuclear Regulatory Agency.

Arrangements for initial training and retraining of operating staff

Training process starts from the moment of signing of contract between the candidate and the Kozloduy NPP and continues until the end of employment.

Before admission to work alone, newly recruited workers and professionals need to complete an initial training in order to: acquire knowledge and skills related to operation and maintenance of specific facilities and systems, procedures, technologies and operating instructions, specific requirements for nuclear and radiation safety, and to form relationships, ensuring high safety culture. Knowledge and skills, obtained after the initial training is maintained, further developed and build within continuous training – periodic and extraordinary (to carry out specific or rare tasks).

Requirements for initial and follow-up training (duration, forms, methods, planning, documentation) are defined in "Rules for quality assurance. Training and qualification of Kozloduy NPP personnel", and the instructions relating to the analysis of training needs, planning and organizing training.

Initial training courses are developed based on the required knowledge and skills to carry out assigned functions, as well as the requirements of the job descriptions. The courses are prepared for the position and the workplace (division, structural unit). Input to the development of courses is the results from an analysis of the needs of specialized training. Different analysis methods are used, including job and tasks analyses, competence analysis, and analysis using combined methodology.

Support training for staff from groups A and B is held annually on the basis of individual programs. Training is carried out only by separation from the operations. Topics include refresher courses, topics of the programs for initial training, changes in systems, equipment, regulations and departmental documents, etc.

Support training for all staff is conducted on the basis of plan programs (periodic) or separate requests (extraordinary). Different positions have different duration of the training, depending on the needs of the individual position, changes in equipment, systems, documents, etc. and are carried out both on-line and with interruption of operations.

According to the Training and qualification System, MCR operational staff undergoes mandatory specialized training at a full-scope simulator. The scope and duration of simulator training are specified in the programs for specialist training - initial and support.

According to individual training programs, different duration of the training is determined for each of the operators, depending on the analysis of training needs and the individual capabilities.

Capabilities of the simulator

The requirements for establishing and maintaining compliance of the full scope simulators with the reference unit is contained in the Regulation on the Terms and Procedures for Obtaining Professional Qualification and on the Procedures for Issuing of Licenses for Specialized Training and of Individual Licenses for Use of Nuclear Energy and the NRA Guide on licensing of full

scope simulators. Particular technical requirements to simulators are based on the US national standard for NPP simulators - ANSI/ANS-3.5-1998.

General requirements towards the simulator systems and processes are based on the obligation that the simulator as a technical training tool be used for initial training, retraining and evaluation of operators. Simulation scope should be such that the operator will perform the same actions with the same procedures, for control of processes and systems, as the reference unit.

Full-Scope Simulator (FSS-1000) for Units 5 and 6 has been contracted, built and operated in compliance with the legislative requirements. Kozloduy NPP internal documents are developed and being implemented for the operations of FSS-1000, namely "Instruction to ensure compliance of the technical means of training with the equipment at the workplace" and "Instruction for elimination of simulator non-compliances". At the end of each year, an annual plan to implement the activities associated with FSS-1000 for the following calendar year is prepared, which includes a description of any planned changes and modifications of the FSS, as well as the terms and conditions for their implementation.

Arrangements for training of maintenance and technical support staff

Arrangements for training of maintenance and technical support staff are analogous to the activities described above.

Kozloduy NPP has facilities for training of maintenance personnel, equipped with appropriate models and technical means. Before the implementation of complex maintenance operations or operations with increased dose loads, test activities are carried out on samples to acquaint the maintenance personnel with the implementation of the work.

Before and after the implementation of significant modifications and in other necessities, extraordinary staff briefings and trainings are held.

Improvements in training programs as a result of safety analysis, operating experience and others

Periodic evaluation of training programs in order to maintain them in state of the art state is done following the requirements of "Instruction on quality. Evaluation of training effectiveness". Instructions determine data collection and processing, as well as the indicators for evaluation of the programs for initial training.

An effective system is established for collection, assessment and implementation of corrective measures from the operating experience of Kozloduy NPP and other plants, and its use in the simulator training. Training topics are planned, considering the event analysis at the Kozloduy NPP and the information on events at other VVER units, as well as significant events reported through WANO.

Methods used to assess the sufficiency of staff at nuclear installations

The total number of Kozloduy NPP personnel and the minimum qualification degree required for each position in the structural units are specified in the Positions Payroll. Deviations from the specified staff number are analyzed and controlled. The analyses are performed to align the structure with the functional distribution of tasks between the structural units and the optimization of the Positions Payroll.

Structure and organizational arrangements and number of operational staff are defined by considering the uninterruptible production cycle and the requirements of the technical specifications. The composition of the operational shift is defined and structured in a manner to

manage and control the whole technological cycle. The timetable for the work of operational staff is determined for one calendar year and is approved by the Executive Director.

The work schedule is organized in five shifts with conformity with the regulatory requirements on: maximum duration of the working day and the working week; to ensure sufficient rest between days and weekly; and to ensure continuous shift work under conditions of reduced working time. To provide time for operators training and recovery (paid annual holidays, leave due to temporary disability) in addition to the five operators required by the shift schedule, two more are needed for a job position.

Policy or principles governing the use of contracted personnel

Relationships with external organizations, providing services or performing activities in Kozloduy NPP are conducted in compliance with the Bulgaria legislation in force. Internal rules and procedures have been developed for that purpose.

In compliance with the conditions of the Kozloduy NPP operating license, a system for assigning, managing and control of activities of external organizations is implemented and maintained. Requirements towards contractors and staff qualification of external organizations are determined by the contracts' terms of reference, tendering negotiations, and the terms of the contracts. One of the requirements is the availability of a certified Quality Management System and in certain cases the contractor shall present a Quality Assurance Program or a Quality Control Plan. The Program and the Plan are subject to approval by the Kozloduy NPP.

Kozloduy NPP controls the activities of external contractors through on-site inspections, reporting the inspection results, control over elimination of non-conformities, and carrying out of audits of quality.

Methods used to assess qualification and training of contractor's personnel

The operating organizations specify requirements on the specific skills and qualifications of the staff of outside contractors, which are required to demonstrate that they have sufficient and qualified personnel, who is able to perform the activity. Assessment of qualification of outside contractors is done by the Kozloduy NPP according to the System for assigning, managing and monitoring the activities of outside organizations.

The whole staff of outside contractors shall pass a mandatory training course on "Introduction to NPPs" and for individuals performing activities in the controlled area additional training course on "Radiation Protection". Both courses end with knowledge examination and evaluation.

Description of the national supply of, and demand for, experts in nuclear science and technology

Establishment and maintenance of a modern system of training and retraining of specialists is a key precondition for the reliable and safe operation of NPPs. Preparation of specialists for the nuclear industry in the universities, as well as the subsequent additional training at the NPPs is a key task of the nuclear sector. The system of nuclear training and qualification in Bulgaria follows the multistage approach and include:

- Secondary vocational education;
- Higher education (masters degree) for obtaining the relevant degree in natural sciences and engineering;

- Initial and support specialized training to obtain an individual license to work in a NPP on a specific position (further qualification in licensed specialized training centres).

Authorised universities in the Republic of Bulgaria, higher education of graduates in the field of nuclear technology and nuclear science is carried out in the fields of: physics, energy and chemical technologies as follows:

- Technical University of Sofia - "Thermal and nuclear energy" and "Nuclear energy";
- Sofia University – "Nuclear Engineering and Energy", "Nuclear Chemistry", "Physics of the nucleus and elementary particles", "Nuclear Engineering and Technology", "Nuclear Engineering and Nuclear Power";
- Plovdiv University – "Nuclear Engineering and Applied Nuclear Physics";
- Chemical University of Sofia - "Chemical technologies in nuclear power".

Currently, the total number of employees in the nuclear energy sector is around 7370 employees. The majority of them (about 65%) are directly involved in maintenance and operation of the Kozloduy NPP, 14% of the staff is part of companies providing technical support and repair and maintenance of equipment, approximately 7% are employed in science, education and engineering. About 38% of staff has academic degree "Master". The average age of workers in the energy sector is about 50 years, and particularly for Kozloduy NPP the major part is in the range of 45-50 years. Thus, in this respect, currently the country is secured with sufficient staff in the nuclear energy sector.

The table below presents the aggregated data on needs for additional personnel in the nuclear energy sector of Bulgaria till 2013 (including those for Belene NPP).

Specialty	**Number**
Nuclear Energy, masters degree (in the area of technical science)	180
Nuclear Energy and Technology, masters degree (in the area of natural science)	60
Nuclear Chemistry, masters degree	67
Power generation and electrical supply, masters degree	60
Electrical engineering, masters degree	50
Automations, Information and Control Technology, masters degree	98
Information Technology, masters degree	27
Others, masters degree	247
Secondary professional education	614
Primary	65
Total:	**1468**

A Plan for Ensuring Personnel for the Nuclear Energy Sector in Bulgaria for the period 2009-2013 is developed and implemented at the institutional level, which main tasks are:

- Preparation and adoption of a national legal act on the selection, training and stabilization of personnel for the nuclear energy sector;
- Ensuring the required number of educational vacancies in vocational schools and universities;

- Establishment of a Nuclear Technology and Education Centre for development and deployment of nuclear technology and personnel training after the completion of higher education;
- Create a special account by energy companies for the training of students and personnel recruitment;
- Transformation of some bachelors degrees in masters;
- Conduct analysis and propose amendments to the Regulation on the Terms and Procedures for Obtaining Professional Qualification and on the Procedures for Issuing of Licenses for Specialized Training and of Individual Licenses for Use of Nuclear Energy;
- Investigate the possibilities for ensuring nuclear education outside the country - universities in the EU, the Russian Federation and others;
- Develop and implement programs for postgraduate training in inter-disciplinary science for the needs of public and private sector in nuclear law, energy diplomacy, corporate management of energy in a liberalized market economy, energy, economics of nuclear fuel cycle, security of nuclear sites.

Regulatory review and control activities

NRA carry out review and assessment of submitted documents, supporting an application for a license for specialized training to verify compliance with the ASUNE and the Regulation on the Terms and Procedures for Obtaining Professional Qualification and on the Procedures for Issuing of Licenses for Specialized Training and of Individual Licenses for Use of Nuclear Energy.

Under the license conditions, NRA periodically receives information on the performed specialized training. The information is reflected in the public register of individual licenses for work in nuclear facilities and with sources of ionizing radiation.

NRA inspectors carry out inspections on the activities of licensees and persons who have been issued individual licenses. During regulatory inspections for unit start up after annual outages, NRA verifies the availability of MCR staff and their training.

Article12 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.

Overview of arrangements and regulatory requirements to take human factors and organizational issues into account

The Regulation on Ensuring the Safety of Nuclear Power Plants contains a series of requirements, which aim at ensuring that the design take into account the possibilities and limitations of human factors. The Regulation requires that design shall provide technical means, by which human errors are excluded or their consequences are limited. Layout of control means and the presentation of information at the MCR should be such that the operational staff to be able to clearly and quickly determine: the status and behaviour of the unit; compliance with the operational limits and conditions; identification and diagnostics of the automated operation and functioning of the safety systems. Control systems for normal operations shall ensure the most favourable conditions for making the correct decisions by the operational staff. Safety systems shall function in such a way that the initiated actuation will lead to complete implementation of the safety functions, while their recovery to initial state will require successive actions by the operational staff. Automatic actuation of safety systems shall block the possibility of their switch off by the operational staff for not less than 30 minutes. Possibilities for a wrong action of the safety systems shall be minimized. Schemes for remote control of safety systems shall ensure their actuation by at least two logically related actions (two keys, key and selected field, etc.).

The Regulation contains requirements for the organizational structure of the operating organizations and the way for amendments to it, when it is important for safety. During the operation of NPP, the personnel should be provided with the necessary resources and conditions for implementation of activities in a safe manner. The operating staff shall operate NPPs in accordance with written instructions and procedures, which specify responsibilities, ways of interaction, and give specific operational directions for implementation of operational activities at all operating states. Actions of staff to identify the condition of the unit and to restore or compensate for impaired functions for safety and prevention or mitigation of damage to the core shall be defined in Severe Accident Management Guidelines and in Symptom-Based Emergency Operating Procedures (SBEOPs). When operating a nuclear unit, at least two licensed operators shall be at the MCR.

Regulation on the Conditions and the Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation requires the licensee to develop and maintain a system for collecting, registration, investigation, analysis and evaluation of the operating events in nuclear facility, and to define and implement corrective measures to prevent recurrence. Analysis of events associated with the human factor shall contain the reasons and circumstances, the occurring problems with human behaviour, contributing to event development. Analyses highlight the areas of human errors and other problems in human behaviour, which may be related to procedures, training, communications, human-machine interface, management or supervision. Analysis of operational experience identify trends in behaviour of staff and operation of the equipment, and trends of various indicators for safe operation and allow for making conclusions and recommendations for improving the operation and maintenance of the SSC, as well as improving education and training of staff, or to improve the management of operational activities.

Consideration of human factors in the design of nuclear installations and subsequent modifications

Kozloduy NPP

The requirement that the design of Kozloduy NPP Units 5 and 6 shall be tolerant to human errors is achieved by:

- Automatic actuation of protections and interlocks and of safety systems, in cases where operating actions or changes in equipment status may cause changes in operating parameters which to exceed operational limits or levels of safety system actions;
- Design of safety systems allows operators intervention only when a sufficient time is available to diagnostics and performance of corrective actions;
- Data on parameters and means for their control, in normal operation and accidental conditions, are localized and concentrated through appropriate location of control and management means at the MCR;
- MCR data is sufficient to detect failures and to assess the effects of the operators' actions.

New diagnostic systems were assembled and put into service during the implementation of the modernization program, which aim to: significantly improve information provided to operators; to perform earlier diagnosis; to better monitoring of processes; and to support decision making. This is done through presenting the information in an easily accessible, concise and clear format. Such diagnostic systems are:

- System for detecting foreign objects in the primary circuit, including: reactor, steam generators, main circulation pumps and primary piping;
- System for monitoring of leakages from the primary circuit;
- Vibrations control system of the main circulation pumps;
- System for limiting the thermal cycles of the equipment from the primary circuit;
- New information systems for various parameters, covering the range of normal and emergency conditions, were installed within the framework of the modernization program:
  - Post Accident Monitoring System (PAMS);
  - Safety Parameters Display System (SPDS);
  - System for operational monitoring and maintenance of the parameters of the water chemistry in primary circuit.

In implementing the program for modernization of Units 5 and 6, all control and information systems were replaced. The contractors were international companies, leading in the in this field. New and modern computer systems with modern man-machine interface, with significantly improved functional properties, have been introduced. Systems provide improved opportunities for operators both to monitor processes in real time and to monitor the information in the form of graphs, tables of data, historical charts, records of events, etc. All new systems have diagnostics and self-tests, while in most cases allow operators to control built-in logic, allowing for easy search and detection of failures in both the system and the measurement channels and control units. Newly installed systems are designed to be user friendly for testing, tuning and readjustment. In the implementation of all designs for protection, control and information systems, one of the most important requirements of Kozloduy NPP, as the contracting organisation, was compliance with all ergonomic principles and practices in the design of such

systems in NPPs. Other NPPs were specifically visited and different views on the design and implementation of such systems were considered, in order to obtain systems with adequate man-machine interface, with enough good and intuitive means of indication and control, and last but not least indicators of new systems to be consistent both with new systems installed and with the operators habits of work with replaced systems.

Also, measures are taken to ensure reliable communication between the MCR and local control rooms. Replacement of the existing system with a modern one is planned, as one of the objectives of the new system is to increase the number of communication points. Installed and put into operation is a DECT communications system. The system is new and expands by DECT cells the existing in Kozloduy NPP phone system. Operational staff and managers of all levels are equipped with DECT phones and through the existing phone system can connect with each other and with all phones in Kozloduy NPP. This system ensures freedom of connectivity as the mobile phones do.

Following activities have been carried out to improve the working environment of the operators:

- Replacement of ceilings, lighting, air conditioning and ventilation of the MCR and of the Water Chemistry Panel;
- Reconstruction of the panel of Reactor Monitoring System and of operators premises located outside the MCR.

A special computer managed lighting system is installed at the MCRs of Units 5 and 6. It has improved lights regulation capabilities and is in line with the latest developments in the field of lighting rooms with 24 hours use by staff.

Belene NPP

In the design process of the Belene NPP is carried out:

- Analysis of the design in respect to impact of Human Factors (HFs) on the safety and reliability of operation. Based on analysis results, decisions are made on the necessity and sufficiency of the measures on HFs management;
- A comparative analysis of NPP design with design of prototype units, concerning the measures on HFs management;
- Analysis of human reliability in terms of operational risks identified in the prototype units and establishing measures, of organizational and technical nature, to eliminate the risks;
- Systematic analysis of operating experience in order to: detect all causes that negatively affect safety; application of methods for analysis of human conditions; to investigate the events associated with HFs and recommend the adoption of corrective measures.

National Electric Company (NEC) analyzes the Belene NPP design in view of its conformity with the requirements for minimization of the impact of human factors on safety and reliability of operations. Particular attention is paid on how design decisions:

- Facilitate the work of staff and assist in implementing the optimal actions in normal operation, deviations from the normal operational states, and accidents;
- Ensure optimal man-machine interface, which takes into account the staff workload as a result of the need for decision-making and implementation of a series of operator actions to implement these decisions;
- Identify the necessary and sufficient information that will allow operators to:
    * Take appropriate actions in normal operation, deviations from the normal operational states and accidents;

* Routinely and adequately evaluate the overall condition of the systems and equipment in normal operation, deviations from the normal operational states, and accidents;
* To monitor the conditions of the reactor installation and the reactor core in all modes of operation;
* Routinely and adequately to detect important safety changes in the status of systems and equipment;
* If needed, to remotely duplicate the automation actions, aimed at ensuring safety in failure of automation;
* To ensure that automation or operators actions have led to the desired result.

Belene NPP design provides:

- Automation actions address ensuring safety of equipment and systems and are brought to their logical end;
- Measures that exclude for certain time operators intervention in the work of the automatic protections (protections actuation time);
- Periodic monitoring of technological protections and interlocks;
- Indication (message) to staff that monitor and control the technological process for failures or taking out of service of safety systems channels or equipment;
- Adequate and reliable means of connection/communication. Communication tools are designed so that their availability is ensured in all modes of operation, including accident states;
- Comfortable microclimate at the workplace.

Methods and programmes of the licensee for analysing, preventing, detecting and correcting human errors

Structural units are established in Kozloduy NPP for the management and implementation of the analysis, prevention, detection and correction of human errors in operation and maintenance of the units. They are provided with the adequate resources, support and supervision.

Separate sectors are established for the analysis of operational activities and business planning and quality control of maintenance, which are ensured with trained staff and needed equipment. The activity of these organizational units is associated with coordinating the preparation of analysis of events, equipment failures, variations in the process, detect and correct human error. Requirements for the implementation of these activities, their periodic review and improvement based on operational experience are regulated by internal documents.

Two methods are approved in Kozloduy NPP for analysis of direct and root causes of events and human errors - ASSET and HPES. A graded approach is applied depending on the safety significance of events or deviations - root cause analysis is applied to significant events, while events of lower significance are analysed for direct causes and trends are monitored of low-level events and defects.

Staff training includes lessons from operational experience, changes in systems and equipment, legal and regulatory requirements, and the results of event analysis. Special training is conducted on error prevention techniques.

The goal - easy to be operated unit - is achieved through the presence of procedures (administrative, operational and emergency) to facilitate interaction of staff with the unit. Developed and implemented are SBEOP that meet all requirements for similar documents. They

have gone through verification and validation and staff have been trained to work with them at a full-scope simulator. In the periodic simulator training of MCR staff, operators are trained to work with the SBEOP. Alarm procedures are also prepared that describe the operators actions in the occurrence of any of the MCR alarms.

Requirements on various operational relationships are specified by Kozloduy NPP internal documents. Means to conduct operational calls, and also operational documentation to provide written proof carried out operational duties and work relationships are specified. Equipment conditions and activities carried out thereon are registered by records in the operating logs.

Operational communications are clear, accurate and understandable, and no informality is allowed. When using technical communication means, any instruction shall be repeated in order to avoid misunderstandings and errors in perception of the commands, while the one giving the order shall finally confirm that the responder correctly interpret or repeat the command (3 way communication).

To coordinate the necessary operating actions and to avoid errors in the authorization, the following basic principles are used:

- Each worker has only one immediate supervisor, determined by the job instruction and the operational structure;
- Worker is obliged to unconditionally implement the orders of supervisor, except when it threatens human life or integrity of equipment, or is contradictory to previous orders or the legislative requirements;
- All orders of indirect superiors are performed after informing the direct supervisor and within the specified time;
- Operating switchovers of equipment shall be done only by the responsible operational staff.

A system of requirements is established for implementing a consistent approach to equipment labelling to assist and facilitate the work of personnel in identifying equipment. Approved for use are signs and standard labels, which ensure the required identification of components, facilities, equipment, valves, gears, pipes, circuit breakers, switches, electrical panels, shields and control boards, as well as electrical components located inside the panels. During shift walk downs, the personnel control the presence and integrity of the required labelling. Procedures and methods on replacement of lost or damaged labels are documented.

Operating staff work time, breaks, work overtime and replacements are specified in the job descriptions according to the requirements of the Labour Code and the Rules for the internal work order in Kozloduy NPP. For other staff, relevant requirements are defined by Rules for the internal work order and job descriptions.

During the shift change, three licensed operators are present in the MCR. Substitution between them and short absence from the MCR of individual members of this team is regulated by the work instructions.

Kozloduy NPP Units 5 and 6 do not have a position of “safety engineer”. However, there are two other positions which cover the functions of a “safety engineer”, namely: “Controlling Physicist” and “Chief Technologist of the unit”.

Controlling physicist is working on shift and is responsible for the continuous operations with fresh or irradiated nuclear fuel leading the reactor start-up if it has been shut down, conducting core related tests, carry out of experiments with expected changes in reactivity, carrying out hazardous tasks. His/her functions are to control the neutron-physical parameters and to stop activities leading to violation of nuclear safety or dangerous operating modes. During emergency and post-accident processes, supervise the work of operators and the status of the core, the basic parameters of primary circuit and critical safety functions.

Some of the functions of the "safety engineer" are performed by the Chief Technologist. He/she does not work in shifts, but is responsible for the overall condition of the unit and the proper implementation of the technological processes and is working on continuously availability. All important switchovers, tests, experiments and important changes in operational states are made under his/her knowledge and approval.

Kozloduy NPP carries out risk assessments to take actions to address the occupational hazards at the workplace, through preventive measures reducing the likelihood of hazards in the job activities. The risk assessment covers business processes, work equipment, accommodation, jobs, work organization, use of raw materials, and other outside factors that may pose a risk. Prepared and implemented are programs for risk management of health and safety, which contain information on working and psychophysical conditions at work places and on specific measures to modify work conditions.

Self-assessment of managerial and organizational issues

Self-assessment of plant employees is done once a year and is included in the study of staff motivation. This study started in 2007 and is held annually. At least 10% of staff is included in the study. They are randomly selected and the principles of anonymity and confidentiality are applied.

The survey aims to measure employees' attitude towards different factors of the working environment. This attitude (satisfaction with working conditions) is closely related to work motivation of employees, their labour activity and their desire to achieve better results. To a large extent, the survey reflects the perception of self realization and the commitments of various categories of employees, differentiated by gender, education, age, work experience, position and structural unit. Another important aspect is the possibility of sharing views and making suggestions fro improvements. By conducting this study, a feedback line is ensured from staff to management, providing the management with a clearer picture of employee evaluation of management factors and work environment.

In 2009, by order of the Executive Director, a group was formed of representatives of different structural units with the task to prepare an Action Plan to maintain and increase staff motivation. The plan was prepared by considering all views and suggestions of the staff with respect to problem areas in which there is less than 50% of motivated employees. The plan was approved by the executive director and currently part of the measures are being implemented, while others are in progress.

To ensure two-way feedback, results of motivation surveys (reflecting employee self-assessment and organizational issues), as well as the progress in Action Plan implementation are published in the internal information network. Thus, staff receives information about the indicators and the actions of plant management to optimize them.

Arrangements for the feedback of experience in relation to human factors and organizational issues

An operational experience feedback program is implemented at the Kozloduy NPP to effectively use lessons learned from plant own experience and the experience of other NPPs and improve safety and reliability of the units. Human errors are part of the program. The program includes strategy, organization (resources, procedures), actions, results and control of effectiveness of the feedback and determines responsibilities, methods, criteria, priorities and procedures for the evaluation of internal and external operating experience.

Requirements, responsibilities and procedures for providing feedback are specified in quality instruction. The main topics in it are:

- Self-assessment of safety and effectiveness during operation;
- Carrying out checks by management and providing respective feedback;
- Reporting and analysis of the experience from the operation of PG-2 and other plants;
- Making staff proposals on improvements and analysis of their effectiveness.

Instructions have been developed, which include staff performance criteria and standards for work quality. This is intended to assist staff in achieving such quality in work performance, which to ensure prevention of errors in operational, maintenance and engineering support activities.

A system of indicators is in place, which among others include low-level events (defects, small events are near-misses, human errors, etc.). By screening, antecedents for errors, hidden organizational problems, or weaknesses in organizational programs are highlighted. When degraded trends or problem areas are identified, an additional study is performed to determine the common causes for the area. When a hidden organizational weakness is determined in a specific area, common cause analysis is extended to other areas with similar changes in the organization.

