REPUBLIC OF BULGARIA

SIXTH NATIONAL REPORT

UNDER THE

CONVENTION ON NUCLEAR SAFETY

Sofia, 2013

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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 five previous review meetings in 1999, 2002, 2005, 2008 and 2011, organized pursuant to Article 20 of the Convention, as well as the Second Extraordinary Meeting under the Convention held in 2013. 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 the Convention requirements has been successively presented in the previous five national reports where the measures of the competent authorities and organizations for the fulfilment of the country obligations are described as well. In accordance with the rules, adopted for the review process, answers have been promptly provided to all raised questions.

This is the National Report of the Republic of Bulgaria for the sixth review meeting on the implementation of the Convention, which will be held in 2014. The report examines the developments in the country after the fifth national report review meeting and reflects information on the implementation of the recommendations received and the priorities identified. The assessment of obligations fulfilment is based also on the Bulgarian legislation and regulations, and the status of the nuclear facilities. Where necessary, reference is made to documents of the International Atomic Energy Agency (IAEA), containing internationally accepted requirements and the IAEA Safety Standards. Bulgaria is a member of the European Union (EU), thus the EU directives being transposed into national legislatio are also taken into account in preparing the report.

The report reflects in detail the safety assessments and analyses conducted over the reporting period, as well as the implemented programems for reconstruction and modernisation on the operating nuclear power units. It also describes the methods used for evaluation of safety, the results obtained and the major conclusions. Safety during NPP operation 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 analyses of safety, and inspection activities. The main activities and changes that have been completed or are in progress after the fifth review meeting have been presented.

The national report is structured in conformity with the minutes of the meeting of the persons responsible for organizing the sixth Convention review meeting, held in October 2012. Section B, “Summary”, presents the consistent 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. The sixth national report has been developed as a stand-alone document that does not require knowledge of the previous reports and at the same time clearly and precisely highlights the developments in the respective areas after the fifth review meeting. Particular attention in the report is devoted to the striving of the regulator and licensees for continuous safety enhancement and the activities in the country in response to the Fukushima Dai-ichi NPP accident.

Annexes to the report:

Annex 1: List of operational events reported over the period 2010-2013.

Annex 2: List of secondary legislation in connection with implementing of the ASUNE.

Annex 3: List of the peer reviews conducted in Bulgaria

Annex 4: Topics from the Summary Report on the Second Extraordinary Meeting under the CNS.

SUMMARY

National nuclear programme

Nuclear energy is a major factor in the country's energy mix in terms of high technology and production efficiency, competitive prices and maintaining a high level of nuclear safety and radiation protection. National policy for the development of nuclear energy 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 form an internationally recognized framework that is used as a reference when developing national regulations on safety of nuclear facilities. Adopted in 2002, amended and supplemented in 2010, the Act on the Safe Use of Nuclear Energy (ASUNE) and the 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 the IAEA standards and safety guides.

In June 2011 the new Bulgarian Energy Strategy until 2020 was approved. The Energy Strategy is the basic document of the national energy policy that reflects the political vision of the Government for the European development of Bulgaria. The Strategy complies with the current European framework for energy policy and the world trends for development of energy technologies. The main Energy Strategy priorities can be summerized in the following five directions:

- Ensuring the security of energy supplies;
- Achieving the targets for renewable energy;
- Enhancing of energy effectiveness;
- Development of competitive energy market and policy focused on assuring of the energy demands;
- Defending the consumers' interests.

These priorities define the government's vision for the energy sector development in the coming years, namely:

- Maintaining a reliable, stable and secure energy system;
- Energy remains a leading branch of the Bulgarian economy with clearly defined foreign commercial orientation;
- Highlights on clean and low-emmission energy from nuclear and renewable sources;
- Balance among quantity, quality and prices of electrical energy produced from renewable sources, nuclear energy, coal and natural gas;
- Transparent, efficient and highly professional management of the energy companies.

Regarding nuclear energy, the Bulgarian Energy Strategy until 2020 foresees preservation of the electrical power share generated from nuclear energy. This strategy will be implemented through long term operaton of the existing nuclear units and through new build.

Assuming that the use of nuclear energy for peaceful purposes contributes to economic and social development of the country and enhancement of the standard of living, the Republic of 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 first and highest priority.

Nuclear profile

The Bulgarian nuclear energy program was launched in 1974 with the commissioning of the first nuclear power unit of the Kozloduy Nuclear Power Plant (KNPP). Nuclear power in the country is concentrated at the Kozloduy NPP site where six units have been built. Two WWER-1000 reactors are currently in operation, while four WWER-440 have been shut down for decommissioning.

An interim pool type spent fuel storage facility and a newly built dry spent fuel storage facility are also located at the Kozloduy NPP site. A State Owned Facility for treatment and storage of low- and intermediate level radioactive waste (RAW) is situated on-site as well.

The Republic of Bulgaria was planning the construction of a new nuclear energy unit on the Belene site. The Belene NPP was planned to include two nuclear power units, equipped with WWER-1000/ A92 design reactors. The plant design was undergoing a review at the Nuclear Regulatory Agency (NRA) for over four years. This review process included a number of internal and external expert assessments and analyses by Bulgarian and international expert organizations. In March 2012 the Bulgarian Government took a decision to terminate the Belene NPP project, and a month later made a decision to build a new nuclear power unit at Kozloduy NPP.

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 state regulation and control. The responsibilities and duties are clearly defined and allocated among the respective authorities as follows:

- Nuclear Regulatory Agency (NRA) – the regulatory body on the matters of nuclear safety and radiation protection and the safe management of radioactive waste (RAW) and spent nuclear fuel (SF).The NRA establishes regulatory requirements on nuclear safety and radiation protection, issues licences and permits, carries out regulatory control and imposes enforcement measures to ensure compliance with the regulatory requirements, etc.;
- Ministry of Economy and Energy (MEE) - implements the state policy on energy development. The Ministry developes 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 (SEWRC) - implements the state policy of control of electricity prices and issues licences for the electrical and thermal power generation;
- Ministry of Health (MH) 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 carries out specific functions in the area of health protection in the process of using nuclear energy and ionizing radiation. Such specialized units are the National Centre of Radiobiology and Radiation Protection (NCRRP), as well as the departments “Radiation Control” at the Regional Health Inspectorates;
- Ministry of Environment and Water (MEW) directs, coordinates and supervises the development and implementation of the state policy on environment protection protection and use of water and the earth. The Ministry is in charge of the National System for Environmental Monitoring and is the competent decision making body in respect of Environmental Impact Assessments;
- Ministry of Interior (MI) provides the security of the nuclear facilities and the related sites, identified as particularly important in terms of physical protection. The Ministry, through the General Directorate “Fire Safety and Civil Protection”, coordinates activities to protect

the population and the economy in case of natural hazards or accidents, including the conduct of risk assessment, preventive measures, rescue and emergency recovery works 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, the coordination among the different authorities is within the responsibilities of the NRA Chairman.

Legislative framework

The fundamental Act ensuring safety of facilities and activities is the Act on the Safe Use of Nuclear Energy. The Act regulates the public relationship concerning 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 specifyiing 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.

The NRA policy statement declares that "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 it is necessary". In the course of implementing this policy, NRA developed amendments and supplements to the ASUNE, in force since October 2010. The amendments take into account the new EU legislation, new or amended IAEA documents as well as the experience gained from the Act enforcement.

Detailed requirements for nuclear safety and radiation protection are specified in the regulations on implementing the ASUNE (over 20 regulations) that are listed and described in Annex 2. Following the coming in force of the amendments to the ASUNE, the NRA developed and has been implementing a programme for review and revision of all regulations, related to the enforcement of ASUNE. In the process of the legal requirements review, special attention has been paid to the lessons learned from the Fukushima Dai-ichi NPP accident. More details are provided in the part dedicated to Article 7. It is the NRA'a intention to periodically revise the legal requirements, upon issuance of new IAEA documents, considering the lessons learned from the Fukushima Dai-ichi NPP accident.

The Environmental Protection Act, the Health Act, the Disasters Protection Act and other laws and regulations also interface with the safe use of nuclear energy. In particular, their requirements and interfaces are addressed in the report under Article 7.

Highlights from the previous review under the Convention

The discussions on Bulgaria, following the presentation of the fifth national report, identified a number of measures planned to enhance safety (rapporteur's report), such as:

- Completion of the safety improvement programme resulting from the periodic safety review on KNPP units 5 and 6;
- Conducting an IAEA mission for review of the regulatory activity in the country (IAEA IRRS);
- Implementation of the severe accident management guides on the units in operation;
- Revision of the secondary legislation in connection with the implementing of ASUNE;

- Preparation of units 5 & 6 for long-term operation;
- Approval of the Belene NPP design and the actual construction of the plant.

The current Sixth National Report reviews the completion of the measures planned for safety enhancement, and outlines the future plans in this aspect. The completion status of the above measures is described in detail, in the texts per articles 7, 8, 14, 15, 17, 18 and 19. Here follows a short summary of the major results attained over the reporting three-year period.

Severe Accident Management Guides

The development of the Severe Accident Management Guides (SAMGs) began in 2003÷2004, following an extensive study.As a result, key strategies for protection against severe accidents were defined, SAMGs drafts were developed, and technical measures for management of severe accidents were identified. The SAMGs underwent a successful process of verification, validation and operators' training. The SAMGs were put in effect in late 2012. This was preceded by a considerable amount of analyses and implementation of design changes as regards severe accidents. The National Action Plan based on the Stress Test, foresees that by the end of 2014, the analyses of the phenomena, resulting from a severe accident in the spent fuel pool (SFP) and in the shutdown open reactor, will be completed. On this basis SAMGs will be developed for SFP and shutdown reactor.

Safety improvement programme

The units 5&6 periodic safety review performed in 2009 is the basis for the operating licence renewal for another 8 and 10 years, respectively. The review resulted in the development of a safety improvement programme. Completion of the measures from the programme is a condition in the units' operating licences, and the greater number of them have already been implemented. This programme has been combined with the actions applicable to enhance nuclear safety and radiation protection derived from:

- The recommendations of the IAEA Follow-up Mission for Assessment of the Modernization Programme on KNPP units 5&6;
- National Action Plan for reactor safety harmonisation in the WENRA member-countries;
- The measures of the National Action Plan as follow up of the stress tests review;
- The licensing conditions and improvement notices of the NRA.

The actual measures, applicable to the period 2013-2015, have been included in the Programme for Maintaining and Enhancing the Safety of Kozloduy NPP. The modification and reconstruction works completed by May 2013 are discussed in Article 18.

Review of the secondary legislation

Following the amendments approval to the ASUNE in 2010, the NRA developed a programme for review of all secondary legislation documents, related to the application of the Act. The Programme comprises review and update of all current regulations, and also the development of three new ones. For the present four updated regulations and one new have come into force.Drafts have been developed for amending and supplementing of five regulations, and they are undergoing now a public discussion. Completion of the Programme is expected by late 2014.

In the process of the regulatory document drafts development have been considered the changes made to international conventions and agreements, the new EU legislation, and the new or modified IAEA documents, as well as the experience gained in the implementation of the Act. The legal requirements review has paid special attention to the lessons learned from the Fukushima Dai-ichi NPP accident.

IRRS mission to Bulgaria

At the request of the Government of the Republic of Bulgaria, from 6th to 19th April 2013, an international team of senior safety experts held at the Bulgarian NRA a Full Scope Integrated Regulatory Review Service. The Bulgarian team included also representatives of the National Centre of Radiobiology and Radiation Protection (NCRRP) at the Ministry of Health (MoH) concerning their responsibilities for radiation protection of patients, personnel and public.

The mission team consisted of 25 experts (16 senior regulatory experts from IAEA Member States, six IAEA staff members and three observers). The review covered all regulatory areas, as well as all facilities and activities within the NRA scope of regulation. The mission review paid special attention to the Fukushima Dai-ichi NPP accident and respectively to the IAEA Nuclear Safety Action Plan implementation. The mission report concluded that:

- Bulgaria has a clear national policy and strategy for safety, supported by a clear legal framework;
- NRA operates as an independent regulatory body and conducts its regulatory process in an open and transparent manner;
- In response to the Fukushima Dai-ichi NPP accident, NRA reacted and communicated promptly and effectively with the interested parties.

The mission identified a number of good practices and offered some recommendations and suggestions that shall contribute to enhancing the regulatory frame efficiency.

The IRRS Mission Report is published on the NRA site – www.bnra.bg. The conduct of this mission also complies with the IAEA Nuclear Safety Action Plan in terms of strengthening the role of peer reviews. Reporting of the mission conclusions and findings in this report is consistent with the results from the 2nd extraordinary meeting under the CNS in August 2012.

Belene NPP

In March 2012 the Government of Bulgaria took a decision to terminate the Belene NPP project, which ended the project licensing procedure.

Lessons learned from incidents and accidents

Following the Fukushima Daichi NPP Accident, the public worldwide took actions to analyse the causes for and lessons learnt from the event. Being a member of the European Union, Bulgaria took part in the safety review of all nuclear facilities on the basis of comprehensive and transparent risk assessment ('stress tests'). The 'Stress Tests' were developed on the basis of the initial WENRA (West European Nuclear Regulator Associations) recommendations and, in May 2011, the ENSREG (European Nuclear Safety Regulators Group) and the European Commission approved a Joint Declaration on the forthcoming 'stress tests'. The annexes to the Declaration contain a specification (methodology) for the tests conduct, the national reports submission dates, issues concerning the process transparency, etc.

At the end of 2011 Bulgaria issued to the European Commission its National Report on the European "Stress Tests" (the report is published on the BNRA web site). Pursuant to the ENSREG Declaration, the national reports were subjected to peer reviews and ENSREG published the results as a Country Report for each country, a main Peer Review Report and a Compilation of Recommendations and Suggestions from the review of the European "Stress Tests".

The results from the safety reassessment and the results from the Second Extraordinary Meeting under the CNS were compiled in a National Action Plan (NAP). The Bulgarian National Action Plan foresees 63 measures aimed mainly at improving the external impact resistance, severe accident management and emergency preparedness. The prevalent part of these measures have been planned for completion at the end of 2014.

In connection with the supervision on the NAP implementation, a Task-force Group was established at the NRA, headed by its Deputy Chair. The mission of the Task-force Group is as follow: receipt and analysis of objective information on the technical contents, the status and documenting of the results from the NAP measures' implementation, in view of adequate and timely achievement of the targets, identified in the National Report of the Republic of Bulgaria on the European "Stress Tests". The NAP measures have been allocated among the NRA directorates in order to exercise supervision. Responsible persons have been assigned to control the measures with the task of receiving objective information regarding their completion schedule.

Kozloduy NPP submits quarterly reports on the NAP implementation progress. Completion of each measure is reported within an individual report. The NRA inspectors monitor the NAP measures implementation.

Future challenges

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

- Implementation of the NAP;
- Completion of the review process on the regulations, taking into consideration the adoption of ASUNE changes and the lessons learned from the Fukushima Daichi NPP Accident ;
- Long-term operation of Kozloduy NPP Units 5 and 6;
- Construction of a National Repository for Low and Intermediate Level Radioactive Waste;
- Decommissioning of Kozloduy NPP units 1-4.

Conclusion

In conclusion, it should be noted that, the Republic of Bulgaria has been fulfilling its obligations under the Convention application, while adhering to the Convention goals.

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

The Republic of Bulgaria has one operating nuclear power plant - Kozloduy NPP with six nuclear units.

Units 1 to 4 have WWER 440/V230 reactors. Units 1-2 (with two independent safety system trains) were commissioned in 1974 and 1975. Units 3-4 (upgraded B-230 model with triple redundancy of the safety systems) were commissioned in 1980 and 1982, respectively .

In connection with the commitments undertaken by Bulgaria, concerning the EU Accession Treaty, the operation of units 1-4 was terminated prior to their operating design life expiry. Units 1-2 were finally shut down for decommissioning at the end of 2002, and units 3-4 at the end of 2006. Following the units' shutdown, KNPP was issued operating licences for their "E"-mode operation (without generation of electrical and/or heat power, while storing spent nuclear fuel in the reactor pools). More details on units 1-4 are provided in the section on Nuclear Facilities Finally Shut Down for Decommissioning.

Units 5-6, with WWER-1000/V-320 reactor type (with containment, and triple redundancy of the safety systems), were commissioned in 1987 and 1991, respectively. In October 2009, Kozloduy NPP obtained an operating licence renewal for these units, valid till November 2017 for unit 5 and October 2019 for unit 6.

Facilities associated with the safe storage of SF

Management of spent nuclear fuel and radioactive waste is carried out in conformity with the Strategy, adopted by the Council of Ministers in December 2011.

On Kozloduy NPP site are located two spent nuclear fuel storage facilities for WWER reactor type spent fuel.

The wet spent fuel storage facility (SFSF) has a total under-water storage capacity of 168 baskets. The storage facility has been operated in accordance with a NRA licence issued in 2004, with a validity term of 10 years. Next to the wet storage facility, a dry spent fuel storage facility has been built. The Dry SFSF storage technology uses casks, air cooled as per the natural convection principle. The casks are of the CONSTOR 440/84 type with a load capacitry of 84 spent fuel assemblies from WWER-440. Currently the facility is in the process of commissioning in conformity with a commissioning permit, issued by the NRA on 24 November 2011.

Overview of important safety issues for Units 5 and 6

Issues important to safety

The implementation of the safety improvement programmes for the Kozloduy NPP, and the National Action Plan following the Fukushima NPP accident, discussed herein below, is aimed at

resolving a number of issues important to the plant's safety, the more significant of which are as follow:

- Safety Analyses Report liaison to the KNPP plans to increase the units' thermal power up to 3120 MW(t).
- Comprehensive survey of the physical condition and residual life time evaluation of SSC on units 5 and 6 in regard to long term operation;
- Implementation of the major actions of the National Action Plan , such as:
  - Ensuring power supply for the Spent Fuel Pools cooling and make-up systems through a mobile DG;
  - Construction of an off-site Emergency Response Centre (ERC);
  - Installation of additional hydrogen recombiners within the containment;
  - Study the possibilities to localize (contain) the melt-through in case of severe accidents;
  - Assess the volume of the generated liquid RAW in the containment in case of severe accident, as well as the adequacy of the available measures to prevent the release into the environment;
  - Implementation of the project for preventing the early containment bypass in case of a severe accident;
  - Provision of recharging of one battery of the safety systems by a mobile DG;
  - Assessment of possible damage under extreme external impacts on the regional road infrastructure surrounding the plant.
- Updating of PSA, level 2, for operation at low power and shutdown reactor; Considering the results of PSA, level 2, in developing strategies for severe accident management;
- PTS analyses of spectre leaks on the primary circuit and transients with loss of residual heat removal for the PSA defined modes for shutdown reactor at units 5 and 6.

Events reported to the NRA from 2010 to 2013

Over the past three-year reporting period no operating events important to safety have been registered as per the International Nuclear Events Reporting Scale (INES). As at 01.07.2013 a total of 40 events have been reported for units 5 and 6 (21 for unit 5 and 19 for unit 6), all of which have been rated as level 0 as per INES. Use of the results from operating events assessment and analysis, as well as the corrective actions, as elements of the operating experience feedback system, are described in article 19(7) of this document. Annex 1 contains a list of the events.

Programmes and actions planned for continuous safety improvement

Programmes for improvement of nuclear safety and radiatiom protection on units 5 and 6 are implemented by Kozloduy NPP, that foresee measures deriving from:

- The results from the Periodic Safety Review conducted in 2009;
- The recommendations of the IAEA follow-up mission (2008) for assessment of the Modernization Programme, implemented on KNPP units 5&6;
- The National Action Plan for harmonization of the safety of reactors in WENRA member-countries;
- The measures of the National Action Plan based on the 'stress tests';
- The licensing conditions and NRA improvement notices.

The specific measures applicable for the 2013-2015 period are included in the Kozloduy NPP Programme for Maintaining and Enhancing of Safety. Article 18 reviews the modifications and reconstruction works completed by May 2013.

Kozloduy NPP stress tests

Over the July-October period in 2011, "Stress Tests" were performed on the nuclear facilities, located on Kozloduy NPP site. A Summary Report on the Stress Tests was submitted to the NRA on 28.10.2011. In late December 2011, the NRA submitted to the EC the National Report of the Republic of Bulgaria on the Stress Tests at Kozloduy NPP.

Based on the results of the stress tests, a programme for implementation of the recommendations and a programme for improvement of Kozloduy NPP preparedness, for response in extreme conditions, have been developed and are currently in progress.

Peer review

Following the submission of the National Report of the Republic of Bulgaria on the Stress Tests at Kozloduy NPP in late 2011, ENSREG initiated, in the beginning of 2012, a peer review process covering all national reports. The process was undertaken in three stages.

The first stage, a Topical Review of the National Report of the Republic of Bulgaria was completed in early February 2012, in Luxemburg. The discussion was attended by experts from the NRA, Kozloduy NPP and the engineering organisations that had analysed the stress tests. The National Report of the Republic of Bulgaria received a total of 167 queries on the three main topics (earthquake, flooding and other extreme natural events; loss of power supply and heat sink; severe accident management). On all issues comprehensive information was submitted either in advance or on the spot.

The second stage of the peer review occurred from 12 to 15 March 2012 with a team of experts from Slovakia, Greece, Hungary, the Ukraine, Finland, France and the EC visiting the Kozloduy NPP. The peer review team appraised highly the condition of plant equipment, the general quality of the National Report and the information provided in it, as well as the information submitted to the experts during the Topical review and the inspection on-site. The peer review concluded that Kozloduy NPP has developed a detailed programme of corrective actions, covering all upratings currently in progress or planned for the future. The peer review report contains also some specific recommendations for additional activities to be undertaken, in relation with the stress tests conducted.

Stage 3 – Country Report of ENSREG with results, final conclusions and technical measures for improvement.

National action plan of the Republic of Bulgaria

In response to the requirement of the European Council of June 2012, and the subsequent joint initiative of ENSREG (the European Nuclear Refulators' Group) and the EC for complete and timely implementation of the measures, deriving from the stress tests, KNPP together with NRA developed in 29.10.2012 – 21.12.2012 the National Action Plan for the Republic of Bulgaria after the Fukushima Dai-ichi NPP accident.

The National Action Plan unites all technical and organizational measures, and joint actions at the level of KNPP and at institutional level, resulting from the safety re-assessment of the nuclear facilities in operation. The plan defines implementation timescales and responsibilities of the operating organization, and the respective organizations and ministries, while taking into account the findings and recommendations provided by as follows:

- The National Report of Bulgaria for the stress tests at Kozloduy NPP;
- The ENSREG Country Report on Bulgaria;

- The ENSREG compilation of recommendations and suggestions;
- The ENSREG Action Plan;
- The National Report for the Second Extraordinary Meeting under the Convention on Nuclear Safety;
- The decisions and conclusions resulting from the Second Extraordinary Meeting under the Convention on Nuclear Safety.

Following the NRA review and approval, the National Action Plan was submitted to ENSREG in late December 2012.

The National Action Plan foresees a total of 63 measures and activities, the greater part of which are planned to be completed by the end of 2014. Only some of the long-term measures are planned for implementing in the period 2015-2017.

KNPP issues to the NRA quarterly reports regarding the progress on the National Action Plan, and once all measures have been completed a final report on the Plan will be submitted. The NRA inspectors monitor the National Action Plan implementation by inspecting, on periodical basis, the impelentation status of the individual measures.

WANO Mission

From 27 February to 2 March 2012 a WANO Technical Support Mission was conducted on "Training for the OSART mission". The areas covered by the mission were Operations, Maintenance, Technical Support, Chemistry and Emergency Planning and Preparedness.

All the weaknesses found and the recommendations made by the experts were carefully analysed by the teams, established for each of the inspection areas. The correctiev actions from this analysis were incorporated in the new revision of the Programme for Preparations for the OSART 2012 Mission on Units 5 & 6.

OSART Mission

From 26 November to 13 December 2012, an IAEA OSART Mission was conducted on units 5 and 6 at Kozloduy NPP. A group of IAEA experts performed a detailed review of the operating safety, on the basis of the IAEA safety standards. The review areas were Management, Organization and Administration; Operations; Maintenance; Technical Support; Operating Experience Feedback; Radiation Protection; Chemistry; Fire Safety and Emergency Planning and Preparedness.

The OSART mission experts identified some good practices, made recomemndations for improvements of operational safety in some review areas, the more importat of which are as follows:

- the plant should justify the current method of operation of the systems for mechanical filtration of drain water and for temporary storage of liquid waste, and reflect it in the operating procedures;
- the plant should develop and implement severe accident management guidelines for both open reactor conditions and the spent fuel pools;
- the plant should consider strengthening the quality of the root-cause analyses connected to human factor, so that the analyses are carried out in a thorough and timely manner;
- the plant should consider reinforcing the contamination control practices, in order to minimize the potentialities for spread of contamination and the risk of internal contamination;

- the plant should perform dose assessment for neutron radiation, for everyone working in neutron fields, and develop appropriate procedure for this assessment.

The OSART team concluded that the management of Kozloduy NPP is committed to improve operational safety and reliability of the plant. A clear and consistent approach was demonstrated in implementing of measures aimed at achieving and maintaining high standards of nuclear safety.

The OSART mission is compliant with the IAEA Nuclear Safety Action Plan in the field of peer reviews and operating organisations, and the conclusions of the second extraordinary meeting on CNS in 2012.

Long Term Operation

The Government programme for European development of the Republic of Bulgaria has included as a priority the extension of the operational lifetime of KNPP units 5-6. The design lifetime of unit 5 runs out in 2017, and that of unit 6 in 2021.

Kozloduy NPP held a tender procedure on the subject "Complex Assessment of the Actual Condition and Residual Life Time Evaluation of the Equipment and Facilities on KNPP Units 5 and 6", and selected a contractor – the Consortium Rosatomenergo - Électricité de France (EdF).

The general timeschedule for realization of complex assessment activities, preparation and implementing of the "Programme for Units' Preparation for Longterm Operation in Compliance with the Licensing Conditions for Units 5 & 6", includes the following major stages:

- Complex Assessment and Residual Life Time Evaluation of the Equipment and Facilities on KNPP Units 5 and 6, with completion date May 2014;
- Implementaion of the Programme for Preparation of the Untis for Long Term Operation;
- Conducting an extended Periodic Safety Review in terms of units' 5&6 licence renewal;
- Development and submission to the NRA a Safety Analysis Report (SAR), confirming the operating capability within the justified time period;
- Conducting SALTO (Safe Long-Term Operation) mission of the IAEA to confirm the preparednesss for long-term operation of untis 5-6;
- Preparation of the documentation for licence renewal;
- Submitting an application for operating licence renewal;
- Untis 5-6 licence renewal.

Pursuant to the licensing conditions of units 5-6, Kozloduy NPP issued to the NRA the documents related to the complex assessment and the residual life evaluation of SSCs. The documents have been reviewed and assessd by NRA experts, and the licence-holder was instructed to correct the non-conformances found. In the beginning of 2013 a working meetign was held between the NRA and KNPP to discuss non-conformances and measures proposed for their correction.

Nuclear facilities shut down for decommissioning

This category of nuclear facilities includes the Kozloduy NPP units 1 to 4. With Decrees of the Council of Ministers, dated 20.12.2008 for units 1-2, and 19.12.2012 for units 3 - 4, the units were declared facilities for management of radioactive waste (RAW) and were transfered to the State Enterprise Radioactive Waste Management (SE RAW). On 18.10.2010, the NRA issued operating licences to SE RAW for units 1-2, and on 25.02.2013 for units 3-4, as facilities for management of radioactive waste subject to decommissioning, and respectively rescinded the licences to Kozloduy NPP for operation of these four units in 'E'-mode. The spent nuclear fuel has been removed from the reactor pools. The SE RAW licences provide for management of the waste backlog, preparations for the decomissioning of the units, including dismantling of part of the non

contaminated equipment. Meanwhile, SE RAW has applied to the NRA for a decommissioning licence for units 1-2.

Statement by the Member Country on the status of nuclear facilities

The actions undertaken and planned by the Republic of Bulgaria are in conformity with the requirements of Article 6 of the Convention. The Kozloduy NPP units 1-4 shutdown is a political decision, concerning the country's accession to the European Union. Measures have been planned and implemented for the safe decommissioning of the units.

A large-scale Modernization Program has been implemented on units 5&6, remaining in operation, thus resolving the internationally identified WWER-1000 safety issues. Actions are in progress to complete the units' complex assessment and rest life time (RLT) evaluation of the equipment, and the preparations for their lifetime extension programme, in accordance with the regulatory requirements and internationally recognized operational experience. Implementation is continuing of the National Action Plan after the Fukushima Dai-ichi NPP accident, as a result of the European stress tests conducted, and in conformity with the IAEA Action Plan for Nuclear Safety.

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 (ASUNE). ASUNE regulates the public relations in connection 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. The state regulation is effected by the NRA Chairman who is an independent specialized authority of the executive power.

Act of amending and supplementing ASUNE (AAS of ASUNE)

The NRA policy statement confirms 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". For implementation of this policy, in 2009-2010, a working group at the NRA prepared a draft law on amendment and supplement to the ASUNE, taking into account the regulatory 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. The amendments to the ASUNE were approved by the National Assembly and promulgated in the State Gazette in October 2010. The amendments and supplements to the ASUNE, concerning the nuclear installations safety, are described herein below.

The amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) was ratified by the Republic of Bulgaria by a law. As required by the Convention, the NRA is defiend as the competent authority, a point of contact and coordinator for the CPPNM. Ensuring the physical protection is included as one of the main asepcts of the law, together with nuclear safety and radiation protection. Consideration is given also to a number of specific obligations of the Republic of Bulgaria under the CPPNM, and the Safeguards Agreement under the Non-Proliferation Treaty (NPT).

The Agreement between EURATOM and Non-Member States of the European Union on the early exchange of information, in the event of radiological emergency (ECURIE), was signed by the Republic of Bulgaria in 2003 and ratified by law in 2005. Pursuant to the Agreement, the NRA Chairman is designated as the central authority and contact point under the Agreement.

Since 2007, Bulgaria has been 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/Euratom, establishing a Community framework for nuclear safety of nuclear installations, promulgated 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-assessment of the national framework, and to organize international peer reviews, in order to constantly enhance nuclear safety. In this respect, upon the request of Bulgaria an IAEA mission was held on 08-19 April 2013 at the NRA to review the regulatory activities in the country (IAEA IRRS Mission). The results of the review mission are described in detail in Article 8 of this report.

The Act incorporates the fundamental safety principles, established by the reissued in 2006 IAEA fundamental document on the safe use of nuclear energy - IAEA SF-1 Safety Fundamentals.

A decommissioning licence has been introduced to replace the issuance of a series of permits to the licensees. The aim is to secure the licensee's responsibility for the safety of the facility throughout the whole process of decommissioning, lasting for decades. The Decommissioning Licence will be issued for up to 10 years and will be renewed on the basis of a safety re-assessment. The proposed changes give the legal possibility, the nuclear facility decommissioning to be undertaken by a specialized organisation, that is different from the operator.