Results and indicators trends are announced to staff by placing them on the Intranet (an internal information system). Every month unit heads review trends, while every three months, all trends are summarized. Annual review of trends and annual self-assessment of the entire system are done.

Other nuclear events are reviewed and screened every three months by using the established criteria, priorities and policy. Annually, a review is carried out of WANO events annual reports, which include identified causes and problems. Problems, human errors and organizational weaknesses are identify, which may be acted upon. Effectiveness of operational experience feedback is reviewed on an annual basis.

Regulatory review and control activities

Human factors are subject to regulatory review and control by the NRA in the following regulatory activities:

- Evaluation of the Belene NPP design;
- Review and assessments of modifications to safety related SSC to issue the respective permits;
- Periodic analysis of safety indicators - to identify priority areas for regulatory inspections;
- Analysis of reports on operational events - to determine the final INES rating and control the implementation of corrective measures;
- Conducting an independent analysis of safety significant events;
- Conducting continuous control over the operations – through the on-site inspectors.

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.

Provisions and regulatory requirements

According the ASUNE persons who use nuclear energy are required to maintain high quality of activities performed. The Regulation on Ensuring the Safety of Nuclear Power Plants require the NPPs operating organizations to develop, implement and maintain Quality Assurance System (QAS) for the siting, design, construction, commissioning and operation of NPPs, including the control of activities of persons working or providing services for NPPs. Persons who work or provide services to NPPs shall develop and implement Quality Assurance Programs for the respective activity, which to be in conformity with the in accordance with the QAS of the operating organization.

Operating organization management shall implement and maintain an effective system of quality assurance, based on the following principles of quality assurance:

- Management provide for planning, directions, resources and help achieve the objectives in a safe manner;
- Operating staff are aware and trained to perform their work according to established rules;
- Independent assessment of management processes and implementation of activities is done, leading to high quality and implementation of corrective measures, when necessary.

Operating organization QAS shall cover all activities, graded according to their importance to safety, including:

- Defining of organizational structure, responsibilities, powers, and interactions and management processes;
- Improving and maintaining the qualification of staff, who carry out activities related to ensuring and controlling safety;
- Supplies, construction, installation, operation, maintenance, repair and modification of the SSC, important to safety;
- Providing for adequate resources for implementation of safety requirements.

QAS documents should reflect the intentions of the management of the operating organizations declared in a clear, concise, unambiguous and consistent manner and which are designed, coordinated, approved and used by established procedures.

For all technical safety related activities should be developed:

- Pre-tested procedures, describing the basic measures to ensure quality, special conditions to be met before start-up of activities, implementation steps and those to eliminate deviations;
- Procedures for reporting, evaluation and validation of results and decision making for further corrective actions.

In connection with the implementation of the National Action Plans for harmonization with the WENRA reference levels, concerning the safety of power reactors, NRA is developing a Regulatory Guide, which will contain guidance to licensees on how to develop and implement a management system that integrates all management aspects and gives priority to safety.

System for quality management at the Kozloduy NPP

Kozloduy NPP, as a holder of licenses to operate nuclear facilities, maintains and develops quality management system to guarantee safe, reliable and clean electricity production, in accordance with national and international requirements. The QMS has been developed in accordance with EN ISO 9000:2000, as the main attention is paid to the recommendations contained in the IAEA documents 50-C/SG-Q.

Kozloduy NPP QMS is applied, maintain and continuously improved to secure the implementation of Company goals and achieve high level of safety and stakeholders' satisfaction. The quality management system is based on the following principles:

- QMS is a management tool providing for effective and safe operation of the nuclear facilities, protection of life and health of workers and the public, and protection of the environment;
- Directing Company activities to continuously improve safety through planning, control and surveillance activities, by application of a graded approach;
- Maintain an organizational structure that provides the necessary financial, material and human resources;
- Achieve a high level of safety and satisfaction of stakeholders, including staff and the general public;
- All activities related to safety are carried out by authorized personnel with appropriate qualification;
- Applies a uniform policy for training and qualification, aimed at achieving high safety culture;
- Activities related to safety are carried out following established and up to date procedures. Results of operations are documented in a manner allowing comparison and verification;
- All applicable requirements are implemented in a systematic and cost-effective way, to avoid trends adversely affecting safety;
- Staff at all company levels is aware of, understand, and observe company requirements.

Considering the changes and QMS development, a new revision (3) of the Quality Management Handbook is approved. The new revision of the manual is in force since 2009 and includes the main cornerstones of an integrated management system, considering many of the requirements of IAEA safety standard GS-R-3.

In fulfilment of licenses conditions, quality assurance programs are developed at the Kozloduy NPP operating nuclear facilities: PG-1; PG-2; Spent Fuel Storage and Decommissioning unit.

In separate structural units, systems for accreditation/certification are in place within the QMS, as required by the legislation or Company policy.

Audit programs

Internal audits are carried out in accordance with approved annual plans for the main structural units and subunits, having built in quality systems for the purposes of accreditation/certification. Planning takes account of safety importance and Company management priorities.

Audits of vendors and suppliers

The supply of safety related goods or services, a requirement for conducting audits at the external organization on behalf of Kozloduy NPP is included yet at the stage of reference, developing the Terms of Reference. If appropriate, number of audits and respective stages of the contract could be specified. Audits of vendors and suppliers are carried out under an order of the Executive Director of the Company.

Status with regard to the implementation of integrated management system

In respect of changes to IAEA safety standards (the replacement of 50-C/SG-Q with GS-R-3) and the adoption of EN ISO 9001:2008 as a national standard, there is a need to restructure and upgrade the existing QMS and planned transition to an integrated management system (IMS) was initiated. In planning this change, the specifics of organizational structure, traditions in Company management, actual processes and good practices are taken into account. In this respect, the concept of transition to an integrated management system was developed, which sets available and required conditions for IMS implementation and determine plant vision for IMS construction and deployment.

The next step is to identify the specific activities and resources for the transition to IMS. For this purpose, a Program for Transition to an Integrated Management System was developed and is being implemented. Program activities are consistent with the recommendations of the IAEA Safety Guides GS-G-3.1 Application of the Management Systems for Facilities and Activities and GS-G-3.5 The Management Systems for Nuclear Installations.

Main stage of transition to IMS is determining the Company processes. Processes description is done by using the software for analysis and management of business processes ARIS.

Further development and upgrade of the system is also ensured for measurement, evaluation and improvement of Company management. The system of indicators was revised taking into account the requirements of the process oriented approach. This resulted in development and introduction of a Program to Introduce a System of Indicators for Effective Management of the Kozloduy NPP.

Future developments of the management system include:

- Implementing and continuously analyzing the activities of the Program on transition to an integrated management system and establishing a system of indicators for effective management;
- Joining the IMS and the system of indicators for effective management;
- Completion of the planned transition to IMS.

Belene NPP Quality Assurance Systems

Quality Assurance Program (QAP) of Project “Construction of Belene NPP” is developed to meet the legislative requirements and ensure high quality in the performance of the construction of Belene NPP. QAP was developed in accordance with the requirements of the basic standards for quality management - ISO series and IAEA documents.

QAP describes principles and objectives that are guiding the quality management at all stages of the Project “Construction of Belene NPP” (the Project). This applies to all activities affecting the quality of products and services, and appears important for safety and reliability, taking into

account the need for continuous improvement, and binds all persons and entities responsible for implementation of the Project.

QAP complements the Project Management Guide, which described management arrangements, defines processes for implementation and management of the Project, and specifies contractual and functional relationships between different parties.

For Project management and implementation, the NEC has created an organizational unit, which is written down in the Rules of Organization and Activities of Belene NPP Enterprise. The document describes in detail the responsibilities of managers performing tasks related to managing and implementing the Project.

The main Project related activities are planned and implemented in controlled conditions and in accordance with established quality operating instructions, procedures and drawings. Designing is carried out in accordance with established technical standards and rules. The Project, including design means and Project input and output parameters are reviewed and confirmed by individuals and organizations, which do not participate in the development of the initial design. Design changes, including changes in requirements used during the execution of various stages of Project implementation are being monitored. Products and services supplied shall conform to specified requirements. Suppliers are evaluated and selected based on specified criteria. Purchase documents include requirements on the quality of products and services. Inspections and testing of specific products, services and processes are conducted in accordance with established acceptance criteria and the criteria for adequacy of work performance.

Products, services and processes that do not meet certain requirements are analyzed in terms of their impact on safety. Appropriate corrective actions are determined, depending on the outcome.

Documentation Management includes the development, approval, distribution, maintenance in good conditions and storage. Documentation was identified, which contain description of the status, configuration and characteristics of products and services, as well as processes and quality records.

Evaluation of management system effectiveness is a continuous process, during which the QAP and documentation on quality assurance are updated in accordance with established requirements.

Programs to ensure the quality of safety related activities or services

Belene NPP Enterprise is responsible for the full range of Project activities, while using one or more major contractors, who may on their turn contract with other entities (subcontractors). Contractors' activities under the Project are conducted in accordance with the terms of signed contracts, which include Contractor responsibility in respect of design activities, purchase, production, delivery on-site of equipment, construction and installation. QAPs and quality plans, developed by the Contractor, are reviewed and approved by Belene NPP Enterprise during contract preparation and are included as quality assurance requirements in the contract. These quality programs include applicable requirements, which fully comply with Project QAP.

Contractor shall require its subcontractors to prepare their own QA programs, which has to be reviewed and approved. Contractor and subcontractors, supplying equipment or services of categories QA1, QA2 and QA3, shall have a certified QMS in accordance with the requirements of ISO 9001:2008 and to apply it in all activities. Subcontractors, supplying equipment or services from other categories shall have a quality management system in accordance with ISO 9001:2008 or have a QA program, developed in accordance with Contractor requirements.

Audits at suppliers

Belene NPP Enterprise conducts audits of the Contractor at appropriate intervals during the Project implementation, in accordance with established procedure. Purpose of the audit is to review the effectiveness of implementation of Contractor quality programs. Each audit is

prepared, conducted, and recorded and corrective actions are controlled in accordance with established procedure. Procedures and instructions for inspection and testing are developed, paying particular attention to the acceptance criteria, methods to be used, requirements for equipment, records and independent verification. A graded approach is applied, based on the safety relevance of any product, service or process.

Control and test plans, developed by the Contractor, shall be provided to the Belene NPP for review, evaluation and adoption before they are put in practice. In the plans for manufacturing and control, Belene NPP defines whether its representative will be present during the inspection and testing in order to obtain the immediate impression and get the results. Before a device or a system is put into operation, inspection and test results are documented and evaluated, to ensure that specified requirements are met.

Regulatory review and control activities

NRA carry out preventive control in the process of issuing licenses and permits. This among others includes review of Quality Assurance Program, as the main document describing the system of quality assurance in the operating organization.

Verification of the practical implementation of quality assurance programs is carried out in the process of inspection of implementation of the conditions of licenses and permits. One of the thematic areas, included in the NRA Annual Inspection Plan for nuclear facilities, is Quality. Within the inspection framework, all elements of the system of quality assurance are checked, including the processes on assessment and improvement of system effectiveness. For this purpose, results of audits and management reviews of the system are inspected, as well as the implementation of corrective measures and analysis of their effectiveness.

Safety important activities, which are carried out by external organizations, are implemented in accordance with quality assurance programs/quality plans. Those programs, after approval by the operating organization, shall be submitted to the regulatory body as part of the application documents for authorization of the activity. Under its control activities, NRA verifies the practical implementation of the programs/plans.

Article 14 Safety Assessment and Verification

Each Contracting Party shall take the appropriate steps to ensure that:
i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;
ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

Article 14 (1) Assessment of safety

Overview of arrangements and regulatory requirements to perform comprehensive and systematic safety assessments

The Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy requires a preliminary, interim or final safety analysis report of the nuclear facility to be submitted for approval of the selected site, nuclear facility design approval, as well as for issuance of a new operating license or license renewal.

In the case of application for a permit for modifications, the Regulation also requires the submission of the amended parts and sections of the safety analyses report, which related to the planned modification. Specific requirements regarding the changes in NPPs are presented in the Regulation on Ensuring the Safety of Nuclear Power Plants. These requirements stipulate that modifications leading to changes in unit configuration or in operating limits and conditions shall be evaluated by independent experts, other than those implementing the respective design or modification. These evaluations should include deterministic - Safety Analysis Report and probabilistic (PSA) methods to confirm the design bases and Defence in Depth.

Interim and final safety analysis reports are submitted to the NRA to conduct review and assessment in respect of design approval or issuance of operating license. Operating organizations shall keep the safety analysis report up to date, in accordance with the changes of structures, systems and components important to safety, new analyses of transients and accidental modes, as well as to ensure conformity with the current safety requirements and the quality management program of the operating organization. Computer programs and analytical methods used in safety analysis shall be verified and validated and results uncertainties shall be quantified. Programs and methods shall be used in a way to ensure greater confidence than the method of best estimates.

For the purposes of PSA and the development of emergency procedures, analyses shall be carried out, which realistically describe transients and accidents development. Detailed requirements for the development of transients and accidents are presented in the NRA “Guide for performing deterministic safety assessments”, and detailed requirements for risk assessment are presented in the NRA Regulatory guides on “PSA use in support of the safety of nuclear power plants” and “Development of PSA”.

Extensive and systematic safety assessment is an essential part of the licensing process. As a condition for obtaining an operating license, deterministic and probabilistic safety assessments and analysis shall be performed. They shall be submitted to the NRA for review and assessment. To ensure confidence in and correctness of NRA decisions, safety review and assessment

includes an independent external expertise, including if necessary verification of computer calculations.

Safety assessments within the licensing process and SARs for different stages in the lifetime of nuclear installations

Kozloduy NPP, Units 5 and 6

In implementing the Modernization Program, each individual application for design modification is submitted to NRA, together with the amended section or part of the SAR, concerning affected SSC. In the process of documents review, the operating organization is assisted by an outside engineering consulting team, while NRA is supported by West European Regulators.

Within the MP, a comprehensive updated SAR for each unit has been developed, based on the modified parts and sections resulting from design modifications; and the analyses of postulated initiating events, design basis accidents, and beyond design basis sequences without scram (e.g. ATWS). SAR of Units 5 and 6 are developed in accordance with the national legislation, relevant contemporary Russian and American standards and the IAEA guidelines. The main instrument used is "Requirements to the contents of SAR of NPPs with VVER reactors".

In 2008, NRA has sent the final report from the SAR independent international expertise, carried out in NRA support within the frame of a PHARE project. Final Report of the expert study "Safety Analysis Report of Kozloduy NPP Units 5 and 6 Review and Assessment in Compliance with International Requirements" refers to specific recommendations and corrective actions, aimed at improvement of the information presented. On that basis, Kozloduy NPP prepared new working documents:

- Methodology for the maintenance of SAR in updated state;
- A program to update the SAR on the bases of review recommendations.

Kozloduy NPP has established new structural units to be responsible for subsequent updates of SAR and PSA, and for coordination of amendments and supplements with the NRA.

During 2009, most of the SAR deficiencies were eliminated and the new revision was submitted to the regulatory body. Implementation of remaining corrective actions is included as condition in the operating licenses of Units 5 and 6.

Activities for development and use of PSA are planned and carried out in accordance with the requirements of the Regulation on Ensuring the Safety of Nuclear Power Plants. Under these requirements, PSA shall include all operational modes - full power, low-power and shut down state.

The first PSA of Units 5 and 6 was developed in the period 1992-1995, and reflects the configuration for full power operation of Units 5 and 6 in 1993. This is the first PSA for VVER-1000 reactors. Risk is analyzed for internal events, internal floods, fires and earthquakes. This analysis is reviewed by an IAEA mission in 1994-95 and by RISKAUDIT in 1997. Recommendations and comment are reflected in the latest version of the study.

In the period 2002-2005, PSA has been updated to reflect the configuration of the units in 2001 (start up of MP). It covers all states of the units - full power, low-power reactor and shut down conditions. Level 1 PSA for full power analysis the risk from internal events, internal floods, fires and earthquakes. PSA Level 1 for low-power and shut down state covers only internal events.

In 2006, PSA Level 2 for full power was completed. It covers internal events, internal flooding, internal fires and earthquakes.

In 2010, update of PSA Level 1 for full power, low power and shut down reactor is near completion, including the state when nuclear fuel is located in the SFP. PSA reflects units configuration at the end of 2007. This is the status of Units 5 and 6 after the full implementation of the MP. Internal events, internal floods, fires and earthquakes are analyzed. Findings and recommendations of the international independent review of PSA level 1, performed in 2008 in support of the NRA, are considered. Some of the major design changes, which led to reduction in risk (CDF) are:

- Commissioning of a Diesel Generator for the site;
- Replacement of steam generators safety valves, allowing their use for cool down of the first primary circuit;
- Replacement 6 kV and 0,4 kV circuit breakers;
- Introduction of SBEOP;
- Replacement of the control systems for normal operations, based on the digital system Ovation.

As required by the Regulation on Ensuring the Safety of Nuclear Power Plants, unnecessary conservatism in PSA model has been reduced. These key areas are:

- Recovery of the external network in the event of loss of outside power;
- Determining the probabilities of common cause failures by using the method of Multiple Greek Letters;
- Performing of specific thermo-hydraulic analyses;
- Use of specific data and applying Bayesian approach.

With regard to the PSA level 1 model, the new key issues are:

- All initiating events dependencies have been considered, such as dependencies in respect of unit response to initiating events with failure of electrical supply sections;
- Sequences involving failure to close of secondary side steam dump systems following reactor scram have been considered (SDC and SDA);
- An integrated model has been developed that will produce results for both full power PSA level 1, as well as PSA level 1 for low power and shut down reactor;
- A symmetrical model has been developed;
- Sequences with failure of reactor scram (ATWS) have been considered.

Updates of PSA level 2 for full power, low power and shut down states are planned. Updates will reflects also the recommendations of the independent review of PSA Level 2, carried out by NRA in cooperation with GRS-Germany (revision 2006).

Belene NPP, Units 1 and 2

In May 2007, NEC obtained by NRA a design permit for Units 1 and 2 of Belene NPP. Under the contract, signed with Atomstroyexport and following an approved schedule, in early 2008 ed began the submission of individual packages of the Technical Design (TD), including ISAR and PSA (level 1 and 2), Revision 0.

In respect of the legal procedure for approval of the TD, NEC organises internal and external expert reviews to assess TD compliance with the requirements of the Bulgarian regulations and design Terms of Reference. NEC internal expert reviews have been carried out by experts of his consultant Risk Engineering and Belene NPP architect-engineer - Company Worley Parsons. TD documentation, including PSA (level 1 and 2) reports, is subject of internal review. NEC external

expert review is conducted by a team of recognized experts designated by the IAEA, as the subject of expertise is ISAR.

Expert reviews reveal a number of inconsistencies and gaps in the documentation, submitted by Atomstroyexport, requiring further development and improvement of the documents. In early 2009, expert reviews comments and recommendations are sent of Atomstroyexport for their timely elimination. In October 2009, NRA comments were received, which among others include reports done by NRA external expert consultants. They have also been sent to Atomstroyexport for consideration and removal.

In 2009, several meetings were organized between the NEC, its consultants and Atomstroyexport to reflect the correct questions and comments and to achieve coordinated positions. Final harmonized revision 1 of the documentation (TD, ISAR and PSA) was adopted and approved by the NEC in January 2010. At the end of April 2010, revision 2 was issued, which includes amendments made to Revision 1 and reflects the comments made by NRA and its Bulgarian and international independent experts on Revision 0 of TD, ISAR and PSA.

Periodic safety assessments using deterministic and probabilistic methods of analysis

In accordance with the requirements of the Regulation on Ensuring the Safety of Nuclear Power Plants and conditions of operating licenses, reassessment of safety of Units 5 and 6 was carried out. Nine areas were selected for the safety reassessment, covering all operational aspects. The areas are based on:

- Regulation on Ensuring the Safety of Nuclear Power Plants;
- IAEA: Safety Standards Series, Safety Guide NS-G-2.10 Periodic Safety Review of NPPs, IAEA, Vienna, 2003;
- Concerning level of detail, each area is broken down to sub-area (factors). Particular criteria are specified for each factor, based on the requirements of the following documents:
  - Legislation in force (regulatory requirements);
  - WENRA, Reactor Safety Reference Levels, March 2007;
  - IAEA requirements.

Overview of safety assessments performed and the main results for existing nuclear installations

Periodic safety review results are reflected in “Report of safety reassessment of Kozloduy NPP Units 5 and 6”. Parts of the corrective measures to eliminate deficiencies have been implemented and others are included in safety improvement programs.

Identified deficiencies have no significant negative impact on SSC, operational practices and safety status of the units.

Based on the safety review it could be concluded that there are no limitations to the safe operation of the units, in respect to the reviewed areas. Design and operational practices conform to the requirements of the national legislation and the IAEA international safety standards.

Regulatory review and control activities

Kozloduy NPP, Units 5 and 6

SAR reports and updated PSA Level 1 and Level 2 reports are assessed by both NRA and external international expert organizations contracted by NRA. Periodic safety reassessment report was independently reviewed by a Bulgarian technical support organisation. In addition, those reports are also subject to internal review and assessment. Results of independent evaluations are specified as requirements in the "Program to improve nuclear safety and radiation protection of the units" and used to define transitional conditions of renewed operating licenses.

Belene NPP, Unit 1 and 2

After the issuance Belene NPP units 1 and 2 design permits in May 2007, the next step is the approval by the NRA Chairman of the technical design. In this regard, in April 2008, NRA received the first documentation package from the TD, while by the end of November 2008 the complete documentation package was received, including ISAR and PSA.

In order to justify and substantiate regulatory decisions, three external expertise were conducted to support NRA in TD approval, namely:

- Main design technical solutions, in the period 12/2008 - 09/2009;
- ISAR, in the period 12/2008 - 12/2009;
- PSA, IAEA review 01/2009, IPSART mission 05/2009.

In June 2010, NRA received Revision 2 of the TD, ISAR and PSA. Three independent expert reviews are contracted to assess the extent of accounting of NRA comments to the previous revision.

Article 14 (2) Verification of safety

Overview of arrangements and regulatory requirements for the verification of safety

As required by the Regulation on Ensuring the Safety of Nuclear Power Plants, operating organization system of technical and organizational measures shall include responsibility to maintain in good condition SSC, important for safety. This shall be done through early detection of defects, taking preventive measures, replacing structures and components with expired lifetime, and operation of an effective system for recording of activities and operational monitoring.

Structures, systems and components, important to safety, their composition, location and operational status shall ensure fitness for testing, maintenance, repair, inspection and control throughout the lifetime of the NPP, without significantly reducing their operational availability. Monitoring program of reactor coolant circuit shall ensure monitoring of the influence of irradiation, the formation of cracks by stress corrosion, and aging embrittlement of construction materials, especially in places with high levels of radiation and other factors. The status of basic metal and welded joints of SSC, important for safety shall be monitored periodically by qualified non-destructive testing in respect of areas, methods, detection of defects and efficiency using specifically established procedures.

Operating organization shall develop, periodically review and implement programs for testing, maintenance, repair, inspection and control aimed at maintaining availability and reliable operation of structures, systems and components, important to safety, in accordance with the

design and throughout the lifetime of the NPP. The frequency of tests, maintenance, repair, inspection and control should be based on:

- Safety importance;
- Reliability requirements of manufacturers;
- Operational experience and results of monitoring;
- Possible impact of performed activities on the safety of the NPP.

Procedures shall be developed for implementation of different types of testing, maintenance, repair, inspection and control activities, which should be written in accordance with the QMS.

Main elements of programmes for continued verification of safety

Programs that are used to verify the technical conditions of the SSC of Kozloduy NPP Units 5 and 6 are:

- Programs and schedules of activities during annual outages and refuelling for each unit;
- Programs for re-licensing of vessels and pipes under pressure;
- Programs for operational control of the basic metal, welded surfaces and joints of pipelines and equipment of primary and secondary circuits;
- Control program of the corrosion conditions of the equipment;
- Specific programs to evaluate the radiation aging of reactor vessels;
- Control program of reactor installation load cycles;
- Control program of nuclear fuel load cycles;
- Programs for functional testing of systems, important to safety;
- Report on neutron-physical characteristics of the new reactor core and analysis of compliance with accepted criteria.

Programs are implemented by qualified personnel, mainly from the operating organization. Part of operational control of the metal, selected maintenance activities and some specific activities are performed by external organizations.

In 2009, a Programme for Surveillance of the Equipment on Units 5 and 6was introduced. Program objectives are:

- Verification that conditions, under which safety has been justified, are maintained during operation;
- Verification that safety level is in compliance with the requirements and that sufficient margins are available in expected operational events, personnel errors and equipment failures;
- Maintenance and improvement of equipment preparedness, confirmation of respective limits and conditions;
- Detection and elimination of any violation from normal operations, before the occurrence of significant safety implications.

To achieve these objectives, the abovementioned program has been developed taking into account the requirements of SAR, technical specifications, results of reliability analysis of safety systems, operating experience, data requirements and manufacturer demands, requirements of

control authorities and statutory technical documents, with the requirements of specific surveillance activities.

In the surveillance program, particular attention is paid to monitor the status of protective barriers, as well as the use of graded approach to preparedness and availability of safety systems, systems important to safety and systems for normal operation.

Control requirements, including frequency, type and volume of inspections, tests and calibration of systems and equipment are contained in the technology and technical specifications of the units. Implementation of control schedules is verified by the inspectors of the operating organization. NPP operational and managerial staff conducts continuous monitoring of compliance with the limits and conditions for operation.

Surveillance programs, maintenance and repair using risk-informed approach

In 2004, a pilot project was carried out at Units 5 and 6 for testing and optimization of the operation, maintenance and repair of on the basis of risk analysis. The survey was complex and covered pre-selected safety systems. It is based on the results of PSA Level 1 and includes the following main sections:

- Changes in frequency, volume and type of non-destructive testing;
- Assessment of tests scope and frequency;
- Assessment of scope and frequency of maintenance and repairs;
- Assessment of rest lifetime of SS equipment;
- Reliability analysis of SS electrical equipment, replaced during the MP;
- Criteria for testing and acceptance of equipment after SS maintenance and repair;
- Analysis of impact of existing legislation on the technical specifications;
- Daily risk assessment of reactor operations.

Project was completed in 2008. Safety margins were evaluated during the implementation of respective risk analyses.

Elements of ageing management programmes

A significant part of the measures of the MP of unit 5 and 6 are oriented towards evaluation and ensuring of equipment resources, reconstruction and replacement of aged and worn out SSC. Another significant part of the MP is the widespread deployment of new, mainly diagnostic systems, which creates a good basis for future activities and maintenance orientation to equipment conditions.

Currently, the process of lifetime management continues, as with the funds of the maintenance, production and investment program, Kozloduy NPP is running a complex of activities on replacement and lifetime assessment of SSC from the SS, such as:

- Replacement of Technologic Systems Controls with a new advanced control system;
- Replacement of Diesel Generator Set accumulating batteries with seismically qualified ones;
- Design, supply and replacement of elements of the SS;
- Supply of cylinders for the fast acting cut-off valves;
- Supply and replacement of the high pressure heaters with heaters of chamber type;
- Replacement of switches, etc.

Activities on maintenance and repair, non-destructive testing of metals, modernization and reconstruction, certification and testing of equipment, including its classification, are included in a lifetime management program. The selection of SSC, which to be subject to monitoring and evaluation of residual lifetime is made to the following criteria:

- Criterion 1 - SSC is of great safety importance, i.e. their classification and qualification are taken into account;
- Criterion 2 - SSC is of great importance to plant lifetime – components are considered, which are not important for safety, but the failure of which may prevent the fulfilment of a safety function;
- Criterion 3 - SSC for which may perform safety functions when required;
- Criterion 4 - rationality. When selecting SSC account is taken of realistic possibilities for failures, any possible degradation, inspection interval and functional limitations;
- Criterion 5 - Economic efficiency. SSC of the SS will be selected so that the cost of maintaining their lifetime to be optimal.

A "List of safety important SSC, subject to maintenance and repairs at Units 5 and 6" was adopted, based on the above criteria. The list is updated in accordance with the results MP implementation.

Kozloduy NPP is also carrying out research and development projects (R&D), aimed at maintaining efficiency and reliable operation of the SSC and ensuring lifetime extension of Units 5 and 6. Examples are:

- Justification of pressure reduction of primary circuit hydraulic tests and increase of time between hydraulic tests;
- Study of high energy pipe performance after 100,000 hours of operation;
- Optimization of the operations, maintenance and repair through changes in frequency, volume and type of non-destructive controls, changes in volume and frequency of technical inspections and repair, changes in the frequency of testing.

Existing programs related to reactor vessel lifetime management cover supervisory, repair, operating and research programs. Experience shows that to increase efficiency, it is necessary to establish good coordination between the programs and SSC lifetime related activities. In accordance with the recommendations of IAEA documents "Implementation and review of aging management program of NPPs" and Safety Reports Series № 15 "Program for Lifetime Management", Kozloduy NPP applies an integrated type of implemented activities (umbrella) in order to detect and limit aging degradation, well before safety limits are reached.

Committed and planned activities

Significant activities, related to ensuring and management of rest lifetime were completed in the past years, using both own efforts and external services. One of the MP program objectives was to ensure safety during the planned operational lifetime and within a further period of 15 to 20 years. Widespread implementation of new systems and components creates a good basis for future activities in this area.

To detect and record defects in metal and welding joints and to assess status of metal and welded joints of pipelines and equipment in the primary and secondary circuit, non-destructive testing is performed following developed work programs. The programs are applied in the planning, preparation and implementation of operational control during PAO.

In order to reduce corrosion processes of construction materials, to reduce precipitation on heat exchanger surfaces, and to increase lifetime of SS equipment, the appropriate instructions for maintaining of optimal water chemistry regime are applied.

According to the manufacturer's passport data, the operational lifetime of VVER-1000 reactor pressure vessel is estimated at 40 years, which makes it one of the most important components determining the operational life of the NPP. Assessment of the state of reactor metal cladding is carried out within the frame of the MP, as well as by external research organizations.

To ensure implementation of SSC ageing management activities, a specialised unit was established. A training course was prepared and conducted for professionals from NPP Kozloduy middle management on “Equipment Aging Management”, which comply with IAEA documents.

In connection with the forthcoming comprehensive assessment of SSC rest lifetime, Units 5 and 6 have developed methodology for assessing the rest lifetime of equipment and structures; and model work program to evaluate SSC rest lifetime. Terms of reference for the forthcoming comprehensive assessment of Units 5 and 6 lifetimes is being developed.

Arrangements for internal review by the licence holder of safety cases to be submitted to the regulatory body

Consideration of issues and solving of safety related problems shall be subject to review and discussion by a wide range of specialists. This is organized through the creation of Expert Councils, having the appropriate status and rules. The following types of Councils are established, depending on the scope of the issues:

- Council for Safety and Quality - on issues common to the company safety and quality during operations, repair, reconstruction and decommissioning of nuclear facilities, the management of nuclear fuel and radioactive waste and maintaining emergency preparedness;
- Safety Council - on issues relating to:
  - Units start-up and shut down programs, functional testing, design changes, documents concerning the systems important to safety;
  - Analysis of events, corrective and preventive measures, including use of experience of other NPPs;
  - Matters relating to the system of quality assurance;
- ALARA Council - on issues relating to:
  - Application of ALARA principle for optimizing staff radiation exposure and the radiation protection during the operation of the units;
  - Analysis and planning of for all types of radiation related activities under optimum radiation conditions;
  - Reduce individual and collective radiation exposure of workers and the public;
  - Dynamics of individual and collective radiation exposure of maintenance personnel;
  - Prediction of radiation exposure and establishment of dose constraints;
  - Radiation protection programs for standard and specific maintenance activities;
- Council on operational experience - in matters relating to:
  - Assess the feasibility of external operating experience;
  - Suggestions for improving the existing system using own operating experience;
  - Decisions on activities to improve or develop a system of feedback from operational experience;

  - * Analyze and evaluate the system for feedback of operational experience, based on the requirements and recommendations of national and international instruments and best practices in the industry;
  - * Preparation of annual programs to develop the system for feedback from operational experience;
  - * Analyze and evaluate the implementation of annual programs to develop the system for feedback from operational experience.
- Expert Technical Council - on issues related to technical or technological developments and proposals for modifications to equipment and systems, particular specialized areas.

Regulatory review and control activities

NRA review and assess the following documents, which Kozloduy NPP shall submit under the licenses conditions:

- Before unit shut down for maintenance and refuelling:
  - * Program for operational control of the base metal, welded surfaces and joints of equipment and pipelines;
  - * Maintenance schedules and programs;
  - * Report of the neutron-physical characteristics of the new reactor core.
- After unit start-up following the planned annual outage:
  - * Results of operational control;
  - * Results of leak tightness monitoring of loaded assemblies;
  - * Comparison analysis of calculated neutron-physical characteristics and the operational data;
  - * Resources of fuel;
  - * Residual lifetime of the reactor pressure vessel and equipment, for which rest lifetime is assessed;
  - * Results of the test program;
  - * Results of the program for neutron control of reactor vessel;
  - * Results of the unit start-up program.

Also, under a license condition, NRA Commission (inspection team) verifies unit preparedness for start-up and operation following planned annual outage and refuelling. Unit start-up approved by an Order of the NRA Chairman. The order approves the positive findings of the inspection team on unit preparedness for start-up and operation.

Article 15 Radiation Protection

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

Regulatory requirements for radiation protection at nuclear facilities

The general requirements for licensees and holders of permits and the basic principles, norms and rules to ensure radiation protection that shall be observed in carrying out activities in nuclear power plants are set out in ASUNE, the Regulation on Basic Norms for Radiation Protection (RBNRP), the Regulation to Ensure the Safety of NPPs and the Regulation on Radiation Protection during Activities with Sources of Ionizing Radiation. According to the ASUNE, nuclear energy and ionizing radiation are used in accordance with the requirements and principles of radiation protection to ensure the protection of population and environment from the harmful effects of ionizing radiation. The use of nuclear energy and ionizing radiation and radioactive waste management and spent fuel with ionizing radiation exposure of the staff and the population is maintained to as low as reasonably achievable level. Basic requirements and criteria for ensuring radiation protection in nuclear power plants are as follows:

- Radiation effects under all operating conditions of NPPs (consisting of normal operation and anticipated operational occurrences) is maintained lower than the reference range of doses from external and internal exposure of workers and the public and is at reasonably achievable low level. In all conditions of normal operation and anticipated operational occurrences, annual effective dose to members of the public due to liquid and gaseous radioactive discharges from the site of NPPs to the environment shall not be greater than 0.15 mSv, irrespective of the number of nuclear facilities of the site.
- Severe accident in NPPs (BDBA that results in significant damage to the reactor core) activity of vented cesium-137 should not be greater than 30 TBq, which does not enforce restrictions on long-term use of soil and water in the surveillance zone around NPPs. The combined discharge of other radionuclide should not cause long-term, starting three months after the accident, risk greater than the risk due to the release of cesium-137 activity of 30 TBq.
- For NPPs, put in operation before the issuing of the Regulation on Ensuring the Safety of Nuclear Power Plants, the annual effective dose to members of the public due to the impact of liquid and gaseous discharges into the environment should be less than 0.25 mSv in any operating conditions of the NPPs.

Areas with special status are created around nuclear facilities. Areas with special status are:

- Radiation protection area - an area around the nuclear facilities in which during the normal operation is possible the annual effective dose to members of the public to be greater than 1 mSv (i.e. the limit of the annual effective dose to population as determined in accordance with the RBNRP);
- Surveillance area - an area outside the Radiation protection area, in which the radiation monitoring for the purposes of radiation protection is carried out.

The boundaries of Radiation protection area and Surveillance area are defined in the design of the nuclear facilities. Radiation protection area outer border is the line defined by mathematical

modelling that connects the outermost points around the nuclear facility, obtained simultaneously with the following dose criteria:

- Annual effective dose to members of the public during normal operation of a nuclear facility should not be greater than the dose quota;
- Annual effective dose to members of the public on the border of Radiation protection zone and beyond should not be greater than 5 mSv in the first year after the accident. If one site has two or more NPPs it is necessary to take account the total radiation effects while maintaining the established quota dose for the site.

The design of the NPPs shall include automated radiation monitoring system and control system of radiation situation in Radiation protection zone and the Surveillance zone around NPPs. These systems shall provide the necessary information on radiation environment, the state of physical barriers and activity of radionuclides, as well as information for predicting the dynamics of processes in case of emergency.

Automated radiation monitoring system should include technical means for:

- Radiation technological control;
- Radiation dose control;
- Radiation monitoring of the premises and site of the NPPs;
- Radiation monitoring to limit the spread of radioactive contamination.

Radiation monitoring in Radiation protection area and Surveillance area is a responsibility of the licensees and is covering at least the measurement of:

- A dose of external gamma radiation;
- General and specific activity of liquid and gaseous discharges into the environment;
- Specific activity of ground-air, atmospheric deposition, topsoil and vegetation;
- Specific activity of surface and groundwater and water supply networks and facilities;
- Specific activity of plant and animal materials and products;
- Radioactive contamination of vehicles;
- Meteorological parameters.

The scope and volume of radiation monitoring is approved by the competent authorities - Ministry of Health and Ministry of Environment and Water. Control of radiation parameters of the environment and agricultural production within Radiation protection zone and Surveillance zone and an assessment of exposure of the population is carried out by licensees and independent bodies of executive power.

Regulatory requirements for the licensee to optimize the dose and application of the ALARA principle

The three basic principles of radiation protection (justification of actions, optimization of protection - ALARA and limiting of exposure) are defined in RBNRP. In accordance with the ALARA principle dose limits (quota dose) for staff and public and safety factors in planning for protection from external and internal exposure are introduced. Dose quotas are planned and justified during the licensing process for activities at nuclear facilities.

Values that are rated in RBNRP are grouped in the following hierarchical scheme that includes three levels:

- I level - basic (primary) level of doses from external and internal exposure of individuals and staff population, which include annual limits of equivalent dose and effective for the categories of exposed persons;
- II level - secondary (derivatives) levels in external and internal exposure of individuals and staff population, which include limits for equivalent dose rate and the annual submission of radionuclides in the body by inhalation and ingestion;
- III level - limits for radiation control and protection planning (control limits) in the external and internal exposure of individuals and staff population, which include: limits on the average volumetric activity of radioactive aerosols and noble gases in the air of working premises for personnel; range of surface radioactive contamination levels of annual flux density of ionizing particles / electrons, photons, neutrons / external exposure to personnel / body, ocular lens and skin; limits for the average volumetric activity of radioactive noble gases and aerosols for ambient air levels, average volumetric activity of radionuclides for drinking water.

The main limitations of doses from external and internal exposure of personnel are:

- Limit of effective dose to staff is 100 mSv over five consecutive years (i.e. 20 mSv per year), the maximum effective dose should not exceed 50 mSv in any single year;
- Limits of the annual equivalent doses (respecting limits on effective dose) are 150 mSv for the eye lens and 500 mSv for the skin, hands, arms, feet and ankles.
- In RBNRP are defined the principles for occupational radiation protection of exposed persons:
- Preliminary risk assessment and optimization of protection;
- Classification of jobs and zoning of the area;
- Categorization of occupational exposed persons;
- Radiation Monitoring of the working environment, including individual monitoring;
- Medical surveillance of staff.

Measures to reduce occupational exposure have been defined by creating a controlled and supervised area, dividing the staff into two categories - A and B, informing the staff about the risks of radiation and radiation protection requirements, reviewing of the effectiveness of personal protective equipment, consulting with qualified experts in radiation protection.

Radiation protection in the operation of Kozloduy NPP. Implementation of radiation protection programs

Occupational exposure of the staff

Independent control of occupational exposures is carried out by Control Centre “Personal Dosimetry” in Kozloduy NPP, accredited by the Institute for Accreditation as a body to control the type C, according to BS EN ISO / IEC 17020. The table presents data for occupational exposure at Kozloduy NPP in the past five years.

№	Indicator	2005	2006	2007	2008	2009
1	Collective effective dose [man.Sv]	3.00	1.60	1.10	0.70	0.70
2	Internal dose percentage [%]	1.00	0.00	0.00	0.00	0.00
3	Exceeding the annual limit for occupational exposure 50 mSv	0.00	0.00	0.00	0.00	0.00
4	Average individual effective dose of the controlled persons [mSv]	0.63	0.45	0.33	0.21	0.19
5	Maximum effective dose [mSv]	13.42	13.02	8.57	9.29	7.28

As it is shown in Fig. 1, the collective effective dose in KNPP during last five years is reduced more than four times.

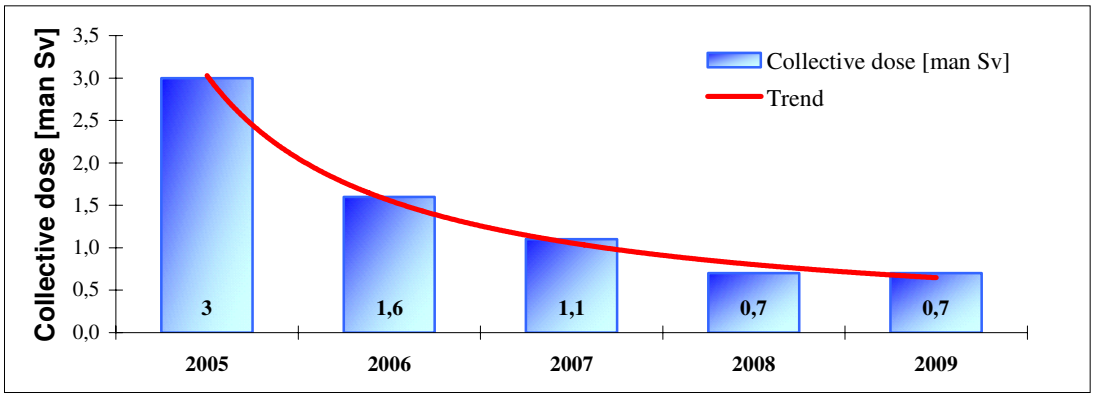


Fig 1. Collective dose in KNPP, 2005-2009

The collective dose in 2009 year in KNPP, normalized to the number of the reactors in operation (VVER) is 0.28 manSv/unit. This value is two times lower than the average value for 265 reactors type PWR for 2008 that according to the data in the Report "WANO'2008 Performance Indicators" is 0.59 manSv/unit (Fig 2). The same indicator in 2008, average in ISOE report for 261 reactors PWR, is 0.69 manSv/unit . The average indicator in KNPP during last two years is without change.

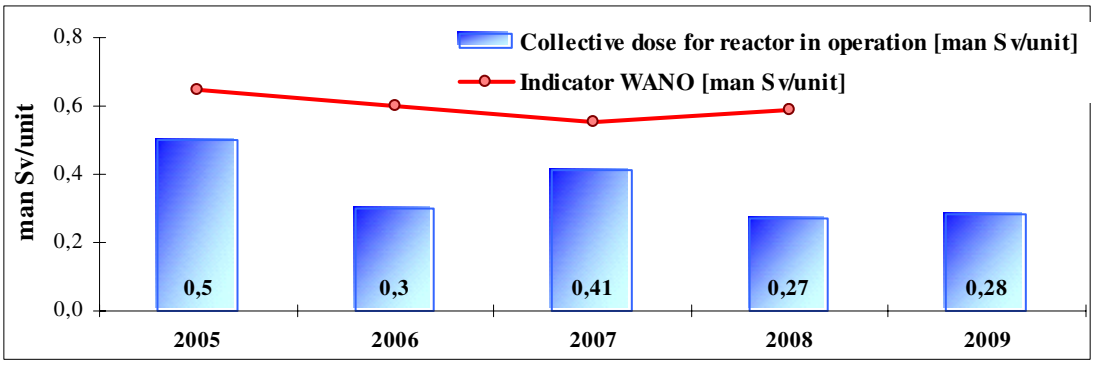


Fig 2. Collective dose for reactor unit in KNPP, 2005-2009

The average individual annual dose for the controlled persons in KNAPP in 2009 is 0.19 mSv, with 10% lower than in the previous year and keeps the tendency to decrease during last five years.

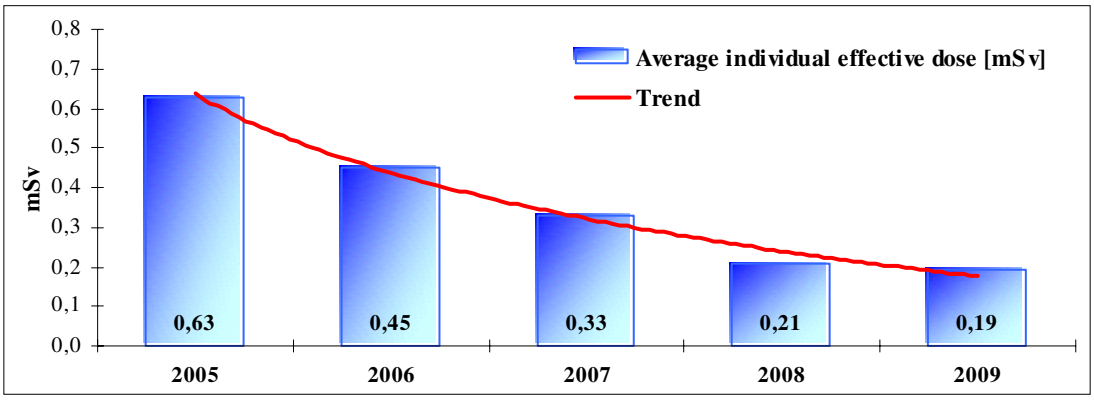


Fig 3 . Average individual effective dose in KNPP, 2005-2009

Over the past five years in Kozloduy NPP, an individual effective dose exceeding the limit for occupational exposure 50 mSv, according RBNRP is not registered.

Conditions for release of radioactive substances into the environment, measures for operational control and main results

Liquid and gaseous discharges from Kozloduy NPP in the environment

Liquid discharges from NPP Kozloduy are controlled by two parameters:

- Total activity of sewage water from the manufacturing process;
- Volumetric activity (waste water from production processes and municipal waste waters, where there is a possibility of radioactive contamination).

In the following table the limits and control levels for the total activity of waste water from production processes throughout the plant are given.

Indicator	Unit of measurement	Quarterly control level	Quarterly limit	Annual control level	Annual limit
Total activity (except tritium)	GBq Ci	37 1	185 5	148 4	740 20
Tritium	GBq Ci	6475 175	46250 1250	25900 700	185000 5000

For the wastewater from the production process are defined:

- Limit of volumetric activity (excluding tritium) - 1850 Bq/l respectively and the control level 370 Bq/l, which are controlled operationally before and during drainage;
- Limit of volumetric activity of municipal waters, with the possibility of radioactive contamination: 11 Bq/l.

At the end of 2006 Kozloduy NPP developed a project for changes of the limits of gaseous discharges from the plant. NRA issued at the end of 2007 permits for the modification of the technical specifications of every reactor unit in accordance with the presented documentation. The annual limits for gaseous radioactive discharges are defined as components so that the annual individual effective dose to member of the public not to exceed 50 μSv/a. The resulting limits for the whole plant are allocated to the separate Ventilation Tubes (VT) on the basis of operational experience. Verification of received values is done with software to assess the individual effective dose from gaseous releases based on the methodology CREAM, recommended by the IAEA.

The values of annual limits for gaseous discharges from NPP Kozloduy are given in the table.

Components of releases	VT-1 units 1,2	VT-2 3,4 units	5 VT 5 unit	6 VT 6 unit	0 VT AB-3	VT-SFSF	KNPP total
Noble gases, TBq	100	100	1400	1400	700		5600
131-I, GBq	3	3	13.5	13.5	5		65
Aerosols, GBq	3	3	12	12	5	3	50
3-H, TBq	10	10	60	60	60		250
14-C, GBq	1000	1000	9000	9000	9000		38000

To optimize the radiation protection of the population control daily limits are introduced and are given in the table.

Components of releases	VT-1 1,2 units	VT-2 3,4 units	5 VT 5 unit	6 VT 6 unit	0 VT AB-3	VT-SFSF	KNPP total
Noble gases, TBq	0.4	0.4	3.8	3.8	2		15
131-I, MBq	8	8	38	38	14		178
Aerosols, MBq	8	8	33	33	14	7	137

The amount of the limits for individual discharges from VT at the site of Kozloduy NPP (given in Tables 2 and 3) is lower than the value set for the whole site (in the last column of the table) for the purposes of effective implementation of the ALARA principle in the control of discharges. Values for the concentration of radioactive aerosols, 131-I and Radioactive Noble Gases (RNG) in air discharges are derived from the control levels for operational monitoring of gaseous discharges.

Two types of monitoring of discharges into the environment - operational and periodic monitoring are organized in Kozloduy NPP. The operational radiation monitoring of discharges into the environment is carried out continuously and automatically. A concentration in the waste air of RNG, 131-I and radioactive aerosols and the concentration of radioactive substances in wastewater is determined. The purpose of operational monitoring is to monitor the discharges and provide information on:

- exceeding of the established control levels, specified in the technical specifications and operational instructions;
- early detection and on-line assessment of trends for the disposal of larger quantities of radioactivity into the environment.

Unlike the operational radiation monitoring to be undertaken to quickly and promptly register the trend for increasing discharges and to prevent exceeding the control level, periodic radiation monitoring is carried out in order to:

- provide data for the most realistic assessment of radiation exposure of the population;
- provide information to the public on discarded radioactivity in the environment;
- serve as a criterion for safe operation of units;
- confirm the results of operational monitoring;
- prove that the monitoring of discharges at source shall be in accordance with the requirements of national and European legislation, licensing conditions and practices in other countries.

Results of the periodic monitoring of liquid and gaseous discharges into the environment

Gaseous discharges

	RNG, TBq	131-I, MBq	Aerosols, MBq
Year	**PG-1 and PG-2***	**PG-1 and PG-2**	**PG-1 and PG-2**
2006	6.8	261.9	69.6
2007	1.2	103.9	69.6
2008	0.545	1.1	18.5
2009	0.656	5.6	62.53

The determination of C-14 and H-3 in gaseous discharges started from 2010. During the period the content of these components in the waste air is only theoretically evaluated and taken into account when assessing the radiation exposure of the population. Since the beginning of 2007 the four reactor units of the EP-1 have been suspended.

Liquid discharges

	Total activity , MBq (without H-3)	H-3, TBq
Year	**PG-1 and PG-2**	**PG-1 and PG-2**
2006	682	20.15
2007	283	22.12
2008	177.6	18.774
2009	229.4	23.789

During the period 2006-2009 the releases into the environment with radioactive gaseous and liquid discharges from Kozloduy NPP are less than 1% of the specified limits. The activity of tritium in liquid discharges is less than 13% of the specified limits.