The Act settles a number of deficiencies associated with the transfer of safety liability in case of ownership transfer or bankruptcy, both in the process of constructing a new nuclear facility, and at the other stages of the facility life cycle. Succession of the responsibilities and rights is ensured.

Related 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 specialized 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. All of them shall exercise control as per the authorites they have been granted. Such authorities are granted mainly by the following laws:

- Law on Environmental Protection;
- Energy Act;
- Law on Spatial Planning (LSP);
- Health Act;
- Disaster Protection Act;
- Law on 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, any international treaties, ratified constitutionally, promulgated and entered into force for the Republic of Bulgaria, are part of the country legal system and prevail over any conflicting provisions of national law, which contradict them.

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

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

Following the Fukushina Dai-ichi NPP accident, the international community took a number of initiatives to review the major conventions, serving as legal tools and regulating public relations. The Republic of Bulgaria supports the efforts to improve the international regime in the field of nuclear safety and radiation protection. The NRA is a leading organization in the process of formulating a unified state concept on the amendment of the respective legal tools.

Regarding the proposed amendments to the Convention on Nuclear Safety, the Convention on Early Notification of a Nuclear Accident, and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Republic of Bulgaria actively participated in the process of forming a unified European position. Concerning the preparations for amending the Convention on Nuclear Safety, specific texts were discussed, that will assist the inclusion of existing good international practices in the appropriate, legally binding provisions of the convention.

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

Secondary legislation

The ASUNE article 5, section 17 provides that the NRA shall develop and submit for approval to the Council of Ministers (CM) any secondary legislation (Regulations) for the Act enforcement. The documents shall be prepared in compliance with the Law on Normative Acts. The drafts of Regulations and the annexes thereto shall be published on the NRA web page and the portal for public consultations of the CM. Pursuant to the Rules of Procedure of the Council of Ministers and its Administration, the draft regulations shall be agreed with all the ministries and other state bodies. They shall be submitted to the CM by the responsible Deputy Prime Minister. Any amendments and supplements to the secondary legislation shall be made in conformity with the above sequence.

The secondary legislation (Regulations), regarding the ASUNE application (Annex 2) have been developed and approved in 2002-2005. Following the ASUNE amendment in 2010, the NRA developed a programme for review of all secondary legislation, related to the application of the Act. The Programme comprises review and update of all current regulations and also the development of three new ones. The programme completion is expected in late 2014. Currently, the following regulations have been updated:

- Regulation on Emergency Planning and Emergency Preparedness in case of Nuclear or Radiological Emergency (October 2011);
- Regulation on the Basic Norms of Radiation Protection (September 2012);
- Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy (September 2012);
- Regulation on Radiation Protection during Activities with Sources of Ionizing Radiation (September 2012).

Two new regulations have been approved:

- Regulation on Radiation Rrotection During Work Activities with Materials with Increased Concentration of Natural Radionuclides (October 2102);
- Regulation on Radiation Protection in Activities with Radiation Defectoscopes (April 2013);

Drafts have been developed for amending and supplementing of the following regulations, as well as one new regulation:

- Draft of Regulation on the Provision of Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances;
- Draft of Regulation on Safe Management of Radioactive Waste;
- Draft of Regulation on Safety of Spent Nuclear Fuel Management;
- Draft of Regulation on the Conditions and Procedure of Transport Radioactive Material;
- Draft of Regulation on the Safe Operation and Technical Supervision of facilities of high risk important to nuclear safety (boilers, pressure vessels, pipes etc., part of SSCs important to safety, upon whose breakdown radioactive products may be released) – a new document.

The drafts development has considered the changes made to international conventions and agreements, the new legislation of the European Union, and the new or revised documents of the IAEA, as well as the experience gained in the implementation of the Act.

Another draft under development is the amendment to the Regulation on the Conditions and Procedure for Acquiring Professional Qualification and the Procedure for Issuing Licences for Specialized Training and Certificates for Qualification for Use of Nuclear Energy.

The legal requirements review pays special attention to the lessons learned from the Fukushima Dai-ichi NPP accident. The legal analysis undertaken shows that attention shall be focused on several regulations, the most important among them being the Regulation on the Special Status Zones, and the Regulation on providing the safety of nuclear power plants. The NRA intention is to periodically revise the existing legal requirements upon issuance of new IAEA documents, considering the lessons learned from the Fukushima Dai-ichi NPP accident.

Guides issued by the regulatory authority

The basic requirements on nuclear safety, radiation protection and physical protection of nuclear facilities are set out 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 that 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 Act 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).

Regulatory guides are not mandatory in nature and the criteria set out in the guides are not necessarily binding. The NRA has established a comprehensive programme 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 programme, have been selected by analysing the proposals made by the various NRA departments. The programme is reviewed annually and is updated based on the new proposals for RGs, change of priorities, changes in the legislative framework, etc.

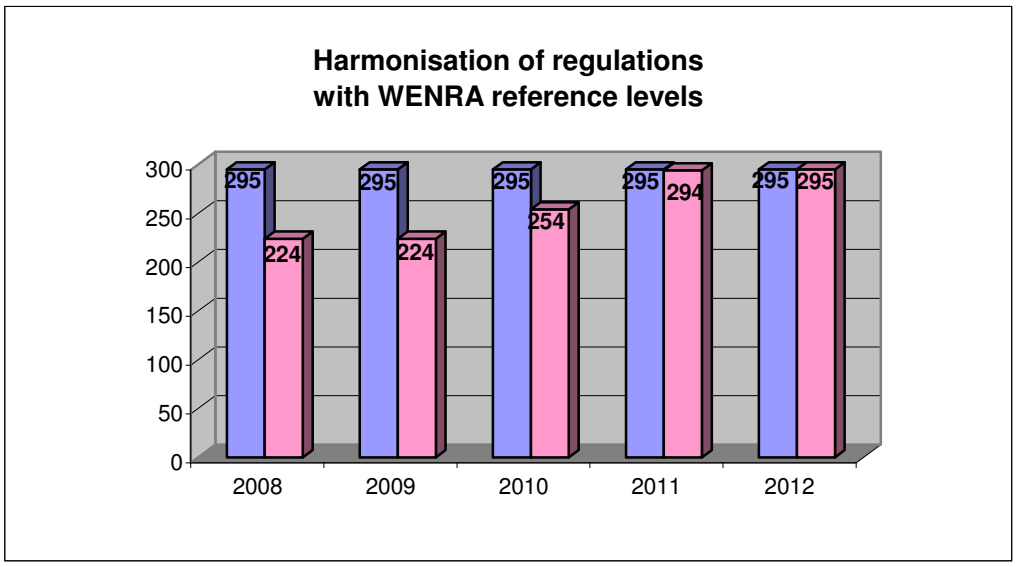
In order to ensure broad distribution and easy access, RGs are being published in electronic format on the NRA web site, www.bnra.bg. Guides are distributed to all interested organisations with a formal letter.

Activities for harmonization of safety requirements

After the NRA was accepted as a member of WENRA (in March 2003), NRA experts take part in the activities of the two safety harmonization working groups – one for the safety of the nuclear power plants (Reactor Harmonisation Working Group), and the other for the safe decommissioning and management of radioactive waste and spent fuel (Working Group on Waste and Decommissioning). NRA members are actively involved in the working groups activities for development of safety reference levels, assessmnet of harmonization status, planning and

reporting the progress on harmonization of the national requirements with the WENRA reference levels.

The process on harmonization of the national nuclear regulations with the WENRA reference levels, applicable to nuclear power plants, started with the preparation and approval of the regulations concerning the ASUNE enforcement, and was actually completed with the putting into effect of a number of regulating safety guides in 2011-2012. The chart below shows the change in time of the number of nuclear safety reference levels, with which the regulatory provisions have been harmonized.



In parallel with the safety harmonization of NPPs in operation, the Working Group undertook a Pilot study on the safety of new reactor designs, which WENRA published for discussion by the interested parties. In November 2010, this resulted in WENRA publishing a Statement with final formulation of the safety targets, with the intention for them to be used in the following years as a basis for developing a common standpoint on key technical aspects of safety, inherent to new plant designs. In the process of regulatory review for approval of the Belene NPP technical design (TD), the NRA considered both the new NPPs safety targets, as well as the key technical aspects, that should be addressed in the safety analysis of the design. This resulted in the NRA requesting from the applicant to submit further information on the interim safety analysis report on Belene NPP, including in the form of topical reports. The new data obtained were reviewed for compliance with the safety targets for new reactors and the key technical issues, considered by WENRA.

Together with other activities, following the Fukushima Dai-ichi NPP accident, WENRA approved and published, in the beginning of 2013, a Position Paper on the Periodic Safety Reviews taking into account the lessons learned from the accident. The Position Paper highlights the neccessity to reassess the external hazards characteristic for a given site, the concept for continuous safety enhancement, including the implemention actions for severe accident management, as well as the transparency and publicity of the results from periodic safety reviews. The NRA has considered those aspects in establishing its regulatory approach, incorporated in the document “NRA Position on the Periodic Safety Review for KNPP Units 5 and 6 Long Term Operation, in the context of the Fukushima NPP Accident”.

Article 7 (2) (ii) Licensing system

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

- Responsibility for ensuring nuclear safety and radiation protection lies in full with the persons, responsible for the facilities and activities and may not be transferred to others;
- Persons responsible for the facilities and activities shall establish and maintain an effective safety management system;
- The expected economic, social and other benefits, shall outweigh any possible adverse effects of the 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 the personnel and public shall be limited and maintained as low as reasonably achievable level;
- The concept of defence in depth shall be applied, while implementing all reasonably 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/or uncontrolled exposure shall be justified and optimized;
- The competent authority, which carries out the state regulation of the safe use of nuclear energy and ionizing radiation, shall be provided with human and financial resources, sufficient to carry out its responsibilities in full.

The ASUNE defines the scope of activities, facilities and materials subject to licensing. Licence is issued to operate a nuclear facility (unit of a nuclear power plant, facility for spent fuel management, facility for radioactive waste management, research reactor), and also for its decommissioning. The maximum term of the license validity is 10 years. Thus, the operator can plan long-term activities and allocate more resources to safety improvements. An option has been given to renew the license on the basis of a periodic safety review. The Act places very precise and clear requirements to the operator, in respect of the conditions and criteria to be met in order to obtain a licence, by which the subjective decision-making by the regulatory authority, is avoided to the greatest degree possible.

For given single-time activities, the Act envisages permit issuance as follows:

- 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 limits and conditions for safe operation, on the basis of which is authorized to oparate;

  - Internal rules for the activity, including procedures, programmes, technical specifications annexed to the operating licence;

- Transport of nuclear material;
- Business transactions with nuclear facilities;
- Import and export of nuclear material;
- Transit of nuclear material.

Licence or permit, its modification, or the refusal of the NRA Chairman to issue the respective document, may be appealed to the Supreme Administrative Court.

The terms and conditions, for issuing licences and permits, are specified by the Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy (latest revision in force, since September 2012). According to this Regulation, the licence or permit applicant shall submit the respctive documents, confirming compliance with the requirements on nuclear safety and radiation protection. These requirements are defined mainly in the Regulations on the implementation of the ASUNE (Annex 2).

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 includes:

- Preventive control by issuing licences and permits for activities and individual licences;
- Monitoring the implementation of the terms of licences and permits for activities and individual licences;
- Follow-up monitoring on the implementation of recommendations and instructions given by the control bodies.

In fulfilment of his control powers, the NRA Chairman shall:

- Perform periodic and extraordinary inspections through designated authorized officials;
- Inform other specialized control authorities to take measures within their competence;
- Alert the prosecuting authorities upon evidence of a crime;
- Amend or revoke issued licences or permits, or individual licences;
- Impose enforcement administrative measures and administrative sanctions, as provided by the ASUNE.

The NRA Chairman is entitled 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 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 control, identified by the ASUNE, and the conditions of the effective licences and permits. The inspection activities are planned by taking into account the operating status of nuclear facilities, the results of previous inspections, and planned modifications, in such a way as to ensure coordination with the activities planned by the operators. Financing of the inspection activities is secured within 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 and permit-holders (in the case of NPP - daily), when issues are discussed in an open dialogue. The aim is to assist licensees and permit-holders in implementing the requirements of the Act and the Regulations, so that the planned measures shall be acceptable to both parties. Enforcement and administrative penalties are imposed only if all other possibilities have been unsuccessful. Discussions shall take place on a routine basis both at the NPP site, and the NRA headquarters, at the initiative of one of the two parties.

The NRA Chairman authorises certain officials from 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 entities and sites, at any time, to check the status of nuclear safety, radiation protection and the technical status of the nuclear facilities, and the ionizing radiation sources;
- To require from the respective officials 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;
- To draw up statements on administrative violations;
- To make proposals to the NRA Chairman for modification, suspension, termination or revocation of the permits, licences or individual licences issued;
- To issue improvement notices for ensuring nuclear safety and radiation protection.

Inspection results are recorded in a Protocol of Findings, to which the evidences collected, explanations and results of monitoring, measuring and/or 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.

Review and assessment of safety

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

- Reception and registration of the application and its attached documentation;
- Determination of a programme and a team of experts to review and evaluate the documentation and, in some cases, specific 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 of 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, and on the basis of the conclusions a proposal is made to issue the licence/permit or a motivated refusal instead;
- The final decision on the issuance of a licence/permit, or a motivated refusal, lies within the responsibility of the NRA Chairman.

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

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

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

Analysis and evaluation of operational events

The requirements for providing information by the licensee and the permit-holder to the NRA, including the requirements for mandatory notification to the Agency in case of an event, incident or accident are defined by a Regulation. The Regulation defines the cases when the regulatory body shall be notified for violations of the requirements on nuclear safety and radiation protection. The Regulation also determines the procedure and sets time limits for notifying the regulator, the methodology for evaluation and analysis of the events, and also the format and contents of the reports.

A written report shall be submitted within 30 days for each event. 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 shall be requested or additional analyses and expertise conducted in order to clarify the root causes of the specific event. In case of events important to safety, NRA inspectors participate in the event investigation teams.

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

To prevent and discontinue any administrative violations, or to prevent and eliminate their consequences, the NRA Chairman imposes sanctions (fines and penalties) and enforcement administrative measures. The ASUNE assigns different amounts of penalties, depending on the type of offence. The ascertainment of violations, issuance, appeal and enforcement of penal provisions follow 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 authorisation activity;
- Suspension of an individual licence;
- 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 findings 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 Social Insurance Code. Appeal does not suspend execution, unless the court orders otherwise.

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

The NRA applies enforcement administrative measures and prosecution solely when all other possibilities have been ineffective. The effectiveness of the regulator's policy has been confirmed by the few penalties and compulsory administrative measures imposed.

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 and became one of the co-founders of the international organization. In June 1957, by Resolution No. 603, the Council of Ministers established a Committee for the Peaceful Use of Atomic Energy, the mandate of which was to monitor and promote the R&D activities in the use of nuclear energy. After commissioning of the first two units of Kozloduy NPP in 1975, by Decree No. 31 of the Council of Ministers of 15 March 1975, the Committee was given also control functions. In 1985 was adopted the first Act on the Use of Nuclear Energy for Peaceful Purposes. The Act created a Committee for the Use of Nuclear Energy for Peaceful Purposes and determined in detail the functions and the tasks of the organization, An Inspectorate on the Safe Use of Nuclear Energy for Peaceful Purposes was also established.

The Act was amended several times until 2002 when it was fully repealed by the new Act on the Safe Use of Nuclear Energy (ASUNE). The ASUNE is consistent with the current trends in the field of nuclear law, including the legislative practice of the EU countries in this area. In developing the Act, the recommendations of the IAEA experts reviewing the draft were considered. By this Act, the Committee was transformed into Nuclear Regulatory Agency, which is a 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 ASUNE. The state regulation of the safe use of nuclear energy and ionizng radiation, and the safe management of radioactive waste and spent nuclear fuel is effected by the Chairman of the Nuclear Regulatory Agency. The NRA is an independent specialized body of the executive power.

The 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.

Mission and objectives

The regulatory functions performed by the NRA in the public interest, determine the organization's mission, namely: “Protection of the individuals, public, future generations and environment from the harmful effects of ionizing radiation”. To achieve its mission the NRA is guided by the 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, the 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 generating the 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 management "Policy Statement", which identifies priorities and expectations to staff.

Authorities and Responsibilities

Under the ASUNE, the NRA Chairman shall have the following authorities and responsibilities:

- Manage and represent the Agency;
- Issue, amend, supplement, renew, suspend and revoke licences 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 licences 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, in respect of the use of nuclear energy and ionizing radiation, and management of radioactive waste and spent nuclear fuel;
- 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 regards of the safe use of nuclear energy and ionizing radiation, and in the management of radioactive waste and spent nuclear fuel;
- Provide the public, legal persons or state 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 in the use of nuclear energy and ionising radiation, and in the management of radioactive waste and spent nuclear fuel, as well as the activity of the NRA;
- Organize and coordinate the preparation of, 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;

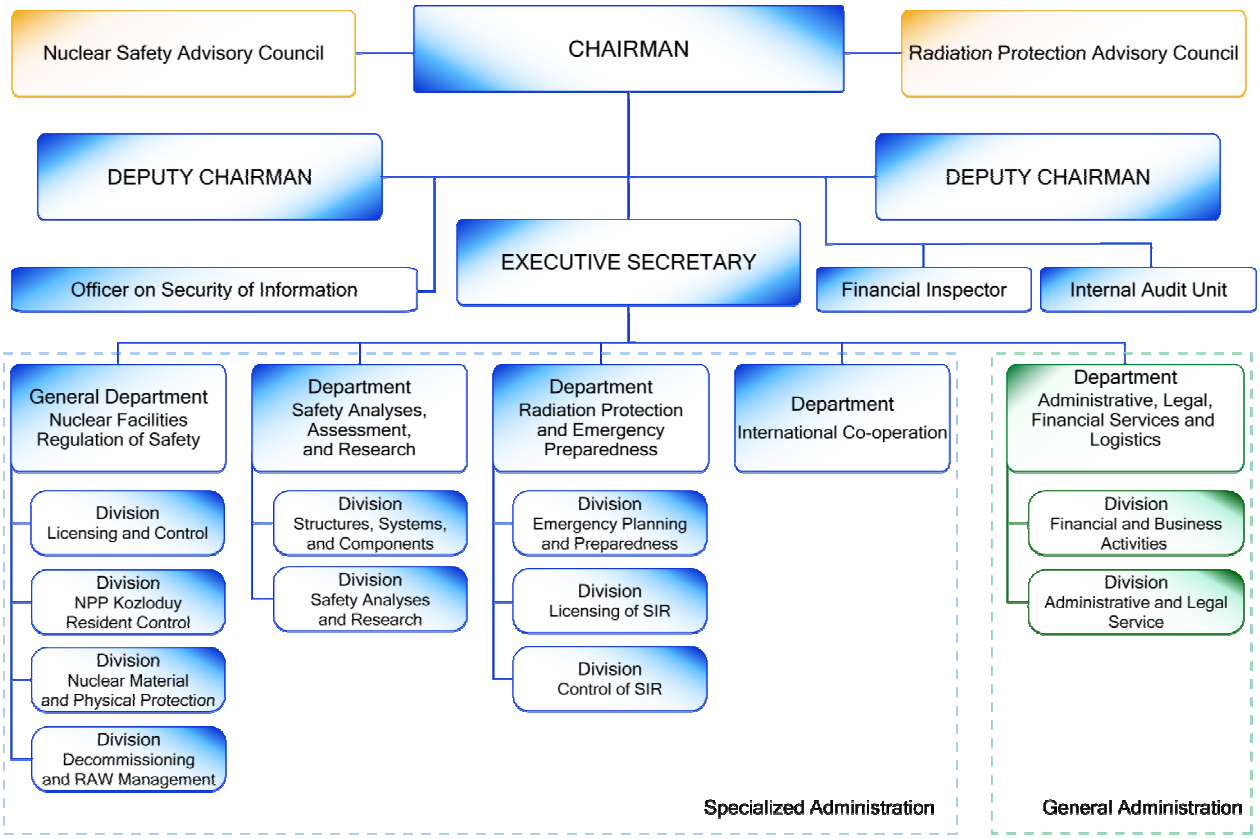
- Develop and propose for adoption to the Council of Ministers the Regulations on the implementation of the ASUNE.

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

Organizational Structure

According to the ASUNE, the NRA Chairman is assisted by an Administration 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. The NRA Administration is headed by an Executive Secretary. The NRA employees are divided into general and specialized administration. The General Administration provides technical support to the activities of the Specialised Administration and carries out administrative services to citizens and legal persons. The Specialized Administration is organized into four Directorates and assists the Chairman in carrying out his regulatory and supervisory functions related to nuclear facilities, sources of ionizing radiation, nuclear material, radioactive waste, emergency preparedness and international cooperation. The Specialized Administration includes a regional office at the Kozloduy NPP site. The NRA organizational structure is shown on the figure herein.



Development and maintenance of human resources

The enormous responsibilities of the NRA staff members to the public 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, the NRA has 114 staff positions, and as at August 2013 the NRA human resources number is 99 of actually employed staff. Regardless of the NRA's efforts to employ experts for the vacant positions, there are 15 vacancies at present. Analysis confirms that this is due mainly to the high requirements that the NRA puts to the professional competence and expertise of the candidates, as well as the difference between the remuneration rates payable by the Agency and by the basic licence holders.

As a result, the Agency has continued its policy of employing young people, the greater number of whom join the regulator straight from the university. Each newly recruited employee is developed an individual training programme on the basis of his/her job description and analysis of the necessary competences and skills. The programme consists of theoretical training, practical training and coaching. As an example of practical training, in 2012 for six newly employed inspectors was conducted a three-month training on Kozloduy NPP site with preliminary agreed programmes. The training provided the young inspectors with the opportunity to get close knowledge on the Kozloduy NPP site and the facilities located there, as well as to take part in the on-site inspection activities.

Development and maintenance of competence

In recent years, the NRA employees' workload has been constantly growing. This is due to the new challenges before the organization such as the construction of a national repository for low and intermediate level waste, the revision of the secondary legislation documents, and considering the lessons learned from the Fukushima Dai-ichi accident.

NRA applies a consistent approach to increase the performance effectiveness of the employees, 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 performance and ensuring responsibility and accountability in planning and execution of tasks; etc.

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. It should be noted that nearly half of the employees are up to 45 years of age, allowing for continuity of knowledge and professional experience.

To fulfil its public responsibilities and functions, 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 expert knowledge and skills. Each year, an annual plan is developed for training of the employees in administrative matters. It is obligatory

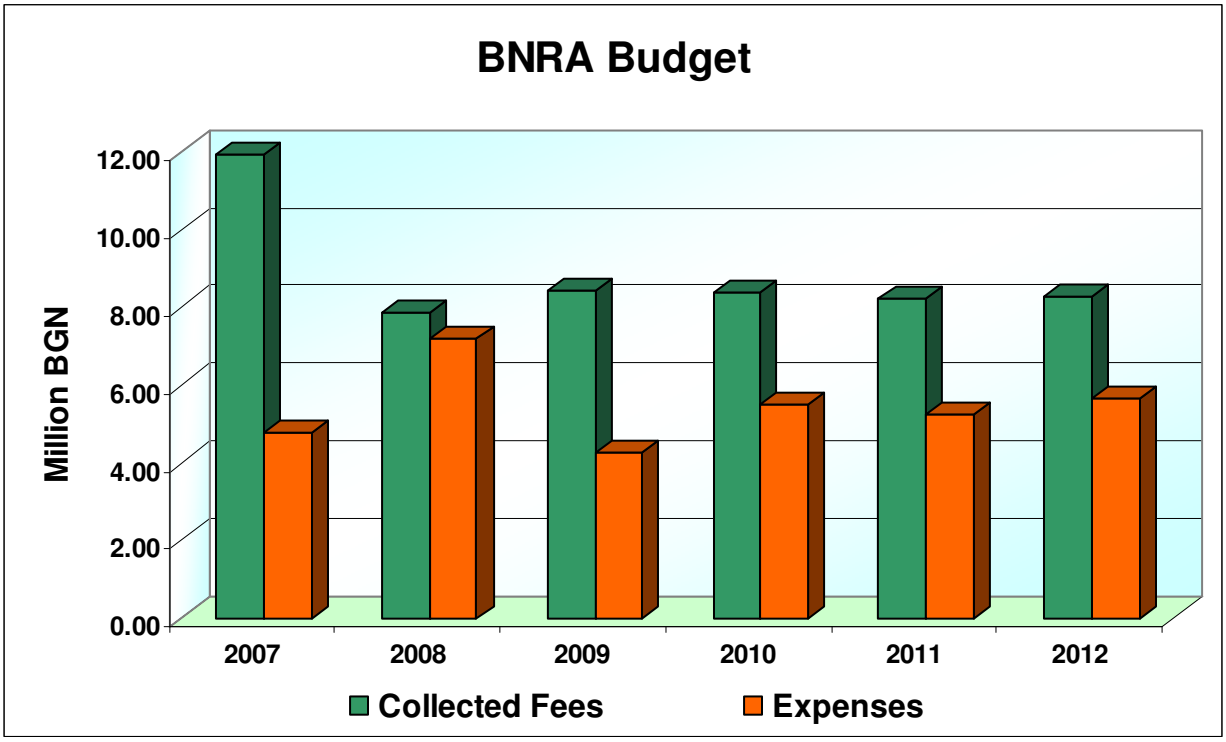
that such training pass newly recruited staff and those appointed for the first time on a management position.

Education and training to improve expertise and skills take into account the specificity of individual positions and the future challenges, facing the organization. In order to implement a systematic approach at all stages, a Competency and Training Management System is being developed at the NRA. Currently, in accordance with the NRA organizational structure, competence matrices have been developed and adapted for the main positions. A Software Tool Kit has been developed and implemented for statistical data processing to allow determining the needs for periodic training and setting appropriate priorities.

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 that is directly negotiated with the Ministry of Finance. As a result, in recent years, there has been stability in the financing of the organization.

The diagram shows the trend of the NRA budget in recent years. Stability of funding allows the NRA to carry on its long-term policies, cover all the areas of regulatory control, complete in full the planned activities on safety assessment, and ensure the preservation and the growth of payment of employees.



Quality Management System

To meet its mission of protecting human health, the public, future generations and the environment from harmful effects of ionizing radiation, the Nuclear Regulatory Agency develops, implements, and continuously improves a Quality Management System (QMS).

The QMS has been developed on the basis of the IAEA standards. The following are defined in the process of QMS establishing and applying:

- approach to the NRA activities;
- obligations of the separate organizational units;

- periodic performance assessment;
- the required financial and human resources and good work conditions;
- training for enhancement of the employees' knowledge and skills;
- periodic review of the performance functions (self assessment and auditing).

The 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 the NRA policy and basic principles for implementation of activities;
- Level 3 - Work Instructions, giving detailed directions 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 terms of their importance to the fulfilment of the NRA mission and objectives, the activities are divided into main and support ones. As main activities are defined: Licensing and Authorization; Inspection Activity; Application of Enforcement Measures; Safety Review and Assessment; Development of Legislative Documents, Regulations and Guides; International Cooperation; Emergency Preparedness. Supporting activities cover: Management activities; Administrative Support; Public Relations; and Staff Training. Procedures (level 2), instructions (level 3), and, where applicable, guides (level 4), are being developed for each main or support activity.
QMS developing and maintenance process requires significant human and material resources. In the period 2010-2013, about 30 documents have been reviewed and revised, including the procedures for licensing of nuclear facilities, conducting regulatory inspections, and performing of safety analyses and evaluations.
The NRA policy provides that the QMS is an open and live system, that reflects changes to international standards in the area in a timely manner. Following the adopted new IAEA safety standards, which reflect the integrated management system concept, the NRA has been taking appropriate actions to comply with the new requirements.

Openness and transparency

We are living in a society that is sensitive to the use of nuclear energy and the problems related to the radioactive waste management. In terms of this, the open dialogue with all the stakeholders, the transparency of our activities and decisions, and ensuring public access to information appear as the key issues for efficient regulatory activity. The NRA webpage provides a lot of and varying information on nuclear safety and radiation protection, as well as the activities of the NRA. Access is free to the public registers of issued licences and permits for nuclear facilities and ionizing radiation sources, licences for specialized training and certificates for qualification to implement activities with SIR or work on nuclear facilities.

At the web address: www.bnra.bg all Annual Reports of the NRA since 2003 have been published, also all National Reports of the Republic of Bulgaria under the Convention on Nuclear Safety, the Reports under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The publications include also the reports on implementing the country's obligations as per the IAEA Codes, and the European Directives in the area of radiation protection.

The NRA regularly updates the public information as regards all the events on nuclear facilities or events with SIR. It is one of the tasks of the organization to guarantee timely information to the media about everything happening in the area of nuclear safety and radiation protection. Improving the communication between the professional language of the specialists and the

language of the public on such important topics remains a challenge. In the light of this, NRA regularly organizes training seminars for journalists, traditionally attended by representatives of all national media, as well as the public relations officers of the authorities and organizations concerned.

External technical support

The NRA has a specialized organizational unit (department) for review and assessment of nuclear safety and radiation protection. This unit works in close cooperation with the rest of the specialized units, thus ensuring that experts of the required competence participate in the process of review and assessment. In order to improve the internal expertise in different technical areas, framework contracts have been signed for cooperation and expert support with 19 Bulgarian engineering companies and R&D organizations. To avoid conflict of interests, the contracts contain provisions for informing the NRA about changes of company competences or capabilities, as well as of the contracts awarded by licence-holders.

The NRA is fully responsible for the regulatory decion-making, and has provided human and financial resources to secure the efficient performance of the technical support system through:

- 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 assessment reports, performed by the technical support organisations (TSOs);
- availability, within the organization and at the TSOs, of necessary assessment tools and computer codes to carry out the assessments;
- sufficient financial resources to pay for the contracts;
- access of the NRA staff and TSOs to new developments in science and technology;
- continuous improvement of own and TSOs expertise, through training and education programmes, as well as participation in international research and exchange programmes, etc.

Advisory Councils

Pursuant to Article 9, Paragraph 1 of the ASUNE, two advisory councils are established in support of the NRA Chairman:

- Advisory Council on Nuclear Safety;
- Advisory Council on Radiation Protection.

The Advisory Councils have adopted rules for their work, and their meetings are chaired by the NRA Chairman or by an authorized representative. The 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 to:

- Make proposals in the process of establishing of NRA priorities;
- Discuss and give opinions on existing regulations and new drafts;
- Discuss and give advice on programmes 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 expetise, 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.

Pursuant to the provisions of Article 9 of ASUNE, the advisory councils staff is appointed 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, management of radioactive waste and spent nuclear fuel. The 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 of the regulatory body in the governmental structure

In terms of Article 4 of the ASUNE, and Article 19, Paragraph 4 of the Law on Administration, the Chairman of the Nuclear Regulatory Agency is considered an executive authority. As such, it annually submits to the Council of Ministers a report on the status of nuclear safety and radiation protection in the use of 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 Rules of Procedure of the Council of Ministers and its Administration (RPCMA), there is a direct line of communication between the government and the authorities specified in Article 19, Paragraph 4 of the Law on Administration, the NRA Chairman being one of them. This communication 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 Prime Minister. 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.