The maximum individual effective dose of the population from liquid and gaseous discharges from Kozloduy NPP in the hydrosphere and atmosphere in 2009 was 4.96 μSv/a and is much lower than that specified in the Regulation on Ensuring the Safety of Nuclear Power Plants an annual dose of the population by discharges - 250 μSv/a. It represents 0.2% of the population exposure from natural radiation background, typical for this geographical area - 2.4 mSv/a. Over the last decade the maximum individual effective dose ranges 2-5 μSv/a.

Implemented processes and steps taken to ensure that personnel exposure is as low as reasonably achievable for all operating and repair activities

In Kozloduy NPP the following approaches in implementing the ALARA principle to radiation exposure of personnel engaged in operational and maintenance activities are made:

Support of senior management

- ALARA Councils in PG-1 and PG-2 - permanent advisory bodies to assist the Chief Engineer, who consider and decide issues related to optimization of radiation protection and reduction of individual and collective radiation exposure of personnel;
- Determination of the lower control levels for radiation exposure of personnel. They shall be regulated by an order of the Executive Director of NPP;
- Maintenance of units responsible for radiation control and enforcement measures for radiation protection of staff in the structure of the “Operation Department”.

Organizational measures

- Planning of radiation hazardous activities - development of special programs, preparation of budgets for individual collective dose during planned activities and operations;
- Analysis of the implementation of activities and feedback;
- Organizing a system of access for the staff;
- Conducting briefings.

Technical measures

- Evaluation of the radiation environment in workplaces;
- Classification of premises in different areas on the basis of the possibility of radiation doses ;
- Individual dose control - use of electronic alarm and TL dosimeters;
- Use of shielding, suitable for these types of radiation;
- Use of devices for remote operation;
- Use of individual means for radiological protection;
- Decontamination of the equipment;
- Organizing check points between areas with varying degrees of radioactive contamination and the control of surface contamination of hands, feet and clothing to non-radioactive contamination.

Personnel Training

- Maintenance and operational activities are performed by well trained and qualified staff. Thereby the time for work is shortened and radiation exposure is reduced.

Environmental monitoring and basic results

Around Kozloduy NPP 36 monitoring stations are established, which carry out measurements and sampling for the content of natural and anthropogenic radionuclides. Radioactivity in air, atmospheric deposits, vegetation, soil and gamma background are periodically monitored. Beyond that samples of water, milk, fish and others are analyzed with special focus on drinking water and the Danube River, in which there are several sampling points. Standardized and validated methods of practice, such as gamma spectrometry, low background radiometers for total beta activity, liquid scintillation spectrometry for the determination of tritium and radiochemical isolated radio strontium, and others, are used. A specialized mobile laboratory is used for radiation surveillance and field measurements. Annually, over 2200 samples are tested from different sites of the environment: air, water, air, soil, vegetation, milk, fish, crops, etc. The total number of laboratory tests exceeds 3,700. Also over 1500 measurements of radiation gamma background in the control points and routes with portable devices and static dose located thermo-luminescent dosimeters are made. The quality control of the analysis is done at all stages of activities, from sampling to final result. Internal control is performed by blank and duplicate samples that are marked, control tests of the apparatus. External laboratory control is provided with regular participation in international comparisons with laboratory BfS/PTB (Germany), IAEA - ALMERA, WHO (UN), NPL (UK) and others.

The results from the measurements obtained during 2006 - 2009, show that the equivalent dose rate of gamma radiation varies within the natural radiation background of 0,044 to 0,150 μSv/h. The measured values at the industrial site fence and settlements in the 100 km zone are fully comparable. Detected radionuclides (90-Sr, 137-Cs) in several environmental compartments (soil, vegetation, air, water, etc.) are generated as a result of atmospheric nuclear tests conducted

over 50 years and the Chernobyl accident in 1986. The measured concentrations are much lower than legal standards and are comparable with data from previous years and pre-release period (1972-1974). No changes are recorded in the radio ecological parameters due to the operation of the Kozloduy NPP.

Regulatory control

Nuclear Regulatory Agency

Specific requirements regarding the radiation protection, radiation monitoring control and the frequency and type of reporting the results of the control to NRA are included in the operating licenses of all units of the Kozloduy NPP. Monthly reports for gaseous and liquid discharges at the site of Kozloduy NPP and regular reports for the occupational exposure are presented in NRA. Annual reports for the results of the control of radiation exposure of staff and annual reports for the results from the radiation control of the environment, including assessment of exposure of the population from the discharges are submitted also. NRA implements the regulatory control on radiation protection in Kozloduy NPP by inspecting the site and through analysis and performance evaluation of documents, submitted by Kozloduy NPP, implementing the terms of licenses issued. Periodic review of the status of radiation protection includes analysis and performance evaluation of the data for: radiation exposure of staff, gaseous and liquid discharges, state of the radiation control system, and compliance with the regulatory and licensing requirements. Summary of the results of regulatory review is published in the annual reports of the NRA.

In pursuance of Article 35 of the EURATOM Treaty and the EC recommendation a “Procedure for independent regulatory control of radioactive discharges from NPP Kozloduy” No QMS-IA-P-01 was developed by the NRA inspectors. The procedure describes the scope and organization of the control program and timetable for taking and analyzing samples, the responsibilities of the various participants, requirements for reporting of the results. Sampling program defined by the NRA, includes at least 5% of the number of samples of Kozloduy NPP operator depending on their type. The procedure regulates that the conduct of regulatory controls has to be performed by analyses of samples in an independent laboratory assigned by NRA. At the site of Kozloduy NPP an aerosol sampler device of the NRA is located. Since mid-2009 the practical application of the procedure has began. The results will be ready in 2010.

Ministry of Environment and Water

Ministry of Environment and Water through the Executive Environmental Agency and its regional structures implements an independent control of environmental radiation status in the 30-km zone of Kozloduy NPP. Radiological environmental monitoring is carried out in two ways:

- through an automated system for on line monitoring;
- laboratory- analytical system for monitoring off line.

The Executive Environmental Agency (EEA) administers the National Automated System for Continuous Monitoring of Gamma background. It is a measurement and information system for early warning, whose main goal is timely recording and notifying the state government and the population for the presence of radioactive contamination following the accident at a nuclear facility in the country or the existence of cross-border transmission of radioactivity resulting from nuclear accident outside the Republic of Bulgaria.

The system consists of 26 local monitoring stations, located throughout the country with a greater concentration of stations in the 100 km zone around the NPP Kozloduy. Users of the operational data from the automated system are:

- Ministry of Interior - General Directorate for Civil Protection;
- Nuclear Regulatory Agency - Emergency Centre;
- Ministry of Defence;
- Kozloduy NPP.

The system is integrated into the European system for exchanging radiological data (EURDEP). Under normal conditions, EURDEP data are to be transmitted once a day and in the presence of abnormal values - each hour.

Radiometer measurements in real conditions, sampling and laboratory and analytical support in the region of Kozloduy nuclear power plant are carried out by regional EEA laboratories for radiation measurements in Vratsa and Montana. A periodic monitoring is performed for: atmospheric aerosols, uncultivated soils, waters from the plant, surface water and sediments of the Danube River and other waters in the region. The data obtained from the measurements show a lack of influence of the operation of nuclear power on the components of the environment.

The results from ongoing radiological monitoring are published in journals of the EEA - daily and quarterly newsletters and a National Report on the environment.

Since 2006, EEA has carried out a radiological monitoring in the area of Belene to establish the radiological status of the environment before the commissioning of the NPP.

Ministry of Health - National Centre of Radiobiology and Radiation Protection

National Centre of Radiobiology and Radiation Protection at the Ministry of Health carries out a public health control on the work environment to identify and reduce exposure of individuals from ionizing radiation and to assess the exposure and radiation risk for the population as a whole or groups. State Health Control in Kozloduy NPP is done by inspections, including:

- evaluation and issuance of opinions on the compliance of the draft design, construction, reconstruction, expansion, commissioning and other activities with health requirements and requirements for radiation protection of personnel and population;
- sampling or measurements of radiation factors in the working environment, carrying out laboratory analysis, data processing and preparation of protocols / reports and when violations are detected, issuing of mandatory requirements;
- examinations of the radiation risk to workers, individual doses to personnel and measures to reduce the exposure.

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.

Article 16 (1) Emergency plans and programmes

Overview of the arrangements and regulatory requirements for on-site and off-site emergency preparedness

The main legislative and regulatory requirements for the structure and organization of the emergency preparedness in Republic of Bulgaria are specified in the Act on the Safe Use of Atomic Energy, Disaster Protection Act and the Law on Ministry of Interior.

The requirements for emergency preparedness during operation of nuclear facilities are specified in the Act on the Safe Use of Atomic Energy. According to Article 16 of the ASUNE, the licensee who perform activities connected with operation of nuclear facilities are required to take actions for prevention of incidents and accidents and for mitigation of their consequences. Article 35 specifies that a license for operation of a nuclear facility may be issued only to a legal person who has an approved emergency plan for response in the event of an accident.

According to Article 117 of ASUNE the measures for emergency planning are established by the emergency plans as follows:

- for protection of the population (off-site emergency plan), which regulates the emergency planning areas and determines the actions to be taken by the competent authorities to protect the population, property and environment in case of an accident;
- for nuclear facility or for a facility with sources of ionising radiation (on-site emergency plan), which determines the actions to be taken by the licensee for accident mitigation and remediation of consequences, according to the off-site emergency plan.

In case of an accident, the licensee/relevant permit holder shall be obligated to:

- immediately warn the population and the mayors of municipalities within the emergency planning areas and other competent authorities;
- take actions for mitigation and remediation of accident consequences;
- control and regulate the exposure of the persons engaged in accident mitigation and liquidation;

- ensure continuous monitoring of the radioactive releases into the environment;
- participate in activities included in the National Monitoring System;
- perform any other obligations as may be established in the emergency plans and by the ASUNE.

According to the requirements of the Disaster Protection Act, the Council of Ministers specifies the state policy in the field of the protection in case of disaster:

- implements the general management of the protection in case of disasters;
- adopts a National Program for Protection in Case of Disasters and Annual Plans for its implementation;
- adopts a National Disaster Protection Plan and a National Plan for Performance of Rescue and Emergency Repair and Recovery Works;
- introduces a National System for Early Warning and Notification of the executive authorities and the population in case of disaster and determines, through a Regulation, the conditions and the procedure for its implementation under the proposal of the Minister of Interior;
- provides for funds for protection in case of disaster.

The Law of Ministry of Interior sets obligations of the Ministry as follows:

- protection in case of disasters, assistance and rehabilitation, provision of necessary resources and receiving incoming aid through procedure established by Law;
- coordination of activities of the Unified Rescue System in compliance with the Disasters Protection Act.

The Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident sets the conditions and the procedure for developing Emergency Plans, the persons responsible for their application and their obligations, the actions and measures for mitigation (localization) and liquidation of the consequences of nuclear or radiation accident, the methods for informing the general public, the procedure for maintaining and testing the emergency preparedness. The Regulation defines the risk categories of the facilities, determines the intervention levels for the expected and averted doses, the dose rate and the specific activity for application of protective measures and an analysis of the cause that led to the accident.

In addition to these legislative acts, the requirements for emergency planning are set in:

- Regulation № 28 for the conditions and procedure for medical insurance and medical norms for persons in case of radiation accident (OJ 84/17.10.2006);
- Regulation for procedure for construction, maintenance and use of collective means of protection (OJ 23/27.03.2009);
- Regulation for early warning and notification of disaster (OJ 26/07.04.2009).

Structure of the National Emergency Plan, the role and obligations of NRA and the executive authorities

The last update of the Off-site (National) Emergency Plan was approved by the Decision № 120 of the Council of Ministers on 12 March 2010. The Off-site Emergency Plan is inseparable part (part III) of the National Plan for Protection Against Disasters. In the Off-site Emergency Plan in details are given the obligations, responsibilities and the rights of the Ministries and Authorities responsible for management of activities in case of nuclear accident.

The National Plan contains 8 Sections/Chapters and 42 Annexes concerning various activities, assessments, references and data. From the prognosis of results in case of an accident are determined also:

- information flow chart and the order of mutual interaction;
- ways of counteraction;
- organization of the off-site and on-site radiation control;
- planning and organization of protective measures in the emergency planning zones;
- ensured operation of the management system;
- use of protective means, iodine prophylaxis and organization of medical care;
- preparation of the population in the area of emergency planning for life and activities in condition of enhanced radiation.

Obligations for planning of activities in case of radiation emergency, as well as for maintaining emergency preparedness have the following organs of the executive authorities:

- Minister of Interior;
- Chairman of Nuclear Regulatory Agency;
- Minister of Health;
- Minister of Environment and Water;
- Minister of Agriculture and Food;
- Minister of Foreign Affairs;
- Minister of Economy, Energy and Tourism etc.;
- Mayors of municipalities and governors of districts.

Obligations for planning activities in case of a radiation accident, as well as for maintaining emergency preparedness have the Bulgarian National Radio and the Bulgarian National Television and the legal persons who perform activities on the territory of Republic of Bulgaria.

The functions of the competent State authorities, responsible for radiation protection, having responsibilities for emergency planning, emergency preparedness and activities in case of nuclear or radiation emergency can be generalized as follows:

- NRA caries out the regulatory control of activities using nuclear energy and ionising radiation and with the safety of radioactive waste management and spent fuel management. NRA gives objective information to individuals, legal entities and State authorities about the condition of nuclear safety and radiation protection. Gathers, processes and analyses information for the accident and informs the international organizations;
- Ministry of Interior carries out specialized control of the physical protection of the nuclear facilities and manages activities connected with emergency planning, emergency response and maintains emergency preparedness for protection of the population in case of disasters;
- Ministry of Health carries out specialized control of the professional exposure and exposure of the population, carries out medical observation of the personnel and the monitoring of the working and the living environment. In emergency situations performs evaluation of the doses and the consequences for the population and orders undertaking of protection measures (iodine prophylaxis etc.);

- Ministry of Environment and Water manages the national system for control of the environment and performs the radio –environmental monitoring;
- Ministry of Agriculture and Food carries out specialized control of radioactivity in the agricultural produce.

Implementation of the National Emergency Plan

The activities for protection in case of disaster are coordinated into an unified (national) rescuing system. The emergency preparedness in case of nuclear or radiation emergency is a part of joint national measures for protection in case of disaster.

The main components of the Unified Rescue System (URS) are the General Directorates of Ministry of Interior (MI) – "Civil protection" and "Fire safety and rescue", the regional directorates of the MI and the Emergency Centres for Medical Care. The structures of the main components of the URS are established across the entire territory of the country in accordance with the administrative and territorial division. The other components of the URS, local representatives of the executive authorities, legal entities, other medical establishments, render assistance upon request from MI in accordance with the plans for conducting rescue and emergency repair and recovery works.

The protection from disasters is carried out on National, regional and municipal levels as the main obligations are separated for each level according to the respective competences. The MI is developing a National Plan for Performance of Rescue and Emergency Repair and Recovery Works, while the regional structures of the General Directorate "Civil Protection"-MI co-ordinate the developing of the regional plans, which are approved by the governors of districts.

The co-ordination of the elements of the URS is carried out through the operative Communication – Informational Centres of MI, which:

- receive and assess information regarding the occurred disaster;
- notify the competent parts of the URS and coordinate follow-up activity on the basis of standard operational procedures;
- notify executive authorities for any occurred disaster;
- Include additional forces and means according to the Plan for Performance of Rescue and Emergency Repair and Recovery Works on request form the manager on the site, the mayor of the municipality or the governor of district.

The State Authorities, including NRA, within the limits of their competence:

- analyse the likelihood origins of the risk and perform preventive activities for elimination or limitation of the risk factors, which may cause the disaster;
- participate in developing the plans for Performance of Rescue and Emergency Repair and Recovery Works and the off – site emergency plans;
- in accordance with the plans for Performance of Rescue and Emergency Repair and Recovery Works keep in readiness the available forces and means and ensure the participation of their subordinate structures as a constituent part of the URS;
- perform control for implementation of the safety measures in the controlled or managed by them area.

Implementation of emergency preparedness by the license holders

For optimisation of the requirements towards the actions and measures for mitigation and liquidation of the consequences of an accident and for the purposes of the emergency planning, the facilities, sites and activities are categorised in five risk categories, according to IAEA SS GS-R-2.

Classification of emergencies

According the Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident, depending on the possibility to control the processes during an accident and the severity of its consequences, and for the purposes of emergency response, the accident in facilities, sites and during activities are classified into one of the following classes:

- "general emergency"
- "site area emergency"
- "facility emergency"
- "alert"
- "other emergencies".

For the purposes of ensuring prompt and adequate response and for protection of the population and the environment in case of an accident emergency planning zones are defined according the Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident. The zones are defined on the basis of analyses of the beyond design basis accidents and severe accidents of the units VVER-1000 (B-320) and radiation consequences in accordance with dose limitations and decision criteria for application of protective measures. Emergency planning zones for Kozloduy NPP are:

- On-site emergency planning zone (protected area) – it is under the direct control of the licensee (operator) and the access is limited and controlled;
- Off-site emergency planning zone, which include:
  - The precautionary action zone around Kozloduy NPP – with radius of 3 km;
  - The urgent protective action planning zone around Kozloduy NPP – with radius of 30 km.

Main elements of the on-site emergency plan for nuclear installations

The emergency plan of the Kozloduy NPP is the basic guidance on action in case of an emergency at the NPP. The plan has been developed on the basis of the national legislation, requirements of the ratified international conventions and agreements, the results and recommendations from missions and exercises in NPP.

The last update of the on-site emergency plan of Kozloduy NPP is made on 2007. In the updated revision the criteria for activation of the plan are actualised. The objective of this plan is to create an organisation that guarantees maintaining of constant emergency preparedness of the Kozloduy NPP personnel for carrying out localisation, rescue and other urgent activities in case of an accident at the Kozloduy NPP. The emergency plan sets an organisation different from that existing during normal operation and defines also the order of activities in case of:

- beyond design basis accidents;
- events which may lead to accident's development not foreseen in the design;
- extraordinary events as a result of a human activity outside the Kozloduy NPP site, natural disasters, fires, etc.

The radiation accidents, characterised by deviations from the limits for radiation impact on the personnel and the environment, as defined in the legislative documents, are a subject to review and classification. Events without direct radiation impacts (non-radiation accidents) causing actual or potential precondition for significant decrease of the safety level of the facilities, personnel, and the environment, are also under consideration.

For action at naturally occurring emergencies at Kozloduy NPP have been developed:

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

The Emergency Action Plan for accidents during the transport of fresh and spent nuclear fuel, Action plan for medical insurance in case of accident and Action plan in case of emergency conditions in the hydro-technological facilities.

The management of the facilities' operation is carried out by twenty-four-hours operational shifts seven days a week. These shifts are managed by the plant shift supervisor. He is responsible for the implementation of urgent measures in case of an emergency, other natural events and natural disasters, as well as first aid to the injured personnel.

The Kozloduy NPP staff is trained and instructed to report to the plant shift supervisor about each condition or event that may lead to safety level decrease. This fact enables prompt classification of the events and implementation of corresponding measures in time. By actuation of the emergency plan an emergency organisation is imposed at the NPP, which includes also parts of the organisational structure during normal operation.

The imposition of the emergency organisation is accomplished on two levels, depending on the emergency conditions:

- Level A - in all emergency conditions;
- Level B - in "local accident" or "general accident" conditions only.

This emergency organisation is also based on organised and permanently maintained emergency shifts, ensuring unhindered establishment of the emergency structures. The emergency teams are created based on the permanent staff of the Kozloduy NPP. The specific duties of the different positions according to the on-site Emergency Plan and the order of their fulfilment are stated in separate instructions and procedures.

The following groups and teams are included in the emergency organisation structure:

Management Team

The management team reports to the Head of Emergency Activities and is mobilised in all emergency situations. The Main Control Room team lead by the plant shift supervisor performs the management team's functions until the last management team arrives.

The main tasks of the management team are as follows: organisation of the receiving of information on the condition of the failed unit and of the operating ones; management of the emergency assessment activities; preparation for decision making on implementation of measures aiming at accident limitation and localisation, as well as public and personnel

protection; preparation of orders of the Head of Emergency Activities for shut down or continuation of the operation of the rest of the units.

Team 1

It is established by the shift and reserve shift personnel. It has the following main duties: performance of the Kozloduy NPP operation according to the existing operational documents; performance of safety functions monitoring; performance of a preliminary assessment of the initial emergency events and determination of the emergency situation; implementation of the Emergency Plan according to the determined emergency situations and levels in case of accidents, natural disasters, fires, etc.; management and fulfilment of the Emergency Plan's activities until the emergency structures' establishment; notification and information of the personnel, the population and the competent state bodies on local and national level; organisation and implementation of the urgent emergency measures aiming at protection of the personnel; performance of activities on accident management; performance of personal monitoring of the shift staff; performance of urgent emergency and remediation activities.

Team 2

This team reports to the Head of Radiation Monitoring. The main obligations of the team are as follows: performance of radiation monitoring, recording keeping of the results and duly reporting to the Head of Emergency Activities; data analysis carried out by the specialised technological monitoring; performance of an assessment of the radioactive source; carrying out of forecasts on the radiological consequences at an early or intermediary emergency stage; preparation of proposals for personnel protective measures; organisation and control of the activities related to the planned increased exposure of the emergency staff; performance of control and ensuring of the implementation of the mandatory measures on individual protection until the elimination of the emergency; setting of fences, markings and signs for radiation danger; assessment of the necessity for performance of decontamination activities.

Group for Analyses and Prognosis

The group for analyses and prognosis is established during an emergency as a consultative body to the Head of Emergency Activities. It is not authorised to make decisions for execution by the staff or other emergency structures. The main duties of the group are as follows: obtaining information and monitoring of the facilities condition; carrying out of periodical classification of the emergency situation during the emergency development; performance of the necessary engineering analyses; preparation and proposal of measures on the emergency management; ensuring of the necessary support to the Team 1 staff; carrying out of consultations with external supporting organisations.

Group on Technical and Information Support of the Emergency Management Centre

The Group on Technical and Information Support of the Emergency Management Centre is established during the accident and is located at the Emergency Management Centre (EMC). It comprises of specialists on telecommunications, computer information systems, engineering facilities maintenance and a doctor. The group's main duties are as follows: ensuring of communication connections; ensuring of reliable operation of the EMC information system; maintaining of the necessary operational conditions for the emergency teams; ensuring of pre-medical aid to the emergency team personnel.

The structure of the emergency response authorities includes also the following services related to the implementation of the Emergency Plan:

- Regional Fire and Emergency Department;
- Specialised Police Security Team;
- Medical Service;
- Road transport.

Off – Site Emergency Preparedness

The Off–site Emergency Plan in detail sets the duties, obligations and the rights of the Ministries and other Authorities, which have attitude to the activities for protection of the population and preserving the environment upon an accident in a nuclear facility. The Off–site Emergency Plan determines the organization of URS for implementation of the plan for Performance of Rescue and Emergency Repair and Recovery Works in case of "general emergency" in Kozloduy NPP and the responsibilities of its constituent parts.

From the prognosis of the results, upon a likelihood accident, are determined:

- the way of collection, treatment and assessment of the data from the individual and general radiation monitoring and forecasting of the further development of the radiological situation;
- the planning and organization of protective measures in the area of emergency planning;
- the use of protective means, the iodine prophylaxis and the organization of medical and transportation services;
- the preparation of the population within the area of emergency planning for life and activities in the conditions of increased radiation;
- maintaining of engineering and fire protection means;
- ensuring public order, logistics etc.

The maintenance of emergency preparedness for reaction against accidents with likelihood radiological consequences includes:

- creation and maintenance of emergency teams for national actions;
- maintaining the system for notification and early warning of the population;
- ensuring means for radiation protection and radiation monitoring including the prognosis for the radiation situation and the consequences from an accident;
- ensuring financial means for plan for Performance of Rescue and Emergency Repair and Recovery Works;
- periodic updating of the emergency plans by the respective authorities, territorial management units and licensees;
- training of persons designated for actions according to the emergency plans and conducting exercises and training for emergency plan implementation;
- notification of the population for important questions dealing with the radiation protection and protective measures in case of an accident.

The measures for radiation protection of the population are applied based on the criteria and principles set in the Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident. The protective measures for the population are carried out under instruction of the MI.

Training and exercises, evaluation of the activities and main results of performed exercises;

For maintaining the emergency preparedness and improving the emergency response the executive authorities, regional authorities and the legal persons periodically conduct emergency exercises and training set in the Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident. The National Emergency Exercises and Training are organized and conducted:

- every 5 years – the full–scope emergency exercise for adoption of the National Emergency Plan;
- annually – training and drills of the elements of the plan.

In the full scope emergency exercise participate the executive authorities, NPP operator and legal persons who are included in the National Emergency Plan, as well as local authorities and the population in the areas of emergency planning. The scenario for conducting the exercise is approved on a National level by Minister of Interior. The aims of the exercise are described, the elements of the emergency plan which will be verified, the participants (ministries, administrative structures, population, media etc.) and participants-observers and controllers, as well as the time table for conduction of the exercise are given.

In the period 2007 – 2010 Bulgaria participated in the following national and international exercises:

- Annual exercise for action in case of accident in Kozloduy NPP (2007, 2008, 2009) with different scenarios;
- Headquarter exercises with participation of various ministries and authorities (2007, 2008, 2009);
- International exercise of IAEA for check of emergency notification forms "SEESIM08" in case of accident in NPP (2008);
- ECURIE exercises;
- Full scope National exercise "Protection-2009".

In 2009 a full scope National exercise "Protection of the population upon a likelihood radiation accident in Kozloduy NPP" was organized. During the exercise the good coordination between emergency unit of Kozloduy NPP with the National coordination headquarters and Kozloduy and Miziya municipalities was established. Real-time evacuation of the victims of the personnel, sheltering and evacuation of the population from the city of Kozloduy was tested. Comparison of various prognosis software programmes (EPA-Dose and RODOS) was performed, with real meteorological data and technological parameters.

The training is performed according to preliminary prepared and approved programme. Developed scenario is used for training of all shifts. The aim of the training is to check and maintain the personal preparedness for adequate action upon an accident in Kozloduy NPP. After each all-station training the management team prepares a written report and points out the measures for elimination of weaknesses and faults.

During the all-station emergency training the following items are checked:

- the on duty shift readiness for correct and exact actions upon radiological accident;
- the readiness for implementation of the emergency plan;
- speed and exactness, organization, coordination and interaction of the emergency teams;
- functioning of the information systems, notification and management upon non-radiation and radiation accident;
- preparedness and possibilities for timely sheltering of the personnel followed by evacuation to city of Kozloduy;
- technical condition and functionality of the planned emergency technical protective means;
- interaction and coordination with external organizations and authorities;

- functional and practical value of the developed plan for protection of the personnel upon a likelihood accident in NPP;
- preparedness and the possibility of the NPP personnel for rapid orientation and calm actions during the emergency;
- exact knowledge and skills of the personnel, its practical abilities for actions in a complex emergency situation.

Evaluation of the emergency training is given by an expert commission, appointed by the manager of the NPP, which may include representatives of NRA, MI, etc.

Regulatory review and control activities

Emergency preparedness is a continuous process requiring constant improvement and updating. That is why the emergency plans are checked annually, the results are analysed and are updated if necessary.

The emergency plan (off-site and on-site) is based on preliminary developed by the licensee and accepted (approved) by the regulatory body analyses of the beyond design basis accidents and severe accidents, including the observation of dose limitations and decision criteria for application of protective measures etc.

The off-site emergency plan is coordinated by all participants and is approved by the Prime Minister. The on –site emergency plan is coordinated by the NRA, General Directorate "Civil protection", MI, MH, MEW and other specialized control authorities (upon necessity and their competences). Following its coordination it is approved by the head of the facility (operator). The license for operation of nuclear facility is issued only after the approval of the emergency plan.

The regulatory body conducts control and annual inspections of the nuclear facilities and sites using SIR on a preliminary plan for control activities:

- the preventive control – when licenses and permits are issued for activities according to ASUNE;
- the periodic control – is for implementation of the conditions of the issued licenses and permits for activities;
- the follow-up control – for implementation of recommendations and prescriptions of the NRA.

Article 16 (2) Information of the public and neighbouring states

Informing the public in the vicinity of the nuclear installations about emergency planning and emergency situations

According to the ASUNE, the NRA gives to the public information about the condition of nuclear safety and radiation protection in normal operation, as well as in emergency. According to the Regulation on emergency planning and emergency preparedness in case of nuclear or radiological emergencies the executive bodies are obliged to notify the public in case of emergency, according to their competencies.

In the National Emergency plan and in the Emergency plans of the competent state authorities are defined requirements and rules for notification and periodical information of the public for the period of emergency up to its liquidation. The Ministry of Interior organises, coordinates and

determines the order for distribution of information to the public in case of nuclear or radiological emergency.

Separate section of the Regulation on emergency planning and emergency preparedness in case of nuclear or radiological emergencies defines specific requirements for notification the general public. Ministry of Interior and NRA shall submit to the population in the urgent protective action zone the following preliminary information:

- Planned measures for population health protection including the measures envisaged in the off-site emergency plan for notification, protection and assistance to the general public in case of an accident;
- Actions to be taken by the general public during the accident;
- Basic educational facts about radioactivity and its effects on human health and on the environment;
- General information about various types of accidents and their consequences upon the general public and the environment.

In case of accident the affected population shall be immediately notified by the executive bodies in accordance with their competencies and periodically shall be informed for the accident, its characteristics, implemented protective measures, and in case of necessity – for the measures for health protection which have to be implemented, including:

- Type of the accident and where possible, its characteristics (origin, extent and probable development);
- Useful advice for personal hygiene and decontamination;
- Useful advice for implementation of measures for health protection such as:
  - limiting the consumption of certain foodstuffs likely to be contaminated with radioactive substances;
  - recommendations to stay in-door;
  - organisation and distribution of the individual protection means and medications;
  - arrangements for likelihood evacuation;
- Information recommending co-operation with the executive bodies and emergency response teams and observing their orders.

According the Regulation on emergency planning and emergency preparedness in case of nuclear or radiological emergencies, notification of the public is the basic protective measure in case of accident. Ministry of Interior support the National system for early warning of the population in case of calamities and accidents (transmission of sound signals and announcement to the public in emergencies).

For notification of the public and the competent authorities in emergency with likelihood radiation consequences off-site is used communication-notification network, including

- fixed and mobile phones, faxes;
- sirens, transmitted signals and messages;
- loud speakers;
- national and international radio and TV stations, local radio-translators, mobile radio stations, satellite video and radio channels;
- national postal network;

- inter-institutional networks;
- computer networks.

International agreements, Arrangements to inform competent authorities in neighbouring countries

ECURIE (European Community Urgent Radiological Information Exchange)

ECURIE is a system for emergency notification and exchange of information between EU countries in case of nuclear accident or event of radiological emergency. According Council Decision 87/600/Euratom Republic of Bulgaria is a member and operates ECURIE system. In case of emergency ECURIE is a platform for notification and exchange of information for emergency conditions, meteorological information, protective actions etc.

EURDEP (EUropean Radiological Data Exchange Platform)

EURDEP is both a standard data format and a network for the exchange of environmental radiation monitoring data between European countries in real-time. Participation of the EU Member States is based on the Recommendation 2000/473/Euratom. The system is continuously operating with a daily data exchange routine and there is a general consensus that participating in the system automatically means that the data transmissions will continue during an emergency in an elevated frequency.

ENAC (IAEA Emergency Notification and Assistance Convention)

NRA is the national competent authority for notification abroad in case of emergency. NRA submits the information to the IAEA trough the IAEA ENAC web site.

Bilateral agreements

Republic of Bulgaria has signed bilateral agreements in the area of emergency preparedness, including neighbouring countries:

- 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;
- 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;
- 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;
- 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;
- 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;
- AGREEMENT between the Government of the Republic of Bulgaria and the Government of the Russian Federation in the domain of peaceful use of atomic energy;

- 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.
- An agreement between NRA (Republic of Bulgaria) and the radiation safety directorate (regulatory body of Macedonia) for cooperation in radiation protection matters its ratification is expected.

According to the agreements NRA submits the requested information and ensures means for notification. Ministry of External Affairs informs the diplomatic corps and Bulgarian embassies in case of nuclear or radiological emergency.

Article 17 Site Selection

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.

Article 17 (1) Evaluation of site related factors

Overview of arrangements and regulatory requirements relating to the siting and evaluation of sites

The authorization regime for determining the site of a nuclear facility (site selection) is specified by the Act on the Safe Use of Nuclear Energy. In essence, it represents a two stage decision making process – two regulatory decisions are made by the NRA Chairman, namely:

- Issuance of a siting permit – a permit to carry out site selection activities;
- Site approval order – approving the proposed by the applicant site, based on review and assessment of substantiation documentation.

Assessment of the environmental impact of the facility, including transboundary aspects, is required by the Law on Environmental Protection. The same law specifies the organization of public discussions of EIA results, together with municipal authorities and the competent authority, which issued the decision on the EIA. In this discussion shall participate representatives of municipal administration, state and public organizations, public, and interested persons and entities.

Procedure for granting of a siting permit for a nuclear facility and issuance of a site approval order is specified by the Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy. For a siting permit, together with the conceptual description of the nuclear facility and the acceptance criteria for the sites, the applicant shall submit a Plan for preliminary sites investigations, description of the measures to implement the studies, methods to be used for the investigations and for evaluation of the results.

For approval of the selected site, the applicant shall submit a Preliminary SAR, which shall include comparative analyses of proposed sites in respect of nuclear safety and radiation protection, and a choice shall be made on the basis of:

- Impact of factors of technogenic or natural origin on the safety of the facility;
- Radiological impact of the facility to public and the environment;
- Site specific characteristics of importance for migration and accumulation of radioactive substances;
- Possibilities for application of public protection actions in emergencies;

- Areas with specific requirements (radiation protection and surveillance areas) and emergency planning zones.

It shall include the results of the study of the characteristics of the selected site, including:

- Geographical, topographical and demographic conditions;
- Technogenic factors;
- Hydro-meteorological conditions;
- Geological, hydro-geological, seismic and engineering-geological conditions;
- Specific site and region characteristics in respect of emergency planning, accident management, and physical protection.

The documents necessary to approve the selected site also include:

- Site monitoring programs including: seismic monitoring, system of groundwater and surface water monitoring, and monitoring of other natural phenomena;
- A program of additional site investigations, where the need is identified by the SAR;
- Positive decision on the EIA, issued by the Minister of Environment and Water.

The selected site is approved by the NRA Chairman, if it complies with the statutory requirements, and if it has been proved that: all factors have been identified, which may impact the design process; and in normal operation and design basis accidents, the exposure of personnel and the public will be low as reasonably achievable, without exceeding of specified limits.

Specific requirements to NPP sites are defined in the Regulation on Ensuring the Safety of Nuclear Power Plants. The Regulation specifies the scope of engineering studies and investigation processes, phenomena and factors of natural and technogenic origin, which may affect the safety of NPPs, and the relevant technical measures to reduce the risk. The Regulation establishes the conditions and criteria for identifying a site as favourable or unfavourable for the construction of a NPP and the factors excluding such a construction. In general, conditions and factors that are considered refer to the following:

- Compliance with: legislation on environmental protection; the rules and regulations for radiation protection; fire protection requirements; and physical protection requirements;
- Geological and geographical facts, as for example low intensity of the maximum design basis earthquakes, impossibility of site flooding, absence of differential crust movements, and potentially active or abated landslides and slopes, or other dangerous processes;
- Climate preconditions, such as wind characteristics, intensity and significance of storms, hurricanes and other extreme weather conditions.

Assessments made and criteria applied for evaluating all site related factors affecting the safety

In selecting sites for nuclear power plants, frequency of occurrence and characteristics of phenomena and factors of natural and technogenic origin are investigated and evaluated, to check for precluding (excluding) conditions and factors and to determine whether sites are favourable for NPP construction. In order to consistently apply the concept of Defence in Depth, NPP design defines impact parameter values of recurrence of external events that could affect safety. Potential consequences of external events, included in NPP design basis, are analyzed using deterministic methods.

Belene site

Belene site is situated in northern Bulgaria, on the right bank of Byala arm of the Danube River. Development of the Belene project was presented in the previous national reports, starting with the initial siting in 1970, determining the characteristics of the site in 1980-81 and the start up of construction activities in 1984. The original design envisages the construction of four VVER/V 320 1000 MWe reactors. Due to financial constraints, in 1991, the project was frozen. At that moment, the construction activities of the first unit have been completed about 50%. Excavation activities of Unit 2 were completed and the ground was prepared for laying down of the foundation (fundament).

For the period from 1990 to 2000, a large number of analyses were carried out to update the information of Belene site characteristics. Investigation scope included evaluations of seismic safety, analysis of engineering-geological and hydrological conditions, periodic weather and aero-logical reports, research on demographic characteristics of the area around the site, analysis and assessment of exceptional events caused by human activities and extreme situations. During this period, several IAEA missions were organized to review and analyse the seismic safety of the site.

Methods, sequence and results of these studies are included in the EIA report, the feasibility study and the preliminary SAR.

The analysis of seismic hazard for Belene site shows that the absolute acceleration of the maximum design basis earthquake (repetition period of 10 000 years) that can be expected for the site is 0.24 g.

Results of surveys of seismic and tectonic conditions around the site of Belene NPP show that the site satisfies the requirements of the IAEA and the Regulation on Ensuring the Safety of Nuclear Power Plants and is suitable for construction of a nuclear power plant.

Potential hazards of technogenic origin have been investigated, derived from nearby industrial, transport and military sites. Design basis external events and estimated maximum values of impacts parameters have been determined and their influence on NPP safety has been assessed.

Kozloduy site

Site of Kozloduy NPP is situated in north-western Bulgaria, on the right bank of the Danube River, near the town of Kozloduy. The area of the site is flat with an average altitude ranging from 28.0 to +36.0 m height in the Baltic system. The Danube valley and the site are protected by dike reaching absolute elevation +30.0 m. The site is located on a non-floodable terrace o with absolute elevation +35.0 m.

Kozloduy NPP construction was accompanied by preliminary studies, research and analysis of geological and hydro-geological, climate, anthropogenic, demographic, economic conditions and other factors directly or indirectly influencing safety. By engineering and geological studies were defined:

- Geological and litho-logical structure of the site;
- Hydrogeology;
- Physical-geological phenomena and processes;
- Physical-mechanical properties of engineering geological types.

In connection with the design and construction of Kozloduy NPP, a large number of geological and tectonic studies were carried out in the Kozloduy Valley and a wider region around. The results of these studies, extended and generalized are used to determine macro-seismic characteristics of the region and micro-seismic characteristics of the site. In the initial design, site seismicity, taking into account engineering and geological conditions, was set at 6 ball (by MSK-64) with likelihood once every 100 years and 7 ball with likelihood of once in 10 000

years. New evaluations, conducted after 1990, required reassessment of site seismicity to 7 and 8 ball respectively.

After the commissioning of Units 5 and 6, the following monitoring programs were developed and are being implemented:

- Recent crust movements;
- Seismic monitoring;
- A monitoring program of groundwater;
- A monitoring program of surface water (hydrology);
- Geotechnical ground control;
- Weather monitoring.

Activities on the reassessment of site related factors are described in the texts under Article 17 (3).

Overview of design provisions used against human made external events and natural occurring external events

Belene site

Design solutions for protection against natural phenomena and events are based on the criteria that when considering the effects of natural phenomena in the design of safety important SSC, such as earthquakes, tornadoes, hurricanes, floods, tsunamis and more, the SSC ability to perform assigned safety functions shall be maintained. To achieve this design criterion, taken into account are: the characteristics of the most severe natural phenomena that are historically inherent for the NPP site; relevant combinations of normal and natural phenomenon conditions; as well as the significance of safety functions to be implemented.

Building structures and equipment of category I are calculated to withstand the following specific natural impacts:

- Extreme wind, snow, loads and temperature loads and other extreme weather loads with a likelihood of occurrence - once in 10,000 years;
- Maximum Design Basis Earthquake (MDBE) with a likelihood once in 10,000 years;
- Loads of flying objects at extreme environmental impacts;
- Flooding of the site with likelihood once in every 10,000 years.

In calculating building structures, impacts of extreme loads are considered together with the operational loads.

Designed hermetic is a double containment: primary from pre-stressed concrete with sealing metal lining and secondary of ordinary concrete, covered with a spherical dome. The secondary containment takes the loads of external influences: the fall of an airplane or of the ventilation stack; external air shock wave, extreme wind, snow and temperature, seismic impact of MDBE (SL-2). The secondary containment ensures reduction of dynamic impact parameters of equipment area at the accident location area and increases the operational reliability of the primary containment, which is operated in stable temperature and climate conditions. A special case is postulated when calculating the containment and the elements ensuring its functions - simultaneous impact of MDBE (SL-2) and design basis accident. Building structures of I category of seismic resistance are verified for seismic impact exceeding MDBE by 40%.

Building structures of buildings and facilities of category I are calculated to withstand the loads, resulting from external technogenic impacts, including air shock wave, flying objects, falling of

an aircraft. In the role of a design impact of an airplane crash is the fall of a military aircraft. Design takes account also of the impact of the crash of a large commercial aircraft.

Kozloduy site

Designs of Units 5 and 6 were developed in the early 80's of the 20-th century under the regulations and industry standards in force at that time. Changes in regulations and standards have lead to changes in the design requirements for Units 5 and 6 concerning seismic impact.

Studies performed by the Geophysical Institute of the BAS on the seismic resistance of Kozloduy NPP site, confirmed by IAEA missions (in 1995 and 2000) come to the conclusion that an earthquake of 0,1 g acceleration could be expected once in 100 years and the MDBE of 0.2 g once in 10 000 years.

In 2004-2006, research and analysis were carried out of seismic resistance of buildings on-site at SL-2 0.2g (0.1 g for SL-1), as well as analyzes the behaviour of safety systems equipment during an earthquake. As a result, all measures related to re-qualification and ensuring the seismic resistance of safety systems equipment and structures, in respect of the increased seismic impact, were fully implemented.

Reactor building layout meets all the basic principles for protecting the personnel, population and environment from radiation effects - principles accepted in the international practice in NPPs design and reflected in the IAEA publications INSAG - 3, INSAG - 10 and others.

Reactor building structure (of Units 5 and 6) represents a spatial design system that can be seen as composed of four main parts - foundation block; containment (containment); auxiliary facilities; and internal structure. The four main parts are joint by a plate of reinforced concrete with thickness of 2.40 m.

In 2006-2007, engineering analyses were performed using the end elements method. Data applied was obtained both: during the operation of the system for automatic control of pre-stressed and deformed state of the containment; and of field and laboratory testing and research of containment elements. Assessment of containment structure reliability was carried out for all design basis internal and external impacts, in accordance with current requirements and taking into account the actual condition of structure straining system. Containment behaviour in severe accidents was analyzed and limiting load capability of the containment was established. Aging processes were analysed, critical elements were identified and a program was developed for management of containment rest lifetime. Analysis and evaluation results were compared with the specific requirements and was demonstrated that Units 5 and 6 containment is able to fulfil its functions in all types of design basis internal and external events.

Regulatory review and control activities

Activities for approval of Belene site

The application of the National Electric Company for permit for siting was submitted to NRA in June 2004 and the permit was issued at the end of the same year, following review and assessment of the documents, submitted by the applicant in fulfilment of the Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy.

With its application for approval of the selected Belene site, in August 2005, the National Electric Company submitted to the NRA the Preliminary SAR and other required documents. In this regard, NRA implemented a program for review and assessment of submitted documents to verify compliance of declared data and circumstances with safety requirements and criteria. Two external expert reviews of the Preliminary SAR were carried out in support of regulatory review - by a team of the Bulgarian Academy of Sciences and by GRS-Germany.

Belene site was approved at the end of 2006 and applicant future obligations and responsibilities were specified, including monitoring the parameters of processes of phenomena of natural origin and regular control of parameters factors of technogenic origin.

Regulatory activities associated with the Kozloduy site

Activities relate to the reassessment of site factors and characteristics and are described under Article 17 (3).

Article 17 (2) Impact of the installation on individuals, society and environment

In accordance with the ASUNE, proposals for construction of NPPs shall be submitted by the Minister of Economy, Energy and Tourism accompanied by evaluations of nuclear safety, radiation protection and environmental impact. The Minister organizes a discussion of the proposal, which is attended by government bodies and local authorities, representatives of public organizations and interested individuals and legal entities. When the operation of NPPs may impact the territory of another State, Minister of Foreign Affairs shall notify the competent authorities of that country and provide for the information necessary to analyze and evaluate the possible impact of NPPs on their territory, from the viewpoint of public safety and environmental protection.

The Regulation on Ensuring the Safety of Nuclear Power Plants requires that during site selection shall be defined the radiation situation for all operating and emergency conditions and that technical and organizational measures to ensure public safety shall be implemented. Consequences from a possible radiation impact on population and environment of accident radioactive discharges in the surveillance shall be determined by considering the required conservatism and specificity of the nuclear facility and respective site.

According to the Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy, to approve the selected site, a positive decision on the EIA, as well as site monitoring programs shall be submitted. For authorization of commissioning of a nuclear facility, the same Regulation requires the submission of a program for monitoring of site radiological parameters and a program of radiological monitoring of the environment during its lifetime.

Criteria for assessing nuclear facility impact on public and the environment

Belene site

Analysis of radiation impact on public and environment is carried out as part of the overall EIA process. EIA report is prepared in accordance with the Law on Environmental Protection and the Regulation on procedures for evaluating the environmental impact of investment proposals for construction, operations and technology.

EIA report for the construction of Belene NPP was submitted for consideration at the Ministry of Environment and Water in March 2004. An English translation was sent to the Romanian Ministry of Environment and Water Management.

During the period April - September 2004, EIA report received public hearings in the towns of Belene, Pleven, Nikopol, Svishtov (Bulgaria) and Turnu Magurele (Romania). A written statement was issued concerning comments, questions, suggestions, and received written remarks (including the Republic of Romania). Prompt answers were provided to all questions raised by the Romanian side.

Based on review of EIA, the MEW made the following conclusions:

- Substantial impact on the environment and the population in the region, including cross-border dimension, is not expected by the construction and normal operation of the facility;
- Belene site is suitable and has the potential for the construction of a NPP of 2000 MW;
- Region with developed infrastructure is selected for project implementation, which exclude the need of distortion of new land.

The positive decision on the EIA was submitted to NRA together with all other documents required for approval of the selected site.

Kozloduy site

The analysis of Kozloduy NPP impact on public and the environment are included in the updated SAR of Units 5 and 6. Analyses take into account the region natural radioactivity, demographic data, and agricultural products realization pathways and envelop the following components:

- Radioactive contamination of the surrounding environment;
- Chemical pollution of the surrounding environment;
- Disturbance of thermal regime of environment;
- Effectiveness of radiation protection of public and environment;
- Critical pathways of entry of radioactive and chemical products in the human organism.

Under the Law on Environmental Protection, an EIA Report for Kozloduy NPP has been prepared in 1999. General EIA conclusions in respect to main topics discussed are presented below:

- The main objectives of ensuring nuclear safety and radiation protection in the operation of the Kozloduy NPP are in compliance with Bulgarian requirements and internationally accepted criteria and standards;
- The radiological impact of the Kozloduy NPP on the environment is negligible. Radiation conditions in the radiation protection and surveillance areas is stable and does not cause an unacceptable risk to public and the environment;
- The impact of Kozloduy NPP on the atmosphere and the risks from air pollution to public health and the environment are insignificant;
- The impact of Kozloduy NPP on water and the risks from water pollution to public health and the environment are insignificant;
- Generalized results from the regular monitoring show that all observed deviations from the normal radiation background are negligible (in absolute value) and that there is no increasing trend;
- The impact of Kozloduy NPP on the soil, protected areas, flora and fauna is negligible;
- Health risk of Kozloduy NPP is negligible. Radiation protection corresponds to the national policy and meets international criteria;
- Radiation monitoring in Kozloduy NPP is very well established. Radiation conditions on-site and at the controlled points of the 100 km zone is analyzed according to the established and agreed with the NRA, Ministry of Health and MEW “Programme for radiation monitoring of the environment”.

Systematic health examinations and investigations of staff and the general public, as well as recorded individual doses confirm the conclusions for negligible impact on the environment and the population. Evaluations are confirmed: by the National Centre of Radiobiology and Radiation Protection through independent whole body analysis and measurements of the population, carried out in larger settlements within the 30 km area around the NPP; and by the official medical statistics showing low incidence of potential radiogenic diseases of the population in the region.

The EIA decision was submitted to the NRA in 2009, together with the set of documents for renewal of Units 5 and 6 operating licenses. In accordance with the conditions of the operating licenses, the licensee shall annually submit to the NRA information on the status of nuclear safety and radiation protection, including the implementation of radiation monitoring programmes and program for radiation protection of the staff.

Article 17 (3) Re-evaluation of site related factors

Activities for re-evaluation of the site related factors to ensure the continued acceptability of the safety

Belene site

Pursuant to the requirements of the site approval order, the holder shall prepare and implement additional programs for investigation of the selected site. Investigations scope includes:

- Hydrogeology and migration of radionuclides at the Belene site;
- Determination of hydrological and hydraulic characteristics of the Danube River related to the design, construction and operation of the Belene NPP;
- Analysis of the origins of events caused by human activity;
- Development of a database for monitoring the site parameters of natural, technogenic and anthropogenic origin;
- Radiation monitoring of the environment before commissioning of Belene NPP;
- Prepare a program on investigation of the health status of risk population groups at the Belene NPP region;
- Update of data on region agriculture;
- Update the demographic characteristics of the region;
- Prepare a justification on the areas with special requirements and emergency planning zones around the NPP.

Reassessment of site related factors is implemented in accordance with regulatory requirements, the EURATOM Treaty, and the applicable IAEA standards.

Kozloduy site

Activities on reassessment of site related factors were carried out within the framework of the PSR of the NPP. Review areas which have to be covered by the PSR are defined by the Regulation on Ensuring the Safety of Nuclear Power Plants. The Regulation requires review of site characteristics considered in the design and if necessary reassessment to be done on the basis of new data received and new methods used.

The Kozloduy NPP implements monitoring programs (monitoring, analyzing and documenting) the factors of natural and anthropogenic origin, including seismic monitoring, monitoring of site

hydro-meteorological characteristics, hydrologic characteristics, geodynamic processes, specific features of the site relevant to the migration and accumulation of radioactive substances.