International regulatory review service

Upon the request of the Government of the Republic of Bulgaria, from 6th to 19th April 2013, a team of leading international experts visited the Bulgarian NRA and conducted a full scope Integrated Regulatory Review Service (IRRS). In the mission took part also representatives of the National Centre of Radiobiology and Radiation Protection (NCRRP) at the Ministry of Health (MH), in terms of their responsibilities for the radiation protection of patients, personnel and the public.

The objective of the mission was to review the effectiveness of the Bulgarian regulatory body and exchange regulatory information and experience in the area of nuclear safety and radiation protection, safety of radioactive waste and transport of radioactive material. The mission provided an impartial assessment on the nuclear regulatory practices against the IAEA Standards and Guidelines, and good international practices. The team used as prelimenary information on the regulatory basis and practices the Information Package, provided in advance, including the results of the Agency's self assessment (covering the period September 2011 – December 2012) and the Plan for Improvements, issued following the self assessment.

The mission team consisted of 25 experts (16 senior experts from IAEA Member States, six IAEA staff members and three observers). The review included all regulatory areas, such as: responsibilities and functions of the government; global nuclear safety regime; responsibilities and functions of the regulatory body; management system of the regulatory body; licensing, review and assessment; inspection; enforcement measures; regulations and guides; emergency preparedness and response; control of medical exposures; occupational radiation protection; control of discharges and materials for clearance; transport of radioactive substances; radioactive waste management and decommissioning; environmental monitoring; interface with nuclear security.

The scope of the mission covered all facilities and activities regulated by the NRA: the KNPP nuclear units (two in operation and four in decommissioning); the SF and RAW management facilities; facilities and activities with sources of ionizing radiation; and transport of radioactive substances. The mission review paid special attention to the Fukushima Dai-ichi NPP accident and the respective IAEA Nuclear Safety Action Plan. A number of issues concerning the Bulgarian regulatory practice, were reviewed and discussed: Long-term operation of NPPs, and Naturally Ocurring Radioactive Material (NORM) legislation and practices.

The mission provided exceptional opportunity for exchange of information and expertise between the team members and their colleagues from the NRA and the NCRRP. To evaluate the regulatory system effectiveness a number of interviews and discussions were held with the NRA staff. The mission team observed also NRA inspection performance on-site of Kozloduy NPP and SE RAW, and two other facilities with industrial and medical sources (the Permanent Repository for RAW at Novi Han, and the Tokuda Hospital in Sofia). Additionally, the team witnessed the emergency response drill at the NRA. In the mission report the team stated they had received full cooperation and support on all matters, and specially highlighted the openness and competence of Bulgarian experts.

The report concludes that:

- Bulgaria has a clear national policy and strategy for safety, supported by a definite security framework;
- NRA operates as an independent regulatory body and conducts its regulatory processes in an open and transparent manner;
- In response to the Fukushima Dai-ichi NPP accident, the NRA reacted and communicated promptly and effectively with interested parties.

The mission identified a number of good practices and made some recommendations and suggestions that shall contribute to enhancing the regulatory frame efficiency. Some of the strong points and good practices are as follows:

- A no blame policy is applied for investigation of nuclear events and radiation safety-related events, supported by a regulatory framework;
- The TSOs support system, adopted by the NRA, is a good basis for more efficient use of the competence available;
- The process in effect for developing and revising of Regulations and Guides is well structured and includes active participation of all stakeholders;
- The NRA has a clear policy of public transparency and openness, which covers provision of information on safety related events and the role of NRA in emergencies;
- A National radiation dose registry has been set up, including comprehensive medical and radiation dose information, that allows the conduct of detailed cause-effect analyses.

The team also identified the following issues that require additional attention or improvement:

- Distinguishing of responsibilities among organizations that regulate and control radiation protection activities;
- Filling up vacant staff positions;
- Development of an integrated management system;
- Establishment of formal public consultations in the final phase of the licensing process;
- Improvements on the procedures and instructions for safety assessment and analysis;
- Oprimisation of the inspection process;
- Development of additional regulatory guides.

The mission report is published on the NRA site – www.bnra.bg. The conduct of this review mission also complies with the IAEA Nuclear Safety Action Plan in terms of strengthening the role of peer reviews. Reporting of the mission conclusions and findings in this report is consistent with the results from the 2nd Extraordinary Meeting under the CNS, in August 2012.

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

The responsibilities of licensees are specified in the Act on the Safe Use of Nuclear Energy, and the Regulation on providing the safety of NPPs.

In 2010 the ASUNE was significantly amended. One of the objectives of the amendment was to incorporate in the Act the fundamental safety principles, as formulated in the IAEA documents (Fundamental Safety Principles, Safety Fundamentals, No SF-1), and also the provisions of the Directive 2009/71/EURATOM of the EC, dated 25 June 2009, establishing the community framework for nuclear safety of nuclear installations.

The amendments have introduced for the first time in the Act the explicit principle that 'the responsibility for ensuring nuclear safety and radiation protection, lies in full with the persons responsible for the facilities and the activities, and may not be transferred to other persons'.

The licences and permits, issued by the NRA, include requirements that regulate the performance of the main activity. For example, each licence defines the activity scope and type; 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 to the regulator about: the operations, including fulfilment of license conditions; the procedure for notification in case of change of the circumstances in which the license was issued; the procedure for licence amendment or extension of its validity;
- the obligations of the licensee in connection with the regulatory control, carried out by the NRA, the applicable legislation, interfaces with other permits or licences; etc.

According to the Regulation on providing the the safety of NPP: '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 ionizing 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 that is important to safety. Such changes shall be justified in advance, systematically planned, and evaluated after their implementation.

For issuing a permit or a licence, 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 system 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.

Allocation of the prime responsibility for safety

The allocation of responsibilities by the licence holder is described in the Kozloduy NPP internal organizational documents. The internal document entitled "Rules for the Organization and Operation of the Kozloduy NPP", specifies the overall organizational structure; management priorities; management bodies and their functions; principles underlying the organizational structure; functions and tasks of different structural units; and lines of interaction. The Directorates in which the company has been subdivided, have their own rules for organization and activity, compliant with the general Rules of the plant.

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

The responsibilities of personnel are defined by job descriptions for each job position, while those for the operating personnel are also included in job instructions.

Regulatory body requirements for prime responsibility for safety by the licence holder

The Nuclear Regulatory Agency carries out control over the fulfilment of the licensee obligations, using various approaches, including control over changes to internal documents, on the basis of which the licence has been issued.

In case of changes to internal documents, it shall be demonstrated that the regulatory and legal requirements have been met, and that the changes comply with the procedure for introducing of changes adopted by the plant. If substantial changes have been made to internal rules for performing the activity, the regulatory body shall issue separate permits.

When changes important to safety are being made to the organizational structure, before issuing a permit for modification, the NRA shall check and verify that those changes have been justified in advance, whether they comply with the statutory requirements, and whether they have been planned and systematically assessed, as per the internal documents established for the purpose.

Description of the mechanisms for maintaining a transparent and open public communication by the licence holder

The following major priciples apply to the KNPP communication policy implementation:

- transparency;
- authenticity and accuracy of the information provided;
- communication is proactive, not reactive in nature;
- systematic and consistent approach;
- equality of all participants in the communication process.

Kozloduy NPP carries out a number of activities directed towards the public, including the population in the region surrounding the nuclear power plant, institutions, NGOs, scientific societies, the younger generation, partners, etc., applying also the mechanisms of the IAEA Nuclear Safety Action Plan, more precisely the section dealing with improvement of transparency and efficiency of information distribution. These activities comprise as follows:

- Supporting a corporative internet website, in which the following topics are present: About the Plant; Current Information; Generation; Safety; Information Centre;
- Maintaining a constant dialogue with the mass media, some of the activities being:

- Delivery of press releases with topical information on all aspects of the KNPP activity and their dissemination to the mass media (regional, central, and international);
- Organizing of press conferences and briefings for the media, in case of information occasions or important events;
- Arranging of reports and interviews with representatives of the KNPP management team or experts;
- Organizing annual meeting of the plant management with representatives of the mass media, where the results from KNPP annual activities are presented;

- Preparation and distribution of printed and information publications;
- Annual reports providing a comprehensive picture of KNPP annual activity;
- Organizing of sightseeing tours – Topical programmes for groups or individual visits of citizens, school children and university students in order to familiarize them with the nuclear power plant;
- Holding of 'Open Days' – aimed at obtaining of personal impression from the NPP*;*
- Arranging of meetings, workshops, round-tables, public discussions with partners from the country and abroad, and representatives of NGOs, the media and the public.
- Holding public opinion polls on the level of public acceptability of the nuclear power plant.

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 the measures and regulatory requirements regarding policies and programmes to ensure priority of safety

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 the management of radioactive waste and spent fuel, nuclear safety and radiation protection have priority over all other aspects of this activity', while observing the following basic issues: the responsibility for ensuring nuclear safety and radiation protection lies in full with the licensees and may not be transferred to other entities; the licensees establish and maintain an efficient system of safety management. The application of this principle is further developed in the Act in terms of the criteria to be met by applicants for a licence to operate a nuclear facility, who shall:

- have financial, technical, and 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 level of education and training;
- have adopted a program of measures, including internal rules, necessary for ensuring and maintaining the quality of all activities for the operation of the nuclear facilities;
- have provided the conditions for maintaining a high level of safety culture.

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

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 licencee shall conduct statistical analyses of specific indicators for safe operation. The nuclear facility safe operation indicators and the methodology for their calculation shall be determined by the licence holder, with the NRA agreement.

Pursuant to the Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy, the applicant shall attach to his application for approval of the nuclear facility technical design, the results from an independent review (verification) of the safety analysis.

Measures taken by licensees to implement regulatory requirements for priority of safety

Safety policies

The Kozloduy NPP long-term intentions, regarding the company management, are declared in the Management Policy Statement.

The priorities as identified by the management for ensuring the highest level of safety, efficient and competitive production, qualified, competent and motivated personnel and financial stability are developed and justified in the KNPP policies: safety management policy, environmental management policy, policy on the management of health and safety at work, security management policy, quality management policy, finance and economy management policy, personnel training

and qualification policy, fire safety policy, HR policy. The liner managers have familiarized their subordinate personnel with the policies adopted. The KNPP policies are subject to periodic review to confirm their up-to-date and applicability status.

The Safety Management Policy declares that: "A top priority for the company are nuclear safety and radiation protection, under the stable operation of the nuclear facilities, throughout their operating lifetime, as per the licences issued by the NRA". The policy further specifies the goals set by the company in terms of safety management:

- Ensuring nuclear safety;
- Effective protection of the personnel, public and environment from the harmful impact of ionizing radiation;
- Safe management of fresh and spent nuclear fuel;
- Safe radioactive waste management;
- Safe decommissioning of nuclear facilities;
- Continuous improvement of the safety culture;

The same document contains the principles followed in the safety management process:

- Observing the requirements of international and national legislation in the area of safe use of nuclear energy and ionizing radiation, and the safe management of RAW and SF;
- Maintaining a high standard of safety culture by everybody, everywhere and in all activities;
- Planning, assuring and monitoring of the resources needed;
- Observing the design limits and operating conditions of the nuclear facilities;
- Implementing of the defence-in-depth concept;
- Making all safety related decisions on the basis of the conservative approach;
- Preventive analysis and risk assessment, taking into account any possible and significant consequences in the activities' implementation, while applying the cost-benefit analysis to optimize the radiation protection;
- Keeping up a continuous emergency preparedness through an internal emergency response plan and organizational structure;
- Analysis, assessment and implementation of own experience and good practices from other NPPs;
- Applying the "No blame" principle when reporting on safety related mistakes;
- Strict control and accountability on radioactive materials;
- Informing the personnel on the status and measures for continuous safety enhancement;
- Ongoing monitoring, control, analysis and assessment of the planned actions and practices implementation, foreseen for safety purposes.

To achieve the planned objectives and observe the above principles, the Plant Management commits to maintain and develop the system for monitoring and assessment of safety, using highly qualified, trained and well motivated personnel that implements and controls the operation of the nuclear facilities, while observing the safety requirements. The Plant Management guarantees the

implementation of the commitments made and encourages, in a deserved manner, any initiative and action of the employees, leading to enhancement of safety culture and the level of safety.

Programmes for safety culture enhancement

Safety culture enhancement is subject to systematic long-term approach that includes: annual planning of the activities to enhance safety culture, engaging the whole staff to actively participate in these activities, and motivating appropriately the personnel for his attitude to work, that leads to positive outcomes.

In the light of safety culture enhancement, in 2010-2011, together with the IAEA, the project "KNPP1 – Safety Culture Enhancement" was implemented as part of the Programme "Safe Nuclear Energy" for cooperation between Bulgaria and Norway. The project deliverables were: a Guide on setting up values, supporting high safety culture; a Guide on performing safety culture self assessment; a Guide on ongoing safety culture enhancement. KNPP specialists were trained to carry out self assessment on safety culture. Self assessment was performed, using a methodology developed by the IAEA and implemented for the first time at Kozloduy NPP. As per this methodology, data were collected using five methods. The analysis of the data collected identified some strong points and areas for improvement of safety culture. The results from the analysis served for developing a programme of measures for improving safety culture at Kozloduy NPP. The measures' implementation is controlled, and any issues arising in the process of implementation are reviewed by a Safety Culture Council, that takes the appropriate resolutions.

The safety culture enhancement activities are not limited only to the items included in the programme. The planning of future activities considers the general enhancement approaches and activities as described in the Guide on ongoing safety culture improvement, and the implementation of ongoing projects – "Transition to the Integrated Management System", "Extension of the System for Reporting of Low Level Events and Near Misses", and further development of the "HR Management Processes", binding the evaluation of individual performance with career development and remuneration.

The Safety Culture Council plan is approved annually. Safety culture enhancement activity is reported in the Annual Report on the Status of Nuclear Safety and Radiation Protection at Kozloduy NPP, which is submitted to the NRA, as part of the operating licence conditions.

Management of safety

Methodological guidance, coordination and control to ensure and maintain safety of KNPP is realized through the Safety and Quality (S&Q) Directorate, that is directly subordinated to the KNPP Executive Director. The S&Q Directorate:

- Develops and proposes for approval by the Executive Director, the policy for safety management, and submits annual updates thereto;
- Organizes and takes part in developing and updating of KNPP programmes and procedures, training programmes and materials in the following areas: nuclear safety, safe management of SF and RAW, radiation protection, fire safety, technical surveillance, emergency preparedness, indusrial safety, environmental radiation monitoring, licensing process in the field of using nuclear energy and nuclear material;
- Ensures in-house supervision in the above areas and issues mandatory improvement notices, in case of finding any performance shortcomings or safety deficiencies;
- Analyses and assesses the general status of safety and activities, and prepares reports periodically. Develops measures to maintain and enhance safety culture and level of safety;
- Organizes the entire process of receipt of permits and licences, required as per the ASUNE and the following regulations. Registers the conditions identified in the NRA permits, licences and improvement notices, and those of other control bodies, prepares the

documents required to assign their implementation to the KNPP line managers, supervises their implementation and reports on it;

- Evaluates the safety interface of the activities, performed by contractors;
- Controls and accounts for the nuclear material balance on-site. Controls the safety requirements in the process of SF and RAW management;
- Analyses and assigns the tasks for implementing the recommendations, issued by external control bodies, and also for the dissemination of good practices.

Measures for safety monitoring and self assessment

The routine control on the implementation of the safety principles, as exercised by the Safety and Quality Directorate, provides opportunities to detect the early signs of safety decline and the need for improvements, by analyzing the root causes for the deficiencies and taking appropriate corrective action.

The internal inspections and reviews focus on the following:

- Quality Inspections and review of managemant;
- Adequacy and observance of the work procedures;
- Safety Culture;
- Reliability of the systems important to safety.

A system of indicators is being used by the Kozloduy NPP, which is considered as part of the management tools for monitoring and control. Through direct measurement of interelated indicators in terms of goals, measures, initiatives and tasks that summarize the strategy of the plant and the methods for its realization, an implicit assessment is obtained of the efficiency of management. Their determination considers the activity specificities, the experience gained in the system development, and the experience of other nuclear power plants. For each indicator the limit and target values are determined (planned), which are the basis for performance assessment by comparing the actual status against the planned one.

The system of indicators is built 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. In the tasks implementation, the bottom parameters of the pyramid are reached, which are measurable and have quantitative values and evaluation criteria (specific indicators). A report and analysis on the indicators of the system is undertaken quarterly and annually. The analyses identify the corrective actions for recovery of the deficiencies. These reports are reviewed and accepted at specialized technical council meetings, and then being approved by the KNPP Executive Director. Regarding indicators that deviate from the set targets, the corrective actions are being approved by a technical council.

Using the system of indicators, the plant management is able to assess the plant status and compare the actual status against the planned one. Managers at all levels can use the results of the system and undertake corrective measures and actions, for solving or prevention of problems in specific processes or activities.

Independent safety assessments

The NRA undertakes independent inspections on specified topics and issues related to nuclear safety, radiation protection, fresh and spent nuclear fuel and radioactive waste management, and safety culture enhancement.

Independent assessments are also performed by the:

- National Centre of Radiobiology and Radiation Protection regarding topics and issues associated with the requirements for providing radiation protection in use of SIR;
- The Regional Directorate "Labour Inspection" regarding issues of providing of industrial safety;
- The Regional Directorate "Fire Safety and Civil Protection" regarding issues of providing fire safety.

Annex 3 contains information on the completed, international, independent safety assessments.

Management system

An integrated management system (IMS) has been established at Kozloduy NPP. It is based on a process approach, and is consistent with the recommendations in the IAEA Safety Standard GS-R-3 The Management System for Facilities and Activities, and the NRA Guideline: "The Management System for Facilities and Activities'' (for more information see Article 13).

Kozloduy NPP "New Build"

In long-term the goal of Kozloduy NPP "New Build" is design, construction and commissioning of the latest-generation nuclear power unit on the KNPP site, while observing the highest applicable standards for nuclear safety and protection of the public and the environment, as introduced by the IAEA, EU and the Republic of Bulgaria.

According to the Statute of the Company, the Board of Directors implements the management in such a way that nuclear safety and radiation protection, protection of environment and lives and health of the personnel and public from the harmful effects of ionizing radiation take priority above all other aspects of the activity performed.

In the plant Policy Statement, the Management has identified its priorities for ensuring the: highest level of safety, effectiveness, efficiency and economy in the management of the activity, capable, competent and motivated personnel, and financial stability. In the policy implementation, the Management commits to develop the system of values and safety culture by the personal example of managers and the contribution of each plant employee. The plant management supports all employees in their efforts to achieve the major objective of the company and expects them to show responsibility in their daily work, high level of professionalism and positive attitude to safety and technological discipline.

Article 13 describes the current plant management system.

Regulatory process for monitoring and oversight

Safety management is the major topic in the scope of topical inspections of the NRA in the area of Management System, which are held biennially. Subject of inspection are as follows:

- Safety policy, including safety priority, commitment of the plant management to maintain high level of safety, ensuring of resources incorporation of the individual organizational units in the management systems;
- Assessment of the impact of structural and organizational changes on safety;
- Results from self assessment, using indicators;
- Available experience and knowledge of the management staff, focus on the safety problems, graded approach in the risk assessment, and motivation of personnel;
- Safety-related activities – planning, risk assessmnt, optimal intervals for tests and maintenance, questioning attitude to work;
- Monitoring of the activities implementation, and internal assessment.

A project BNRA1 – *Enhancing the NRA capability to monitor the safety culture of the licence holders* was completed in 2010 - 2011. The project was part of the regional programme for cooperation between Bulgaria and Norway for excellence in the safe use of nuclear energy. Within this project a process was developed for monitoring of safety culture (SC) and the NRA inspectors received training on its application. SC monitoring supplements the regulatory control process, using mainly a proactive approach to establish the weak points and negative trends in the organiazational or personnel behaviour practices, adopted by the licensees, which in case no action is taken, may result in non-conformances with the legal requirements.

The NRA management is committed to apply the SC monitoring process and improve it continually. In this connection, a pilot implementation was adopted of an instruction for monitoring of safety culture of the licensees, which is applied as an integral part of the regualtory inspections. The experience feedback from this instruction implementation is used to imrove the monitoring process.

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

The Policy Statement of the NRA management defines that nuclear safety and radiation protection take priority over economic and other public needs, and their assurance is only possible with the strict adherence to the fundamentals of the Act on the Safe Use of Nuclear Energy, and the relevant IAEA documents.

The authorization regime imposed by the ASUNE is one of the guarantees for observing the requirement for priotity to safety in all regulatory activities and decisions. The systematic approach established by the NRA quality management system, follows strictly the ASUNE provisions and the Regulations on the Act application.

Another mechanism for ensuring the priority to safety is the independence of the regulatory body through the ASUNE and the management system. The management system, as based on the Act and international experience, serves to promote independence regarding internal regulatory assessment. The priority to safety is secured by the elements of independence such as: assuring of budget and resources; relations and interfaces with the government; conditions for appointing of chairman and administration; qualification and training of the employees; assuring noninterference in the work of the regulator; ensuring possibility for international cooperation; use of independent analyses and expertise related to nuclear safety and radiation protection; power to enforce corrective actions and impose penalties; conduct of regulatory inspections.

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

Mechanism for providing financial resources to ensure the safety of the nuclear installation

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

- Priority in providing financial resources to ensure safety of the nuclear installation throughout its design lifetime;
- Sufficiency of the secured financial resources for the safety policy measures implementation;
- Timely 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 carries out, on an annual basis, a set of activities, financed by own funds or loans.

In the period 2010 - 2012, the investment costs have been spent on long-term assets and for the continuous improvement of the operational safety and reliability of Units 5 and 6. For the period 2010 – 2012, within the framework of the annual investment programmes, a total of BGN 97 915 thousand have been spent.

In 2013 and 2014, KNPP is planning to invest BGN 136 245 thousand in enhancing the operational safety and reliability of units 5 and 6.

In 2012 started the implementation of investment activities for realization of the strategic objectives for long term operation of units 5 and 6, continuing the nuclear facilites modernization process, and improving their operational safety.

The basic priciples for providing funding for the decommissioning and management of SF and RAW, throughout the commercial operation of the nuclear facilities are as follows:

- Prudence in ensuring financial resources for the subsequent nuclear facility decommissioning and management of spent fuel and radioactive waste. Funds are being allocated on a monthly basis to the Nuclear Facilities Decommissioning Fund (NFDF) to finance the decommissioning activities, and to the Radioactive Waste Fund (RAWF)– for the management of radioactive waste;
- Purposeful spending of the money in the NFDF and RAWF. Funds are spent only for targeted funding, according to the annual programme for decommissioning of nuclear

facilities, to ensure the storage and final disposal of radioactive waste, and for other activities specified by the Act on the Safe Use of Nuclear Energy.

The NFDF assets come from contributions from nuclear facilities operators and allocations from the state budget, which are specified annually by the Law on State Budget for the respective year. The funds accumulated are only used to finance projects and activities for decommissioning of nuclear facilities. The assets of the RAW Fund are generated from contributions paid by organizations whose activities generate radioactive waste, state budget allocations, etc. The table below provides information on the Kozloduy NPP contributions to NFDF and RAWF already made and planned.

Kozloduy NPP payments to NFDF and RAWF, (thousand BGN)

№	Period	NFDF	RAWF	Total for NFDF and RAWF
1.	1999 – 2012	1 138 205	300 242	1 438 447
2.	2011 – 2013	181 127	72 451	253 578
2.1	Inclusive of 2013 (planned)	57 885	23 154	81 038
3	2014 – 2015 (planned)	117 771	47 108	164 879

At national level, six Grant Agreements, totalling 342,442 million euro about funds from the Kozloduy International Decommissioning Support Fund have been signed, in the period 2003-2011.

Additionally, 300 million euro have been allocated for 2010-2013, as per (EURATOM) Regulation No. 647/2010 of the Council, regarding financial aid of the Union for the decommissioning of KNPP units 1-4. In the period to the end of 2013, according to the provisions of the Memorandum and the Regulation, 40% of these funds shall be spent on measures for energy efficiency enhancement, and other measures, to compensate for the negative impacts from the early shutdown of the units; 60% are foreseen for decommissioning measures inclusive management of RAW generated from decommissioning. The actual percentage of the funds for decommissioning was 56% of the total amount as at the end of 2012.

In 2014-2020 the country is expected to receive from the EU additionally about 260 M EURO for decommissioning activities. Bulgaria will also count on extension of this aid beyond 2020.

Statement on the adequacy of financial provisions

The State Energy and Water Regulatory Commission (SEWRC) Regulation on the Licensing of Activities in the Energy Sector requires the development of a five-year plan, which guarantees the proper use and allocation of funds, including those for safety enhancement.

The Business Programme is the fundamental document for the management to state the strategic and business objectives of the plant. Kozloduy NPP issues a three-year business programme and a five-year business plan, in compliance with the licence conditions for electrical power generation. The budgeting and planning system in place guarantees that the funds planned, secured and spent on these activities are adequate in terms of amount and timeliness. In preparing the annual

programmes, priority is given to allocation of the necessary funds for improving the safety of Units 5 and 6.

The programmes are subject to regulatory review of SEWRC and NRA. Annual review is performed on the operational goals, priorities and activities for the coming year, and the three-year business programme is updated accordingly. The provided information shows that funds have been spent consistently through the years and in amounts, completely covering the safety improvement measures.

Financial provisions assessment process

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.

The Kozloduy NPP contribution fee has been determined in accordance with the Regulation on the procedure for defining, collecting, spending and control of funds, and the amounts due to the Nuclear Facilities Decommissioning Fund (NFDF).

The amendments made to this Regulation require each licence holder - operator of a nuclear facility, to propose to the Minister of Economy and Energy a draft methodology for determining the costs for decommissioning funding, and respectively, defining the amount of contribution due. This methodology shall take into account the technological aspects, the requirements of nuclear safety and radiation protection. Until this methodology has been approved, the nuclear facility operators shall have their contribution defined as per the currently effective procedure.

The legal and physical persons, that as a result of their activity have generated radioactive waste from nuclear applications, are obliged to pay a fee to the RAW Fund, the amount of which is determined by a methodology of the Radioactive Waste State Enterprise (SE RAW) and approved by the managerial board of the RAWF, on the basis of estimates for the total annual costs for management of the radioactive waste volumes and radioactivity inventory. The fees of Kozloduy NPP, payable to the RAWF, are 3% of the price of the electricity sold on the regulated and the deregulated market.

Article 11 (2) Human resources

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

In accordance with the ASUNE requirements, activities that affect the safety of nuclear facilities shall be carried out by professionally qualified personnel, holding Individual Licences (Certificates of Competence). The NRA Chairman issues Certificates of Competence to:

- Individuals who carry out activities related to assurance and/or control of nuclear safety and radiation protection, throughout the nuclear installation operation;
- Instructors at full-scale simulators and qualified experts in radiation protection.

The Regulation on Ensuring the Safety of Nuclear Power Plants has the following requirements:

- Operation of a nuclear power plant shall be carried out by sufficient number of qualified staff, who know and understand the design bases, safety analysis, design and operational documents of the power unit for all operating states and emergency conditions;
- Adequacy of staff and their qualifications shall be analyzed and confirmed in a systematic and documented manner;
- Any change in staff numbers, which could be significant for safety, shall be planned and justified in advance, and evaluated after implementation;

- Preparation and training of staff shall ensure sufficient knowledge about the characteristics and behaviour of the SSCs important to safety, and the nuclear plant as a whole, in all operational states and emergency conditions;
- The plant operational staff shall be prepared and trained to occupy a higher operational position, after duplication of the job for a reasonable period of time;
- The operational staff of the MCR shall pass a full-scope simulator training at least once a year, while the operating shifts shall undergo periodic emergency drills;
- The maintenance personnel shall be trained on mock-ups or real components for the improvement of professional skills and reducing the duration of activities with radiological hazard;
- Pre job briefings of personnel involved shall be conducted before the implementation of safety important operations and tests of SSCs important to safety.

The Regulation on the Conditions and Procedure for Acquiring Professional Qualification defines as follows:

- the requirements to personnel selection and qualification;
- the conditions and procedure for acquiring professional qualifications to perform activities in nuclear facilities and with ionizing radiation sources;
- the job positions for which certification is required, and the requirements for educational background, qualification and experience to hold a given position;
- the procedure for issuing, amending, renewal, termination or revocation of licences to undertake specialized training for activities on a nuclear facility or with ionizing radiation sources;
- the conditions and procedure for holding exams to acquire certificates to perform activities on nuclear facilities and facilities with ionizing radiation sources;
- the procedure to control the implementation of the licence conditions for specialized training and certification.

In order to ensure qualified and competent personnel, Kozloduy NPP has developed and implemented procedures for personnel selection and qualification that include as follows:

- carrying out of occupational selection;
- medical and psychophysiological selection;
- ensuring of specialized initial and refresher training;
- maintaining a high level of safety culture;
- initial and periodic knowledge test;
- control on the adherence to the requirements for specialized training and professional qualification.

The occupational selection follows the requirements of the job descriptions that mandatory include education and qualification related requirements, professional experience for the given position, the minimum of knowledge and skills to perform the respective activity, the individual certificates needed (if any) for the position.

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 the operated facilities and systems. The job positions related to safety are included in the first two groups.

Input to the planning and conducting of training are the results from an analysis of the specialized training needs. Different analytical methods are used, including job and tasks analysis, competence analysis, and analysis using a combined methodology. The training needs analysis is performed on the basis of:

- the requirements for appointment to any job position, the key functions and duties, rights and responsibilities as described in the job descriptions;
- the requirements defined in the regulatory documents;
- data and requirements regarding the manner of implementing the activities, described in the internal rules, instructions and procedures;
- rules and requirements in terms of nuclear safety, radiation protection, and occupational safety of the personnel in the controlled area, etc.

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 operational staff, including simulator training

The training process starts from the moment of signing of the 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 SSCs, procedures, technologies and operating instructions, specific requirements for nuclear safety and radiation protection, and also 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 rarely occurring tasks.

The initial training for a job position (for newly appointed workers or as preparation for taking a new position related to safety) is conducted as an off-the-job training.

Refresher training for groups A and B staff is held annually on the basis of training programmes. Training is carried out only off-the-job. Topics include refresher courses, topics of the initial training programmes, modifications to SSCs, regulations and internal documents, etc.

For the rest of the personnel, refresher training is conducted on the basis of schedule plans or individual requests. It varies in duration according to the position type, the needs of individuals/jobs, changes to SSCs, documents, etc. It can be either on-the-job training or off-the-job training.

Training on a full-scope simulator (FSS) is mandatory for shifts personnel Group A, and its duration differs depending on the job. The initial FSS training lasts from 20 days to 3 months, while the annual refresher training takes from 5 to 10 days. The scope and duration of simulator training are specified in the programmes for specialized training - initial and refresher.

Capability of the simulator to accurately reflect processes, systems and components and the scope of the simulated processes

The requirements for establishing and maintaining the compliance of the full-scope simulator with the reference unit are provided in the Regulation on the Conditions and Procedures for Acquiring Professional Qualification and for the Procedure for Issuing Licences for Specialized Training and Certificates for Qualification, and also in the NRA Guideline on licensing of full-scope simulators on NPPs. The particular technical requirements to simulators, as an engineering tool, are based on

the US national standard for NPP simulators, foreseen for training and evaluation of operators - ANSI/ANS-3.5-1998.