Contemporary crust movements are monitored by use of surveying methods and by means of GPS total control is carried out of deformation of buildings and equipment and dikes of water inlet and outlet channels. Seismic monitoring instruments are used to address three major tasks:

- To collect and provide information on site seismic regime, i.e. to monitor the weakest seismic activity around the plant (this task is performed by the local seismic system);
- To collect and provide information on the behaviour (response) of structures and other systems during an earthquake (this task is performed by the SASKOK system and the seismic monitoring system);
- To register seismic acceleration of selected site points (structures) and to provide information for reactor emergency shut down (cranes, refuelling machines, turbines, etc.) under certain pre-selected conditions (this task is performed by the system to generate a signal for seismic protection - SIAZ).

According to a Program for groundwater monitoring, control of water levels and dose control are carried out. Monitoring of groundwater levels around the Kozloduy site is carried in specially built for this purpose tube shaped wells – piezometers. All piezometers are adjusted and connected to the coordinate system of the Kozloduy NPP. A total of 181 piezometers are drilled at the territory of the industrial site of Kozloduy NPP. Measurements of water levels in piezometers take place once a month.

Program monitoring system of surface water (hydrology) includes both an automated system for monitoring of water levels in the Danube River and in the Kozloduy NPP hydraulic structures, as well as control using level racks for visual inspection.

Geotechnical Control makes it possible to observe the following characteristics of the ground:

- Density and moisture in the dual channel dikes;
- Speed and direction of filtration.

The analysis of results from volumetric density control of the skeleton, water content and filtration rate in dikes makes it possible to draw conclusions about dikes conditions and their safety.

Kozloduy NPP Meteorological Monitoring System (MMS) is made up of automatic meteorological station, modification MS & E-3RMD. MMS functionality allow receipt of meteorological information, representative for the region, in normal and emergency conditions. The system automatically processes all information from various automatic weather conditions (total 3 pcs.) and provides the opportunities for receiving representative and current weather data for both current time and the dynamics and the chronology of events in previous periods. Incoming MMS information is needed to estimates radiation exposure in emergency planning zones during the early phase of an emergency. In emergency situations, MMS integrates with the automatic air drilling system. MMS software displays data on speed and direction of the main flaw and the height of mixing layer, which are produced after processing of the data received from the latest aero-logical sampling. This information is necessary in connection with Kozloduy NPP responsibilities under the existing requirements and the Convention on early notification of a nuclear accident.

Results of recent re-evaluation activities

During Kozloduy NPP Units 5 and 6 safety reassessment, carried out in the period 2008 – 2009, are reviewed the following aspects:

- Description of site region;
- Anthropogenic factors, including potential sources of danger in the region and on-site, the probability of occurrence of events, the parameters of the impacts of technogenic origin and their influences on safety;
- Hydro-meteorological factors, including effectiveness of monitoring of region meteorological parameters, assessing the probability and parameters of impacts, and other processes, phenomena and factors of natural origin;
- Geological, hydro-geological, tectonic and seismic-engineering and geological factors, including monitoring, research and complete reassessment of the probability of occurrence of phenomena;
- NPP impact on public and the environment - conventional and radiological aspects of the impact on environment components are re-evaluated;
- Combined list of possible impacts on the site.

Revaluation of 34 criteria relating to these aspects was carried out and additional measures were planned which are included as part of the "Program to improve nuclear safety and radiation protection based on the results of safety re-evaluation.

Regulatory review and control activities

Regulatory review and control of re-evaluation of site related factors is made within the process of administrative proceedings, including renewal of operating licenses.

Authorization regime, as specified by the ASUNE, allows renewal of nuclear facility operating license to be done based on reassessment of nuclear safety and radiation protection. Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy requires the submission of a recent report on the safety reassessment (PSR), together with the application for license renewal.

Article 17 (4) Consultation with other Contracting Parties likely to be affected by the installation

International agreements

Consultations with other Parties, likely to be affected by the facility, are conducted in accordance with the Convention of the Economic Commission for Europe of United Nations to assess the environmental impact in a Transboundary Context, done at Espoo, Finland, and to which the Republic of Bulgaria is a party. In accordance with Article 3 of the Espoo Convention, Ministry of Environment and Water of Bulgaria has notified the authorities of Romania on the plans for the construction of Belene NPP. EIA in a Transboundary Context is described within the information included in the EIA report, with particular attention being paid to aspects of transboundary impacts and measures for their prevention and mitigation.

In compliance with the requirements of Article 105 of the EURATOM Treaty, on 24.01.2007, the Republic of Bulgaria notified the European Commission on the signed agreement between NEC and Atomstroyexport for design, procurement, construction, and commissioning of Belene NPP, Package included all existing agreements and contracts with third parties in the field of nuclear energy.

Bilateral agreements with neighbouring countries, if applicable and appropriate

There are bilateral agreements between the Government of the Republic of Bulgaria and the Government of Romania, Greece and Turkey on Early Notification of a Nuclear Accident and the Exchange of Information on Nuclear Facilities. Under these agreements, the Contracting Parties notify each other when they provide construction of new nuclear facilities and provide the necessary technical information concerning these facilities.

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

Article 18 (1) Implementation of defence in depth

Overview of arrangements and regulatory requirements concerning the design and construction of nuclear installations

The main criteria and rules for nuclear safety and radiation protection, as well as organizational measures and technical requirements for ensuring safety in the siting, design, construction, commissioning and operation are defined by the Regulation on Ensuring the Safety of Nuclear Power Plants. Under this Regulation, NPPs safety shall be ensured by consistent implementation of the concept of defence in depth, which is based on using a system of physical barriers in the pathways of ionizing radiation and radioactive substances distribution; and a system of technical and organizational measures to protect barriers and maintain their effectiveness and for protecting the public, staff and the environment. The system of physical barriers of any unit include: fuel pellet, fuel elements cladding, reactor coolant boundaries, and the containment. It is required that the system of technical and organizational measures shall cover all levels of protection.

The concept of Defence in Depth applies at all stages of activities related to ensuring the safety of NPPs. Measures to prevent adverse events on first and second levels of protection have priority over other safety related measures.

The Regulation specifies the requirements on the design bases and safety assessments of nuclear power plants. It is required that design basis shall determine the necessary features of the NPP, which to ensure that in all operational states the limits for internal and external exposure of personnel and population and the limits on discharges of radioactive substances into the environment and design basis accidents are not exceed. Design basis shall include design limits, NPP operating states, safety classification of the SSC, design key assumptions, and in some cases special methods of analysis.

The Regulation requires that as a minimum design limits shall include:

- Radiological and other technical criteria for acceptability under all operating and emergency conditions;
- Criteria to protect fuel elements cladding, including: fuel temperature; departure from nuclear boiling margins; cladding temperature; tightness of fuel elements; and acceptable fuel damage under all operating conditions and Design Basis Accidents (DBA);
- Criteria for protection of reactor coolant boundaries, including maximum pressure, temperature, thermal and mechanical loads and transients;
- Criteria for protection of the containment of the reactor installation, including temperature, pressure and leak rate, in order to provide the adequate margins, which

to ensure containment integrity and tightness in extreme external events, severe accidents and combination of initiating events.

To determine the boundary conditions, under which safety important SSC are designed, manufactured and installed, design shall define DBA initiating events. Selection of postulated initiating events shall be based on the use of deterministic and probabilistic methods.

The Regulation requires that postulated internal initiating events shall be grouped into separate categories of NPP states, depending on the expected frequency of occurrence. Also, NPP design shall analyse as initiating events: possible human errors and possible combinations of internal and external events. Analyses shall be based on realistic assumptions.

It is required that NPP design shall take account of specific environmental conditions and loads to safety important SSC, resulting from internal events and site specific external events and hazards.

In addition to the design basis, unit behaviour in Beyond Design Basis Accidents (BDBA) shall be analysed. List of BDBA without significant damage to the core is defined, which shall be considered by the design, if not prevented by the inherent safety features of the reactor system and its construction principles.

If the analysis of severe accidents consequences does not confirm the performance criteria for the radiological exposure of the population, identified in the Regulation, the Design shall provide additional technical means for severe accidents management in order to limit their consequences. Furthermore, the NPP shall be designed in such a way that the frequency of large radioactive releases into the environment, which require implementation of public protective, to be extremely low.

SSC important to safety shall withstand, with sufficient margin, the postulated initiating events. In order to determine the case where the principles of diversity, redundancy and independence shall be applied to achieve the required reliability, NPP Design shall analyze common cause failures modes. NPP Design shall prevent to a practically achievable level:

- Conditions leading to degradation of physical barriers;
- Failure of a physical barrier, if there are conditions under item 1;
- Failure of a physical barrier, as a consequence of the failure of another physical barrier.

It is required that under all operating modes and accident conditions, the unit shall be able to fulfil the fundamental safety functions and other related functions. The Design shall use the principles of diversity, self-testing of safety systems and elimination of inter dependencies between SSC - to the extent practicable.

Postulated initiating events shall be analysed using the criteria for: an independent single failure of an active or a passive component of the safety systems, which has the most negative impact on situation development; or a single human error. Hidden failures leading to violation of safety limits are additionally considered.

Status with regard to the application of the defence in depth concept

Kozloduy NPP

Kozloduy NPP units 5 and 6 Designs were developed in the early 80's in the former USSR based on the unified reactor design VVER-1000/V-320. Safety principles and criteria on which the original design is based are included in the part of the design “Technical justification of safety”. The basic design principles and safety criteria are defined in “General Provisions for Ensuring the Safety of Nuclear Power Plants during Design, Construction and Operation”.

The main principle incorporated in the design to provide protection of workers and the public from external and internal exposure and protection of environment from contamination by radioactive substances. The Design provides technical measures and means directed to ensuring safety in case of a single failure of a normal operation device, which may coincide with a long lasting hidden unavailability of another device. Together with the failure of the device to normal operation, a failure of one of the independent active protection devices and one of the independent active localization devices is considered. Protective and localisation devices perform their safety functions in all accident conditions, including so-called "Maximum design basis accident". They have characteristics sufficient to perform their functions, and have triple redundancy, including power supply. The primary coolant boundary is located completely in sealed compartments (containment). All containment penetrations are equipped with localizing devices. Individual pressure testing devices are provided for all respective penetrations.

The technical design specifies as a Maximum DBA the sudden guillotine break of a main coolant pipeline in the case of a complete loss of internal power supply and in the event of a maximum earthquake (SL-2).

Used main design principles and safety criteria, including application of independence, redundancy and diversity, in general fulfil the main concept for Defence in Depth, as defined by IAEA INSAG-3 and revised in INSAG-12. Comprehensive international assessment of VVER-1000/320 design, in respect of implementation of Defence in Depth concept, was carried out under the IAEA extra-budgetary program in the period 1992-95. Recommendations given by the relevant report were used to develop Kozloduy NPP Units 5 and 6 "Programs to improve safety and reliability". At present, all planned measures to eliminate identified deficiencies are implemented. The results of the updated safety analysis, including accident analyses carried out using modern computer codes, as well as the periodic safety reassessment show the successful implementation of these measures ensure reliable levels of protection, including maintaining of normal operation, preventing accident development and mitigation of the consequences from design basis accidents. Moreover, the analyses confirm safety is also ensured during BDBA without significant core damage, including Anticipated Transients Without Scram (ATWS). Specific components have been installed to reduce the consequences from BDBA in order to protect workers and the public.

Belene NPP

To compensate for potential failures due to human errors or mechanical failures, the concept of defence in depth is implemented in the Belene Design. It is based on several layers of protection with effective barriers to prevent release of radioactive materials into the environment. Design foresee that all physical barriers be available in normal operation, while the means for their protection are in a standby state. Operators actions are planned for reactor shut down and maintaining in safe shut down state when inoperability of any of the physical barriers or its protective means are identified. For the effective implementation of the concept, safety systems are provided to perform the following functions:

- Emergency reactor shutdown and maintaining of the reactor in a safe sub-critical state;
- Emergency heat removal from the reactor and from the spent fuel, located in the SFP;
- Retention of radioactive materials within the specified boundaries by both active and passive safety systems.

Safety systems are of the following types: protective, localization, support and control.

Containment system together with the hermetic pipelines and cable penetrations is intended to contain radioactive substances within the specified boundaries and prevention of their release to the environment. Containment system consists of primary (internal) and secondary (external)

structure. Primary (internal) containment is made of pre-stressed concrete and is designed to contain radioactive substances in the designed boundaries to limit their release into the environment in design basis accidents. The secondary structure serves to protect systems and components of the reactor building of special natural and anthropogenic impacts. Both structures provide biological protection from ionizing radiation.

Measures for management of BDBA achieving the following objectives:

- No need of urgent protective actions at a distance exceeding 800 m from the reactor;
- No need of delayed actions at any time outside the area with a radius of 3 km from the reactor;
- No need of long-term action of any distance exceeding 800 m from the reactor;
- Limited economic impact outside the site area.

Use of design principles

Kozloduy NPP

The design of Kozloduy NPP Units 5 and 6 SSC, important for the safety, uses design solutions based on: passive principle of actuation, fail-safe principle and inherent safety features (self-control, thermal inertia and other natural processes). The presence of internal self-protection and passive elements of safety systems provide significant safety margins for a successful and long-term reactor cool down.

Specific technical solutions, applied in the design of safety systems, are related to the implementation of the basic requirements of the regulations – multi-channel structure (redundancy), physical separation and diversity. Multi-channel design allows the safety system to perform its functions independently of any failure of one channel (single failure). Automatic devices are triggered by signals, generated by comparing several measurements, in order to prevent spurious actuation of the safety systems in accidental deviation in measurements. Physical separation of channels is achieved through the placement of each channel in separate rooms with separate cable runs. This feature allows the successful work of the safety system, even in the event of failure of one channel due to internal events (fire, explosion, heat, flood, etc.). Diversity principle in safety systems design is applied by using both active (pumps, electric valves) and passive devices (pressurized return valves) in order to eliminate the possibility of failure of all safety systems due to common cause (power supply, working environment, etc.). The combination of redundancy, diversity and physical separation ensures safety systems protection from common cause failures.

Belene NPP

Safety systems are designed failsafe, including common cause failures and are able to perform their functions in case of loss of power supply. To achieve that, the following requirements are applied:

- Any safety system consists of two completely independent subsystems. Each subsystem consists of two channels, each of which is able to perform the functions of the whole system;
- Number of system trains is selected and based on the implementation of the single failure principle;
- Any protective safety system consists of active and passive part, each of which is able to perform assigned safety functions;
- Spatial separation as well as constructive protection is ensured for safety systems trains;

- To minimize operator errors, automatic systems for the introduction of protective actions are used, while control actions are blocked when disturbing implementation of safety functions;
- Active safety systems are provided with power supply from independent sources (diesel generators), meeting the requirements for supporting safety systems.

Implementation of design measures to prevent beyond design basis accidents or to mitigate their radiological consequences

Kozloduy NPP

As part of Units 5 and 6 design modifications, over the past five years have been installed additionally: systems for hydrogen burning in the containment; containment pressure reduction through a filter installation "type scrubber", system for alternative feeding of steam generators at accident conditions with complete loss of external power (blackout), which is powered by a mobile power generator with a diesel engine. Implementation of these measures together with the developed SAMGs result in improved the protection of primary circuit and containment boundaries, so as to reduce the consequences of severe accidents, to reduce discharges of radioactive substances to the environment and to bring reactor installation into controlled state.

Belene NPP

For management of BDBA accidents, including severe accidents, the Design provides technical means for prevention and mitigation of consequences, including:

- Fast boron injection system;
- Means to reduce pressure in the primary circuit;
- A system for passive heat removal;
- A system for control and lead away of hydrogen concentration inside the containment;
- A system to collect and cool down of reactor molten core;
- Passive filtration system of the gap between primary and secondary containment;
- Means for emergency power supply;
- Instrumentation (measurement means) used in management of BDBA.

Improvements implemented for designs for nuclear power plants as a result of deterministic and probabilistic safety assessments

Kozloduy NPP program for modernization of Units 5 and 6 was fully completed after the fourth national report. The main objective of the modernization program was to implement improvements needed to bring the units in accordance with international requirements for safety and reliability. The program was based on IAEA document Safety Issues and Their Ranking for VVER-1000 Model 320 Nuclear Power Plants IAEA-EBP-VVER-05, 1996. Modernization program included 212 measures to improve safety, operations and reliability of the units.

Two thirds of modernization measures were directed to improvement of units' safety and equipment reliability. Various studies were conducted in different aspects of safety such as:

- 5 neutron-physical analysis;
- 32 thermal-hydraulic analysis;
- 4 radiological analysis;

- 7 mechanical strength analysis.

Review of existing and implementation of additional analyses are carried out with extended scope with application of conservative assumptions, modern methods and computer codes and in accordance with internationally accepted requirements.

Equipment ability to perform its design functions was verified. Equipment is classified according to safety, seismic conditions and quality criteria. Safety classification was made according to the requirements of document OPB 88/97 (General Provisions for Ensuring Safety of Nuclear Power Plants) and compared with IAEA requirements - IAEA 50-SG-D1. Seismic classification is done based on IAEA 50-SG-D15 with due consideration of PNAE G-5-006-87 Seismic Design Norms for Nuclear Power Plants. The classification of equipment and piping in quality groups is carried out in accordance with the Russian standard PNAE G-7-008-89 Design and Safe Operation Rules for Nuclear Power Plants Components and Piping. PNAE G -7-008-89.

Within the modernization program, the range of analyses has been significantly expanded to determine units' capabilities to manage BDBA. For this purpose, were investigated:

- 18 design basis accidents, for some of which different scenarios are analysed;
- 10 beyond design basis accidents (with low probability);
- 4 severe accidents (with negligible probability).

The most important results of these analyses are:

- Risk assessment of brittle fracture of reactor pressure vessel confirm the conclusion that reactor vessel lifetime is ensured for at least another 35 fuel cycles (for unit 5), respectively 39 fuel cycles (for unit 6) with the current fuel loading schemes. Moreover, after implementation some additional measures reactor vessels lifetime could be further prolonged;
- Modified algorithms of protections and interlocks (control of steam generators level and control of reactor power) improve units' sustainability in dynamic transients. Thus, the reduction of likelihood for deviations from operational limits reduces the frequency for initiating transients;
- Analysis of transients resulting from initiating events with extremely low frequency demonstrate the inherent safety of the core;
- Analyses of large, medium and small leaks from the primary circuit, as well as the radiological impact of inter-system leaks, confirm safety systems capability to bring units in a safe sub-critical state; to provide core cooling; and to reduce radioactive discharges within established limits.
- Seismic resistance and building structures margins are sufficient in respect to the new seismic impact - 0.2g. For this purpose, 27 analyses of equipment and 47 analyses of pipelines were carried out.

Implemented measures remove known design deficiencies of the VVER-1000/V-320 design. Completely new systems are installed, which were not included in the original design of the units, such as:

- System for continuous hydrogen monitoring and recombination, which prevents the possibility of explosion due to accumulation of hydrogen in the containment, in the case of design basis accidents;
- Strengthening of main steam lines and feedwater piping against local mechanical impacts due to pipe breaks;

- System to measure and control water level in the reactor pressure vessel required for the management of transients (small loss of coolant accidents, leaks from primary to secondary side, residual heat removal without using main circulation pumps);
- Automatic cold overpressure protection of the reactor vessel during reactor start-up and shutdown;
- Filter ventilation system for containment protection from untightness (loss of tightness) and minimization of radioactive discharges into the environment in terms of BDBA;
- System for continuous monitoring of 6 kV motors isolation, when in standby.

Regulatory review and control activities

Implementation of the authorization procedure, as required by the Act on the Safe Use of Nuclear Energy, is carried out following the requirements of the Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy. The Regulation, among others, establishes the process of issuing of a design permit for a nuclear facility.

Evaluation of design and technology of Kozloduy NPP units 5 and 6 of was initially carried out by NRA in the context of review and assessment of the application for construction. At a later stage, the evaluation was continued during their commissioning. Safety of units design is reassessed in 2008-2009 in respect to the renewal of operating licenses, on the basis of the periodic safety review.

Concerning the Belene NPP, a detailed review and assessment of units' safety is being carried out within the process of design approval. The review and assessment focuses on the sufficiency of information to demonstrate compliance with regulatory requirements, particularly the application of Defence in Depth; justification of new technologies used and their qualification by experiments or analysis or any combination thereof.

Article 18 (2) Incorporation of proven technologies

Arrangements and regulatory requirements for the use of technologies proven by experience or qualified by testing or analysis

In accordance with the Regulation on Ensuring the Safety of Nuclear Power Plants design technical solutions, technologies and procedures should be defined and justified in accordance with the recent development of science and technology and internationally recognized operating experience. Own and international operational experience and scientific and technical achievements in nuclear technology shall be systematically analyzed and used for continuous safety improvement.

In fulfilling these requirements, Decision № 260 of Council of Ministers from 2005 to build a nuclear plant at Belene site, agrees to the maximum installed capacity is 2000 MWe to be based on evolutionary design using probated technical solutions of a pressurized water reactor.

Requirement for the use of proven in practice or otherwise qualified technology is incorporated in the conditions of the design permit for units 1 and 2 of Belene NPP.

Measures taken by the licensees to implement proven technologies

Kozloduy NPP

Modernization program improved reliability in the operation and ensures long term operations for Units 5 and 6. Old information and control systems were replaced with new ones, based on digital instrumentation and control. Replacements preserve equipment location in the compartments and the layout of measuring and control devices at the MCR, as well as control and alarm algorithms. The new control safety systems and new computer systems are implemented after evaluation of the experience of their use in manufacturing countries. Other safety systems such as system for overpressure protection of primary circuit and containment hydrogen control and combustion system are put in place following the same procedure. Significant expansion of functionality, enhancing the reliability of the performance of assigned functions and reducing the volume of maintenance and repair is achieved. For example:

- In the new computer information system "Ovation" is implemented all the functions of the previous system Titan. Modern hardware provides virtually unlimited opportunities for storing and archiving information on the various processes of units and needed to optimize the operation of equipment;
- Replacement of outdated analogue equipment with digital control processes improves operator interface, functional reliability and availability of the system. Design is with distributed functions, redundant configurations, easy maintenance features and self-diagnostics, modular design and flexibility for future upgrades without the need of unit shutdown;
- Automated control system of the turbine was replaced with a new computerised system, which uses a common platform and communication network with other I&C systems;
- Installation of new radiation monitoring system provides continuous and accurate monitoring of discharges.

Using of new fuel is preceded by several years of operation of the fuel at Russian and Ukrainian NPPs.

Belene NPP

One of the principles in the design of Belene NPP is the use of proven components with well-documented characteristics of reliability and integrity. New design solutions are selected only if they provide clear advantages in one or more specific areas (e.g. safety, cost efficiency, service reliability) without a significant impact on other areas.

Technical and organizational solutions to ensure the safety of Belene NPP are proven by previous experience or by tests, experiments, operating experience of prototypes. This applies not only to equipment selection and the design, but also to manufacturing of equipment, construction and operation of NPP. In this respect, a number of safety systems implemented in the design have remained practically unchanged from operating plants and modernization of other was carried out based on operational experience and long-term comprehensive research and engineering design work.

During design of safety systems are used well studied processes and phenomena, as well as types and kind of equipment, which are traditional for the safety systems of operating plants.

Analysis, testing and experimental methods to qualify new technologies

Kozloduy NPP

All new technologies, such as digital instrumentation and control have been put into service after appropriate analysis of their reliability and full examination of the manufacturer and on-site, concerning their compliance with design features, including extreme operating conditions. Pre-operational tests are carried out in accordance with step-by-step procedures for validation and verification of software and hardware.

Belene NPP

To confirm the reliability of newly developed equipment, whose characteristics differ from those used in existing NPPs, are carried out calculations and experimental models, as well as actual testing of samples prototypes.

Regulatory review and control activities

Regulatory review and control activities are carried out in conformity with the legislative framework and are described under Article 18 (1). They cover the abovementioned aspects.

Article 18 (3) Design for reliable, stable and manageable operation

Overview of arrangements and regulatory requirements for reliable, stable and easily manageable operation

Regulation on Ensuring the Safety of Nuclear Power Plants provides requirements on the management of technological processes. Management and control systems for normal operation and safety systems of each unit shall be provided with main control room, backup control room, control systems for normal operations, control safety systems and automated devices for registration and storage of information. From the MCR measures are taken to maintain the unit in a safe state or to restore this state under all operating conditions and design basis accidents. Required control and protection systems are designed to automatically trigger the necessary systems, including those for reactor shutdown to ensure compliance with the design limits in anticipated operational occurrences.

NPP Design shall considered human errors as possible initiating events and shall take account of possible combinations of internal and external events based on realistic assumptions. Probabilistic safety analysis shall include analysis of human errors with consideration of factors that may influence the behaviour of operational staff in all operational states and accident conditions.

Implementation measures taken by the licensee

Kozloduy NPP

Modifications related to providing of operational staff at the MCR with expanded in volume and quality information concerning the physical barriers and levels of protection are described under Article 12. Along with the modernization activities, measures are applied for elimination of issues with equipment reliability, failures of which require prompt action of the operators. For example, for the period January - August 2003, 6 cases of power reduction were recorded at unit 6 due to condenser problems. Since 2004, the replacement of condenser modules resolved the issue with tubes plugging, SG water-chemistry regime is improved, as well as efficiency.

Reliability of electrical equipment has been improved by implementing the following activities:

- Replacement of the equipment for continuous power supply (increased mean time to failure from 8000 to 100,000 hours);
- Replacement of safety systems 6 kV Switchgear and installation of two sets of equivalent protections and new microprocessor equipment with increased service time;
- Replacement of the power switches (KAG-24);
- Implementation of additional controls of turbine generator windings isolation. Real time digital radio-frequency system can monitor and detect emerging failures in the high-voltage equipment before they cause serious damage to equipment.