The scope and quality of simulation models in the full-scope simulator for units 5 and 6 (FSS-1000) ensures its adequate functioning as a training and engineering tool for initial and periodic training and evaluation of operations personnel. The man-machine interface (MMI) is a copy of the main control room, while the simulation model supports capabilities to operate under different modes, such as normal operation, transients, and design basis accidents. This creates the conditions needed for the operators to perform the same actions and the same procedures for control of the processes and systems on the reference unit. Plans have been approved to incorporate a computer programme (plant analyser) that shall be used to simulate severe accidents, and for validation of the SAMGs.

The technical characteristics of FSS-1000, allows the facility to be used also as an engineering tool for the validation of symptom-based emergency operating procedures, testing of design modifications, testing of technical solutions, testing of operations instructions and procedures, and analysis of operational events. For the operations of FSS-1000, have been developed and implemented internal documents such as "Instruction to Ensure Compliance of the Engineering Tools for Training with the Equipment at the Workplace", "Instruction for Elimination of Simulator Non-compliances", and the "Simulator Functional Testing Procedure".

At the end of each year, an annual plan is prepared, related to maintain the FSS-1000 in conformity with the reference unit. The plan includes analysis of the planned changes and modifications on the unit, associated with the FSS-1000 configuration, description of the necessary activities and conditions, deadlines and responsible persons for their completion.

Arrangements for training of maintenance and technical support staff

The arrangements for training of the maintenance and technical support staff are similar to the activities, described in the section above: "Arrangements for Initial Training and Retraining of Operations Staff". Kozloduy NPP has facilities for training of maintenance personnel, equipped with appropriate mock-ups and technical means. Before the implementation of complex maintenance operations or operations with increased dose rates, trial activities are carried out on mock-ups in order to familiarize the maintenance personnel with the implementation of the work.

Prior to the implementation of significant modifications, and in case of necessity, extraordinary pre-job briefings are conducted for the personnel to get an insight, and after the modification implementation, the personnel is briefed on the analysis of the maintenance activity performed.

Improvements to the training programmes as result of safety analyses, operating experience, development of training methodologies and practices, etc.

The annual analyses performed on the training efficiency, are the basis for planning and taking of corrective actions to improve all activities, associated with the training process. The training efficiency assessment is a joint activity between the training organization and the plant organizational units. The training efficiency is evaluated on the grounds of data analysis from various sources.

- Feedback or inqiury forms filled in by trainees, observers or managers;
- Results from the training;
- The reflection in the training process of modifications to SSCs, operations procedures, operational experience, etc.

The results from the training efficiency analysis serve as a basis for assessment of the needs of: personnel training; training programmes development, improvement or updating; organizing and holding of initial, refresher or extraordinary training; development, improvement and keeping up-to-date of training materials and engineering training means.

Methods for assessment of staff sufficiency

The total number of the required staff, as per positions and plant organizational units is specified in the KNPP Positions Payroll. It also determines the required minimum educational background for each job position. The staffing number, needed for the Kozloduy NPP operation, is calculated as per the technical specifications requirements, and taking into consideration the uninterrupted production cycle.

Annual reviews are performed on the current Positions Payroll and any deviations are analysed. The analysis is performed in order to accommodate the plant organizational structure with the functional distribution of responsibilities among the organizational units, to optimize the Positions Payroll and prevent exceeding of staff number or availability of vacant staff positions, for which there is no real need. The overall objective is to decrease the redundancy of human resources, while increasing the possibilities of activities performance by the personnel available.

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 in conformity with the legal requirements on the maximum duration of the working day and the working week; to ensure sufficient rest between working days and weeks; and to ensure continuous shift work under conditions of reduced working hours. 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 each job position.

Policy and principles governing the use of contracted personnel to support or supplement the own staff of the licence holder

Pursuant to the licence conditions for the nuclear facilities in operation, KNPP has implemented and supported a system for assigning, management and control of subcontractors, while bearing the responsibility for the activities they perform. Performance of nuclear hazardous works may not be assigned to outside contractors.

Requirements towards contractors and their staff qualification are determined by the contract terms of reference (ToR), tendering negotiations, and the terms of the contracts awarded. The ToRs identify requirements that the contractor shall satisfy, the contractor's staff qualification needed for the activity to be performed, as compliant with relevant regulatory documents, the activity's specifics, and the rules adopted at Kozloduy NPP. The personnel that performs works on-site shall have the appropriate qualification group, as per the rules of industrial safety. In case of performing specific activities, additional requirements shall be in place to specific qualification and skills of the contractor's personnel.

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 and/or a Quality Control Plan. The Program and/or the Plan are subject to approval by the Kozloduy NPP.

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

Quality audits of contractors are also undertaken. If necessary, several audits can be conducted at various stages of the contract completion.

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

The operating organization specifies the responsibilities and the requirements on necessary specific qualifications and skills of the contractor's personnel, within the contract scope. The contractors are required to demonstrate their personnel are of adequate number and qualification

to perform the activity. The whole staff of outside contractors shall pass a mandatory training course on "Introduction to KNPP", while the individuals performing activities in the controlled area shall take an additional training course on "Radiation Protection". Both courses end with knowledge test and evaluation.

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

The system of nuclear staff training and qualification in Bulgaria follows the multistage approach and includes:

- Secondary vocational education;
- Higher education (Master's Degree) for obtaining the relevant degree in natural sciences and engineering, and the educational and research doctor's degree;
- Initial and support specialized training to obtain an individual licence to work at a nuclear power plant, taking a specific position (further professional qualification in licenced specialized training centres).

Secondary vocational education in nuclear technology and science is annually granted to about 770 students (48 of whom take the 'Nuclear Energy' subject) in two specialized secondary vocational schools.

In the Republic of Bulgaria, the higher education of graduates in nuclear technology and nuclear science is carried out in the professional fields of physics, power engineering and chemical technologies, in four accredited higher schools. These schools have a total of 120 students taking bachelor's programmes, and 70 students, involved in master's programmes.

Currently, the total number of people employed in the nuclear power sector is around 7000 employees. The majority of them (about 65% as at the end of 2011) are directly involved in the maintenance and operation of the Kozloduy NPP, 14% of the staff is part of companies, providing repair and maintenance of equipment, approximately 7% are employed in science, education and engineering activities. About 38% of the staff has an Master's Degree, while 11 % of the employees hold scientific research degrees. The average age of workers in the nuclear power sector is about 50, and particularly for Kozloduy NPP the major part is in the range of 45-50 years.

In this respect, currently the country is secured with sufficient staff in the nuclear energy sector.

Methods used for the analysis of competence, availability and adequacy of additional staff in connection with severe accident management, including hired personnel or staff from other nuclear installations

On the grounds of the Stress Tests conducted, and the conclusions drawn from the subsequent emergency drills at Kozloduy NPP, it is planned to prepare a detailed analysis on the availability and sufficiency of staff with the competence needed in relation to severe accident management.

Pursuant to the National Action Plan following the stress tests, the FSS and classroom training are used for the staff training in severe accident management. The FSS scenarios cover the 'accident conditions' of the whole spectre of postulated initiating events. The various topic combinations are selected in a way such as to comprise both the operator's actions with the equipment available, and the existing emergency procedures. The teams receive training to act as per the symptom-based EOPs, to make transition to SAMGs, and introduce the Emergency Response Action Plan. A report with the results from each training performance is issued.

The National Action Plan following the stress tests foresees provision of additional expert support from the WANO Regional Crisis centre in Moscow, and there is an approved work plan in place for the measure implementation.

Regulatory review and control activities

The NRA undertakes review and assessment of the applicant's documents, supporting a licence application for specialized training in compliance with the provisions of ASUNE and the Regulation on the Conditions and Procedure for Acquiring Professional Qualification and for the Procedure for Issuing Licences for Specialized Training and Certificates for Qualification for Use of Nuclear Energy.

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

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

Article 12 Human Factors

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

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 the main legal and regulatory requirements, which aim at ensuring that the design takes into account the possibilities and limitations of human and organizational factors. The Regulation requires that the design shall provide technical means, which help to exclude human errors or to limit their consequences. The layout of the control and operations means, and the presentation of information at the MCR, should be such as to enable the operating staff to clearly and quickly determine the status and the behaviour of the power unit, to keep the operational limits and conditions, to identify and control the automated actuation and functioning of the safety systems. Normal operation control systems shall ensure the most favourable conditions for the operating staff to make correct decisions as regards the NPP control. Safety systems shall function in such a way that the initiated actuation shall lead to complete implementation of the safety functions, while their recovery to initial state shall require successive actions by the operating staff. Automatic actuation of safety systems shall block the possibility of their switch off by the operating staff for not less than 30 minutes. Possibilities for a wrong action of the safety systems shall be minimized. Safety systems remote control schemes shall ensure their actuation by at least two logically related actions (two switches, a switch and selecting field, etc.).

The operation of Nuclear Power Plants shall be carried out by a sufficient number of qualified staff who know and understand the design bases, safety analyses, design and operational documents of the power unit for all operating modes and emergency conditions. The personnel should be provided with the necessary resources and conditions for implementation of the activities in a safe manner. The operating staff shall operate the NPP in accordance with written instructions and procedures, which specify the responsibilities, ways of interactions, and give specific operational directions for implementation of operational activities in all operating modes. Personnel actions provided for in the instructions shall lead to recovery of the unit to a state described in the operational instructions, or to ensure maintaining of the unit in a safe shutdown mode for an extended period following the accident. At any time, at least two operators holding licences issued by the NRA Chairman, shall be present in the MCR.

The actions of staff to identify the condition of the unit and to restore or compensate for impaired safety functions, and prevention or mitigation of core damage, shall be defined in Severe Accident Management Guidelines (SAMG) and in Symptom-Based Emergency Operating Procedures (SBEOP).

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 the analysis of events associated with the human-factor shall contain the causes and circumstances for the occuring problems of human behavoir, contributing to the event development. Analysis shall 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 shall identify the trends in staff behaviour and operation of the equipment, as well as trends of various indicators for safe operation; it also allows for making conclusions and recommendations for improving the

operation and maintenance of the SSCs, as well as improving the staff education and training, or improving the management of operational activities.

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

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

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

New diagnostic systems were installed and put into service to assist the operators of Kozloduy NPP units 5 and 6; they are designed to provide information for early diagnosis, for accurate monitoring of the processes, and support decision making through presenting the information in an easily accessible, concise and clear format. The diagnostic systems for additional control of the technological equipment parameters and for support of the early diagnostics are:

- System for detecting foreign objects in the primary circuit, including: reactor, steam generators, main circulation pumps and primary piping;
- System for monitoring of primary circuit leakages;
- System for monitoring leakages from primary to secondary circuit, based on benchmark nuclide ^{16}N (nitrogen-16) in the main steam pipelines.
- System for monitoring the state of the aggregates bearings;
- System for limiting the thermal cycles of the primary circuit equipment;
- System for operational monitoring and maintenance of the water chemistry parameters in the primary circuit.
- Post Accident Monitoring System (PAMS);
- Safety Parameters Display System (SPDS);

The Modernization programme for Units 5 and 6 was implemented, observing the requirement for the design to take into account the human factor and to be tolerant towards human errors. New contemporary computerized systems and programme software means were introduced, which have up-to-date human-machine interface and significantly improved functional properties. When introducing the new instrumentation and control systems up-to-date standards for design, assembly and testing were used, including validation and verification. Leading companies in this field worldwide were selected as contractors for these projects. All good practices in designing of similar systems in NPPs were applied, when implementing the projects for protection, control and information systems.

All new systems have diagnostics and self-test, and in most cases allow operators to control the built-in logic, allowing for easy search and detection of failures in both the system and the measurement channels and control units. The systems are designed to be user friendly for testing,

tuning and readjustment. A special computer operated lighting system is installed at the MCRs of Units 5 and 6. It has improved regulation possibilities and is in line with the latest developments in the field of lighting rooms with 24 hours use.

Also, measures are taken to ensure reliable communication between the MCR and the local control rooms. The existing communications system for the operating staff, between the control panels, the unit compartments and the site, will be replaced by up-to-date communication systems, and one of the objectives is to increase the number of the connection points. A DECT communications system is installed and put into service. This system provides freedom of connectivity as the cell phones. A cell system for wireless communication is foreseen to be installed. The system is designed to provide connection with the management, the operating and the maintenance staff located on-site, as well as connection with the staff on duty, in relation to the emergency plan and the standby and call out staff in the town of Kozloduy.

The Stress Tests showed that the design solutions of the MCR provide operability and habitability for the staff, under nuclear and radiation accident conditions, including in case of blackout. In order to provide habitability in case of an accident with possible radiological consequences, an emergency system was installed, which maintains over pressure in the MCR and includes an aerosol/iodine filter. In the event of fire, which could impact the atmosphere in the MCR, the air ducts of the existing ventilation system are provided with isolation valves, which close automatically. The National Action Plan provides for performing additional analyses of the potential degradation of the habitability parameters in the MCR and the auxiliary control panels, due to high level of radioactive contamination and damage of equipment on site, including the influence on the access and functionability of the MCR and the local control rooms.

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

Two methods for analysis of the reasons for human errors are approved in Kozloduy NPP. These are ASSET and HPES.

Analysis of events associated with the human factor shall contain the causes and circumstances in which problems with human behaviour have occurred, contributing to the event evolution. The analysis defines the areas of human errors and other problems in human behaviour, which may be related to procedures, training, communications, man-machine interface, management or surveilance.

The rules for analysis of the operating and maintenance staff tasks performance are established at Kozloduy NPP units 5 and 6, with the purpose of determining the required changes in the tasks, training, instructions and procedures. As a result of the analysis, corrective measures are defined to eliminate incompliances leading to non-performance or wrong performance. The corrective measures are related to changes in the documentation, training or job-briefings, administrative measures, etc.

The goal - easily operated power plant - is achieved through the implementation of procedures (administrative, operational and emergency) to facilitate the staff-unit interaction. SBEOP and SAMG are developed and introduced, more information is available in art.19 (4). The SBEOP have been verified and validated on a full-scope simulator and the staff has been trained to work with them. Within the periodic simulator training of the MCR staff, the operators are trained, twice a year, to work with the SBEOP. SAMG have also been verified and validated under the "at a table discussion" method. The operators were delivered a course of lectures on severe accident management. Alarm procedures are also introduced that describe the operators' actions in the occurrence of any of the MCR alarms.

The requirements on various operational relationships are specified by Kozloduy NPP internal documents. They cover relationships between the personnel of one shift and between the shifts, between the operating staff of one organizational unit and of organizational units, between the

operating and the management staff, relationships between separate divisions in Kozloduy NPP, as well as with other companies. These documents specify the ways and means to conduct operational calls, and operational documentation to provide written proof for operational duties, work and relationships carried out. The equipment conditions and activities carried out thereon are registered by records in the operating logs.

A system of requirements is established for implementing a consistent approach to equipment labelling, to assist and facilitate the work of personnel in identifying the equipment. Unambiguous marking of compartments, facilities and components is provided in compliance with the provisions of the legal-technical requirements. Signs and standard labels are approved for use; this ensures the required identification of components, compartments, facilities, equipment, valves, gears, pipes, circuit breakers, switches, electrical panels, control boards, as well as electrical components located inside the panels.

During the shift, three licensed operators are present in the MCR. The internal substitution between them in short absence from the MCR is regulated in such a way, that at any time the presence of at least two licenced operators is ensured in the MCR. Internal substitutions and short absence from the MCR of individual members of the team is regulated by the work instructions.

Kozloduy NPP Units 5 and 6 do not have a separate position for "safety engineer". The "safety engineer" functions are covered by the Controlling Physicist and the “Chief Operations Process Engineer”.

The Controlling Physicist is working on shifts during continuous operations with fresh or spent nuclear fuel, reactor start-up after it has been shut down, conducting core related tests, carrying out experiments with expected changes in reactivity or nuclear-related hazardous tasks. His/her functions are to control the neutron-physical parameters and to stop activities leading to violation of nuclear safety or hazardous operating modes. During emergency and post-accident processes, supervises the operators and the core status, the primary circuit basic parameters and critical safety functions.

A Chief Operations Process Engineer is appointed for each power unit. He does not work on shifts, but is responsible for the overall condition of the unit and the proper implementation of the technological processes, and is working on continuous availability. All important switchovers, tests, experiments, start-up and shutdown operations, etc., are made under his knowledge and approval.

Kozloduy NPP carries out risk assessments to take actions and 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, compartments, working places, work organization, use of raw materials, and other outside factors that may pose a risk. There are health and safety risk management programmes, which contain information on the working and psychophysical conditions of specific work places, as well as on the specific measures needed to modify the work conditions.

Self-assessment of managerial and organizational issues by the operator

Self-assessment of plant employees is included in the yearly study of staff motivation that has been carried out since 2007. The study aims at measuring Kozloduy NPP staff attitude towards 25 factors of the work environment, which are indicators for the staff motivation monitoring.

To a large extent, the survey reflects the self-assessment of the employees on managerial and organizational issues. Another important aspect is the possibility for the employees to raise their opinions and to make proposals for improvements. By conducting this study, a feedback is ensured from staff to management, providing the management with a clearer picture of the employees evaluation of the management factors and the work environment.

With the purpose to ensure a two-way feedback, the results of the motivation surveys, which reflect the self-assessment of the employees, are published in the internal information system.

The self-assessment of the plant personnel safety culture is one of the objectives of the project "Enhancement of safety culture" (KNPP1), implemented in Kozloduy NPP in the period June 2010 - April 2011, under the Regional Excellence Programme within the Norway-Bulgaria Cooperation Programme "Safe Nuclear Energy". More information on this project is contained in the text under Art. 10.

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

Improving human performance and excluding organizational weaknesses is achieved through analysis of operational events, related to human and organizational factors and determining the root causes and the measures for their elimination, targeted at:

- improving the training programmes;
- improving the methods and techniques for reducing human errors - additional trainings and briefings, strengthening the expectations for using written instructions and procedures, introducing additional technical and administrative barriers for minimizing the probability for errors;
- improving the ergonomy and the man-machine interface through implementing design modifications;
- implementing the applicable operational experience in the simulator training classes;
- including the operational experience in the yearly refresher training of the staff - selected internal and external events, related to human and organizational factors, major conclusions and lessons learnt;
- enhancing management expectations as regards reporting and using the operational experience - through meetings with the personnel, intranet communications, posters.

The main indicators, that characterize the human performance, are the functional indicators "Improving human activity", "Improving safety culture" and "Relative share of low level events and near misses related to human and organizational factors". More information for using the operational experience feedback is provided in the texts related to Art.19 (7).

Kozloduy NPP performs an assessment of the staff individual job performance. The main objectives in assessing the individual job performance are: achieving the goals; implementing the duties and developing personal competence; determining the development needs for each employee and improving his/her professional competence; improving professional relationships between managers and subordinates, as well as between the team members; creating conditions for implementing fair and transparent procedures for professional and career development.

Regulatory review and control activities

Human factors management is subject to a regulatory review and control in the following activities:

- assessment of the modifications in SSCs, as regards the man-machine interface;
- planning and implementing activities related to surveillance programmes, as regards work load and the established working conditions;
- periodic analysis of the safety performance indicators, related to human factors;
- analysis of operational events related to human error, breached or non-fulfilled operating procedures, organizational issues;

The regulatory control process includes assessment of the effectiveness of the interaction between various organizational units, the effectiveness of the management decisions and possible effects on safety due to organizational changes. The human factors impact is taken into account in the process of reviewing procedures for minimizing human error.

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 facility.

Provisions and regulatory requirements

According to the ASUNE, persons who perform activities in the use of nuclear energy are required to establish and maintain an effective system for the activities management, which gives priority to safety and ensures high safety culture, as well as to maintain high level of quality of activities performed.

The Regulation on Ensuring the Safety of Nuclear Power Plants requires that the operating organizations develop, implement and maintain a 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 which are relevant to safety, shall develop and implement Quality Assurance Programmes for the respective activity, in accordance with the QAS of the operating organization.

The operating organisation's QAS shall cover all activities, graded according to their importance to safety, including:

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

The NRA Safety Guide "Management System for Facilities and Activities" provides general guidelines and recommendations regarding the development, application, evaluation and constant improvement of the management system, which ensures coordination in the implementation of all applicable requirements to the organization's activity, so that the highest priority of safety is ensured.

Kozloduy NPP Management system

Status with regard to the development and implementation of an integrated management system

In accordance with the licence conditions for units five and six, the licensee is obliged to undertake the necessary actions to develop Integrated Management System and introduce it by the end of 2012. In this respect, an integrated management system was established based on IAEA standards GS-R-3:2006 "Management System for Facilities and Activities", SSR-2/2:2011 "Safety of Nuclear Power Plants. Commissioning and operation", as well as other applicable IAEA standards and guidelines and the Bulgarian standards: BDS EN ISO 14001:2004 "Environment Management Systems", BS OHSAS 18001:2007 "Occupational Health and Safety Management System", BDS EN ISO 9001:2008 "Quality Management Systems. Requirements", and Nr.13 - "Recommendations for nuclear safety as regards physical protection of nuclear material and nuclear facilities" (INFCIRC 225/ Rev.5). The system is described in a Management System Guide.

In compliance with the conditions of the issued licenses and permits for safe use of nuclear energy, quality assurance systems are introduced in the organizational units of Kozloduy NPP, which operate nuclear facilities: Electricity Production-2 and Spent Fuel Storage Facility. Complete continuity is ensured with the management system in place, based on process approach, interdependences and process management, and the activities for achieving high effectiveness in management. Kozloduy NPP management system integrates all management aspects and ensures concordance in the implementation of the requirements regarding safety, health and safety at work, environment, security, quality and economics, so that safety is guaranteed top priority.

Main elements of the management system

The long-term intentions of Kozloduy NPP are set in the Management Policy and the Statement on the Company Management Policy. The main objective stated by the management, is safe, efficient and environmentally friendly electricity generation of guaranteed quality and security of supplies, in compliance with the national and international requirements and the licences issued by the regulatory authorities. In pursue of this objective policies have been developed that are appropriate to the Company activity and in compliance with Kozloduy NPP Management Policy. Kozloduy NPP management assigns paramount priority to safety and declares its commitment to maintain and constantly improve the Safety Management Policy, together with the stated priorities in the Policies on: Environment Management; Health and Safety at Work Management; Security Management; Quality Management; Finance And Economics Management; Staff Training And Qualification; Fire Safety; Human Resources.

These stated policies reflect the higher management commitment to achieve specific goals in these areas, identify the approach and the principles applied to achieve the goals, express the management aspiration for continuous improvement. Maintaining and continuously increasing of safety culture level, together with open communication and good awareness of the staff are among the major principles.

The Policies and the Policy Statement are disseminated, clarified and brought to the whole staff's knowledge. Each staff member is responsible for applying those principles in his/her activity. Kozloduy NPP policies are reviewed periodically, to confirm their up-to-date status and applicability when reviewing the Management System.

Based on the policies and the strategies, the business tasks and conditions, set by the Utility, the company management develops a three year business programme of Kozloduy NPP, in compliance with the applicable regulations, the licences issued and the Company internal documents.

The report on the business programme implementation comprises an analysis of the Company's activity during the reporting period, identifies the risks and the problem areas and is used in the process of decision making, including in undertaking actions in case of deviation from the programme. The reported results on the business programme implementation evaluations are an important part of the input information for review of the management system. More information on the business programme is provided in the texts under Art. 11(1).

The Management System covers 30 processes (3 managerial, 5 main and 22 auxiliary), which comprise all the activities related to: business and planning; management of materials, financial, human resources and knowledge; safety management (nuclear safety and radiation protection, industrial safety and emergency preparedness, environment and security); operational experience; design integrity; surveillance and maintenance, nuclear fuel cycle management; purchase and delivery of products/services; RAW management; organizational changes management; measurement, evaluation and improvement of the management system. The required resources, criteria and methods of functioning, management, monitoring and measurement are provided for all processes, with defined functions of a responsible person, a coordinator and a leader.

A graded approach is applied to the activities and the results thereof (product, service) for each of the processes, based on the evaluation of certain factors on: the importance and the complexity of each individual product or activity; the impact of each product or activity on safety, health, environment, quality, security, economics; the possible consequences of the improper execution of the activity or inconformity of the product. Based on the evaluation, the management system requirements are applied to a different degree to the activities and the results thereof. Applying a graded approach allows for directing the resources and the attention towards the activities/processes and the equipment of higher importance to safety, which results in reducing of the total costs in the process of safety enhancement.

The requirements towards the external organizations and the activities they perform are defined in a way to ensure that:

- the activities performed are in compliance with Kozloduy NPP policy for maintaining high level of safety, continuous enhancement of safety culture, as well as observing the requirements of the applicable regulations;
- there is a well established organization, clear distribution of responsibilities within the external organization, as well as between the external organization and Kozloduy NPP;
- the external organization develops and submits to Kozloduy NPP for agreement a QA Programme for the executed activities;
- the external organization has appropriate equipment in good working order, special tools and emergency kits, necessary for the performance of the activity;
- the activities are executed by qualified and certified personnel, having the required experience;
- an overall assessment of the external organization ability to execute the activities in compliance with the requirements, norms and rules for nuclear safety, radiation protection, physical protection, technical and fire safety and environmental management, that are effective at Kozloduy NPP.

Constant monitoring and evaluation of the executed activities, periodical inspections and independent assessments of all processes, self-assessment on behalf of the managers at all managerial levels preclude deterioration of the safety condition. The results are used for early detection of unfavourable trends, due response to established inconformities, as well as for identification of new opportunities for enhancement of safety and improvement of the management system. Once per year the Management System is reviewed by the Kozloduy NPP management, followed by a report with improvement proposals.

Audit programs

Internal audits of the management system are carried out in accordance with approved five-year and annual schedules, providing for an internal audit of each process in the Company's management system. The audits in the approved schedule are included in the annual plans of the organizational units. When planning, the following is taken into account: Company's policy; management priorities; requirements of the existing management system; statutory, regulatory and contractual requirements; the requirements of the interested parties; changes in the processes and the organizational structure; number, importance, complexity, similarity and location of the audited processes and activities; changes in the management system guide, the quality assurance programmes, guiding documents from the management system; events occurred; state of the performance indicators; conclusions and results from previous audits and inspections.

Audits of vendors and suppliers

The responsibilities and the order for performing purchasing activities related to request, selection of supplier, signing a contract, delivery, receiving and storing the product, are well defined at Kozloduy NPP. The identification of the requirements towards purchasing are based mainly on the impact of the purchased product/service on safety, health, environment, physical protection and economics, with safety having the highest priority.

The control over the suppliers is determined depending on the type of the product, its impact on safety and the requirements of the management system, and it could involve:

- auditing the manufacturer or supplier on behalf of Kozloduy NPP;
- inspection of the materials, designed for complex and important items (it could be performed by the manufacturing organization or in the supplier's warehouses, together with its specialized quality control bodies);
- specialized incoming control, which could be performed by the manufacturing organization or in the supplier's warehouses, together with its specialized quality control bodies.

Kozloduy NPP - New Build Management System

For management of the Project "New Nuclear Unit at Kozloduy NPP", the design company "Kozloduy NPP - New Build" is developing a system for management, that integrates all aspects of management and ensures coordination when implementing the requirements towards safety, industrial safety, environment, physical protection, quality and economics, so that safety can be guaranteed the highest priority.

The management system is being developed in accordance with the good practices in GS-R-3 "Management System for Facilities and Activities", taking into account the requirements of BDS EN ISO 9001 "Quality Management Systems. Requirements", ISO 14001 "Environment Management Systems", and OHSAS 18001 "Health and Safety at Work Management System".

There are 14 processes of the management system determined and structured in three groups: main, managerial, and auxiliary processes.

As of today key documents are approved, which regulate the management processes, such as Policy on Corporate Management, Policy on Assigning Requests for Supply of Goods, Delivery of Services and Construction, Rules for the Structure and Organization of "Kozloduy NPP - New Build".

All necessary documents for the management of the main processes within the current stage of pre-design studies have been developed, approved, and introduced, including: “Guideline on managing the "Investigation for site location of a new nuclear facility at Kozloduy NPP site";Quality Assurance Programme; Project Management Plan, etc.

The auxiliary processes are regulated in a number of documents, such as instructions for gathering, submission and control of input data; management of inconformities, carrying out expert-technical councils, as well as Project Communication Plan.

For the purpose of implementing the pre-design activity, the Company has prepared and carried out three bidding procedures, in compliance with the Policy for Assigning Orders for Supply of Goods, Delivery of Services, and Construction. As a result of the bidding procedures, contracts were signed, which lay the foundations of the future development of the activities related to the construction, operation and decommissioning of a new nuclear power unit, namely, contracts with object as follows:

- Feasibility study for the construction of a new nuclear unit at Kozloduy NPP site;

- Investigation for site location of a new nuclear facility at Kozloduy NPP site;
- Environmental Impact Assessment Report on the construction, operation and decommissioning of the new nuclear unit (EIA), including assessment of the impact of the investment proposal on the protected areas (Compatibility Assessment Report).

The contracts are implemented in accordance with the Terms of Reference, reflecting the "Kozloduy NPP - New Build" requirements, while the quality of the activities is controlled in compliance with the approved Quality Assurance Programmes of the Contractors.

Regulatory review and control activities

NRA carries out preventive control in the process of issuing licenses and permits. This includes review of the documents, describing the management system in the operating organization.

Verification of the practical implementation of the management system is carried out during the inspections on the implementation of the licence and permit conditions. One of the topical areas that are included in the annual plan for control of the nuclear facilities is "Management System". The following major topics are inspected within this area: organization of activities, management of activities, safety management, quality assurance, documents and records management. The results of the internal audits and management system review are also inspected, as well as the implementation degree of corrective measures and analysis of their effectiveness.

The safety important activities, which are carried out by external organizations, are implemented in accordance with their quality assurance programmes/quality plans. Those programmes, after approval by the operating organization, are submitted to the regulatory body as part of the application documents for authorization of the respective activity. The NRA can verify the practical implementation of the quality assurance programme/plan.

Article 14 Assessment and verification of safety

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

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

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

Article 14 (1) Assessment of safety

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

ASUNE requires by the licensees to perform an assessment of the nuclear safety and radiation protection of the nuclear facilities and to undertake actions and measures for their enhancement, taking into account the plant and the international experience, and scientific achievements in this area.

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 (SAR) in the following cases:

- preliminary SAR – for the sitting approval;
- interim SAR - for the technical design approval;
- final SAR – for the issuing of the operation licence or the renewal.

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

Operating organizations shall keep the safety analysis report up to date, in accordance with the modifications of structures, systems and components important to safety, new analyses of transients and accidental modes, the current safety requirements, as well as in compliance with the quality assurance programme. Computer programmes and analytical methods used in safety analyses shall be verified and validated and the results uncertainties shall be quantified. The programmes and methods should be used in a way to ensure greater confidence than the method of best estimates for obtaining results targeted at a more favourable direction.

For the purposes of PSA and the development of emergency procedures, analyses shall be carried out, which realistically describe transients and accidents evolution. Detailed requirements for the development of transients and accidents are presented in the NRA "Guide for Performing Deterministic Safety Assessments". The detailed requirements for risk assessment are presented in the NRA guides on “PSA Use in Support of the Safety of Nuclear Power Plants" and "Development of PSA".

In connection with the implementation of the National Action Plan and taking into account the lessons learnt from the Fukushima NPP accident, a review of the overall regulatory framework is pending, including the Regulation on Ensuring the Safety of Nuclear Power Plants and the NRA regulatory guides.

Safety assessments within the licensing process and SARs for different stages in the lifetime of the nuclear installations (e.g. site selection, design, construction, operation);

Kozloduy NPP, Units 5 and 6

SARs of Units 5 and 6 are developed in accordance with the national legislation, the relevant contemporary Russian and American standards, and the IAEA guidelines. The main instrument used was the Russian document "Requirements to the Contents of SAR of NPPs with WWER Reactors (ПНАЭ Г-1-036-95). In order to keep the SAR up-to-date, Kozloduy NPP has established structural units responsible for periodic update, as well as for coordination of amendments and supplements, after an agreement with the NRA. The "Methodology for Keeping the SAR up-to-date", introduced by the operator in 2009, is used for the SAR annual update.

For the period 2010 till the beginning of 2013 the SARs of units 5 and 6 were updated in relation to the following changes:

- Organizational changes in Kozloduy NPP;
- Implementing new technical modifications;
- Replacement of equipment;
- Update of the data for the collective effective dose at EP-2 for the period 2004-2011;
- Update of the PSA;
- Additional thermo-hydraulic, thermo-mechanical and radiological analyses, related to the use of fuel with greater burnup;
- Additional topical reports.

The 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.

In 2010, an update of PSA Level 1 for full power, low power and shut down reactor was completed, including the state with the nuclear fuel located in the spent fuel pool. The PSA reflects the configuration of units 5 and 6 towards the end of 2007. Risk is analysed for internal events, internal floods, fires and earthquakes. When updating the PSA Level 1 definite goals of the analysis were followed, related to increasing the quality of the PSA Level 1 model itself, so that the requirements set can be satisfied, such as:

- Change of the conservative assumptions with realistic ones, wherever possible;
- Taking into account the comments and recommendations to the model and the documentation of the study, provided by the independent review;
- Development of an integrated model (which allows for obtaining results for both full power PSA Level 1 and PSA Level 1 for low power and shut down reactor);
- Development of a symmetric model, as far as the accounting of the symmetry does not result in the creation of an excessively large and difficult for quantitative analysis model.

A further update of the PSA Level 1 is planned, which should cover all external events (except for earthquakes), that are site-specific for Kozloduy NPP.

In 2006, PSA Level 2 for full power was completed. It covers internal events, internal flooding, internal fires and earthquakes. Within the period 2012-2013, an update of the PSA Level 2 for full power, low power operation and shut down reactor is being implemented. It will address the comments of the independent review, made by the NRA and an external consultant, as well as the renovated interfaces with PSA Level 1, which were obtained as a result of its updating.

In 2012 the operator submitted to the NRA an application for modification of the operation licences for units 5 and 6, in connection with the planned uprating of the thermal output of the reactor installation up to 3120 MWt. The applications for the licence modifications are complemented by documents, justifying the plant safety in the transition to the new output, as well as documents, justifying the necessity to make equipment modifications in this connection.

Belene NPP, Units 1 and 2

In the period 2011-2012, the expert appraisal of the Technical Design and the Interim Safety Analysis Report of Belene NPP were submitted by the NRA consultants, reviewed and assessed against to achieving the goals and fulfilling the tasks set by the NRA. In December 2011, an IAEA expert mission was held to assess the compliance of the Technical Design with the standards of the IAEA and the lessons Learnt from the Fukushima NPP accident. As a result of the mission, proposals were made for project improvements. The review process of the Technical Design and the ISAR for Belene NPP was completed and a report issued to the Chairman of the NRA. The NRA experts gave a positive evaluation of the adopted design solutions and the grounds behind them.

Periodic safety assessments using deterministic and probabilistic methods of analysis

Kozloduy NPP, Units 5 and 6

In accordance with the provisions of the Regulation on Ensuring the Safety of Nuclear Power Plants, the existing design and the operation of a Nuclear Power Plant should be regularly reconsidered, to identify deviations from the requirements in force and the internationally recognized operational experience. The decisions for design modifications, improvements or other measures are made depending on the relevance of safety for the established deviations.

The scope of the periodic safety assessment should cover at least the following areas of review:

- site characteristics, taken into account in the project, and if necessary their reassessment based on new data obtained and new methods used;
- the nuclear power plant design in its status at commissioning and the actual status of SSCs, while taking into account the modifications made, the ageing effects and other effects which impact safety and the design lifetime;
- existing analytical methods for safety analysis and new safety requirements applicable;
- operational experience and feedback effectiveness during the period under review;
- operations organization;
- safety performance indicators and effectiveness of safety and quality management;
- quality, level of staff training and qualification;
- emergency preparedness;
- radiological impact of the nuclear power plant on environment.

The periodic safety assessment should be implemented, using a systematic and documented methodology, which involves deterministic and probabilistic methods. Conclusions should be based on feasible measures for improvements, while taking into account the mutual relations between the established deviations.

In accordance with the requirements of the Regulation on Ensuring the Safety of Nuclear Power Plants and the provisions of the operation licenses, in 2008 a reassessment of safety of Units 5 and 6 was carried out. When carrying out the periodic safety review the IAEA Guide NS-G-2.10 "Periodic Safety Review of Nuclear Power Plants" recommendations were applied, as well as the documents related thereof, relevant to the defined areas, which are subject to the review. The identified inconformities are assessed in accordance with the "Methodology for Categorization of Inconformities with the Requirements for Reassessment of Kozloduy NPP Units 5 and 6 safety"; and eliminated within the framework of the safety enhancement programmes, under the NRA supervision.

The licensee intends to operate units 5 and 6 beyond their design lifetime, and in accordance with the provisions of the operation licences is obliged to perform a complex assessment of the actual condition of the equipment and facilities within the scope and deadlines agreed with the NRA in advance. The procedure for a complex assessment of the actual condition and rest lifetime assessment of the equipment and facilities of units 5 and 6 was started in February 2011. Following a procedure for selection of a contractor, the contract was signed with the consortium PAЭ-EdF (Rosatomexport-Electricite de France). In 2012 the initial version for the rest lifetime assessment of the equipment and facilities of units 5 and 6 was reviewed and assessed by the NRA experts; recommendations for additional assessments were given, which should be made in accordance with the requirements of the methodology for a complex assessment, as a part of the overall process of the periodic safety review.

In 2013 the NRA developed and adopted “Position for carrying out a periodic safety review for long term operation of Kozloduy NPP units 5 and 6, in the context of Fukushima NPP accident”. The position underlines the necessity to reconsider the site-specific external hazards, the concept for continuous enhancement of safety, including the implementation of measures for severe accidents management. It defines also the NRA requirements as regards the form and the content of the periodic safety review documents, in compliance with the new specific IAEA Guide SSG-25 and the documents related to it, which concern the areas (factors) that will be subject to the periodic safety review.

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

The positive results of the periodic safety review performed in 2008 gave grounds to the NRA to extend the operation licences of units 5 and 6 for a further 10 year period. Based on the safety review it could be concluded that there are no limitations to the safe operation in the reviewed areas. The design and the operational practices comply with the requirements of the national legislation and the IAEA international safety standards. The inconformities identified have no significant negative impact on SSCs, the operational practices and the safety status of the units. Some of the corrective measures to eliminate inconformities have been implemented, others are included in nuclear safety enhancement and radiation protection programmes for units 5 and 6, and they are being implemented according to the schedule.

The severe accident at the Fukushima Dai-ichi NPP imposed reconsideration of a number of nuclear safety aspects to the nuclear power plants worldwide. In May 2011 ENSREG and the European Commission adopted a Declaration and Specification for performing "stress tests", as a targeted reassessment of the safety margins of the nuclear facilities in extreme external events, loss of safety functions and severe accidents. In compliance with the ENSREG Specification and the NRA requirements, in 2011 Kozloduy NPP carried out "stress tests" of the nuclear facilities on site. In the end of 2011, the NRA reviewed and assessed the Kozloduy NPP "Stress Tests” Report , adding some and agreeing on the corrective measures foreseen, and submitted The National Report of Bulgaria on the "stress tests" in Kozloduy NPP to ENSREG.

The National Report for the Second Extraordinary Meeting under the Convention on Nuclear Safety, submitted to IAEA in the mid of 2012, reviewed the main results from the detailed safety reassessment of nuclear facilities in the Republic of Bulgaria, similar to the reassessment in the National Report of Bulgaria on the "stress tests" in Kozloduy NPP, submitted earlier to ENSREG.

Both reports paid particular attention to the reassessment of the design bases and the safety margins, obtained as a result from the studies and analyses performed, as well as of the planned measures (at institutional and licensee level):

External events

As a result of the review of the seismic characteristics of Kozloduy NPP site, reassessed in 1992 (Project BUL 9/012 "Site and Seismic Safety of Kozloduy and Belene NPPs"), and the additional studies in 1995 (studies for local earthquakes and probabilistic determination of the seismic impact for the purposes of the seismic PSA), it can be concluded that that seismic stability analysis is conservative enough and it shows that Kozloduy NPP SSCs can assure the plant safety above the maximum possible seismic impacts for the site, considerably exceeding the current design bases.

The maximum water level and its duration are determined, the possibility for ice-blocking of the river is studied, and the possibility for combination of the maximum water level with other unfavourable phenomena is assessed. The results confirm the non-floodability of Kozloduy NPP site.

The analysis of the technical condition of the structures, with a view to the impacts of site-specific extreme meteorological phenomena (extreme winds, tornado, snowfalls and icing, extreme temperatures, extreme rainfalls), as well as the organizational and technical arrangements, designed to provide electrical power supply to the consumers on site and cooling of the nuclear fuel, shows that the power plant has the required resisitance at extreme meteorological conditions.

As a result of the analyses and assessments for external events of natural origin, a number of specific proposals were made for improvement of the power plant resistance to extreme events (earthquakes, flooding, extreme meteorological conditions), which are considered in Annex 4.

Design issues

The safety margins were reassessed in case of events with loss of safety functions, which result in severe accidents for the reactors and the spent fuel storage pools of units 5 and 6, the spent fuel pools of units 3 and 4 and the wet spent fuel storage facility (Wet SFSF). The results from the analyses and the postulated initiating events with loss of power supply and loss of ultimate heat sink, show good stability of the facilities and adequate reserve of time to undertake additional measures, if necessary. Particular proposals are made for improving the stability of Kozloduy NPP towards loss of power supply and ultimate heat sink, which are considered in Annex 4.

Severe accidents

The assessment performed by Kozloduy NPP on the available organizational, technical and operational provisions for severe accidents management has shown that they are effective and confirm the plant preparedness for severe accidents management. The licensee has provided some additional measures which are considered in Annex 4.

To improve units 5 and 6 resistance in severe accidents and the monitoring of the reactor vessel parameters, some corrective measures are in the process of implementation. These measures were defined within the framework of the project related to the development of Severe Accidents Management Guides for units 5 and 6 and confirmed during the periodic safety review of the units in 2008. These measures are also considered in Annex 4.

Regulatory review and control activities

Kozloduy NPP, Units 5 and 6

The updated sections of the SAR, within the period 2010-2012, are reviewed and assessed for compliance with the requirements of the Regulation on Ensuring Safety of the Nuclear Power Plants and with the recommendations of the Guide for Performing Deterministic Analyses. Special attention was paid to the sufficiency of the presented information in each section, the completeness of the list of PIEs, included in the accident analyses section, as well as to the assumptions when analysing deviations from normal operation, the design basis and beyond design basis accidents, including severe accidents. The results of the reviews and assessments were used by the NRA as a basis to approve the modifications.

The NRA has reviewed and assessed for compliance the submitted applications for technical modification of structures, systems and components important to safety, as well as for modifications in the technical specifications and operational documentation. In order to execute current and follow-up monitoring on authorized modifications, the reporting documentation on their implementation has been reviewed.

During the period a number of evaluations were made of documents submitted in pursuance of the provisions of the issued permits and licences of the nuclear facilities at Kozloduy NPP site.

The NRA has received applications for modification of the licences for units 5 and 6 in connection with the project for uprating the thermal output of the reactor installation from 3000 MWt to 3120 MWt. As a result of the review, a wide range of preliminary pre-design studies and designing activities are requested, as well as engineering analyses and calculations to justify safety, whose results, according to the Regulation on the Procedure for Issuing Licenses and Permits for Safe use of Nuclear Energy have to be documented and submitted to the NRA in form of modified sections of the Safety Analysis Report (SAR) of the respective unit.

In the end of 2012, following the "stress tests" a National Action Plan of the Republic of Bulgaria was developed, which combined all technical and organizational measures and joint actions deriving from the safety reassessment of the nuclear facilities in operation, located at Kozloduy NPP site. With an order of the NRA Chairman a Task Force Group was set up to perform periodic control and assessment of the technical documentation, the reports on the results from the implementation of the National Action Plan measures and their status.

The on-site NRA inspectors supervise the implemention of the National Action Plan and perform period ispections of the state of the structures, systems and components (SSCs), designed for protection or monitoring of external initiating events, of the adequacy of the emergency procedures and the staff training for their implementation. The on-site NRA inspectors attend periodic tests and qualified walkdowns of those SSCs.

Within the frame of the cooperation between the NRA and GRS - Germany, for the period 2012-2013, joint activities are being implemented, which cover a review of: (a) Status of the issues related to the application of digital instrumentation and control systems in NPPs with WWER type reactors, relevant to safety and problems solution; (b) Implementation of the recommendations provided in the verification of Severe Accidents Management Guides (SAMG) of Kozloduy NPP units 5 and 6 within the framework of PHARE programme; (c) Implementation of the recommendations provided in the verification of PSA Level 1 for Kozloduy NPP unit 5 and 6 for all operating modes within the PHARE programme; (d) Implementation of the recommendations provided in the verification of PSA Level 2 for Kozloduy NPP unit 5 and 6 for all operating modes within the frame of the NRA - GRS cooperation.

Belene NPP, Units 1 and 2

On 29.03.2012 the Council of Ministers adopted a decision that overrided all former decisions, related to the construction of Belene Nuclear Power Plant. With this regard, in May 2012, the

NRA stopped all activities on the review and assessment of the Technical Design and the Safety Analysis Report for Belene NPP and informed NEC.

Article 14 (2) Verification of safety

Overview of arrangements and regulatory requirements for the verification of safety

As required by the Regulation on Providing the Safety of Nuclear Power Plants, the technical and organizational arrangements of the operating organization shall include responsibility to maintain the SSCs important to safety in good condition. 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 the in-service control.

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. The monitoring programme of reactor coolant circuit shall ensure monitoring of the impact of irradiation, the formation of cracks by stress corrosion, embrittlement, and ageing of structural materials, especially in places with high levels of radiation and other factors. The status of the basic metal and the welded joints of SSCs important to safety, shall be monitored periodically, through qualified non-destructive testing in respect to areas, methods, detection of defects and efficiency, using specifically established procedures.

The operating organization shall develop, periodically review and implement programmes for testing, maintenance, repair, inspection and control aimed at maintaining the availability and the 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 and the manufacturers' requirements;
- operational experience and results of the in-service control;
- possible impact of the performed activities on the safety of the NPP.

Procedures shall be developed for the implementation of different types of testing, maintenance, repair and inspection and control activities, in accordance with the quality management system.

Main elements of the programmes for continued verification of safety

The documents that are used to verify the technical condition of the SSCs of Kozloduy NPP Units 5 and 6 are:

- schedules of activities during annual outages and refuelling for each unit;
- programmes (for start-up and shut-down of the units, testing of equipment during start-up and shutdown, etc.) for annual outages and refuelling;
- programmes for re-licensing of pressure vessels and pipes;
- programmes for in-service control of the basic metal, welded surfaces and joints of primary and secondary circuits equipment and pipelines;
- equipment corrosion condition control programme;
- specific programmes to evaluate the radiation ageing of reactor vessels;
- control programme of reactor installation load cycles;
- control programme of nuclear fuel load cycles;

- programmes for functional testing of systems, important to safety;
- report on neutron-physical characteristics of the new reactor core and analysis of compliance with the accepted criteria.

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

Kozloduy NPP has implemented a Programme for Units 5 and 6 Equipment Surveillance, which covers all the planned activities performed to verify the units compliance with the design operational limits and conditions, and in due time detecting deterioration of SSCs properties, which could result in violation of the conditions and limits for operation.

Surveillance Programme

The objectives of the Surveillance programme of Units 5 and 6 are:

- verification that the design conditions, under which plant safety has been justified, are maintained during operation;
- verification that safety level is in compliance with the requirements and provides for sufficient margins during anticipated operational events, personnel errors and equipment failures;
- maintenance and improvement of equipment preparedness, confirmation of respective operational limits and conditions;
- detection and elimination of any violation from normal operation, before the occurrence of significant implications to safety.

To achieve these objectives, the programme was developed taking into account the requirements of the SAR, the technical specifications, results of reliability analysis of the safety systems (based on real data for failures and defects), operating experience, manufacturers data and requirements, requirements of the control authorities and statutory technical documents related to the specific surveillance activities.

The surveillance programmes pays particular attention to the control of:

- protective barriers condition;
- safety systems availability;
- availability and operability of systems important to safety;
- availability and operability of systems (elements) for normal operation, whose failure could result in decrease of the unit electrical output.

The programme is valid for all activities related to:

- Control of the unit parameters, the unit and and the common plant systems;
- Check and calibration of instrumentation;
- Testing of components and systems;
- Evaluation of the results of the above activities;
- Feedback used as a basis to determine the scope and the type of the administrative, technical and practical measures that are undertaken as a result of the established deviations.

Main documents and principles used for the Programme development

The Surveillance Programme was developed on the grounds of the regulations in force, which are relevant to the control and surveillance of systems and facilities in NPP, the Quality Assurance System in Kozloduy NPP and the IAEA recommendations.

The frequency and the scope of surveillance for each SSC is determined on the basis of their relative importance to safety. Furthermore, the access restrictions and the requirements for maintaining the personnel exposure dose as low as reasonably achievable (the ALARA principle), should be taken into account.

Due to the wide range and diversity of the surveillance activities, and the specific requirements of the statutory technical documents for the specific surveillance areas, the management system for the surveillance programme activities was developed at four levels - Technical specification, administrative and operating instructions, operational documents for the implementation of specific activities, and implementation of surveillance and recording the results thereof.

An Annual Report on the activities of Kozloduy NPP units 5 and 6 is prepared at the beginning of each year. It evaluates the control and the surveillance activities during the previous year.

Risk-informed approach

In 2008 the Pilot Project for the operations optimization, maintenance and repair of Units 5 and 6 was completed. It was based on the results of the PSA - the so called Risk-informed Approach. The study covered the following areas:

- Non-destructive control of the equipment;
- Periodical equipment testing;
- Maintenance of the equipment.

The results of the pilot project include the following major sections:

- Changes in frequency, scope and type of non-destructive testing;
- Assessment of the tests scope and frequency;
- Assessment of the maintenance scope and frequency;
- Assessment of the rest lifetime of Safety Systems equipment;
- Reliability analysis of the SS electrical equipment, replaced during the Modernization programme;
- Criteria for testing and acceptance of the SS equipment after maintenance and repair;
- Analysis of the existing legislation on the technical specifications in place;
- Assessment of the respective safety margins.

A Risk Monitoring Model was developed for the daily risk assessment of units 5 and 6. The Safety Monitor (SM) software is used. Based on the update of the integral model of PSA Level 1, the risk monitoring model is also being updated. For that purpose the Risk Watcher software is used.

Elements of the ageing management programme

Kozloduy NPP applies an Ageing Management Programme to identify all ageing mechanisms of SSCs important to safety, and to determine the possible consequences of the processes and the possible measures to restore the operability of the impacted SSCs.

The selection of SSCs, covered by the Ageing Management Programme and subject to monitoring and evaluation of the rest lifetime, was made in respect to safety, based on the following criteria:

- Criterion 1 - SSCs of great importance to safety, i.e. their classification and qualification is taken into account;
- Criterion 2 - SSCs of great importance to plant lifetime – components are considered, which are not important to safety, but the failure of which may prevent the fulfilment of the safety functions;
- Criterion 3 - SSCs which are proven to be able to perform safety functions, when required during their lifetime;
- Criterion 4 - rationality. When selecting the SSCs for lifetime support, realistic possibilities for failures, any possible degradation, inspection interval and functional limitations shall be taken into account;
- Criterion 5 - economic efficiency. SSCs from the Safety Systems and the Safety-related Systems, whose rest lifetime should be maintained, shall be selected in such a way as to have optimum economic efficiency.

The activities related to the establishment, maintenance and review of the qualification status of SSCs important to safety are presented in the Quality Procedure "Kozloduy NPP units 5 and 6 Equipment Qualification Management".

Separate from this, as part of the Qualification Programme for SSCs from the Safety Systems and the Safety Related Systems, a Safety Shutdown Equipment List was developed (SSEL). This document includes:

- Safety Shutdown System List (SSSL);
- Safety Shutdown Equipment List (SSEL);
- Harsh Environment Component List (HECL);
- Severe Accident Management Parameters Control and Measurement List.

The following major measures were implemented on the equipment from the Safety Shutdown Equipment List (SSEL), under the Investment programme of Kozloduy NPP:

- Development of design-technical documentation of the Control Safety Systems, supply, dismantling of old equipment, installation and adjustment of new equipment;
- Replacement of batteries in DG stations with seismically qualified;
- Supply of cylinders for vast isolation valves for the steam-generators make up system;
- Replacement of breakers in switchgear 0,4 and 6 kV.

A number of new measures are also under the way or planned:

- Seismic qualification of equipment that has not been qualified according to seismic impact, which is required for the safe shutdown of the reactor and for maintaining its subcriticality;
- Supply of pressure pickups qualified for HELB conditions. Replacement of stands, instrumentation sensors leads, cables and cable routes of equipment installed in the area impacted by the HELB environmental conditions;
- Design and installation of a new system for measurement of Primary circuit legs temperature;
- Design, supply and replacement of reliable power supply devices for units 5 and 6 Safety Systems;

- Qualification of Steam Dumps to the Atmosphere to operate with two-phase environment and in HELB mode, etc.

In-service control is performed over the rest lifetime and the SSCs qualification, under approved procedures, within the Maintenance and Operations Programmes, for instance:

- of welded joints, anti-corrosion build-ups, base material in stress concentration areas and areas located against the core, pipelines radius reducers, packing surfaces of covers and bodies, supports, studs, metal in threaded joints and bearing surfaces of hold-down rings, headers welded joints, tube plates of SG, sections with water-steam phase transitions, welded sections of reducers between connections and bodies, connections of pipes and T-junctions to bodies, etc.
- of metal mechanical properties by applying periodic control of surveillance specimens, metal cut-outs (destructive method), determining hardness;
- through monitoring and measurement of various parameters in the process of operation by using diagnostic systems, mechanical or optical measuring devices, thickness testing, ultrasound control, etc.
- by the results from the hydraulic strength and ductility tests;
- of the lifetime based on the number of cycles, hours of failure-free operation, chemical index, etc.

Arrangements for internal review by the licence holder of safety related 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 Expert Councils, with the appropriate status and rights. Depending on the scope of the issues under review, the following types of councils are established:

- Safety and Quality Council - on issues, common to the company, related to the safety and quality during operation, maintenance and reconstruction, management of the nuclear-fuel cycle and radioactive waste, maintaining emergency preparedness, decommissioning of nuclear facilities.
- Safety Council - on issues relating to:
  - units start-up and shut down programmes, functional testing, design modifications, documents concerning the systems important to safety;
  - analyses of events, corrective and preventive measures, including the operational experience of other NPPs;
  - matters related to the quality assurance system;
- ALARA Council - see texts under art. 15;
- Operational Experience Council - see texts under art. 19;
- Expert Technical Council - on issues related to technical or technological developments and proposals for design modifications to equipment and systems in particular specialized areas.
- Safety Culture Council - on issues related to the safety culture.

Regulatory review and control activities

The NRA performs reviews and assessments of the following documents, which Kozloduy NPP shall submit under the operational licenses conditions at least 15 days before the unit outage:

- Programme for in-service control of the base metal, built-up surfaces and welded joints of equipment and pipelines;
- Maintenance schedules and programs;
- Report of the neutron-physical characteristics of the new reactor core.

The procedure for unit start-up, following the plant outage, is determined by the provisions of the operational licence conditions. According to the operational licence, not less than 7 days prior to the start-up of the unit, the licensee is obliged to notify the NRA Chairman. In this relation an order is issued by the NRA Chairman to set up a Commission (inspection team) to verify the unit preparedness for start-up and operation, in accordance with an approved programme, including at least the following topics:

- State of the core and the unit towards the time of the inspection;
- Implementation of measures to increase the unit safety, functional tests and modifications in the operational documentation;
- Implementation of the planned and additional maintenance activities, as well as testing proving systems operability;
- In-service control of the equipment and pipelines metal, carried out during the Planned Annual Outage;
- Control of the facilities of high risk, relevant to nuclear safety;
- Metrological verification;
- Radiation protection during outage, accumulated RAW and preparedness of the radiological control systems;
- Water chemistry and corrosion investigation of Primary and Secondary circuits;
- Analysis of operational events, implementation of the approved corrective measures;
- Fulfilment of the license conditions and ensuring qualified and licensed personnel;
- Conditions of systems, operational documentation on the working places and housekeeping.

Under the licence conditions, the licensee could start-up the unit following refuelling only after the NRA Commission grants a positive assessment on the implementation of the conditions for safe start-up and power operation of the unit, approved by an order of the NRA Chairman.

Within one month after the notification of the NRA Chairman for the unit start-up after refuelling, the licensee shall submit for review and assessment a summary report on:

- Results from the implemented programme for in-service control of the base metal, built-up surfaces and welded joints of equipment and pipelines;
- Results of leak tightness inspection of loaded fuel assemblies;
- Results from the comparison analysis of calculated core neutron-physical characteristics and the unit operational data;
- Resourse of fuel;
- Residual lifetime of the reactor pressure vessel and equipment, for which the rest lifetime is assessed;
- Results of the test programme;
- Results of the programme for neutron control of reactor vessel;

- Results of the unit start-up programme.

During units power operation, the NRA on-site inspectors control the implementation of the periodic Safety Systems tests, the planned annual maintanence activities and the elimination of defects and failures in SSCs that are important to safety.

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 installations

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 the ASUNE, the Regulation on Basic Norms for Radiation Protection (RBNRP), the Regulation on Providing the Safety of Nuclear Power Plants.

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. During the use of nuclear energy and ionizing radiation and radioactive waste and spent fuel management, the ionizing radiation exposure of the staff and the population is maintained to as low as reasonably achievable level.

The new Regulation on the Basic Norms for Radiation Protection dated 2012 has been prepared on the basis of the new ASUNE dated 2010, Issue № 103 of the International Commission on Radiological Protection (ICRP) (2007), Issue "GSR Part 3" of the IAEA (2012) and the Draft on European Basic Safety Standards, published by the European Commission in 2012. The Regulation defines:

- general principles, requirements and radiation protection measures;
- main (principal) dose constraints for external and internal exposure;
- derivative (secondary) constraints for external and internal exposure;
- boundaries for the purposes of radiation monitoring and protection planning;
- rules and limits for free-release of materials.

The changes in the new RBNRP are generally the following:

- The limit of the effective dose from occupational exposure for each individual year has been changed from 50 mSv to 20 mSv. The limit for the annual equivalent dose for the eye lens for staff has been changed from 150 mSv to 20 mSv;
- The annual equivalent dose limit for the eye lens for students and trainees at the age from 16 to 18 years of age who due to the nature of the training need to conduct it in environment with sources of ionizing radiation, has been changed from 50 mSv to 20 mSv.
- The individuals accredited by the Executive Agency "Bulgarian Accreditation Service" for the performance of individual staff monitoring, register the monitoring results and submit Protocols to the relevant enterprises within 15 days after processing the individual measurement with periodicity which corresponds to the conducted individual monitoring.
- The accredited individuals are obliged to send up-to-date data for the enterprises, the number of the staff working for them, the periodicity of the monitoring and the type of

the measurement equipment used to the National Register which is kept by the NCRRP.

- In case of accidental dose exposure the imparted dose and its distribution within the body should be assessed by a Radiation Protection Expert.
- The NCRRP has the right to require from the enterprises the necessary data for assurance of full identification of the individuals who are subject to individual monitoring.
- When external personnel are admitted to work in the controlled area, the plant shall provide protection means and individual monitoring equipment as the ones envisaged for its own staff.
- Chapter 3 from the Regulation is completely revised on the basis of Issue GSR Part 3 of the IAEA. The following is given as attachment:
  - the levels of activity and the specific activity of materials for relevant number of radionuclides (exemption levels) for which, for deginite activities with them, there is no requirement for issuance of licenses and permits (for quantities up to 1000 kg);
  - the levels of the specific activity of the human-induced radionuclides (clearance levels) for which a given radioactive material is not subject to regulatory control and can be free-released (for quantities over 1000 kg);
  - the levels of the specific activity for natural radionuclides for which a given material can be free-released;
  - the levels of the specific activity for human-induced radionuclides for which metals, subject to recycling, can be free-released.
- The radiation and the tissue weight factors for assessment of internal and external irradiation, given in attachment 3 of the Regulation are in accordance with Issue № 103 if the ICRP.

In line with the Regulation on Providing the Safety of Nuclear Power Plants the basic requirements and criteria for providing the radiation protection in a nuclear power plant (NPP) are the following:

- radiation impact under all operating conditions of the NPP (consisting of normal operation and anticipated operational events) is maintained lower than the regulatory range of dose limits 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 events, the annual effective dose to members of the public due to liquid and gaseous radioactive discharges from the site of the NPP to the environment shall not be greater than 0,15 mSv irrespective of the number of nuclear facilities on site.
- in the event of severe accident in the NPP (BDBA which results in significant damage to the reactor core) the activity of vented cesium-137 to the atmosphere should not be greater than 30 TBq, which does not enforce restrictions on long-term use of soil and water in the surveillance area around the NPP. The combined discharge of other radionuclides should not cause in a long-term perspective, beginning three months after the accident, risk greater than the risk due to the release of cesium-137 with activity of 30 TBq.
- regarding NPPs commissioned before the Regulation on Providing the Safety of Nuclear Power Plants became in force, 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 all operating conditions of the NPP.

Areas with special status are established around the nuclear facilities. These areas are as follows:

- Preventive Protective Measures Area - the territory around nuclear facilities which is established for the limitation of the exposure of the population in the event of accidents;
- Surveillance area - the territory outside the boundaries of the Preventive Protective Measures Area in which the radiation monitoring for the purposes of radiation protection is carried out.

The boundaries of the Preventive Protective Measures Area and the Surveillance area are defined in the course of licensing of the nuclear facilities.