Managerial and organizational aspects related to human factors are discussed in the text of Article 12.

Belene NPP

To ensure reliable, stable and manageable operation, Belene NPP technical design includes the following measures:

- Providing the operator with the means to manage the NPP, including means for operational and dispatching local and remote controls for interlocks, protections, signalling and automatic regulation, and automation equipment supplied complete with IT equipment;
- Control, detection and reporting of deviations from the normal processes, including means for visualisation and registration;
- Ensuring the independence of safety actions, including reactor shutdown from control actions;
- Prevention of adverse consequences of accidents for a considerable time span (minimum 30 minutes) without operator intervention, and providing the necessary means for follow up actions, if necessary;
- Organization of man-machine interface of the operating personnel based on the display control and management means and individual reserve control means.

The following types of management of technological facilities are provided:

- Automatic control;
- Functional-group management;
- Automated remote control;
- Management of the site.

In general, highest priority has automatic control. Then, according to the importance of priorities follow: a functional-unit management, automated remote control and control at the place.

In automatic management control, operations are performed without the participation of staff. The operating staff can, if necessary, set the conditions for implementation of automatic control for various states of normal operation of the unit.

In determining the level of automation of technological tasks, using functional-unit management, human operator is regarded as main central management unit, who performs the most responsible tasks in unit management in normal operation regimes. Moreover, the human factor plays an important role in ensuring the safety of the plant. In functional-unit management operations are performed according to algorithms to solve technological problems. Programs for

functional-group management are implemented taking into account the following principles of interaction with the operator:

- The operator carries out continuous monitoring of management processes and implement some of the operations or management functions independently (principle of “active operator”);
- Extremely responsible operations are performed by the operator or by the automation after the decision of the operator and under his control (the principle of “responsibility”);
- Automated remote control is realized in the following ways:
  - Display means of control (display control);
  - Individual and backup control with the use of individual controls.

Individual means for management and control are provided only in case of complete (short or long) failure of the display controls and control room panel.

Individual control means are located near the display control means. Individual means of control used on the safety panels are placed by trains. This is due to the convenience and safety of all of these means, including repairs. Within a separate safety train, individual control and management means are grouped according to the safety functions.

Regulatory review and control activities

Regulatory review and control activities are described in Article 18 (1) and are carried out in accordance with the legislation and internal rules (see also Article 7 (2) (iii)).

Article 19 Operation

Each Contracting Party shall take the appropriate steps to ensure that:
i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;
ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;
iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;
iv) procedures are established for responding to anticipated operational occurrences and to accidents;
v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;
vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;
vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;
viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

Article 19 (1) Initial authorization

Overview of arrangements and regulatory requirements for the commissioning of a nuclear installation

Regulation on Ensuring the Safety of Nuclear Power Plants requires the development of a program for commissioning to verify construction and installation activities compliance with the design and conformity of SSC characteristics and parameters of technological processes with design requirements. NPP commissioning shall be performed in successive stages and a separate program for each stage shall be developed. The implementation of each stage shall be preceded by an evaluation of the results from the previous stage and confirmation that objectives and design requirements have been met. Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy specifies the documents, which shall be submitted to the NRA to obtain a commissioning permit, in general for each stage separately.

Conduct of appropriate safety analyses

Safety analyses shall be included in the Interim SAR, which is required for design approval by an Order of the NRA Chairman (a licensing stage prior to commissioning entry). Commissioning programs shall provide for all necessary tests to confirm the design characteristics of the NPP referred to in the interim SAR.

Commissioning programmes

Any commissioning program shall include objectives, descriptions and implementation timetable for all important activities. Programs shall describe:

- The sequence, timing and logical connections between activities on the stage;
- Requirements on technological preparation and provision of power sources and fluids;
- Criteria for acceptability and for assessment of their fulfilment;
- Initial and final time of the respective stage;
- Organization of activities and required staff;
- The conditions for transition to the next stage;
- List of specific procedures for implementation of activities.

Programmes of verification that installations, as constructed, are consistent with the design and in compliance with safety requirements

Before initial core loading with nuclear fuel, shall be completed:

- Safety important systems shall be installed, tested and be available;
- Tests to determine the characteristics of the reactor coolant circuit shall be carried out;
- Effectiveness of the biological shielding shall be tested;
- Radiation monitoring shall be carried out at the premises, the site, the radiation protection and surveillance zones.

Before initial criticality of the reactor installation, functional tests of safety important SSC shall be carried out, to confirm the fulfilment of design functions and the compliance with design characteristics. The transition from one to other levels of reactor power shall be done after successful neutron-physical experiments on the reactor installation and completion of all construction and installation activities.

Protocols shall be written for all conducted tests and experiments, which shall include:

- Description of the activities;
- Compliance analyses design and actual characteristics of tested equipment;
- Description of defects and failures;
- Analysis and conclusions about the causes and acceptability of deviations of actual from design characteristics and measures for their elimination.

Regulatory review and control activities

Before issuing of a commissioning permit for a particular stage, it is required that a NRA Commission carries out an on-site inspection to verify compliance with the declared facts and circumstances and licensee preparedness to implement the respective stage. Based on the NRA inspection report, recommendations and comments of by other specialized authorities as well as the report on elimination of identified deficiencies, the NRA Chairman may give consent on the implementation of the respective stage.

Article 19 (2) Operational limits and conditions

Overview of arrangements and regulatory requirements for the definition of safe boundaries of operation

The Regulation on Ensuring the Safety of Nuclear Power Plants requires the operation of nuclear power plants to be conducted in conformity with the operating limits and conditions, in order to maintain the levels of protection of the physical barriers in a state of availability. Operating Limits and Conditions (OLC) shall be defined and justified by the Design and safety analysis, and shall be adjusted according to test results during commissioning. They shall be reviewed periodically and if needed in order to reflect operational experience, modifications to SSC, new safety analysis, and development of science and technology. Operating Limits and Conditions shall cover all operating conditions, including at power operations, sub-critical state of the reactor installation, refuelling all the transitional states between these modes of operation. They shall include at least:

- Safety limits;
- Actuation parameters of safety systems;
- Operational limits and conditions;
- Testing, inspection, supervision and operational control of the SSC, important to safety;
- Minimum operational control in respective operating conditions, including qualified and experienced personnel at the main control room;
- Operators' actions in deviations from the limits and conditions for operation.

OLC, collected in one document (Technical Specifications) shall be easily accessible to MCR staff, who shall be well acquainted with them and their technical bases.

Implementation of operational limits and conditions, their documentation, training in them, and their availability to plant personnel

Safety limits and OLC are justified in the technical design and SAR of Units 5 and 6 and are reflected in the Technical Specifications of each unit. The Technical Specifications include all operating limits and conditions, justified in the original design, taking into account the modifications in SSC important for safety.

Administrative control to implement the operational limits and conditions is carried out by managers of operating sectors. Compliance with operational limits and conditions are discussed at the daily briefings at the office of the Chief Engineer. In the case of an entry into the areas restricted by the operating limits, immediate action ate taken to restore to normal operation. Those cases are documented in accordance with the operating instructions and are reported to the NRA. Violations of operating limits and conditions are monitored by the monthly indicators for self-assessment. The number of entries into monitored areas and the number of violations of operating limits and conditions are monitored, recorded and trended.

Compliance with operational limits and conditions is part of the safety culture and staff receives appropriate training at the Training Centre, in accordance with the methods and means of initial training and retraining. In modification of operational limits and conditions, briefings and additional training are carried out.

Review and revision of operational limits and conditions as necessary

Changes in operational limits and conditions may be required: by implementation of technical solutions for modifications to safety important SSC; by operating experience; by changes in the status of the nuclear facility; or by the analysis of operational events. Proposed amendments shall be thoroughly analysed for possible consequences, following an approved internal procedure. Changes shall be justified and submitted to the NRA together with a request for authorization of the amendments to the technical specifications.

New Technical specifications structure and contents were approved, in respect of the large number of SSC modifications, implemented during the Units 5 and 6 Modernization Program, as well as to ensure more convenient use by the operational staff. The new revision takes account of IAEA Safety Guide NS-G-2.3 “Operational limits and conditions and operational procedures for NPPs”.

Regulatory review and control activities

NRA site inspectors carry out daily control of performed activities and fulfilment of operational limits and conditions. Changes to OLC are subject to authorization, which requires their detailed justification. One of the cornerstones of NRA review and assessment of changes to OLC is the impact of the proposed changes on existing limits and conditions.

Article 19 (3) Procedures for operation, maintenance, inspection and testing

Overview of arrangements and regulatory requirements on procedures for operation, maintenance, inspection and testing

The Regulation on Ensuring the Safety of Nuclear Power Plants requires:

- Operating personnel shall operate the NPP in accordance with written operating instructions and procedures, which shall be developed on the basis of design and technical documentation, OLC, and commissioning results. Operating instructions and procedures shall include personnel responsibilities, ways of operational coordination and interrelations, and particular directions on tasks implementation under all operating conditions.
- Operating organization shall develop, periodically review and implement programs for testing, maintenance, repair, inspection and control in order to maintain efficiency and reliable operation of safety important SSC, in accordance with the Design and QMS throughout the lifetime of the facility. To carry out different types of testing, maintenance, repair, inspection and control, written procedures shall be developed and approved in accordance with the QAP.
- Base metal and welded joints conditions shall be periodically monitored by qualified non-destructive control of areas, methods, personnel, ability to detect defects, and effectiveness - following specially designed procedures.
- Control activities and tests that are not described in the Technical specifications or operating instructions, shall be implemented using specially developed programs and procedures, which shall be approved by the NRA.

Establishing of operational procedures, their implementation, periodic review, modification, approval and documentation

Kozloduy NPP Units 5 and 6 are operated in accordance with written instructions and procedures, developed on the basis of design and technical documentation, limits and conditions for operation, results of commissioning and preoperational tests (initial and after PAO with account of modifications made).

Operational documentation includes instructions for operating systems and equipment, programs or procedures for maintenance, testing, inspection, instructions for execution of various activities (e.g. analysis of operating experience, design modifications, etc.), alarm and emergency procedures. The level of detail in each instruction, program or procedure is consistent with the objectives of the document to provide clear, concise and to the extent possible, verified and substantiated guidance.

QMS determines the order to develop, update and control the operating instructions and procedures, which to reflect the actual status and safety requirements. Requirements towards controlled documents and in particular format and contents, development methods, identification, coordination, promotion, and distribution, as well as maintaining them up to date are specified by an internal instructions part of the QMS: "Format and contents of PG-2 documents", "Control of documentation at PG-2", and "Management of documentation at PG-2". Documentation Management System ensures the use only of latest versions of the documents. Modifications in documents take effect after their approval by a specific authorizing document.

Availability of the procedures to the relevant staff

Operating instructions and procedures are clearly identified. Easy access to them is ensured at all control rooms and panel, as well as at other operational compartments. A list of instructions in force is maintained at the working places.

Programs and procedures for maintenance, testing, inspection and surveillance are used in implementing the respective activities. As annexes are included check-lists for step-by-step implementation and recording of results. Depending on safety importance, of completion of an activity is documented by an Act, Protocol or Maintenance report card.

Involvement of relevant staff in the development of procedures

Operational procedures and programs for testing, inspection and supervision are developed by the staff and with respect to the required and appropriate competence and knowledge. Operational and maintenance personnel are acquainted with the contents of detailed instructions and procedures and amendments thereto. QMS determines the order to acquaint operational staff with changes to documents.

Incorporation of operational procedures into the management system

Irrespective of the management system applied – IMS or QAS, operational instructions and procedures occupy the lowest hierarchical level. Requirements of both management systems to those level documents are identical and consist in the fact that they shall be suitable for use by certain individuals and that their content is clear, concise and unambiguous.

Regulatory review and control activities

The ASUNE requires authorization of changes to internal rules for the activity, including instructions, programs, Technical Specifications and other documents, which are attached to the operating license. Attached to the operating license is a list of respective documents like: Technical Specifications with the OLC, procedures on: emergencies, metal control, physical protection, radiation monitoring, organizational documents and quality control. NRA also supervises the revision of operational documents, resulting from modifications to SSC important for safety.

Article 19 (4) Procedures for responding to operational occurrences and accidents

Overview of arrangements and regulatory requirements on procedures for responding to anticipated operational occurrences and accidents

Regulation on Ensuring the Safety of Nuclear Power Plants requires that actions of staff in DBA and BDBA shall be defined by instructions, which shall be developed on the basis of the Final SAR, OLC and further examination and analysis of plant behaviour under degraded conditions. Personnel actions provided in the instructions shall lead to recovery of the unit to a safe state or to ensure maintaining of the plant in a safe state for an extended period after the accident. Personnel actions to diagnose unit condition, to restore or compensate degraded safety functions, and the prevention or mitigation of core damage consequences, shall be specified by SBEOP and SAMGs. SBEOP should include procedures to diagnose conditions, for optimal recovery in transients and design basis accidents, to monitor the conditions, and to restore safety functions. They shall clearly identify transition to SAMGs.

Form, structure and content of SBEOP are specified. Requirements to use specific units' data have been established. Emergency operating procedures shall be verified and validated by independent experts. Procedures shall be validated with computer programs and models in respect of operators' actions effectiveness. Implementation of operating steps shall be validated by means of simulators. Procedures shall be updated periodically. After modification, procedures shall undergo re-validation.

Establishing of event based and/or symptom based emergency operating procedures

SBEOP were introduced for use in September 2009, after successfully carrying out the process of verification, validation and staff training. They replace the existing event oriented emergency instructions. SBEOP reflect all modifications made during the Modernisation Program.

SBEOP set includes:

- Diagnostic instruction;
- Instructions for optimal recovery, based on the event principle;
- Instructions for functional recovery, based on the control of critical safety functions and their degradation;
- Operating instructions in case of degraded barrier, covering BDBA.

Introducing SBEOP was preceded by a significant analytical work, justifying the critical safety functions and their degradation, as well as main and alternative operator actions. Important points are:

- International Nuclear Safety Program (INSP) of the U.S. DOE. Within program framework, which purpose was to develop SBEOP for VVER-1000, theoretical justification analysis (analytical substantiation) of SBEOP of Kozloduy NPP were carried out by PNNL-USA, OKB Gidropress, Energoproekt and INRNE-BAS (in the period 1997 - 2003). These assays were used to develop the first and second revision of the SBEOP;
- In 2002, the task "Identification of critical safety functions and their degradation at Kozloduy NPP Units 5 and 6" was completed and analyses results were used in the next revision of the SBEOP;
- In 2006, analyses of postulated ruptures of steam generators feedwater piping were carried out. Analyses results were used to justify the modifications associated with introducing new protections and interlocks and design changes to steam generators feedwater system. Respectively, emergency procedures were modified.

Emergency procedures, covering incidents and transients without actuation of the reactor protection are being developed. Some are already in use.

Establishing of procedures and guidance to prevent severe accidents or mitigate their consequences

An extensive study was carried out in the period 2003 ÷ 2004 on phenomena and development of guidelines for management of severe accidents (PHARE project). As a result, key strategies for protection against severe accidents were defined, SAMGs were developed and technical measures for management of severe accidents were identified. In the subsequent period, technical solutions on management of severe accidents were implemented like: installation of large-scale temperature control of the reactor vessel; installation of high-temperature plugs in the ionization chambers channels in the reactor shaft; installation of a system for alternative feeding of steam generators in the event of total blackout. Alternative feeding of steam generators was installed on both units, during the planned outages in 2008 and 2009.

Implementation is planned of installation of high-temperature plugs in the ionization chambers channels and installation of high-temperature control of the reactor.

Regulatory control and review activities

NRA gives methodological guidance and controls the process of developing SBEOP since the beginning. All licensee documents related to elimination of deviations from normal operation and accidents prevention are part of the operating license and are subject to review and assessment by the NRA. In all cases, in which licensee applies for modifications to SSC or to operational documents, assessment is made of impact on SBEOP or SAMGs.

Article 19 (5) Engineering and technical support

General availability of necessary engineering and technical support for all nuclear installations

Construction, commissioning and operation of Kozloduy NPP units were carried out by engineering and technical support by Bulgarian and Russian design and engineering organizations and research institutes, as well as and manufacturers of equipment. General Designer of the units is OKB "Gidropres", a supervisor is Kurchatov Institute. Bulgarian Design

Institute Energoproekt is the designer of separate systems of the secondary circuit and some plant common systems.

Availability of necessary technical support on the site

Each Kozloduy NPP Power Generation department (PG-1 and PG-2) consist of three divisions - "Operations", "Maintenance" and "Engineering Support". The "Engineering Support" concentrates activities on: management of modernization and reconstruction of SSC; design safety analysis and evaluations; research and development; analysis of the results of periodic testing of safety systems; and calculation and control of neutron-physical characteristics of the core. All engineering activities are carried out using procedures and instructions, which define procedures, rules, requirements, responsibilities and interactions between internal and external structures.

Engineering and technical support of maintenance activities is provided by the "Maintenance" division. In the case of using external contractors, division produces the TOR, assesses tender documents, carry out supervision during the implementation of maintenance and repair activities. These activities are specified by internal instructions and procedures.

Dependence on consultants and contractors for technical support

Specific activities of scientific support, specialized technical assistance or services are performed by specialized organizations and research institutes in Bulgaria, Chief Designer and General Designer of the units. Major renovations of turbine hall equipment - turbines, generators and pumps, and maintenance of specific and non-standard equipment and metrology inspection of measuring instruments are performed by specialized external organizations. Kozloduy NPP has signed contracts with the chief designer and factories producing basic equipment for head-engineering presence on site. Such, the necessary advice is provided on current issues or discussion of long-term measures to modifications of equipment is ensured. Examples are contracts with AREVA NP GmbH, Westinghouse, OKB "Gidropres" Kurchatov Institute, producers of the main circulating pumps and turbine generator.

Regulatory review and control

Conditions of operating licenses require that licensee shall submit to the NRA company annual production, maintenance and investment programs. Thus enables the regulator to assess and monitor the activities planned by the engineering and maintenance departments and their contractors.

One of the thematic areas covered by regulatory inspections is providing engineering support. Inspections include questions related to organization, functions and responsibilities, and procedures for contracting, control and acceptance of the work of external contractors. Operational engineering support is also inspected in respect to development of instructions and procedures, water chemistry regime, control of neutron-physical parameters of the core, etc.

Article 19 (6) Reporting of incidents significant to safety

Overview of regulatory requirements for reporting incidents significant to safety

Reporting of incidents to NRA is based on the requirements of the Regulation on the Conditions and the Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation. The Regulation defines the categories of events to be reported, according to their importance to safety (deviations from normal operation, incidents and accidents), procedures, timetable and method of notification. Form of notification and contents of related information are specified. There are special requirements on the contents of investigation, analysis and evaluation reports, analyses of staff attitudes towards safety. To determine safety significance of events licensees shall use the International Nuclear and Radiological Event Scale (INES).

Regulation requires the licensee to establish a system for collecting, recording, investigation, analysis and assessment of events occurring in the nuclear facility and to determine and implement corrective measures to prevent re-occurrence.

Review the criteria for reporting and reporting procedures

Kozloduy NPP reports events to NRA following the internal safety procedure "Reporting and Analysis of Operational Events at Kozloduy NPP". The instruction specifies the terms and responsibilities for reporting, analysis of operational events, ordering and monitoring the implementation of corrective measures. In terms of impact to safety, reliability and plant efficiency, the impact on health and environmental the events are classified into three categories - events, low-level events and "almost" events (near misses). Low-level events and near misses are investigated and analyzed internally in the Departments and in accordance with approved instructions.

Statistics of reported events for the past three years

For the last three years, Kozloduy NPP has reported to NRA total of 36 events, rated at level "0" on the INES international scale. Distribution is shown below.

	PG-1	PG-2	Total
2007	1	17	18
2008	3	8	11
2009	1	6	7

During the three-year period, 77 additional low-level events and near misses were analyzed. They are not of safety significance but have been analyzed in depth in fulfilment to established instructions for investigation and analysis.

Documentation and publication of reported events and incidents

Kozloduy NPP stores all information on deviations, incidents and accidents in a joint database that provides easy sorting and processing of information and extraction of the necessary data. Information contains a detailed description of the event, the causes, safety consequences and corrective measures.

Departments maintain own database for registration and treatment of defects and failures. Department heads determine responsible officials for the databases and writing permits. The rest of the NPP personnel are entitled to access the database "events", but information is only available for reading.

For internal exchange of operational experience, the reports of analyzed events are distributed to other units that have not participated in report preparation, as well as to the Training Centre. Event reports are distributed to various engineering organizations as input data, depending on the implemented projects.

Notification of the World Association of Nuclear Operators on analyzed and registered events in Kozloduy NPP is carried out following the "Procedure for the exchange of operational events with WANO".

The ASUNE and respective Regulations specify that NRA is responsible to provide information on events at nuclear facilities to the specialized international organizations, government bodies, legal entities and citizens. Nuclear Regulatory Agency has an internal procedure, which specifies the process and responsibilities for publication of event reports on the NRA website (all reported events are posted). Communication policy is to publish event in Bulgarian and English language and on the day of receipt of the initial notification by the licensee.

Policy for use of INES scale

Use of INES scale is a legal requirement. Assessment of events safety significance is done using the criteria and practical examples of the INES User's Manual. Preliminary assessment of the INES rating is carried out by the NPP, as the final event rating is determined by the NRA.

Regulatory review and control

NRA carries out its own investigation and assessment of selected operational events. A Group for Events Analysis is established at the NRA with the tasks to periodically evaluate event analysis reports and the safety consequences. Regulatory inspections on unit start-up after planned annual maintenance verify the implementation of corrective measures for the previous fuel cycle. In some cases, NRA inspectors check on-site the event circumstances and conduct their own investigation of operational events.

Article 19 (7) Operational experience feedback

Overview of arrangements and regulatory requirements on the licence holders to collect and analyse and share operating experience

The Regulation on Ensuring the Safety of Nuclear Power Plants requires the licensee to collect and record data on failures during tests, maintenance, repair and inspection of safety important SSC. Collected data are analyzed and used for lifetime management of SSC.

The same Regulation requires that licensee shall develop and implement programs for the collection, analysis, documentation and dissemination of own and foreign operational experience, as well as events, deviations and trends that decrease the level of safety or reduce the identified safety margins. This has to be done to determine the best operating practices and take corrective measures.

The Regulation on the Conditions and the Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation requires

that licensee shall conduct analyses of operating experience and statistical analysis of specific indicators for safe operation. Analysis of operational experience shall identify trends in behaviour of operating staff and of equipment performance, indicators trends, and conclusions and recommendations for improving the operations and equipment. These findings and analysis are used to improve staff training and management of operational activities.

Overview of licensee programmes for the feedback of information on operating experience

To implement feedback from operational experience, Kozloduy NPP have developed and applies operational experience feedback procedures at both Power Generation Departments. General procedures are applied for use of foreign operating experience and the methods of analysis and evaluation.

A fundamental principle in the application of operational experience feedback is the identification and monitoring of trends, where weaknesses in equipment and staff performance are studied; procedures deficiencies identified by event, deviations and defects are analysed. Summary and a more complete picture of the processes is obtained by monitoring trends in changes in data and processes from organizational processes at other NPPs.

Every month, heads of units review trends, while all trends are summarized every three months. Monitoring of trends and self-assessment of the entire system is carried out annually.

In accordance with the procedures for operational experience feedback, Kozloduy NPP has established and operates Operating Experience Councils. Councils are specialized advisory bodies to the Chief Engineers of the two Departments and:

- Discuss the state of the feedback system of operating experience and compliance with the requirements and recommendations of national and international instruments and best practices;
- Conduct an initial assessment of the applicability of foreign operating experience and identify the relevant professionals to carry out comparative analysis and final assessment of the feasibility of a proposal for discussion by the Safety Council.

Procedures to analyse domestic and international events

Procedures for the analysis of internal events are described in “Procedure for reporting and analysis of operational events at Kozloduy NPP” and the methodology “Analysis of events and operating experience”. The methodology combines two different methodologies - ASSET and HPES, which have proven effectiveness in identifying problems with human factors and equipment.

At both Power Generation Departments have been developed low tier documents, in respect of the specific conditions, relating to the application of operational experience feedback and analysis of deviations in the performance of equipment, procedures and personnel.

Procedures for applying foreign operating experience include criteria in respect of events impact on nuclear safety and reliability of operations. Events are rates as high, medium and low priority.

The information on external events, received by WANO, IRS (IAEA), international seminars and scientific-technical meetings, is analyzed for applicability using criteria such as: similarity of design, technology, operating practices and procedures; deficiencies in human performance (human errors); organizational shortcomings; relevance, importance and likelihood.

Procedures for extracting and applying useful experience

The procedures for extraction and application of lessons learned are described in the instructions for feedback from operational experience and in the instructions for design modifications. The methods of screening; trend analysis; detection of problems in organizational programs; common causes and subsequent implementation of root cause analysis using ASSET and HPES methodologies.

The final event analysis reports are distributed to all departments concerned to be aware and extract lessons learnt. They are also provided to the Training Centre, where actual staff and equipment behaviour is compared and analysed using the simulator. When necessary, programs and instructions for staff training are accordingly corrected.

Mechanisms for sharing experience with other organizations

Dissemination of operational experience outside the Kozloduy NPP is specified by the procedure "Exchange and dissemination of operational experience". The criteria for dissemination are set in accordance with WANO "Operating Experience Program Guideline - WANO/WPG02" and "GL 2003-01 Guidelines for Operating Experience at Nuclear Power Plants".