The annual effective dose for members of the public on the border of the Preventive Protective Measures Area and beyond should not be greater than 5 mSv for the first year after design based accident. If one site has two or more nuclear facilities it is necessary to consider their total radiation impact while maintaining the established dose quota for the site. The Surveillance Area is established via an Order by the Chairman of the NRA.

The design of the NPP should include automated radiation monitoring system in the NPP and radiation monitoring system within the Preventive Protective Measures Area and the Surveillance Area around the NPP. These systems shall provide the necessary information on the radiation environment, the state of the protective physical barriers and the activity of the radionuclides, as well as information for predicting the dynamics of the processes in case of emergency.

The Automated Radiation Monitoring System should include technical means for:

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

The Radiation monitoring in the Preventive Protective Measures Area and the Surveillance area is a responsibility of the licensee and covers as the minimum the measurement of:

- A dose rate from external gamma radiation;
- Gross and specific activity of liquid and gaseous discharges into the environment;
- Specific activity of ground-air, atmospheric depositions, topsoil and vegetation (flora);
- Specific activity of the 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 the radiation monitoring is approved by the competent authorities - Ministry of Health (MH) and Ministry of Environment and Water (MEW). The monitoring of the radiation parameters of the environment and the agricultural production within the Preventive Protective Measures Area and the Surveillance Area, as well as assessment of the exposure of the population is carried out by the licensee and the independent bodies of the executive power.

Regulatory requirements to the licensee to optimize the doses and application of the ALARA principle

In line with the ALARA principle dose limits (dose quotas) for the staff and the public and safety factors in planning the protection from external and internal exposure are introduced in the RBNRP. The dose quotas for the different nuclear facilities are justified in the course of the licensing process.

The quantities which are rated in the RBNRP include the following:

- secondary (derivative) levels in external and internal exposure of individuals from the staff and the population, which include limits for equivalent dose rate and the annual intake of radionuclides in the body via inhalation and ingestion;
- limits for the radiation control and protection planning (control limits) in the external and internal exposure of individuals from the staff and population, which include: limits on the annual average volumetric activity of aerosols and radioactive noble gases in the air of working premises for the personnel; limits of the surface radioactive contamination levels; limits of the annual average density of ionizing particles flux /electrons, photons, neutrons/ for external exposure to personnel /body, ocular lens and skin/; limits for the annual average volumetric activity of radioactive noble gases and aerosols for ambient air; limits for the annual average volumetric activity of radionuclides for drinking water.

The requirements for radiation protection of the occupationally exposed individuals are defined in the RBNRP:

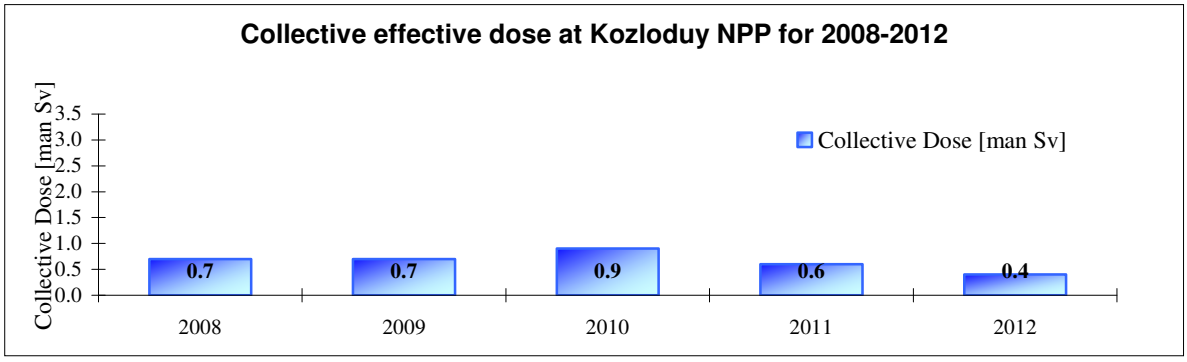
- Preliminary risk assessment and optimization of protection;
- Classification of the work places and zoning of the territory;
- Categorization of occupationally exposed individuals;
- Radiation Monitoring of the working environment, including individual monitoring;
- Medical surveillance of staff.

Monitoring results of the individual dose exposure at Kozloduy NPP

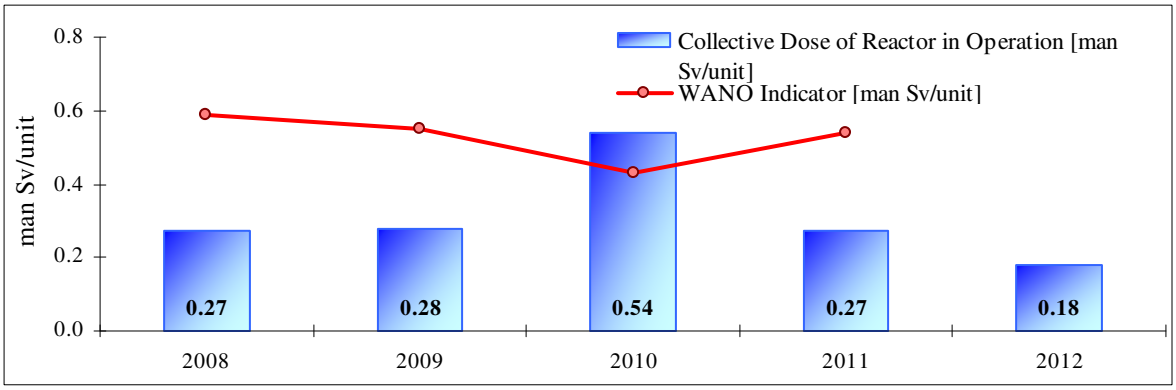
The independent monitoring of the occupational exposures is performed by the “Personal Dosimetry” Control Center which is accredited by the Executive Agency "Bulgarian Accreditation Service” as per BDS EN ISO/ IEC 17020.

The table below presents data for the occupational exposure at Kozloduy NPP (Units 3 - 6 and the Wet SFSF) for the last five years. Units 1 and 2 were transferred to the State Enterprise "Radioactive Waste" with a decision by the Council of Ministers in the end of 2008.

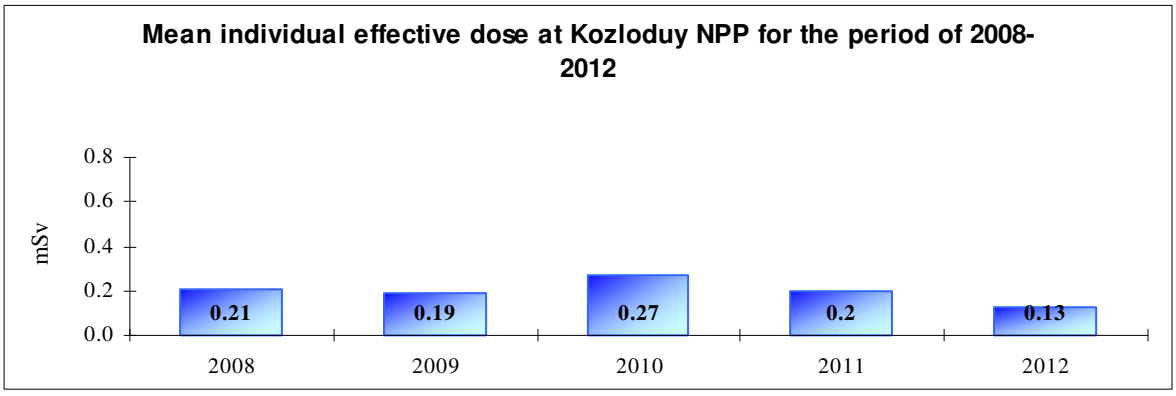
No.	Indicator	2008	2009	2010	2011	2012
1	Collective effective dose [manSv]	0.7	0.7	0.9	0.6	0.4
2	Internal dose percentage[%]	0	0	0	0.5	0
3	Exceedance of the annual limit for occupational exposure (RBNRP)	0	0	0	0	0
4	Average individual effective dose for the monitored individuals [mSv]	0.21	0.19	0.27	0.20	0.13
5	Maximal effective dose [mSv]	9.29	7.28	10.64	6.86	6.75



The collective dose in 2012 for Kozloduy NPP, normalized to the number of the reactors in operation (WWER 1000) is 0.18 manSv/unit. For the last five years the collective dose is comparable or lower than the mean value from the WANO indicator for the PWR-type reactors (as shown in the figure).



The average individual annual dose of the monitored persons at Kozloduy NPP in 2012 is 0.13 mSv and it maintains the tendency to decrease in the last years.



Over the past five years there was no individual effective dose exceeding the occupational exposure limits registered, as per the RBNRP.

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

The main principles, norms and rules which have to be observed in the course of releasing radioactive substances into the environment, which are obtained as a result of licensed or permitted practices, have been specified in the ASUNE and the Regulation on the Basic Norms of Radiation Protection.

The ASUNE does not foresee the issuance of a separate permit for the release of gaseous and liquid radioactive substances in the environment. The radioactive releases from nuclear facilities are evaluated during the review of the technical design of the facility and are permitted via the license for operation as an integral part of the limits and condition for operation of the nuclear facilities.

Liquid and gaseous discharges in the environment

The Technical specifications contain the limits and conditions for operation and also include limits for the discharges of radioactive substances in the environment during normal operation. These limits are periodically updated to follow the trends for constant reduction of the actual releases in the environment.

Limits for the Liquid Discharges

Liquid discharges at Kozloduy NPP are controlled in terms of two parameters:

- Total activity of waste water from the industrial process;
- Volumetric activity.

The limits and the control levels for the total activity of waste water from the industrial processes throughout the plant are presented in the following table:

Indicator	Unit of measurement	Quarterly control level	Quarterly limit	Annual control level	Annual limit
Total Activity (without Tritium)	GBq Ci	37 1	185 5	148 4	740 20
Tritium	GBq Ci	6475 175	46250 1250	25900 700	185000 5000

The following control levels and limits have also been defined for the wastewater:

- Limit of volumetric activity (excluding tritium) - 1850 Bq/l and the respective control level of 370 Bq/l, which are controlled operationally before and during drainage;
- Limit of volumetric activity of waters from wash basins, toilets and bathrooms located in the Controlled Area: 11 Bq/l (3.E-10 Ci/l).

Limits for the Gaseous Discharges

The annual limits for the gaseous radioactive discharges are defined as components so that the annual individual effective dose to a member of the public not to exceed 50 µSv/a. The resulting limits for the whole plant are allocated to separate ventilation stacks (VS) on the basis of operational experience. Verification of received values has been done with software code for assessment of the individual effective dose from gaseous discharges based on the CREAM methodology recommended by the IAEA.

The values of the annual limits for gaseous discharges from Kozloduy NPP are provided in the table below:

Emissions Components	VS-1 Units 1, 2	VS-2 Units 3 , 4	5VS Unit 5	6VS Unit 6	0VS AB-3	Wet SFSF-VS	NPP total
RNG, 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 have been introduced and are given in the table below:

Emissions Components	VS-1 Unit 1.2	VS-2 Unit 3.4	5VS Unit 5	6VS Unit 6	0VS AB-3	SFSF-VS	NPP-total
RNG, 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

Two types of monitoring of the discharges into the environment - operational and periodic monitoring are organized at Kozloduy NPP.

The operational radiation monitoring of discharges into the environment is carried out continuously. The concentration of RNG, ^{131}I and radioactive aerosols contained in the waste air and the concentration of radioactive substances in the wastewater is determined.

The purpose for operational monitoring is to monitor the discharges and to provide information on:

- exceedance of the established control levels, specified in the Technical specifications and the operational instructions;
- early detection and assessment of the trends for the discharge of radioactivity into the environment.

The periodic radiation monitoring is carried out in order to:

- provide data for the most realistic assessment possible of the dose exposure of the population;
- provide information to the public on discarded radioactivity in the environment;
- decision-taking with regard to the operation of the power units;
- confirmation of the results of the operational monitoring;

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

Gaseous discharges

Component*	RNG, TBq		^{131}I, MBq		Aerosols, MBq		^{14}C***, GBq		^{3}H***, GBq	
Year	**EP-1	EP-2	EP-1	EP-2	EP-1	EP-2	EP-1	EP-2	EP-1	EP-2
2009	0	0.656	0	7.23	55.3	5.61	-	-	-	-
2010	0	6.43	0	65.7	19.9	7.95	-	519	-	376
2011****	0	9.61	0	122	5.49	10.7	6.71	1000	67.7	478
2012****	0	0.941	0	1.90	15.9	3.35	4.18	706	33.8	555

** The determination of C-14 and H-3 in the gaseous releases began in 2010 for EP-2 and 2011 for EP-1.*

*** Since the beginning of 2007 the four power units of EP-1 are no longer in operation.*

**** The values are for total amount of ^{14}C and ^{3}H (organic and non-organic forms).*

***** The values for the discharges have been reported in accordance with the provisions of item 8 of the Recommendation of the European Commission 2004/2/EURATOM.*

Liquid discharges

Component	Total Activity, MBq (excl. H-3)		H-3, TBq	
Year	**EP-1**	**EP-2**	**EP-1**	**EP-2**
2009	156	73.4	0.34	23.4
2010	61.8	228	0.475	22.3
2011*.	61.1	359	0.269	22.6
2012*.	44.5	368	0.241	23.8

** The values for the discharges have been reported in accordance with the provisions of item 8 of the Recommendation of the European Commission 2004/2/EURATOM.*

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

The total dose exposure of the population within the 30-km area around the Kozloduy NPP due to the radioactive discharges is as follows:

Year	Maximal individual effective dose, [Sv/a]		
	Gaseous	Liquid	Total
2009	$5{,}46.10^{-7}$	$4{,}41.10^{-6}$	**$4{,}96.10^{-6}$**
2010	$8{,}02.10^{-7}$	$4{,}23.10^{-6}$	**$5{,}03.10^{-6}$**
2011	$2{,}72.10^{-6}$	$4{,}26.10^{-6}$	**$6{,}98.10^{-6}$**
2012	1,33.10-6	4,49.10-6	**5,82.10-6**

Free-release of materials containing radioactive substances

In line with the provisions of the RBNRP activities with sources of ionizing radiation which meet the following dose criteria are not subject to regulation under the ASUNE:

- the effective dose which is expected to be imparted for one year by any member of the public should not exceed 10 μSv;
- the effective dose which is expected to be imparted for one year by any member of the public in a scenario with a low probability of occurrence should not exceed 1 mSv.

The radioactive materials originating from the regulated activities, for which it is envisaged to be disposed, recycled or reused, are subject to regulation. Radioactive material is free-released for each particular case by an Order issued by the BNRA Chairman, upon request by the licensee or the permit holder.

Materials subject to recycling or reuse are free-released upon the condition that at any moment in time for all of the radioactive substances the sum of the ratios of their specific activities to the specific activities for the respective radionuclides (clearance levels) is not bigger than one. If the specific activity of individual radionuclides is bigger than the respective clearance levels, it is required to have a preliminary justification with regard to the intentions, manner and area of utilization of the radioactive substances and materials in question. The NRA assesses for each individual case the compliance with the dose criteria.

For Units 1-4 which are in the state of preparation for the decommissioning process there are procedures developed for free-release (clearance) of large quantities of metal. Kozloduy NPP are in the course of approval of free-release (clearance) procedures for materials obtained during the operation of Units 5 and 6.

Implemented processes and steps undertaken to ensure applicability of ALARA principle for all operational and maintenance activities

During the past few years Kozloduy NPP maintains staff and public dose exposure levels which are comparable to the best international practices.

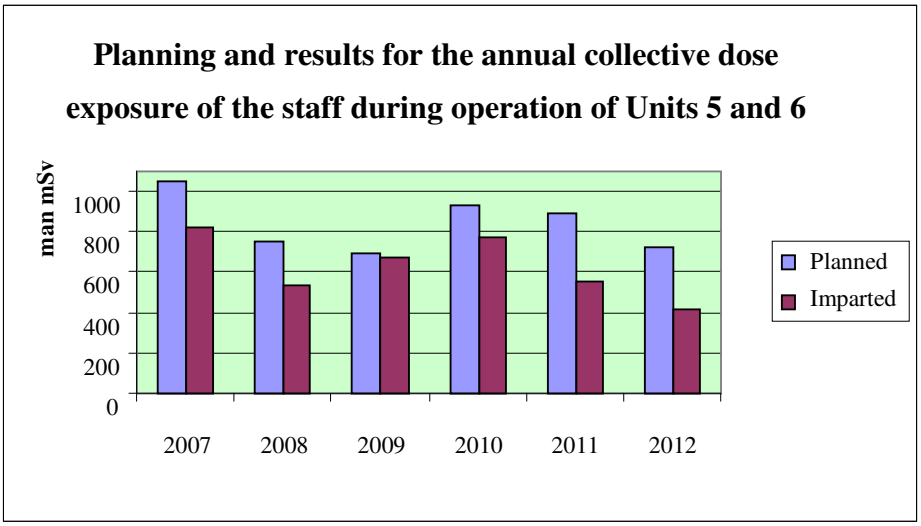
The main directions in the application of the ALARA principle at Kozloduy NPP are the following:

- Administrative management of the measures for optimization of the dose exposure;
- Reduction of the dose exposure in the arrangement and conduct of the annual outages;
- Reduction of the dose exposure in-between outages.
- Improvement of the dosimetry work permit system and the dosimetry monitoring system;
- Informational and methodological provisions for optimization of the dose exposure;
- ALARA methodology staff training;
- Report and analysis of the dose exposure; Feedback from operational experience.
- Evaluation of the efficiency in the implementation of the ALARA principle.

Basic approach in the optimization of the radiation protection system at Kozloduy NPP is the radiation exposure planning. Planning and the administrative regulation of the dose exposure for the personnel is performed by:

- Determination of control levels for annual individual radiation exposure.
- Determination of control levels for the concentration of radioactive substances in the air and the surface contamination of the premises within the Controlled Area in such a way as for the committed individual effective dose due to internal exposure of the staff to be maintained as low as possible.
- Preparation of dose budgets for collective exposure planning.
- Planning the exposure of members of public by establishing control levels for liquid and gaseous radioactive discharges into the environment;
- In case of extraordinary maintenance/repair activities with increased radiation risk, the dose budget is a part of the relevant radiation protection programme.

The results of the planned and imparted dose exposure of the personnel for last few years are presented in the figure below:



The leading role in the implementation of the principle for optimization of dose exposure of staff and public is played by the ALARA Council, chaired by the Chief Engineer of Units 5 and 6. Members of the Council are line managers, capable of providing a large scope of information necessary in the execution of tasks and the implementation of functions in an environment with ionizing radiation. The ALARA Council is responsible for: the selection of a strategy for radiation protection optimization; review and analysis of measures related to the optimization of radiation protection; dose budgets consideration and approval; control and analysis of the imparted individual and collective doses; control on the measures for non-spread of radioactive contamination.

Environmental Monitoring and General Results

There are 36 monitoring stations established around Kozloduy NPP, in which measurements and sampling for the content of natural and human-induced radionuclides are carried out. Radioactivity in the air, atmospheric depositions, vegetation, soil and the radiation gamma background are periodically monitored. Beyond those stations samples of water, milk, fish and others are analyzed with special focus on drinking water sources and the Danube River where there are several sampling points at its stream. Standardized and validated methods of practice are in use, such as gamma spectrometry, low background radiometry for total beta activity, liquid scintillation spectrometry for the determination of tritium, strontium, etc. A specialized mobile laboratory is used for the radiation surveillance and field measurements. Annually, over 2200 samples from different sites of the environment are tested: air, water, air, soil, vegetation, milk, fish, agricultural crops, etc., whereas the total number of laboratory analyses exceeds 3800. What is more, over 1300 measurements of the radiation gamma background are performed in the control points and routes with portable dosimetry devices and static thermo-luminescent dosimeters.

The quality assurance of the analyses is performed by analyses of blank, duplicate and marked samples, control tests of the instrumentation and regular participation in international laboratory comparisons.

Regulatory Control

Nuclear Regulatory Agency (NRA)

Specific requirements regarding the radiation protection, the radiation monitoring and the frequency and type of reporting the results of the control to NRA are included in the issued licenses for operation. Monthly reports for gaseous and liquid discharges, annual reports with the results of the occupational exposure, and annual reports for the results from the environmental radiation monitoring, including assessment of dose exposure of the population are all submitted to NRA.

The NRA implements regulatory control on the radiation protection at Kozloduy NPP by inspecting the site and performing analysis and evaluation of the documents on the implementation of the terms and conditions of the issued licenses submitted by Kozloduy NPP. The periodic review of the condition of the radiation protection performed by the NRA inspectors includes analysis and performance evaluation of the information submitted to NRA for compliance with the regulatory and licensing requirements for radiation protection. The results of the regulatory review are published in the annual reports of NRA.

A "Procedure for independent regulatory control of radioactive discharges from Kozloduy NPP" has been developed by NRA. The procedure describes the scope and organisation of the control, the programme and timetable for taking and analyzing samples, the responsibilities of the different participants, requirements for reporting the results. The sampling program specified by the NRA includes at least 5% of the number of samples of Kozloduy NPP depending on their type. The procedure regulates the conduct of regulatory control by assigning the performance of the sample analyses to an independent laboratory. There is also an aerosol sampling device owned by the NRA, situated at the site of Kozloduy NPP.

In the period of 2009-2012 analyses of more than 90 samples from the radioactive discharges of Kozloduy NPP have been performed for the contents of gamma radionuclides, transuranium elements, ^{90}Sr, tritium and ^{14}C. The data from the sample analyses records indicates a very good correspondence with the results of Kozloduy NPP.

MEW

The Ministry of Environment and Water through the Executive Environmental Agency and its regional structures implements an independent monitoring of environmental radiation condition 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;
- through laboratory and analytical system for off-line monitoring.

The continuous and periodic monitoring is performed over the following radiological parameters:

- radiation gamma-background;
- atmospheric radioactivity;
- concentration of human-induced radionuclides in uncultivated plots from points in the surveillance area;
- radiological indicators in surface water from the 30-km zone and discharge waters from the power plant;
- concentration of human-induced radionuclides in sediments from the Danube River.

The Executive Environmental Agency (EEA) administers the National Automated System for Continuous Monitoring of Gamma Background. The system consists of 27 local monitoring stations, located throughout the whole country with a greater concentration of stations in the 100-km zone around the Kozloduy NPP.

The users of the operational information from the automated system are the Ministry of Interior - General Directorate "Fire Safety and Civil Protection" and the Nuclear Regulatory Agency - the Emergency Center. There are 8 automated stations from the off-site dosimetry monitoring of Kozloduy NPP integrated to the system which are located in a 1.8 km radius of the power plant. The system is integrated into the European Radiological Data Exchange Platform (EURDEP). Under normal conditions, data is being transmitted to EURDEP once a day and in the presence of abnormal values - each hour.

The EEA also administers the Automated System for Radiation Monitoring of waters from the Danube River in the area of Kozloduy NPP. The system consists of two local monitoring stations located at the Kozloduy Port before the plant site and at the Oryahovo Port, downstream the hot channel of the plant. The stations perform continuous sampling of the river and carry out automated analysis for concentration of gamma-emitting radionuclides. The system has not identified any abnormal levels of human-induced radionuclides - Cesium-134 and I-131.

The radiometric measurements in real conditions, sampling and laboratory and analytical activity in the region of Kozloduy Nuclear Power Plant are carried out by the Regional Laboratories for Radiation Measurements in Vratsa and Montana under the EEA. Periodic monitoring is performed for: atmospheric aerosols, uncultivated soils, discharge waters from the plant, surface water and sediments of the Danube River and other water basins in the region. The data obtained from the measurements indicate a lack of influence of the operation of the plant on the components of the environment.

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

National Center of Radiobiology and Radiation Protection

The National Center for Radiobiology and Radiation Protection (NCRRP) carries out the state public health control on the work and living environmental factors affecting the exposure of individuals from sources of ionizing radiation and assesses the exposure and the radiation risk for the population as a whole or for certain groups of it. The State Health Control at Kozloduy NPP is performed by an Inspectorate under the NCRRP and it includes:

- evaluation and issuance of statements of opinion on the compliance of the design, construction, reconstruction, expansion, commissioning and other activities with sources of ionizing radiation with the health requirements and the requirements for radiation protection of personnel and population.
- sampling or measurements of radiation factors of the working environment, carrying out laboratory analyses, data processing and preparation of records/reports and when violations are detected, issuance of mandatory requirements.
- topic reviews (4 times a year) for: observance of the requirements for radiation protection and the condition of the documentation, the radiation risk to workers, individual radiation exposure of personnel and measures to reduce the exposure.

The Inspectorate under the NCRRP performs regular measurements of the ambient dose rate, surface contamination and volumetric activity of aerosols within the Controlled Area of Kozloduy NPP Units 5 and 6.

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 emergency preparedness in case of nuclear or radiological event in the Republic of Bulgaria is a part of the general national arrangements for protection in case of disaster. The main legislative and regulatory requirements for the structure and organization of the emergency preparedness are specified in the Disaster Protection Act (DPA), the Act on the Safe Use of Nuclear Energy (ASUNE), the Ministry of Interior Act (MIA), and the Regulation on emergency planning and emergency preparedness in case of nuclear and radiation accident.

The Disaster Protection Act establishes at national level unified approach and organization in planning, maintaining emergency preparedness and response during disasters. The Act is harmonized with ASUNE as regards the requirements for development of emergency plans, their contents, the human resources required, material and technical support, etc.

According to the DPA, the Council of Ministers establishes the state policy and adopts a National Plan and a National Programme for protection in case of disasters; it also introduces a National System for Early Warning and Notification of the executive authorities and population in case of disaster and determines, through a Regulation, the conditions and the procedure for its implementation, provides for financial resources for protection, including in case of nuclear or radiological emergency situation.

The general management of the activities related to the protection of the population and environmental preservation in case of disaster is implemented by the Council of Ministers.

The requirements for emergency preparedness during operation of nuclear facilities are specified in the Act on the Safe Use of Atomic Energy. In accordance with ASUNE, entities implementing activities related to the operation of nuclear facilities are obliged to undertake measures to prevent emergencies and accidents and to mitigate the consequences thereof.

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 zones 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 (on-site emergency plan), which determines the actions to be taken by the licensee or the permit holder to mitigate the accident and eliminate the consequences thereof, according to the off-site emergency plan.

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

- immediately warn the population and the mayors of municipalities within the emergency planning zones and other competent authorities;
- take actions for mitigation and remediation of the accident consequences;
- control and regulate the exposure of the persons engaged in the accident mitigation and liquidation;
- ensure continuous monitoring of the radioactive releases into the environment;

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 limitation (localization) and liquidation of the consequences of a nuclear or radiological accident, the methods for informing the general public, the procedure for maintaining and testing the emergency preparedness.
- risk categories of the sites, facilities and activities, as well as classification of the emergencies. IAEA recommendations in GS-R-2 "Preparedness and Response for a Nuclear or Radiological Emergency" are observed.
- the intervention levels as values of the predicted dose and averted dose for a certain period of time, the dose rate and the specific activity values, whose reaching initiates the implementation of protective measures.

The Regulation defines emergency planning zones, which are as follows for Kozloduy NPP:

- on-site emergency planning zone – protected area (zone No.1, Kozloduy NPP site);
- off-site emergency planning zone, divided as follows:
  - precautionary action zone (PAZ) - with a 2 km radius and centre between the vent stacks of units 5 and 6 (zone No.2);
  - urgent protective action planning zone (UPZ) - with conditional radius of 30 km around Kozloduy NPP (zone No.3);
  - long-term precautionary measures zone (LTZ) - no definite external boundary (zone No.4).

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

- REGULATION on the conditions and procedure for establishing of special-statutory areas around nuclear facilities and facilities with sources of ionizing radiation;
- REGULATION on basic norms for radiation protection;
- REGULATION № 28 on the conditions and procedure for medical insurance and medical norms for persons in case of radiation accident;
- REGULATION on the procedure for construction, maintenance and use of collective means of protection;

- REGULATION on the conditions and procedure for functioning of the National System for Early Warning and Notification of the executive authorities and the population in case of disaster and for notification in case of air hazard;
- REGULATION on the procedure for establishment, storage, renewal, maintenance, delivery and recording the stocks of emergency kits;
- REGULATION Nr. 11 on the determination of the requirements towards the limits of radioactive contamination of food in case of radiation accident.
- REGULATION on the conditions and procedure for notification of the Nuclear Regulatory Agency about events in nuclear facilities and sites with sources of ionising radiation.

National Disaster Protection Plan

In accordance with Article 9, Paragraph 4 of the Disaster Protection Act (DPA) the Minister of Interior shall draw up the National Disaster Protection Plan in conjunction with representatives of ministries, agencies, the Bulgarian Red Cross and local self-government bodies. The National Disaster Protection Plan (NDPP) was adopted by Decision No. 973 of the Council of Ministers in 2010, and has been supplemented with the "National emergency plan against oil spills in the Black Sea" (adopted by Decision No. 868 of the Council of Ministers in 2011), Part III "Off-site emergency plan of NPP Kozloduy" (adopted by Decision No. 767 of the Council of Ministers in 2012), Part I "Protection against earthquakes" and Part II "Protection against floods" (adopted by Decision 1004 of the Council of Ministers in 2012). NDPP settles: the way of introducing the plan into action; analysis of possible disasters and estimates of the consequences; measures for prevention or reduction the consequences of disasters; measures to protect the population during disasters; duties of the executive authorities and the persons responsible for the implementation of measures to protect the population; tools and resources provided for liquidation of the disasters consequences; the way of interaction between the executive authorities and the procedure for notification in case of disasters.

In accordance with DPA disaster protection planning is made on municipal, regional and national level. Disaster protection plans shall be made in sections for each of the hazards specific to the area and the parts for earthquakes, floods and nuclear and radiological emergencies are obligatory. DPA includes contents of the Disaster protection plans. According to Article 9, Paragraph 6 of the DPA the central executive authority develops Disaster protection plans for fulfillment of their obligations, described in the NDPP.

The activities related to protection of the population in case of danger or occurrence of disasters shall be:

- warning;
- implementation of urgent measures in order to mitigate the effect;
- announcement;
- rescue operations;
- providing medical assistance in emergency cases;
- initial psychological counselling to victims and rescue teams;
- control and elimination of ecological incidents;
- protection against explosive substances and munitions;
- search and rescue operations;

- radiation, chemical and biological protection in case of incidents and accidents with dangerous substances and materials and against nuclear, chemical and biological weapons;
- limitation and liquidation of fires;
- temporary relocation, evacuation, sheltering and supplying of individual protection means;
- implementation of urgent emergency and restoration works;
- limitation of the distribution and liquidation of occurred epidemic explosions, epidemics and epizootics of infectious and parasitic diseases;
- other operations, related to the protection.

The activities under Art. 19 shall be carried out by the Unified Rescue System (URS), which includes units of ministries and administrations; municipalities; trade companies and sole entrepreneurs; emergency centres, other medical and health institute; non-profit legal persons, including volunteer formations and the armed forces. Main components of the URS shall be the General Directorates of the MI "Fire Safety and Civil Protection", the regional directorates of the MI and the emergency medical centres.

The main components of the URS shall provide continuous preparedness for receiving information in case of disasters, their assessment and immediate actions. The structures of the main components of the URS shall be developed on the territory of the entire country in accordance with the administrative and territory division. The other components of the URS shall provide assistance upon request in accordance with the disaster protection plans. The armed forces shall provide assistance during rescue and urgent emergency repair and recovery works upon permission by the Minister of Defense on the ground of request by the respective state body according to the disaster protection plans.

The coordination of the components of the URS shall be implemented through the operative centres of the General Directorates of the MI "Fire Safety and Civil Protection". The operative centres shall:

- adopt and assess the information for arisen disasters;
- notify the competent components of the URS and coordinate the further activities on the base of standard operative procedures;
- provide early warning and notification of the bodies of the executive authorities, the components of the URS and the population in case of disaster;
- upon request by the Incident Commander, the Mayor of the Municipality or the District Governor shall organize the activation of the components of the URS, specified in the disaster protection plans, as well as of additional forces and resources.

The enterprises, carrying out electronic communications, shall be obliged to cooperate to the MI for implementation of the communications in case of disasters and to the National System for Emergency Calls with Unified European Number 112. The cooperation and the coordination between the components of the unified rescue system, participating in rescue and urgent emergency and restoration works in the region of the disaster, referred hereinafter as "the place of intervention", shall be carried out by the Incident Commander which is the Head of the territorial unit of the General Directorates of the MI "Fire Safety and Civil Protection" or authorised by him/her official, save for the cases of epidemics and epizootics. In these cases the Incident Commander is the Head of the regional health inspection or the district food safety directorate.

The Incident Commander upon implementation of rescue and urgent emergency and restoration works shall be entitled to:

- prohibit and restrict the entry of persons in the place of intervention;

- order temporary evacuation from the place of intervention;
- order immediate completion and termination of construction projects, construction works, land reengineering or demolishing buildings and structures or parts thereof in order to reduce or eliminate risks, related to the disaster occurred;
- require from legal entities or individuals submission of personal or material support;
- create headquarters of the Incident Commander with representatives of the participating teams from the unified rescue system;
- divide the place of intervention to sectors or sites, to determine their managers, to assign them tasks, as well as to distribute forces and means for them.

DPA settles functions of the executive authorities in the disaster protection field:

A. The Council of Ministers shall form the state policy in the field of the protection in case of disaster and:

- ensure overall management of disaster protection;
- adopt a strategy for mitigation of disaster risks;
- adopt National Disaster Protection Programme and annual plans for its implementation;
- adopt a National Disaster Protection Plan;
- introduce a National system for early warning and alert for the executive bodies and the population in case of disasters and specify with a regulation the terms and procedures for its operation on a proposal of the Minister of Interior;
- appropriate funds for the purposes of disaster protection.

An Advisory Board shall be established at the Council of Ministers for the purpose of supporting the activities in the field of the protection in case of disaster which shall consist of representatives of ministries, agencies, the Bulgarian Academy of Sciences, high schools, science research institutes, the National Association of Municipalities in the Republic of Bulgaria and of legal entities related to disaster protection.

B. The Prime Minister of the Republic of Bulgaria shall introduce by order the National Disaster Protection Plan. National headquarters shall be established by this order, comprising personally appointed head and members: ministers, deputy ministers, heads of agencies and their deputies and others representing institutions, having duties related to the implementation of the National Disaster Protection Plan. So as to assist the activity of the national headquarters shall be established expert working groups, whose personal membership shall be predetermined and introduced into the alerting groups of the National system for early warning and alert for the executive authorities and the population in case of disasters. Other experts may also be recruited by order of the head of the national headquarters where necessary. An interdepartmental information group shall be established with the national headquarters for carrying out information activity with personal membership as proposed by the members of the headquarters. The national headquarters shall carry out the following main activities:

- analysis and assessment of disaster situations;
- taking decisions concerning the required volume and resource support for ensuring rescue and emergency repair and recovery works for preventing, mitigation and elimination of the consequences of disaster and for assistance to the population concerned;
- organisation and coordination of the activities of ministers, heads of agencies, regional governors, mayors of municipalities, of legal entities and sole entrepreneurs, to who are assigned functions related to disaster protection;

- supervise the implementation of the tasks and measures to manage disaster;
- informing the population through the media of the development of the disaster, of the actions taken for containing it and for bringing it under control and of the necessary protection measures and actions;
- reporting to the Prime Minister, the President of the Republic of Bulgaria and to the speaker of the National Assembly of the progress of implemented protection measures.

C. The District Governor shall:

- organise and manage the protection in case of disaster in the district;
- organise and is responsible for training of the administration for the action in case of disasters and implementation of the necessary protective measures;
- coordinates and controls disaster preparedness conducted by the regional administration, the regional structures of ministries and agencies, legal entities and individuals in the district;
- organize and control the implementation of preventive measures to avoid or reduce the effects of disasters;
- provide input to the development of the National Plan for disaster protection;
- establish the arrangements for disasters warning system;
- submit to the Ministry of Interior annual report on disaster protection;
- established by an order headquarters to implement the regional plan for disaster protection and interaction with national headquarters.

In case of disaster on the territory of the district, the district governor:

- activate by order the implementation of the regional disaster protection plan;
- may declare a state of emergency in the region or any part of it;
- organize, coordinate and control the process of assistance and disaster recovery;
- coordinate rescue and emergency repair work occurring in the region when they go beyond the territory of a municipality, as well as the mayor has asked;

D. The Mayor of the Municipality shall:

- organize and manage disaster protection in the municipality;
- organize, coordinate and implement preventive measures to avoid or reduce the effects of disasters;
- performed timely warning and information to the public threat thereof or for any disaster;
- plans in the draft municipal budget funds to ensure the planned activities for disaster protection in the municipality as well as a reserve for urgent and unforeseen expenditure relating to the protection of the population;
- submit to the Governor an annual report on the activities on disaster protection;
- established by an order headquarters to implement the Municipal Plan for Disaster Protection and to interact with national headquarters of ministers and other executive authorities, including the governor.

When a disaster arises on the territory of the municipality the Mayor:

- introduce by an order the implementation of the municipal disaster protection plan;
- may declare a state of emergency in the municipality;

- exchange information with the operative centre of the General Directorate "Fire Safety and Civil Protection" - MI in the district;
- may involve legal entities and individuals to provide personal or material assistance in accordance with their opportunities;
- may involve in protection activities any voluntary formations established;
- may request coordination by the Governor;
- organize and coordinate the temporary relocation, and provide emergency assistance to injured parties;
- organize and coordinate the provision of rehabilitation assistance to the population in disasters;
- organize and control the implementation of emergency recovery work in disaster.

On-site emergency plan of Kozloduy NPP

The Emergency Plan (EP) of the Kozloduy NPP (on-site emergency plan) is the basic guidance on action in case of an emergency at the NPP. It is mandatory for implementation by all units and by the whole plant personnel, as well as by the personnel of other organizations on the site.

The EP is developed on the basis of the design documentation; the additional engineering analyses and safety assessments performed; the requirements of the national and international regulations in force; the approved and commonly adopted standards and practices in the filed of emergency planning and preparedness, nuclear safety and radiation protection.

The last revision of the on-site emergency plan is dated June 2013. It aims at establishing an organization, which shall ensure:

- maintaining of emergency preparedness of Kozloduy NPP staff for implementing urgent actions in case of an accident on the site, as well as upon activation of the off-site emergency plan;
- providing and maintaining the relevant methods and programmes for analysis, assessment and forecast of the radiation consequences, as well as technical, transport and communication means and emergency kits for the staff and the emergency teams;
- achieving maximum effectiveness of:
  - accident management, restoring control over the facility, including in combination of accidents and other emergency situations, such as explosion, fire, flooding, earthquake, act of terrorism and limiting the consequences thereof;
  - measures for protection of Kozloduy NPP staff, the population and the environment, targeted at preventing deterministic effects and reducing the risk of stochastic effects to a reasonably achievable minimum.

The EP considers and classifies both nuclear and radiation accidents, as well as events without direct radiological consequences (non-radiation, conventional accidents), that create tangible or potential prerequisites for considerable reducing the safety level of the facilities at Kozloduy NPP.

The accidents related to the transportation of fresh and spent nuclear fuel, and other events related to the safe operation of Kozloduy NPP (such as low or high waters of the Danube river, pollution of the service water supply system with petrol products, accidents with other ionizing radiation sources and relating actions) are subject to separate emergency plans, instructions and procedures.

The management of the facilities at Kozloduy NPP is performed by operational shifts working 24 hour per day, 7 days per week. The senior operating shift leader is the Plant Shift Supervisor. He is responsible for the organization and the implementation of urgent actions in case of an accident

and for providing first aid to the injured. According to the Procedure for operative relations at Kozloduy NPP, during accident the operating shift leader for a certain organizational unit performs the functions of an emergency leader as regards the elimination of the accident, for the personnel working in that organizational unit. The plant personnel is trained to report to the relevant operating leader of any event that could lead to decreasing of the level of safety of the facilities.

According to the EP, the official responsible for the overall management of the works is the Head of the Emergency Activities. The Plant Shift Supervisor performs the Head of the Emergency Activities's duties until the emergency teams are set up.

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

- Regional Service Fire Safety and Civil Protection;
- Regional Police Office of Kozloduy NPP;
- Occupational Health Service
- Transport Service.

The services related to the implementation of the EP are permanently in place and they perform specific tasks regarding the support of the emergency measures. Maintaining separate emergency plans, procedures and preparedness on their part ensures their timely involvement and management in the accident course.

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

1. The Emergency Response Centre (ERC) is designed to ensure the appropriate working conditions for the emergency management team and the emergency staff working at the ERC. The ERC is established on the site territory; it is equipped with means for communication for the regional and national authorities. The external power supply is backed up. There is an independent electrical supply with two diesel generators. It is fitted with an independent filter-ventilation system with the possibility to operate in three modes (pure ventilation, filter ventilation and complete isolation mode), and also with air parameters monitoring, independent water and sewage system with reserve service water and a stock of foodstuffs.

The ERC is equipped with: technological, radiation and meteorological monitoring; software and hardware means for assessment, forecast and visualization of the conditions. The radiation monitoring of the premises is carried out with portable devices, including for aerosol control. Individual dose monitoring of the emergency personnel is done by TLD and digital reading dosimeters.

Each working place, in the ERC, is provided in advance with the required technical and operational documentation in compliance with the provisions of the quality assurance system at Kozloduy NPP.

2. The meteorological monitoring system (MMS) provides representative for the region of Kozloduy NPP meteorological information from 3 meteorological stations. This information is required for the elaboration of forecasts on the radioactive transfer and the dose exposure in the emergency planning zones. The Automatic Aerological Probing System (AAPS) allows to determine the speed rate and the direction of the main transfer and the height of the mixing layer for the region of Kozloduy NPP. The AAPS is integrated with the Meteorological Monitoring System (MMS). The data from the AAPS are provided to the national institutions.

3. The Automated Information Systems for Off-site Radiation Monitoring (AIS VRK "Berthold") consist of basic and control stations for: the equivalent dose rate of gamma radiation and the

ground concentration of I-131; water stations for specific volume activity of waste and treated water discharges. The system is integrated with the National Automated System for permanent monitoring of the radiation gamma background of the Ministry of Environment and Waters, which provides for early warning in case of an radiation accident.

4. The automated information system for on-site radiation monitoring provides information on the gamma background and temperature in 19 points at Kozloduy NPP site.

5. The automatic information system for radiation monitoring of the settlements in the Urgent protective action planning zone of the NPP provides information on the gamma background and temperature in 12 points in the urgent protective action planning zone of Kozloduy NPP (30 km);

6. Software installed in the ERC:

ERC Information System - specialized software for information management during drills or accidents. The information system visualizes the readings of the automated systems, such as the Automated information systems for off-site radiation monitoring, Automated information system for on-site radiation monitoring, Meteorological Monitoring System, SPDS and PAMS. There are an operator station with the new version of JRODOS software, and a station with the programme ESTE for calculation of the radiological impact on the environment in case of radiation accident. These programmes are also installed in the NRA emergency centre.

Four operator stations are provided with the SPDS (Safety Parameters Display System) and PAMS (Post-accident Monitoring System - designed for DBAs and BDBAs) software for units 5 and 6, providing information for the technological parameters which are the most important to safety and information on the critical safety functions (CSF). Apart from the Main Control Room (MCR), this information could be displayed also at the Plant Shift Supervisor desk, in the ERC, and the NRA Emergency centre.

The Smart Fuel software, for control of the position of the nuclear fuel at NPP, Scale software for calculation of the accumulated isotopes and residual heat removal, CASCAD software for monitoring of the level of the Danube river and the channels, and the internal containment pre-stress control system.

Off-site Emergency Plan

The Off-site Emergency Plan for Kozloduy NPP is part III of the National Disaster Protection Plan (last update 2012). The Off-site Emergency Plan in detail sets the duties, obligations and the rights of the Ministries and other Authorities, which have relation to the activities for protection of the population and preserving the environment in case of an accident in a nuclear facility. It specifies:

- the way of collection, treatment and assessment of data from the individual and technological radiation monitoring and forecasting of the further evolution of the radiation accident;
- the planning and organization of the protective measures in the emergency planning zones;
- the use of emergency kits, the iodine prophylaxis and the organization of medical and transportation services;
- the preparation of the population within the emergency planning zone for life and activities under conditions of increased radiation;
- maintaining of engineering and fire protection support;
- ensuring public order, logistics etc.

The Off-site Emergency Plan provides for the following actions in order to maintain emergency preparedness for response in case of accidents with possible radiological consequences:

- 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 means for carrying out rescue and urgent emergency repair and recovery works;
- periodic updating of the emergency plans by the respective authorities, territorial governing authorities and licensees;
- training of persons designated for actions according to the emergency plans and conducting drills and exercises for emergency plans implementation;
- notification of the population on important matters dealing with the radiation protection and the implementation of protective measures in case of an accident.

The measures for radiation protection of the population are implemented based on the criteria and principles set in the Regulation for Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiation Accident.

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

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

- every 5 years - a full-scope emergency exercise for mastering the National Disaster Protection Plan;
- annually - training for mastering the elements of the plan. Since 2010 two general emergency drills are carried out on Kozloduy NPP site.

The entities involved in the full scope emergency drills are the executive authorities, the operator and legal entities who are included in the National Disaster Protection Plan, as well as local authorities and the population in the emergency planning zones. The scenario for the exercise is approved at National level by the Minister of Interior. This scenario describes the objectives of the exercise, the elements of the emergency plan which will be verified, the participants-players (ministries, administrative structures, population, media, etc.), and the participants - observers and supervisors, as well as the time table for the drill with the major issues to be enacted.

In the period 2010 - 2012 Bulgaria participated in the following national and international drills:

- annual drills for action in case of an accident in Kozloduy NPP - twice a year with scenarios covering different topics;
- headquarters exercises with the participation of Kozloduy NPP and the BNRA - 6 exercises each year;
- international participation of the IAEA to check the forms of emergency notification;
- SEESIM10 drills in case of radiation emergency at NPP (2010);
- drills within the EU for the utilization of the early warning system ECURIE;
- international emergency drill under the auspices of IAEA and the Kingdom of Norway, with the participation of Bulgaria and Romania - Nautilus 2011.

- full scope national drill Protection-2009.

The exercises are performed according to preliminary prepared and approved programme. The scenarios developed for the exercises are used for training of all shifts. Within 10 days after each common station exercise the management team prepares a report and points out the measures for elimination of the weaknesses and faults found.

An expert committee provides an assessment of the general emergency exercise. This committee may include representatives of the NRA, Ministry of Interior, Ministry of Economy and Energy, Bulgarian Energy Holding, etc.

Regulatory review and control activities

The NRA performs annual inspections in the nuclear facilities according to a preliminary developed plan for the control activity. When carrying out the emergency planning and preparedness inspection in the nuclear facilities, the following major issues are reviewed:

- Emergency Plan, emergency instructions and procedures and interaction with local authorities;
- Initial assessment of the accident, assessment of the releases in the environment, interventional levels and implementation of protective measures;
- Training of the staff according to the emergency plan, carrying out drills and exercises, preparation of the drills, documenting and feedback;
- Informing the population, preliminary information, notification and periodical testing of the system.

Article 16 (2) Informing the public and neighbouring countries

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

According to the ASUNE, the NRA provides the public with information about the condition of the nuclear safety and radiation protection in normal operation, as well as in emergency situations. 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, within their competencies.

The National Disaster Protection Plan and the Disaster Protection Plans of the executive authorities define the requirements and the rules for notification and periodical information to the public, for the whole period of the emergency until the final elimination of the consequences, in accordance with the Regulation on the conditions and rules for function of the National system for early notification of the bodies of the executive authorities and the population in case of disasters, addopted in 2012.

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

- planned measures for population health protection including the measures envisaged in the National 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 information about radioactivity and its effects on human health and on the environment;

- general information about possible accidents and their consequences upon the general public and the environment.

In case of an accident the affected population in the urgent protective actions zone shall be immediately notified by the early warning systems of Kozloduy NPP and the regional structures of DG Fire Safety and Civil protection - Ministry of Interior; the population shall be periodically informed on the accident, its parameters, the protective measures foreseen, and in case of necessity - on the measures for health protection which have to be implemented, including:

- the type of the accident and where possible, its characteristics (origin, duration and probable development);
- useful advice for personal hygiene and decontamination;
- advice for applying measure for health protection (restricting the consumption of certain food products, staying indoors, organization for distributing and using of emergency kits, arrangements for eventual evacuation);
- information recommending co-operation with the executive bodies and emergency response teams and observing their orders.

For notification of the public and the competent state authorities in emergency with likelihood for radiation consequences off Kozloduy NPP site the communication-notification network system established in the country is used. It includes:

- fixed and mobile phones, faxes;
- sirens, transmitting sounds and speech information;
- loud speakers;
- national and international radio and TV stations and radio stations, local radio-translators, mobile radio stations, satellite video and radio channels;
- national telecommunications and postal network;
- inter-institutional networks for transmission of information;
- computer networks.

International agreements, including for informing the competent authorities in neighbouring countries

ECURIE (European Community Urgent Radiological Information Exchange)

ECURIE is a 24 h system for emergency notification and exchange of information between the EU countries in case of nuclear accident or event of radiological emergency. In compliance with Council Decision 87/600/Euratom, Bulgaria being a member state has an installed a system for information exchange with the EU countries and the EC. During an emergency situation the system is a platform for notification regarding the accident status, the meteorological conditions, protective actions taken, etc.

EURDEP (EUropean Radiological Data Exchange Platform)

EURDEP is a system for exchange of data from the EU countries environmental radiation monitoring systems on-line. In compliance with Recommendation 2000/473/Euratom the countries submit daily information, and in case of an emergency the data submission continues with increased frequency.

Bilateral agreements

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

- AGREEMENTS between the Government of the Republic of Bulgaria and the Government of the Republic of Greece, Romania and the Republic of Turkey on operational notification in case of nuclear accident and exchange of information for nuclear facilities;
- Cooperation 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 Radiation Safety;
- AGREEMENT between the Committee on the Use of Atomic Energy for Peaceful Purposes of the Republic of Bulgaria and the Ministry for Environmental Protection and Nuclear Safety of Ukraine in the field 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 for cooperation in the field 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 for the Environment, Nature Conservation and the Nuclear Safety of the Federal Republic of Germany.
- AGREEMENT between the Nuclear Regulatory Agency of the Republic of Bulgaria and the Radiation Protection Directorate of the Republic of Macedonia for cooperation in the filed of radiation protection.

Following the accident in Fukushima Dai-ichi the NRA has reviewed the existing bilateral agreements with the neighbouring countries for early notification and exchange of information in case of a radiological emergency. New agreements are in being prepared to be signed with the regulatory authorities of Greece, Serbia, Romania and Russia. Thus, Bulgaria fulfils the requirements of the Second Extraordinary Meeting on the Convention on Nuclear Safety in August 2012 and the IAEA Action Plan on Nuclear Safety.

According to the agreements BNRA submits the requested information and ensures means for notification. The Ministry of Foreign Affairs informs the diplomatic corps and Bulgarian representations in other countries in case of nuclear or radiological emergency.

Article 17 Siting

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

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

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

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

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

Article 17 (1) Evaluation of relevant site-related factors

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

The authorization regime for determining the location of a nuclear facility (siting) is specified by the Act on the Safe Use of Nuclear Energy. 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 and approval of site selection.

Implementing an Environmental Impact Assessment for the facility, including transboundary considerations, is required by the Environmental Protection Act. The same act specifies the organization of public discussions of EIA report, in conjunction with the municipal authorities, state and public organizations, the competent authority on environment protection, the general public, and the interested persons and legal entities.

The 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 the issuance of a siting permit, together with the conceptual description of the nuclear facility and the acceptance criteria for the sites, the applicant shall submit Terms of Reference for preliminary site 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 Safety Analysis Report, which shall include comparative analyses of proposed sites in respect of nuclear safety and radiation protection, and selection of an option based upon:

- impact of man-induced or natural origin factors on the safety of the facility;
- radiological impact of the nuclear facility on the public and the environment;
- site specific characteristics that are of importance for migration and accumulation of radioactive substances;
- possibilities for implementation of public protection actions in emergencies;
- size of the special statute areas and emergency planning zones.

The preliminary report shall include the results of the study of the site characteristics, including:

- geographical, topographical and demographic conditions;
- man-induced factors;
- hydro-meteorological conditions;
- geological, hydro-geological, seismic and engineering-geological conditions;
- site specific and region specific characteristics for the purposes of emergency planning, accident management, and physical protection.

The documents necessary to approve the selected site shall also include:

- site monitoring programmes, including: seismic monitoring, system of groundwater and surface water monitoring, and monitoring of other natural phenomena;
- a programme for additional site investigations (of the selected site), where such a 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 BNRA 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 that the exposure of personnel and the public in normal operation and design basis accidents will be as low as reasonably achievable, without exceeding of the specified limits.

The specific requirements to NPP sites acceptance criteria 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 man-induced origin, which might 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, the conditions and factors that are considered refer to the following:

- compliance with the legislation on environmental protection, with the standards and regulations for radiation protection, with the fire protection requirements for technological buildings, and with the physical protection requirements;
- geological and geographical realities, as for example low intensity of the maximum design basis earthquakes, non-floodability of the site, absence of differentiated earth crust movements, and potentially active or abated landslides, or other dangerous slope processes;
- climate preconditions, such as: characteristics, intensity and significance occurrence extreme weather conditions.

Review of the assessments made and the criteria applied for evaluating all site related factors affecting the safety

In selecting sites for nuclear power plants, the characteristics and the frequency of occurrence of phenomena and natural and man-induced factors are investigated and evaluated, whenever possible. The presence of excluding conditions and factors is assessed, and when they do not exist the sites are assessed whether they are favourable for construction of nuclear power plants. In order to consistently apply the defence-in-depth concept in the NPP designs, the impact parameter values for the respective periods of recurrence of external events that could affect safety are defined. Potential consequences of external events, considered in the NPP design bases, are analysed using deterministic methods to confirm the selected defence concept. Reasonably applicable measures are planned for protection from the consequences from rare phenomena and

events, including extreme external events and natural phenomena that could impact the whole site simultaneously.

Kozloduy NPP Site

Kozloduy NPP site and the region are subject to investigation since 1967, when the site was selected for the construction of the first Nuclear power plant in Bulgaria. During the following period a number of additional analyses and investigations have been performed to identify the possible natural phenomena and hazards and the sources of potential man-induced risk. The methodologies of the evaluations carried out and the results thereof are documented in the safety analysis reports of the units and are subject of reassessment within the periodical safety review.

Natural phenomena and hazards

Units 5 and 6 designs were developed in the early 1980s in accordance with the requirements and industrial standards in force at that time. The development of the safety requirements and standards, as well as the results from the reassessments performed of the site characteristics, imposed a modification of the design basis for units 5 and 6 as regards the seismic impact.

The investigations carried out by the Geophysical Institute with the Bulgarian Academy of Science as regards the seismic security of Kozloduy NPP site (reviewed and accepted with IAEA missions in 1995 and 2000) determined:

- Design basis earthquake with acceleration 0.2g (PGA) and recurrence period 10 000 years;
- Design basis earthquake with acceleration 0.1g (PGA) and expected recurrence period 100 years;
- The design floor response spectra for free surface and respective 3D accelerograms with duration 61 s.

Following the IAEA recommendation the floor response spectra and respective 3D accelerograms with duration of 20 s have been determined.

The seismic levels, design floor response spectra and respective 3Daccelerograms were reviewed and confirmed by IAEA experts during the period from 1992 to 2008. The methodology of the probabilistic analysis of seismic hazard is based on the Cornel standardized mathematical model and on the McGuire 1976 and Toro&McGuire 1988 software.

In 2004-2006 the seismic stability of the buildings was studied and analysed at 0,2g (0.1g for SL-1); the safety systems equipment behaviour was also analysed in case of earthquakes. As a result of this, measures were identified and implemented for the seismic re-qualification and securing seismic stability of the safety systems equipment and the building structures with regard to the increased seismic impact. The Review Level Earthquake was also determined - the level against which all SSCs of category 1 seismic stability are checked.

Apart from the geological, engineering geological and seismic-tectonic investigations on Kozloduy NPP site and the location area, the meteorological and hydrological conditions were also studied to determine the design bases of the power plant as regards external hazards, including flooding, temperature, wind loadings, etc. The flooding hazard assessment takes into account the accident with the hydro-technical facilities on the Danube river, forming a maximum water quantity with security 0.01% or occurrence probability once in 10 000 years.

Kozloduy NPP units 5 and 6 safety analysis reports assess also the frequency of occurrence of rare and extreme external impacts, e.g. hurricane, extreme rainfalls/snowfalls, air and water temperatures, icing, thunderstorms, dust and sand storms, river and water basins banks erosion, and tornado.

During the “stress tests” of the European nuclear power plants carried out in 2011 following the accident in Fukushima NPP, an assessment was made of the plant response as a whole and the

effectiveness of the protective measures at extreme external events, affecting all the facilities at the site as a consequence of an earthquake, flooding, and extreme meteorological impacts. The available margins in the facilities and equipment capacity until the occurrence of limit effects were assessed, and the results thereof are summarized in the section regarding article 17(3) in this report, as well as in Annex 4. The National Action Plan of the Republic of Bulgaria, resulting from the stress tests, The IAEA Action Plan on Nuclear Safety and the conclusions of the Second extraordinary meeting on the Convention on Nuclear Safety held in 2012, foresee additional measures for assessment and enhancement of safety at extreme external impacts, causing failure of all facilities, under deteriorated infrastructure and loss of access to the site. Some of these refer to:

- Analysis of extreme meteorological conditions using probabilistic methods;
- Developing emergency procedure for actions to be taken in case of destruction of hydro facilities Zhelezni vrata 1 and 2;
- Reassessment of the technical provisions and the organizational arrangements for action in case of simultaneous accident with fuel melting in the nuclear facilities on the site;
- Update of the on-site and the off-site emergency plans in the context of a simultaneous accident, deteriorated infrastructure and impeded access to the facilities on the site.

Events resulting from human activities

As regards the sources of man-induced hazard in the region of the plant, they have been identified through studies. The analysis of the sources is made according to the distance and probability level screening method. As a result of this, no initiating events were determined with frequency exceeding the limit value of the annual probability rate for occurrence of events with potential radiological consequences, also known as SPL - Screening Probability Level.

The safety analysis reports assess the impact of potentially hazardous sources of the following external impacts, resulting from human activities:

- explosion at Kozloduy NPP site and the fixed and mobile explosion sources located in immediate vicinity;
- emergency release of chemically active substances, including from industrial site where toxic and corrosive substances are processed, used, stored and transported;
- fires off-site the NPP, including on river and road transport vehicles, etc.

Site for a new nuclear unit in the area of Kozloduy NPP

In relation to the Governmental Decision "in principle" for the construction of a new nuclear unit in the area of Kozloduy NPP a project is being implemented for the study and siting of the new unit. There are determined 4 potential sites, located in close proximity to the operating Kozloduy NPP.

Within this project a systematic review of the whole database from previous site investigations is performed. The available data were analysed for their completeness and compliance with the regulations in force; a Programme for additional studies was developed. The obtained results, together with the available data will be used for a comparative analysis of the proposed site. The evaluation methodology takes into account the national requirements that are in place for site selection and the relevant IAEA Safety Standards. The comparative analysis criteria for the proposed sites are grouped by different factors, e.g.: seismics; geotechnics; dangerous meteorological impacts; impacts caused by human activities; dispersion of radionuclides in the atmosphere and in the hydrosphere; interaction between the new nuclear unit and the existing nuclear facilities on site. The preferred site will be selected on the basis of a complex assessment taking into account all current criteria.

The programme for additional studies under the project for study and determining the location of the preferred site foresees as follows:

- Engineering-geological investigations of the potential sites;
- Modelling radionuclides migration in the subsoil space of the potential site;
- Update of the site seismic hazard;
- Definition of the seismic design bases;
- Analysis of the geophysical fields and the contemporary earth crust movements;
- Climatology and local meteorology, disperse characteristics of the atmosphere;
- Hydrology of the Danube river;
- Demography and anthropogenic impacts;
- Additional engineering-geological and geophysical studies of the selected selected site.

Additionally, within the framework of this project an assessment will be performed regarding the Kozloduy site protection from hazardous meteorological, hydrological and geological phenomena. The data will be used for determining the design bases of the new unit in compliance with the current safety requirements.

Review of the design solutions against internal events, caused by human activities and by natural phenomena and hazards

The layout of units 5 and 6 reactor buildings complies with all major requirements for ensuring protection of the personnel, the population and the environment from the radiological impact and it is in conformity with the generally accepted principles and international practice for the designing of NPPs, which are reflected in the IAEA documents INSAG-3, INSAG-10 and etc.

The structure of the reactor buildings of units 5 and 6 is a special structural system which could be reviewed as comprising four basic parts - foundation block, containment, auxiliary facilities and internal structure. The four main parts are joined together by a robust reinforced concrete slab, under the reactor, with thickness of 3.20 m.

In 2006-2007, strength analyses were carried out, applying the end elements method, and using data from the automatic control systems for the pre-stressed and deformed state of the containment, and of field and laboratory testing and research of containment elements. The assessment of the containment strength properties was expanded and specified in 2012, at the update of PSA Level 2. Assessment of containment building structure reliability was carried out for all design basis internal and external impacts, taking into account the actual condition of the structure and the pre-stress system. The containment behaviour in severe accidents conditions was analysed. The limiting bearing capacity of the containment was established for each unit. The ageing processes were analysed, critical elements were identified and a programme was developed for the containment rest lifetime management. The analysis and the evaluation results demonstrate that Units 5 and 6 containments are able to fulfil their functions in all types of design basis internal and external events.

During the stress tests of the European nuclear power plants, carried out in 2011, following the accident at Fukushima NPP, an assessment was made of the SSCs design solutions and the plant response as a whole in extreme conditions, affecting all the facilities at the site. The available margins in the facilities and equipment capacity until the occurrence of limit effects were assessed. The results thereof and the subsequent measures to enhance the power plant stability are summarized in Annex 4.