Accordance with the procedure, responsible specialists evaluate each event in respect of meeting the criteria of the above two documents. When the event meets these criteria, a report is prepared in the approved form, which is sent to the WANO Moscow centre.

The information to the IAEA - IRS system is submitted by NRA.

Besides these channels, Kozloduy NPP provides information on inquiries coming directly from other plants or from the WANO Moscow centre.

Another form of sharing operating experience is the involvement of staff in periodic training seminars of the IAEA, WANO and workshops on specific topics for the exchange of information and experience. Experience is also shared through participation of staff in IAEA and WANO missions.

Kozloduy NPP has specific arrangements for information exchange and sharing of experience between the two Power Generation Departments through a common database for events and meetings.

Use of international databases on operational experience

Kozloduy NPP has access to information databases, which store information about shared experience of operating NPPs. Use of information is defined by the "Procedure for the exchange and dissemination of operational experience". The procedure regulates the activities of searching for information from external sources, responsibility for initial processing of this information and set priorities for processing.

In accordance with the procedure, once a week, responsible experts check for the availability of new information in the IRS and WANO databases. Initial assessment of applicability at Kozloduy NPP is carried out in accordance with specified criteria and priorities are set for further processing of the information by specialists in various areas.

Reports on significant operational experience of types SER and SOER of WANO, and information about the target instruction (Just-in-Time) are translated into Bulgarian.

Kozloduy NPP makes use also of the information published on the NRC website, as well as utilities that publish daily information on the status of their nuclear facilities.

Regulatory review and control of licensee programmes and procedures

Periodically, NRA carry regulatory inspections of licensee system of operating experience feedback, during which instructions and procedures at corporate level are discussed. A review is performed of arrangements for use of foreign experience and connections to exchange information with international organizations (IAEA and WANO). Structure and effectiveness of operational experience feedback system is evaluated.

Every three months, licensee shall submit to the NRA data on trends in some indicators (agreed in advance). More extensive information on the indicators for safe operation is contained in the annual report of the NPP.

Activities at the Regulatory body

In order to increase the objectivity of independent regulatory assessment of events, NRA has created an internal group for analysis of operating experience. The Group consists of six experts from different technical areas. The main tasks of the group are:

- Conducting an independent analysis of the root causes of significant events and evaluation of appropriateness of proposed corrective measures;
- Dissemination of country operational experience to international organizations, as well as screening of the external operational experience and its distribution inside the country;
- Conducting reactive inspections in response to events at nuclear facilities.

Article 19 (8) Management of spent fuel and radioactive waste on the site

Overview of arrangements and regulatory requirements for the on-site handling of SNF and RAW

According to the ASUNE, management of radioactive waste and spent fuel is carried out by legal entities after receiving of the respective permit or license for the safe implementation of the activity. The Regulation on Ensuring the Safety of Spent Nuclear Fuel specify the requirements on ensuring nuclear safety and radiation protection in the management of spent fuel at all stages of the lifetime of the facilities. The Regulation applies to all activities of SNF management and defines certain specific requirements to the design and operation of spent fuel management facilities, as well as to “wet” and “dry” storage.

The Regulation on the Safety of Radioactive Waste Management requires that persons generating RAW shall develop RAW management programs, which describe and justify the actions taken and planned management for all RAW generated till final disposal or release from regulatory control. The Regulation contains requirements for pre-processing, post processing, conditioning, storage and disposal of RAW.

On-site storage of spent fuel

Initially, SNF is stored under water in the near-reactor spent fuel pools of each nuclear unit. SF stays there for a specified period, defined by the supplier, which is clearly described by the Technical Specifications and the operating instructions. Later on SNF is stored in a special “wet” type spent fuel storage facility. Requirements for storage of spent fuel relate to compliance with

the operating conditions in terms of chemical indicators, activity, leakage and temperature of the cooling water. Control over maintenance and operating conditions is carried out by the Kozloduy NPP operational staff.

Manipulations with SNF have been identified as hazardous and are carried out by using approved procedures, which require the implementation of special measures for the initiation of activities (i.e. pre-job briefings, equipment functional testing, consent by the Chief Engineer), as well as implementation of additional measures to ensure nuclear safety, radiation and physical protection.

Treatment, conditioning and storage of RAW

RAW management activities are performed in accordance with the "Comprehensive Program for Management of Radioactive Waste from NPP Kozloduy". Kozloduy NPP carries out collection, sorting, processing and temporary storage of solid RAW. Management of liquid RAW consists of collecting in streams, chemical treatment, pre-treatment (evaporation, filtration), temporary storage and release of waste water into the environment. Operational RAW is stored in dedicated locations in unprocessed or processed form, which does have limited options for their subsequent treatment, release from regulatory control or disposal. Activities are carried out under the administrative dose limits set out in internal regulations, programs for radiation protection, dose budgets and other restrictions related to dose control.

Kozloduy NPP approach, adopted since 2005, is directed to transfer for processing by SERAW of all currently generated RAW and additionally gradual release of accumulated historical RAW. RAW management activities are carried out by administrative structures having clearly defined statute, functions and tasks. Clear allocation of rights, obligations and responsibilities of the two operators of the site (SERAW and Kozloduy NPP) is ensured.

Activities to keep the amount of waste generated to the minimum practicable

To minimize the generated RAW, organizational and technical measures are provided in the following directions - minimizing the quantities of generated primary (by the source) and secondary RAW; prevention of undue radioactive contamination of clean materials; providing a direct link between RAW generation and subsequent management stages.

The following activities are implemented at the Kozloduy NPP to minimize the generated RAW:

- Minimization of solid RAW - measures related to safety culture and reducing operational RAW; timely actions to collect and sort RAW by physical and radiological characteristics;
- Minimization of liquid RAW - organizational measures relating to planning, improvements in procedures, respect of safety culture principles, staff training, analysis of results;
- Technical measures - control of the status of purification systems; separation of oil fractions; maintaining cleanliness in the premises, regeneration of boric acid.

Established procedures for clearance of radioactive waste

Methodologies and procedures for the release of materials from regulatory control are being developed by Kozloduy NPP, both for RAW from the upcoming decommissioning of units 1-4 and from the operation of Units 5 and 6. This includes: radiological characterization of the various streams RAW; selection and justification of methods of measurement and evaluation of specific activities of materials; supply of measurement equipment and its calibration; assessment of radiological consequences for conditional release of RAW and more.

TOR is prepared to justify the approach to conditional release from regulatory control of waste. Radiological criteria for negligible risk for conditional release were adopted in accordance with the requirements of the Regulation on the Basis Norms for Radiation Protection and the recommendations of the IAEA and the European Commission.

Developed and implemented is a program to determine the composition and radionuclide specific activities of iodine from the charcoal filters of ventilation systems and ion exchange resins used in the filters of water purification systems. Submission of results to the NRA to evaluate compliance with the exemption levels is forthcoming.

Regulatory review and control

Management of SNF and RAW is subject to continuous review by the NRA inspectors at the site of Kozloduy NPP. NRA Annual inspection plan include inspections on topics related to safe management of spent fuel and RAW. Periodic information is submitted to the NRA under the conditions of the operating licenses, which is analyzed and evaluated.

List of Abbreviations

AAS	Act on Amendments and Supplements
ASSET	Assessment of Safety Significance of Events Techniques
ASUNE	Act on the Safe Use of Nuclear Energy
ATWS	Anticipated Transient Without Scram
BAS	Bulgarian Academy of Sciences
BDBA	Beyond Design Basis Accident
CPPNM	Convention on Physical Protection of Nuclear Material
DBA	Design Basis Accident
DCM	Decree of Council of Ministers
ECURIE	European Commission Urgent Radiological Information Exchange
EEA	Executive Environmental Agency
EIA	Environmental Impact Assessment
EMC	Emergency Management Centre
EU	European Union
FSS	Full-Scope Simulator
HFs	Human Factors
HPES	Human Performance Enhancement System
IAEA	International Atomic Energy Agency
IMS	Integrated Management System
INES	International Nuclear and Radiological Events Scale
IRRS	Integrated Regulatory Review Services
IRS	OECD/IAEA Incident Reporting System
ISAR	Interim Safety Analyses Report
LMI	Law on the Ministry of Interior
MCR	Main Control Room
MDBE	Maximum Design Basis Earthquake
MEET	Ministry of Economy, Energy and Tourism
MEW	Ministry of Environment and Water
MI	Ministry of Interior
MMS	Meteorological Monitoring System
MP	Modernization Program
NEC	National Electric Company
NPP	Nuclear Power Plant
NPT	Non-Proliferation Treaty
NRA	Nuclear Regulatory Agency
OJ	Official Journal
OLC	Operating Limits and Conditions
PAO	Planned Annual Outage
PG-1	Power Generation 1, representing Units 1-4
PG-2	Power Generation 2, representing Units 5 and 6
PSA	Probabilistic Safety Analysis
QAP	Quality Assurance Program
QAS	Quality Assurance System
QMS	Quality Management System
RAW	Radioactive Waste
RBNRP	Regulation on Basic Norms for Radiation Protection
RG	Regulatory Guide
RNG	Radioactive Noble Gases
RPCMA	Rules of Procedure of the Council of Ministers and its Administration

SAMGs	Severe Accident Management Guidelines
SAR	Safety Analyses Report
SBEOPs	Symptom-Based Emergency Operating Procedures
SDA	Steam Dump to the Atmosphere
SDC	Steam Dump to the Condenser
SERAW	State Enterprise “Radioactive Waste”
SFP	Spent Fuel Pools
SFSF	Spent Fuel Storage Facility
SNF	Spent Nuclear Fuel
SS	Safety Systems
SSC	Structures, Systems and Components
TD	Technical Design
TOR	Terms of Reference
TSOs	Technical Support Organizations
URS	Unified Rescue System
VT	Ventilation Tube
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulator’s Association

Annex 1,
to Article 7 of the Convention

LIST OF SECONDARY LEGISLATION

- ***Rules of Procedure of the Nuclear Regulatory Agency (DCM № 199 of 29.08.2002, OJ 86/2002)***

The Rules of Procedure specify the structure, activities, work management, functions, and staff number of the NRA and its administrative units. According to the document, since 1-st January 2003 the NRA Chairman is primary user of budgetary funds.

- ***Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy (DCM № 93 of 04.05.2004, OJ 41/2004)***

The Regulation specifies all matters related to procedures for granting, renewal, suspension, withdrawal and control of licenses and permits required by the ASUNE. The overall structure of the Regulation is consistent with the specificity of the types of nuclear facilities, activities and sites with sources of ionizing radiation. The scope and content of documents are specified in detail in respect to measures to ensure nuclear safety, radiation and physical protection. Certain activities with sources of ionizing radiation of low risk to public and the environment have lower requirements towards the licensing documentation.

- ***Regulation on the Terms and Procedure for Delivery of Radioactive Waste to SERAW (DCM № 164 of 14.07.2004, OJ 64/2004)***

Persons generating radioactive waste are required to transmit them to the State Enterprise, which is entrusted with the management of radioactive waste after their acceptance.

The Regulation specifies general arrangements for the transfer of radioactive waste to the SERAW and the terms of delivery and non delivery of radioactive waste. Regulation specifies also specific procedures for: delivery of radioactive waste from past practices; of radioactive waste, whose owner is unknown; RAW imported in the country and can not be returned. Radioactive waste becomes state property at the time of acceptance by the State Enterprise.

- ***Regulation on Ensuring the Safety of Nuclear Power Plants (DCM № 172 of 19.07.2004, OJ 66/2004)***

The Regulation specify the issues relating to general criteria and rules for the safety of nuclear power plants, based on the application of the concept of defence in depth.

Subject to regulation are the organizational measures and technical requirements for ensuring the safety during siting, design, construction, commissioning and operation of nuclear power plants. The Regulation contains detailed provisions relating to the definition of design bases and safety assessments, site characteristics and safety requirements at nuclear power plant and its systems.

The Regulation was developed based on the safety standards of the International Atomic Energy Agency and takes into account the reference levels for the harmonization of safety requirements for nuclear power plants, established by WENRA.

- ***Regulation on Ensuring the Safety of Research Nuclear Installations (DCM № 231 of 02.09.2004, OJ 80/2004)***

The Regulation specifies the issues relating to general criteria and rules for the safety of research nuclear installations. Subject to regulation are the organizational measures and technical requirements for ensuring the safety during siting, design, construction, commissioning and

operation of research nuclear installations. The Regulation contains detailed provisions relating to the definition of design bases and safety assessments, site characteristics and safety requirements for research reactors and installations and their systems.

- ***Regulation on Radiation Protection During Activities with Sources of Ionizing Radiation (DCM № 200 of 04.08.2004, OJ 74/2004)***

The Regulation specifies the main requirements to radiation protection rules in activities with sources, as well as rules and procedure for accounting and control. The regulation requires the implementation of radiological monitoring of all sites and practices.

The Regulation specifies the technical and organizational rules to be applied for fulfilment of the in force for the Republic of Bulgaria Basic Norms for Radiation Protection.

- ***Regulation on the Conditions and the Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation (DCM № 188/30.07.2004, OJ 71/2004)***

The regulation specify the responsibilities of holder of licenses and permits to establish a system for collection, registration, investigation, analyses and assessment of events and implementation of corrective measures.

It defines the requirements on the use of events information, including analyses of operating experience, assessment of events safety significance, as well as the terms and conditions for informing the public in respect of events with different safety significance.

- ***Regulation on the Terms and Procedure for Exemption of Small Quantities of Nuclear Material from the Application of the Vienna Convention on Civil Liability for Nuclear Damage (DCM № 201/04.08.2004, OJ 72/2004)***

According to the Vienna Convention on Civil Liability for Nuclear Damage, the operating organization bears the responsibility for nuclear damage cause by a nuclear accident and shall maintain insurance or other financial guarantee, which covers the responsibility.

Any Contracting Party has the right to exclude of small quantities of nuclear material from the application of the Convention, within the framework of maximum guarantees, established by the IAEA Board of Governors. Article 135 of the ASUNE gives the Council of Ministers the authority to issue a regulation which to specify the terms and the procedures for exclusion of small quantities of nuclear material from the application of the Vienna Convention.

The Regulation has been developed with conformity with the Decision of the IAEA Board of Governors from 14-15 September 1978 for the establishment of maximum limits for exclusion of small quantities of nuclear material from the application of the Vienna Convention, as well as with the IAEA safety standards on the safe transport of nuclear material.

- ***Regulation on Ensuring the Safety of Spent Nuclear Fuel (DCM № 196 of 02.08.2004, OJ 71/2004)***

The Regulation defines the main criteria and rules for ensuring nuclear safety and radiation protection when managing spent fuel. It also determines specific organizational measures and technical requirements towards the safety during siting, design, commissioning and operation of facilities for spent fuel management.

Issues related to technical safety, physical protection, fire safety, and emergency arrangements of spent fuel management facilities are covered by the Regulation only to the extent of the application of the Defence in Depth concept.

- ***Regulation on the Safety of Radioactive Waste Management (DCM № 198 of 03.08.2004, OJ 72/2004)***

The Regulation specifies safety requirements, norms and rules for siting, design, commissioning, operation and decommissioning (closure) of facilities for radioactive waste management.

The Regulation specifies the responsibilities of Persons implementing activities on RAW management. Generators of RAW are responsible for their safe management from their generation till their delivery to the SERAW or till clearance.

- ***The Regulation on the Terms and Procedures for Obtaining Professional Qualification and on the Procedures for Issuing of Licenses for Specialized Training and of Individual Licenses for Use of Nuclear Energy (DCM № 209 of 06.08.2004, OJ 74/2004)***

The Regulation determines the terms and procedure for obtaining individual licenses to carry out activities in nuclear facilities and with sources; positions for which individual licenses are required; procedure for issuing licenses for specialized training; as well as terms and procedure of conducting exams for issuing individual licenses.

- ***Regulation on Emergency Planning and Emergency Preparedness in case of Nuclear or Radiological Emergency (DCM № 189/30.07.2004, OJ 71/2004)***

According to the ASUNE, the Regulation specifies the terms and procedure for development of emergency plans, as well as responsibilities for their implementation.

The Regulation determines the measures to prevent and mitigate the consequences from nuclear or radiological accident, intervention levels and criteria on decision making, and respective public information arrangements. Maintenance and verification of emergency preparedness and coordination between state authorities and licensees are also covered.

- ***Regulation on Ensuring the Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances (DCM № 224 of 25.08.2004, OJ 77/2004)***

According to the ASUNE and the Convention on Physical Protection of Nuclear Material, the Regulation specifies the arrangements for ensuring the physical protection of nuclear facilities and physical protection arrangements during use, storage and transport of nuclear material and radioactive substances.

Regulation requirements take account of specific features of different types of nuclear facilities, nuclear material and radioactive substances, which require different level of physical protection, in respect of nuclear material category and the magnitude of the risk.

- ***Regulation on the Basic Norms for Radiation Protection (DCM № 190 of 30.07.2004, OJ 73/2004)***

The Regulation reflects the requirements of Directive 96/29/EURATOM, establishing basic standards for the protection of workers and the public from the harmful effects of ionizing radiation. The Regulation develops the basic principles of radiation protection and defined the limits of exposure of workers and the public. In accordance with the requirements of the Directive, The Regulation introduces the concept of clearance of radioactive substances resulting from authorized activities and the concept of limiting the exposure.

Regulation sets requirements for monitoring the workplace and individual exposure, as well as the recording of the results of such monitoring. Introduced are the requirements of Directive 90/641/EURATOM operational protection of outside workers from the harmful effects of ionizing radiation in their activities in controlled areas.

In connection with the commitments of Bulgarian in the negotiations with European Union, regulation introduces the basic principles and requirements for radiation protection in medical exposure, taking into account Directive 84/466/EURATOM to protect health from the harmful effects of ionizing radiation in medical exposure.

- ***Regulation for the conditions and procedure for establishing of special-statutory areas around nuclear facilities and facilities with sources of ionizing radiation (DCM № 187/28.07.2004, OJ 69/2004)***

The Regulation defines criteria for determining the dimensions and boundaries of areas with special status, the procedure for establishing the zones and to carry out the powers of the competent authorities according to the Law.

This Regulation specifies the activities of licensees and holders of permits in the areas with special status, including the implementation of radiation monitoring of environment and the public. It determines the criteria relating to compensation for damage suffered by restrictions on the use of private property in the Radiation protection areas.

- ***Regulation on the terms and the procedure for collection and provision of information and for maintaining registers on the activities pertaining to the application of safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons (DCM № 210 of 06.08.2004)***

In accordance with Article 126 ASUNE, the regulation defines procedures for collecting and providing information and record-keeping activities under the Agreement between Bulgaria and the application of IAEA safeguards in connection with the Treaty on the NPT and its Additional Protocol. In accordance with ASUNE, persons who are engaged in activities covered by the Agreement and Additional Protocol, develop and implement internal rules and instructions for registration and control of the type, quantity, location and movement of nuclear material and its transportation. They provide the Nuclear Regulatory Agency Chairman with the information necessary to fulfil the obligations of the Republic of Bulgaria arising from these agreements and ensure appropriate access to sites of IAEA and accompanying NRA inspectors, in accordance with the requirements of the ASUNE.

- ***Regulation on Safety During Decommissioning of Nuclear Facilities (DCM № 204 of 05.08.2004, OJ 73/2004)***

Regulation provides for the safe decommissioning to take place through intermediate and advance planning, determining the concept and developing a plan for decommissioning of a nuclear installation, while for each planning stage decommissioning work shall be justified.

The Regulation defines basic safety requirements for decommissioning to: maintenance of systems and equipment important to safety; to the decontamination and dismantling of equipment; to radiation protection and radioactive waste management. It is envisaged that on completion of a decommissioning phase, the holder of the authorization shall develop and submit to the regulatory authority an updated SAR for the stage.

- ***Regulation on the procedure for payment of taxes under the ASUNE (DCM № 206/17.09.2003, OJ 85/2003)***

The Regulation specifies the procedure for payment of taxes, due to the review of applications and issuing of licenses and permits, as well as for control of activities under the ASUNE.

- ***Tariff on the taxes to be collected by the NRA under the ASUNE (DCM № 206/17.09.2003 г., OJ 85/2003)***

The Tariff specifies the amount of taxes which are collected by the NRA for review of applications and issuing of licenses and permits under the ASUNE. Specific amounts of initial and annual licensing fees, as well as the taxes for issuing permits, have been defined in accordance with the complexity and the scope of the regulatory control and the specificity of the respective activity, subject to state regulation under the ASUNE.

- ***Regulation on the assessment, collection, spending and control of the funds and the estimation of the dues for the Fund "Decommissioning of Nuclear Facilities" (DCM № 300/17.12.2003, OJ 112/2003)***

The Regulation specifies the procedure on assessment, collection, spending and control of the funds and the estimation of the dues for the Fund "Decommissioning of Nuclear Facilities", established to the Minister of Economy, Energy and Transport. The Fund shall be managed in a way ensuring the implementation of licensee annual decommissioning program. Fund income is coming mainly from fees from persons operating nuclear facilities and transfers from the state budget, which are specified annually by the Law on State Budget for the respective year.

- ***Regulation on the assessment, collection, spending and control of the funds and the estimation of the dues for the Fund "Radioactive Waste" (DCM № 301/17.12.2003, OJ 112/2003)***

The Regulation specifies the procedure on assessment, collection, spending and control of the funds and the estimation of the dues for the Fund "Decommissioning of Nuclear Facilities", established to the Minister of Economy, Energy and Transport. The Fund shall be managed in a way ensuring the implementation of RAW management activities. Fund income is coming mainly from fees from persons generating RAW and transfers from the state budget, which are specified annually by the Law on State Budget for the respective year.

- ***Regulation on the Terms and Procedure for Transport of RAW (DCM № 156 of 13.07.2005, OJ 60/2005)***

The Regulation lays down procedures to ensure radiation protection and safety for the transport of nuclear material, radioactive waste and other radioactive substances in the Republic of Bulgaria. The Regulation introduces into national law the requirements of international treaties, to which Bulgaria is a party, to various types of transport of dangerous goods of Class 7 (radioactive substances). Regulation provisions are in conformity with the documents for the safe transport of radioactive substances by the International Atomic Energy Agency TS-R-1, taking into account the overall national requirements for the shipment of dangerous goods.

The Regulation transposes the requirements of the European legislation on radiation protection for the transport of radioactive waste as defined in Council Directive 92/3/EURATOM surveillance and control of shipments of radioactive waste between Member States of the European Union as well as import and export from the Community.

Annex 2,
to Article 16 of the Convention

EMERGENCY TECHNICAL FACILITIES, SYSTEMS AND MEANS TO ENSURE THE EMERGENCY PREPAREDMNESS IN KOZLODUY NPP

1. Emergency Management Centre– designed to ensure the appropriate working conditions for the emergency management team and the duty teams during an emergency. EMC is established, according to the design, at the site of Units 1-4. The Centre is equipped with: different system for internal and external communications (autonomous digital phone network of 100 posts, short and ultra-short wave radio stations), including with regional and state authorities; backup power supply by two diesel generators; autonomous filtering ventilation system using iodine and aerosol filters for working conditions of total isolation; system for control and maintenance of the microclimate parameters; separate water supply system with backup service water and deactivation reagents; medical facility for emergency medical care; and protective clothing and instruments warehouse.

Access control regime with a possibility for deactivation is established. EMC is equipped with: technological, radiological and meteorological monitoring; program and technical means for assessment, forecast and visualization of the conditions. Working premises are equipped with the necessary technical and operating documentation. The EMC has its own medical facility, foods store and water reservoirs.

2. Announcing system in the emergency planning zones – Kozloduy NPP site, in the precautionary UPAZ and the 12 km sub-zone of the UPAZ. Announcing system was completely renovated in 2009, with 28 announcing points; power supply racks with computerized control and interface with the internal phone system; radio announcers and personal computers and panels for remote control from the working place for USS NPP-1; USS NPP-2 and EMC.

3. EMC Access control point for the emergency staff using build in monitors for control of surface contamination, showers and sinks for decontamination. Radiation control of premises is carried out using mobile devices, including for control of aerosol content in the air. Individual dose monitoring of the personnel is done by TLD and digital dosimeters.

4. Meteorological monitoring system (MMS) with 3 meteorological stations and air-logical sampling system using balloon and radio-sampling devices, connected through a radio-channel with the NCMH and MEW.

5. Automated Information System for External Radiological Monitoring (AISERM), measuring gamma background and iodine concentration, equipped with 10 stations and integrated with the national system BULRaMo. This system includes also 5 water stations to control liquid discharges, which was recently upgraded.

6. Automated Information System for Site Radiological Monitoring (AISSRM) including 14 points with visualization panels of gamma background and temperature. Displays and gamma detectors have been replaced.

7. EMC Information System – local computer network with 13 stations, video screens, printers, UPS and specialized software for information management in accidents or drills, being upgraded in the last years. Hardware has been completely replaced in 2008and 2009. The computer program for forecast of radiological consequences and protective actions in the early accident phase has been updated and additionally 1 station of the RODOS system was installed. The indications have been ensured at the panels of AISERM, AISSRM, MMS, program for control of fuel positions - Smart Fuel; program for calculation of isotopes accumulation and residual heat –

Scale; program for control of the water level of the Danube River and the dikes; and control of Containment ropes stressing.

8. Emergency packages with Individual Protective Means (IPM) – containing respirators, face masks, respiration filters for radioactive environment, gloves, iodine tablets. They are located in specific cabinets in all large administrative and operating buildings, including for all external contractors located inside the 3 km zone.