Regulatory review and control activities

With reference to the decision for the construction of a new nuclear unit at Kozloduy NPP site, an application was filed to the NRA, in the end of 2012, for issuance of a permit for determining the location of a nuclear facility (siting) in immediate proximity to Kozloduy NPP site. The application comprised the attached documents required by the Regulation on the Procedure for Issuance of Licences and Permits for Safe Use of Nuclear Energy, addressed above. The documentation is in the process of review and evaluation, in the frame of the administrative proceedings.

The regulatory activities, related to the review of the results from the stress tests of nuclear facilities at Kozloduy NPP site for the assessment of the stability to site-specific extreme external impacts from natural origin, cover:

- Review of the scope, contents and methodology for carrying out the stress tests for compliance with the requirements of ENSREG specifications;
- Review of the stress tests results, carried out by the licensee, for compliance with the legal and regulatory requirements;
- Assessment of the effectiveness of the protective measures, proposed by the licensee and the degree of sufficiency of the planned activities for enhancement of the stability;
- Identification of additional measures for enhancement of the stability by the NRA judgement;
- Preparation of a National Report of Bulgaria on the Stress Tests and its submission to ENSREG for a peer review;
- Preparation of a National Report of Bulgaria in relation to the Second extraordinary meeting on the Convention on Nuclear Safety;

NRA representatives took part in the peer reviews of the National Reports of other EU countries, in relation to the Second extraordinary meeting on the Convention on Nuclear Safety, as well as in the ENSREG seminar to discuss the progress in the implementation of the National Action Plans.

The regulatory activities, related to the review and the mechanisms to control the implementation of the National Action Plan of the Republic of Bulgaria, resulting from the stress tests, are described in detail in the text under article 14 of the current report, as well as in the National Action Plan itself.

Article 17 (2) Impact of the facility on the population, society and environment

In accordance with the ASUNE, proposals for construction of a new build shall be submitted by the Minister of Economy and Energy, accompanied by evaluations of nuclear safety, radiation protection and environmental impact. The Minister makes arrangements for a public discussion of the proposal, which is attended by state and local authorities, representatives of public organizations and interested individuals and legal entities. When the operation of NPPs might impact the population and the territory of another country, the Minister of Foreign Affairs shall notify the competent authorities of that country and, if requested, provide the information necessary to analyse and assess the possible impact of the plant 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 the radiation situation shall be defined for all operating and emergency conditions and technical and organizational measures to ensure public safety shall be developed. The consequences from a possible radiological impact of the accidental radioactive discharges on population and environment in the urgent protective action planning zone during the NPP operation, have to be

determined taking into account the required conservatism and specificity of the designed 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 programmes shall be submitted. For authorization of commissioning of a nuclear facility, the same Regulation requires the submission of a programme for monitoring of nuclear facility site radiation parameters and a programme of radiological monitoring of the environment during its operation.

The limit of the individual effective dose from internal and external exposure of the population, caused by the impact of liquid and gaseous releases to the environment, in all operational states of all nuclear facilities at the NPP site, is specified by the Regulation on safety assurance of NPPs. This regulation also limits and individual effective dose from internal and external exposure of the population for the first year, following a design basis accident. In case of severe accidents, the limit value of Caesium-137 discharges into the atmosphere, which will not require long term restrictions in the usage of soils and water in the urgent protective action planning zone, is 30 Tbq. The mixed discharges of other radionuclides, different from the Caesium isotopes, should not cause in long term aspect, beginning three months after the accident, a higher risk than the one defined for the Caesium discharges within the stated limit.

Kozloduy NPP Site

The EIA Report for Kozloduy NPP was developed in 1999, pursuant to the Environmental Protection Act. The results from the analysis of Kozloduy NPP impact on the population and the environment are included in the updated safety analysis reports of units 5 and 6.

In accordance with the provisions of the operation licenses issued for units 5 and 6, Kozloduy NPP, being the licence holder, is obliged to submit to the NRA information on annual basis, regarding the state of the nuclear safety and radiation protection, on the fulfilment of the environment and the working environment radiation monitoring programmes and the personnel radiation protection programme.

The text in the National Report, under Art.15 provides data on the activity of the gaseous discharges in the environment through the vent stacks of Kozloduy NPP (EP-1 and EP-2), the quantity and the activity of the treated waters, discharged into the Danube river, as well as data on the dose exposure of the population within the 30 km zone, all referring to the period 2009-2012.

Site for a new nuclear unit in the area of Kozloduy NPP

A Project for performing EIA of the investment proposal for construction of a new nuclear unit in the area of Kozloduy NPP is being implemented. When implementing this project, the potential impacts from the construction of a new nuclear unit on the environment and the population, will be taken into account.

The EIA Report will determine the significance of a certain impact on the environment and on the population, it will identify the unavoidable and permanent impacts, resulting from the construction, operation and decommissioning of a new nuclear unit, and it will map out compensatory measures. The analysis will cover the territory of the Republic of Bulgaria and the Republic of Romania, being an affected country, and will be taken into account the notes of the Republic of Austria, as country announced to take part in the EIA procedure.

Article 17 (3) Re-evaluation of site related factors

Activities for re-evaluation of the factors related to the site, so as to ensure the continued safety acceptability

Kozloduy NPP Site

Following the events ay Fukushima NPP on 11 March 2011, Kozloduy NPP safety was re-evaluated in detail. Stress tests were carried out by the end of 2011. They showed the power plant response and the effectiveness of the preventative measures in extreme situations, caused by earthquakes, internal flooding and extreme meteorological impacts; the facilities margins were also established as well as the limit effects. The conclusions on this topic made at the Second Extraordinary Meeting under the Convention of Nuclear Safety in 2012 and IAEA Action Plan on Nuclear Safety recommendations were taken into consideration in that re-evaluation. The results of the reassessment of the factors related to the site could be summarized, as follows:

Earthquakes

There are analyses of the seismic stability of the equipment which performs safety functions in these scenarios, and the parameters describing its conditional failure probability are determined (fragility curves). The limit values of the seismic accelerations that any nuclear facility on Kozloduy NPP site could bear, without reaching a heavy fuel damage and radioactive discharges into the environment, are determined. The BDB seismic impact analysis reassures that, as regards seismic, Kozloduy NPP SSCs are in a position to ensure safety of the plant with the maximum possible seismic impacts for the site.

Flooding

The design bases are re-assessed, a new maximum water level is determined, and the duration of its occurrence is re-considered. A study was made on the possibility for ice-blocking of the river, an assessment was performed on the possibility for combination of a maximum water level with other unfavourable phenomena.

The new maximum water level for Kozloduy NPP site (32.93 m) was determined, taking into account the maximum water level of the Danube river with security 0.01% (once in 10 000 years), emergency of hydro facility Zhelezni vrati, and maximum values for rain and wind. An assessment was made with a probabilistic analysis of the combination of the two events - the natural extreme water levels with small probabilities (10-5 to 10-7) and rupture of Zhelezni vrata 1 and 2 hydro facilities. The forecast water levels are:

- $p = 10^{-5}$ (once in 100 000 years) at water level 32.98 m;
- $p = 10^{-6}$ (once in 1 000 000 years) at water level 33.26 m;
- $p = 10^{-7}$ (once in 10 000 000 years) at water level 33.42 m;

These results confirm the non-floodability of Kozloduy NPP site situated at level 35.00 m

Extreme meteorological conditions

The analysis of the technical condition of the structures, with a view to the impacts of the site-specific meteorological conditions (extreme winds, tornado, snowfalls and icing, extreme temperatures, extreme rainfalls) and of the organizational and technical arrangements to ensure power supply to the consumers on site, and for nuclear fuel cooling, shows that the power plant has the necessary stability in extreme meteorological conditions, and the available instructions and procedures are practicable for staff actions in emergency situation.

Site for a new nuclear unit in the area of Kozloduy NPP

Within the current project for constructing a new unit in Kozloduy NPP area, the available data for the site characteristics are re-evaluated. A Programme for additional studies was developed. It is described in the text regarding Article 17(1).

Results from recent activities for re-evaluation of the site

The underground waters level is monitored monthly (over 100 boreholes) at Kozloduy NPP industrial site. The data are submitted to hydro-technical facilities experts for processing, analysis and records.

Regulatory review and control activities

The regulatory review and control of re-evaluation of site related factors are performed in the process of the administrative proceedings, for the renewal of the operating licences of the nuclear facilities. The authorization regime, as specified by the ASUNE, provides for the extension of the operating licence of a nuclear facility based, on an assessment of the nuclear safety and radiation protection (periodical safety review). According to the Regulation on Ensuring the Safety of NPPs, the periodical safety assessment includes a re-assessment of the site characteristics, considered in the design, based on the obtained new data or new assessment methods used. No regulatory review of the periodical safety analysis reports was performed during the period following the preparation of the Fifth National Report of the Republic of Bulgaria under the Convention on Nuclear Safety.

The regulatory activities, related to review of the results from the implemented targeted reassessment (stress test) of the stability of the nuclear facilities at Kozloduy NPP site to extreme external impacts from natural origin, are described in the text relating to Article 17(1).

Article 17(4) Consultation with other Contracting Parties likely to be affected by the installation

International agreements

Consultations with other Contracting parties, likely to be affected by the facility, are conducted in accordance with the Environmental Protection Act, the EIA Regulation, and in conformity with the Convention on EIA in Transboundary Context, to which the Republic of Bulgaria is a party.

In relation to the above, the MEW has notified Romania, as an affected party by the realization of the investment proposal for the construction of a new nuclear unit at Kozloduy NPP. With a view to the letter submitted from Austria to MEW, with a request to receive information on the investment proposal for a new nuclear unit at Kozloduy NPP, a notification is submitted to Austria with information on the access to the ToR for the EIA, provided on the webpage of MEW.

When developing the EIA, the scope of the report will be conformed to the results of all consultations held in Bulgaria, as well as with the countries which have stated their desire to participate in the EIA procedure. In this case, the report should cover also aspects, related to the transboundary impact, proposing also measures for their prevention and limitation.

Bilateral agreements with neighbouring countries

There are bilateral agreements, signed between the Government of the Republic of Bulgaria and the Governments of Romania, Greece, and Turkey, on operational notification in case of nuclear accident and exchange of information for nuclear facilities. Pursuant to these agreements, the contracting parties notify each other, when any of them foresees construction of new nuclear facilities; they also provide the required technical information on those facilities. Following the accident in Fukushima Dai-ichi the NRA has reviewed the existing bilateral agreements with the neighbouring countries for early notification and exchange of information, in case of an

radiological emergency. New agreements are being prepared to be signed with the regulatory authorities of Greece, Serbia, Romania and Russia. Thus, Bulgaria fulfils the requirements of the Second Extraordinary Meeting under the Convention on Nuclear Safety in August 2012 and the IAEA Action Plan on Nuclear Safety.

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 used in the construction of a nuclear installation shall be 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 concept

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, the safety of nuclear plants 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:

- first level - prevention of anticipated operational events;
- second level - prevention of design based accidents on systems for normal operation;
- third level - prevention of beyond design basis accidents with safety systems;
- fourth level - management of beyond design basis accidents;
- fifth level - development and implementation of internal and external emergency plans.

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.

This regulation specifies the requirements on the design bases and safety assessments of a nuclear power plant. It is required that design bases shall determine the necessary features of the NPP, which to ensure that in all operational states and design basis accidents shall not exceed the limits for internal and external exposure of personnel and population, and the limits on discharges of radioactive substances into the environment. Design bases 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, maximum temperature, thermal and mechanical transients and loads;
- 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 in a year. Also, NPP design shall analyse, as initiating events, possible human errors and possible combinations of internal and external events 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 urgent public protective measures, to be extremely low.

SSCs important to safety, shall withstand, the postulated initiating events with sufficient margin.

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 practicably possible.

Postulated initiating events shall be analysed using the criteria for an initiating event, 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 initiating event independent staff 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 Units 5 and 6 designs were developed in the early 80's, in the former USSR, based on the unified reactor design WWER-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 compliance with "General Provisions for Ensuring the Safety of Nuclear Power Plants during Design, Construction and Operation" (ОПБ-88/97) (ПНАЭ Г-01-011-97), Moscow, 1998".

The main principle incorporated in the design is to provide protection of the staff and public from external and internal exposure and protection of environment from contamination by radioactive substances. The project was developed based on a conservative approach and provides inherent safety of the reactor. 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 failure of another normal operation device. Together with the failure of a normal operation device, 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 design accident conditions, including the so-called "maximum possible design basis accident" and they have characteristics, sufficient to perform their functions, and have triple redundancy, including power supply. The primary coolant boundary is located completely in the containment. All containment penetrations are equipped with localizing devices, individual testing devices are provided for penetrations which have seals to withstand design pressure.

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 design earthquake (SL-2).

Existing Units 5 and 6 symptom-based emergency operating instructions (EOPs) and severe accidents management guidelines (SAMG) define staff actions for diagnosis of the unit status, restoration or compensation of violated safety functions and prevent or mitigate the consequences of core damage.

At the end of 2011, as a result of the Fukushima Dai-ichi NPP accident are reviewed and updated the existing site internal and external emergency plans. A secured Emergency Response Centre (ERC) is situated on site, which is equipped with means for continuous monitoring of the parameters of the nuclear facilities and the site, the meteorological situation and emergency means of communication. The communication tools allow emergency personnel to carry out coordination activities with local and national structures. Under the National Action Plan following the accident at the Fukushima Dai-ichi NPP, an additional off-site Emergency Response Centre is planned.

The used basic design principles and safety criteria, including application of independence, redundancy and diversity, as a whole fulfil the main concept for Defence in depth, as defined by IAEA INSAG-3, revised by INSAG-12.

The results of the updated safety analysis, including accident analyses carried out using up-to-date computer codes, as well as the periodic safety reassessment show that are ensured 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 and systems have been installed to reduce the consequences from BDBA, in order to protect the personnel and public.

With regard to external initiating events of natural origin - during the stress tests at Kozloduy NPP was indicated that the margin of Units 5 and 6, in terms of earthquake, represents 0,13 g or 65% compared to RLE (PGA = 0,2 g), i.e. the Units can withstand without damage of the fuel an

earthquake 1.65 times greater than the RLE. Equipment, which is important for safety and participates in emergency scenarios is analyzed for seismic resistance, parameters of functions describing its conditional probability of failure are defined (fragility curves). Certain limit values of seismic acceleration that any nuclear facility can handle without getting to severe fuel damage and release of radioactive substances into the environment. From the above follows that the analysis of beyond design basis seismic impact is sufficiently conservative and gives confidence that in seismic terms, SSC are able to ensure the safety of the plant at the maximum possible for the site seismic impacts. Also for the purpose of stress testing is defined the maximum water level (MWL) and its duration, the possibility of locking the Danube by ice is examined; the ability of combination of MWL with other hazards is evaluated. Analysis of the results confirms that no overflow of Kozloduy NPP is possible.

Use of design principles

The design of Kozloduy NPP Units 5 and 6 SSC, important for safety, uses design solutions based on a 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 longterm 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 of physical principles in safety systems design is applied by using both active (pumps, electric valves) and passive devices (pressurized tanks, 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.

Implementation of design measures or modifications to prevent beyond design basis accidents or to mitigate radiological consequences

As part of Units 5 and 6 design modifications, over the past five years have been installed additional systems for monitoring, qualified for conditions of beyond design and severe accidents:

- system for measuring the temperature at the exit of the core and the level in the reactor vessel, with a working range of the sensors to 1200 ° C;
- sensors with extended measurement range of the radiation within the containment, with measuring range 109 ÷ 1015 Bq/m3 and 102 ÷ 106 Gy/h;
- system for wide-ranging temperature control of the reactor vessel, with measuring range 500 ÷ 1300 ° C.

Data from the measurement channels of these systems enter into a Display System of parameters that are important for safety and a critical parameters monitoring system (PAMS), which are installed in the main control room (MCR), the emergency control room (ECR) and the Emergency Response Centre (ERC). In connection with the installed alternative feedwater system for the steam generators, in case of accidents with total loss of electrical power (blackout), measures have been taken to provide additional power supply from 2 Mobile DGs for the two units. The existing batteries at units 5 and 6 had been replaced, thereby the time for which they provide power

consumers was increased from 30 minutes to 2 hours. Tests conducted, after the events at Fukushima Dai-ichi NPP, on the new batteries show that capacity is sufficient to provide up to 11 hours of power to required users. As a result of the analysis on the necessary equipment for severe accidents management, the power supply of the valves of the emergency gas removal from the primary circuit and the fast acting valves between the primary circuit and the hydroaccumulators was changed, as at present they are powered by the batteries.

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.

Improvements implemented for designs for NPPs as a result of deterministic and probabilistic safety assessments

After the fifth National Report on the implementation of the CNS, additional analyses and studies are performed, aimed at improving the sustainability of Units 5 and 6, in terms of beyond design basis and severe accidents. In this regard were performed analysis and evaluation of the possibility of using part of the existing at Units 3 and 4 equipment, related to the management and mitigation of beyond design basis and severe accidents. As a result decisions were taken to implement the following measures:

- Installation of PAR of hydrogen, in addition to the existing ones at Units 5 and 6, in order to allow for the recombination of generated hydrogen, as a result of the interaction between concrete and core melt at the outer vessel phase of a severe accident;
- Expansion of the system for volumetric measurement of the concentration of gases and steam at units 5 and 6, in order to support decision making by operators in the event of a severe accident;
- Use of the additional systems for steam generator emergency makeup of Units 3 and 4 for Units 5 and 6, the diversification of resources and capabilities to meet specific safety functions in beyond design basis and severe accidents.

Based on the results of the probabilistic safety analyses were made suggestions for changes to improve the safety of Units 5 and 6 of Kozloduy NPP in the following major areas:

- Emergency procedures and training;
- Planning of annual outages and maintenance schedules, and organization and control of maintenance activities;
- Systems design and technological requirements;
- Evaluation of seismic risk;
- Analysis of risk of internal and external fire.

The main part of the performed modifications required to bring the units in accordance with the international recommendations, regarding the safety and reliability are the result of the implementation of the modernization program of Units 5 and 6 (completed 2008). This program included 212 measures to improve safety, operations and reliability of the units.

Two thirds of the 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 analyses;
- 32 thermal-hydraulic analyses;
- 4 radiological analyses;

- 7 mechanical strength analyses.

In the frames of the modernization program, significantly had been expanded the spectre of analyses to determine the capabilities of the units to control the design and beyond design basis accidents.

The most important results of this analysis are:

- Survey on the risk of brittle fracture of the reactor vessels confirmed that the operational lifetime of the reactor pressure vessels is provided for a long enough period of time, under the current schemes of core refueling. Moreover, after the implementation of the recommendations of the reports on other measures of the Program, the resources of the vessels can be further increased;
- Modified algorithms for certain protections and interlocks (level control in the SG, management of reactor power), improve the sustainability of the unit in dynamic transients. Thus, reducing the possible deviations of parameters from the operational limits reduces the frequency of occurrence of emergency processes;
- Analyses of various transient processes, as a result of initiating events with extremely low incidence, demonstrate the inherent safety of the reactor core;
- The considered large, medium and small leaks from the primary circuit, and the radiological consequences of inter system leaks, confirm the ability of the current safety systems to bring the units in a safe subcritical condition, to ensure core cooling and limit radioactive releases within the established norms.
- Sufficient seismic stability and margins of the civil structures related to safety at the designated site new seismic impact SL-2 = 0.2g. For this purpose 27 analyses were performed on equipment and 47 analyses of the pipelines.

A number of measures are implemented to fix known design deficiencies of Units of WWER-1000/V-320 type. Entirely new systems, not included in the initial design are installed, such as:

- A system for continuous monitoring and recombination of hydrogen, which prevents the possibility of explosion, due to accumulation of hydrogen in the containment in the event of a design basis accidents;
- Strengthening of the main steam and feedwater piping, against local mechanical effects due to tears;
- System to measure and control the level of the coolant in the reactor vessel, needed for the management of transients (accidents with small loss of coolant, leaks from the primary to the secondary circuit and cooling without running main circulation pumps);
- Automatic system for protection from cold overpressure of the reactor vessel during shut down and start up operation modes;
- Filtered ventilation system to protect the containment from loss of structural integrity and minimize radioactive releases to the environment in terms of beyond design basis accidents;
- System for continuous monitoring the insulation of 6 kV motors in standby mode;
- System for alternative feeding the steam generators, powered by mobile diesel generators;
- System fir wide-ranging temperature control of the reactor vessel;
- Additional diesel generator for each Unit, supplying the sections for normal operation.

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 and a permit for construction of a nuclear facility.

Modifications of SSC important to safety are carried out after authorization by NRA under ASUNE and conditions specified in the Regulation on the Procedure for Issuing Licences and Permits for safe use of Nuclear Energy. The Regulation defines the documents that must be submitted by the applicant for review and evaluation. Follow-up control of the completed modification is accomplished by conducting inspections.

The process of making a regulatory evaluation and analysis covers the following main activities:

- Establishing the conformity with the statutory requirements of the design bases and operation of structures, systems and equipment, including high-risk facilities related to nuclear safety;
- Review and evaluation of documents submitted to NRA in fulfillment of statutory requirements, conditions of licences and permits and made improvement notices, and other documentation required by NRA;
- Review and evaluation of performed external independent expertise, studies and researches;
- Review and evaluation of all other documents necessary for making regulatory decisions on the safety of nuclear facilities.

In the evaluation process, when necessary and at the discretion of the Chairman of the Agency may be performed:

- Inspection of the facility site, subject to the stated activity;
- Use of external consultants;
- Support of the process of decision making by the consulting boards.

Article 18 (2) Incorporation of proven technologies

Arrangements and regulatory requirements for the use of technologies proven by experience or qualified by testing or analyses

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 improvement of activities.

Measures taken by the licensees to use proven technologies

The Modernization program implementation improved reliability in the operation and ensures long term operation for Units 5 and 6. Old information and control systems were replaced with new ones, based on digital instrumentation and control devices. With the equipment replacement was preserved the equipment location in the compartments, the means for measuring and control at the MCR, as well as control and alarm algorithms. The new control safety systems and new computer information systems were implemented after evaluation of the experience of their use in the

manufacturing countries. Other safety related systems such as the system for overpressure protection of primary circuit and the hydrogen control and combustion system in the containment were 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" are 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 the Units, needed to optimize the operation of equipment;
- Replacement of outdated analogue equipment with digital control of the processes improves operator interface, functional reliability and availability of the system. The implemented 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;
- The 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 a new radiation monitoring system provides continuous and accurate monitoring of gas discharges from the plant.

Permits to perform these modifications and upgrades are issued by NRA after the licensee has shown that these technologies are proven or qualified by testing or analyses.

Analysis, testing and experimental methods to qualify new technologies

All new technologies, such as digital instrumentation and control have been put into service at Units 5 and 6 after appropriate analyses of their reliability and full examination at 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.

Documents for analysis, verification and tests are presented to NRA by the licensee as part of the documentation for the issue of permits for the modifications.

Regulatory review and control activities

The Regulatory review and control of activities are carried out in conformity with the legislative framework and are described under Article 18 (1). They cover the above mentioned aspects.

Article 18 (3) Design for reliable, stable and manageable operation

Overview of arrangements and regulatory requirements for reliable, stable and easily manageable operation

The 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 autonomous devices for registration and storage of information. From the MCR activities can be taken to maintain the unit in a safe state or to restore this state under all operating conditions and design basis accidents.

It is required that 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 consider 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.

The location of the means of control and the way to present information should be such that the operating MCR staff to be able to clearly and quickly determine the condition of the Unit, and the compliance with the limits and conditions for operation, to identify and diagnose the automatic activation and operation of safety systems.

Implementation measures taken by the licensee

The above legal requirements are covered by the original design of Units 5 and 6. The texts under Article 12 reflect the performed modifications, contributing to visualize to the operating personnel of the MCR extended in volume and quality information about the status of physical barriers and levels of protection. Moreover, a number of modifications were made, which addressed issues related to unreliable operation of equipment, failures of which require rapid operational activities to ensure compliance with the limits and conditions for operation.

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.

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 authorisation to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning program 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) programs 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 of international bodies and with other operating organisations and regulatory bodies;

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

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 from the operating organisation to develop a Program for Commissioning to confirm the 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 NRA to obtain a commissioning permit 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 NRA Chairman (a licensing stage prior to commissioning). Commissioning programs shall provide for all necessary tests to confirm the design characteristics of the NPP referred to in the interim SAR.

Commissioning programs

At any stage the commissioning program shall include objectives, descriptions and implementation timetable for all important activities. Programs shall describe:

- The sequence, timing and logical connections between activities at 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 status at the respective stage;
- Organization for implementation of activities and required staff;
- The conditions for transition to the next stage;
- List of specific procedures for implementation of stage activities.

Programs for commissioning should contain information specifying that:

- all the necessary tests to confirm the design features of the plant are provided;
- tests are planned in a way that the plant can be subjected to lighter load conditions before switching to heavier load conditions;
- "holding periods" have been provided in the process of commissioning, in which the plant is operated under certain conditions in a predetermined period.

Programs of verification that installations, as constructed, are consistent with the design and in compliance with safety requirements

Programs for verification of SSC are being developed further back in the conceptual design phase. Verification is performed in the harmonization process between the set design system functions and implementation of modifications in order to upgrade design capabilities. Thus the modification is followed most accurate and conservative to verify whether the newly installed systems are in accordance with the requirements of the project and the imposed new criteria and safety requirements. Combining existing verification programs and such involving equipment and modifications made during subsequent phases are described and evaluated on the basis of documents (e.g., preliminary design report, notes on the phases of the project, research of facilities, documentation of system definition, regulatory documents, procedures or practices related to the project).

Before initial core loading with nuclear fuel, shall be installed, tested and operable systems important to safety needed for this stage, to be carried out tests to determine the characteristics of the circuit of the reactor coolant, to be tested the effectiveness of the biological shielding and to implement radiation monitoring of the premises, the site, the area for precautionary measures and the surveillance zone.

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 analysis of the design with the 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

The Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy requires prior authorisation for the performance of a single stage of the commissioning committee of NRA inspectors to examine the site for compliance with the stated data and circumstances and readiness for carrying out the stage. They perform:

- assessment of procedures and eligibility criteria for admission;
- review of the implementation of these procedures;
- direct observation of the performance of key tests;
- evaluation of results of selected tests;
- confirm the integrity of each engineering barrier.

Based on the findings of the Committee, reported in a Protocol, Statements issued by other specialized bodies and reports for resolved notes from the committee protocol, the Chairman of the NRA may issue a permit to complete the stage.

Article 19 (2) Operational limits and conditions

Regulatory requirements for the definition of safe operation boundaries

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 the test results during commissioning. Periodically and if needed, they shall be reviewed in order to reflect operational experience, modifications to safety related SSC, new safety analyses and development of science and technologies. Operating Limits and Conditions shall cover all operating conditions, including power operations, sub-critical state of the reactor installation, core refuelling and 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, inspections, 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

Administrative control to implement the operational limits and conditions is carried out by managers of operating sectors. In the case of an entry into the areas restricted by the operating limits, immediate actions are taken to restore the 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 and the number of violations of operating limits and conditions are trended.

Compliance with operational limits and conditions is part of the safety culture of the staff and it receives appropriate training in accordance with the methods and means of initial training and retraining. In case of amendments and supplements of the operational limits and conditions, briefings are held and additional training, when needed, is 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 significant operational events. Proposed amendments shall be thoroughly analyzed for possible consequences, following an approved internal procedure. The proposed amendments are subject to a thorough analysis of possible consequences by an established procedure in the plant. The reasons for the changes are presented to the NRA, requesting authorisation for amendments to the technical specifications.

In connection with the large amount of modifications to SSC important to safety, as a result of the implementation of the modernization program for Units 5 and 6, and for more convenient use by the operating staff was developed a new structure and contents of the technical specifications. The new revision takes into account the IAEA Safety Guide NS-G-2.3 “Operational limits and conditions and operational procedures for NPPs”.

Regulatory review and control activities

The NRA site inspectors carry out daily control on the performed activities and adherence to operational limits and conditions. Changes to OLC are subject to authorization, which requires their detailed justification. In reviewing the documents, submitted to NRA with requests for authorization for amendments to SSC important to safety, one of the cornerstones of the analysis is the impact of the changes on existing limits and conditions for operation.

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 that operating personnel shall operate the NPP in accordance with written operating instructions and procedures, 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.

The 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 QAP 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.

Operating procedures shall be prepared before the stage commissioning and operations personnel shall be trained on them. The final version of these procedures is based on the results and experience of commissioning.

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, approved by the NRA.

According to the Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy in the set of documents for an operating licence shall be provided operating instructions, schedules and instructions for testing and control of the systems important to safety, schedule of maintenance and repair of major equipment and an aging management programme for the duration of the license.

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 and results of commissioning tests (initial and after each outage with account of modifications made to SSC or the operating conditions).

Operational documentation includes:

- operating instructions for SSC, including complete operating instructions for start up, operation and stopping for maintanence of safety systems; start-up of a unit, shut down of a unit;
- programs (procedures) for testing, inspection, commissioning, decommissioning of SSC;
- instructions to perform various activities (procedures for reporting events, bringing changes in design, operational relationships, etc.);
- alarm and emergency procedures and instructions:

In terms of implementation, development, expertise and updating of operating procedures and instructions, the following requirements shall be met:

- cover all aspects and activities ensuring safe operation;
- compliance with the limits and conditions of operation and requirements of NRA;
- they shall be prepared by qualified specialists in accordance with the requirements of quality assurance;
- they shall be maintained at a clear and understandable level, avoiding ambiguous interpretation;
- they shall be prepared in accordance with the objectives of the project and in a manner ensuring the implementation of the work without difficulty in the right sequence without additional supervision.

The level of detail in each instruction, program or procedure shall be consistent with the objectives of the document in order to provide clear, concise and, where possible, verified and substantiated guide to action.

QMS determines the order to develop, update and control the operating instructions and procedures, which shall reflect the actual status of SSC and the modification of safety requirements. Requirements towards controlled documents in format and contents, development methods, identification, coordination, approval, as well as distribution and maintaining them up to date are specified by an internal instructions part of the QAS: “Format and contents of documents at EP-2”, “Control of documentation at EP-2” and “Management of archives at EP-2”.

Documentation Management System ensures the use only of latest versions of all 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 as well as at the other operational compartments. A list of instructions in force is maintained at the working places.

The System of Quality Assurance determines the procedure for periodic review of all instructions and procedures, and to bring to the attention of the operating staff all changes to documents. The revised documents enter into force after the issuance of the relevant instructive documents.

Programs and procedures for maintenance, testing, inspection and surveillance are used in implementing the respective activities. As annexes to them are included check-lists for step-by-step implementation and recording of results.

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. There is the practice the best operators to be assigned the development of important operating procedures or test procedures. Verification and validation of operational documents is done with the participation of the operating personnel.

Incorporation of operational procedures into the management system of the NPP

Management of documents and records in Kozloduy NPP is performed by the auxiliary process "Management of documents and records" of the integrated management system. The process ensures that staff of all jobs uses the necessary documents for his activities that are clear, unambiguous, identified, have undergone the respective checks, approved in the established order, latest revision with amendments incorporated. To ensure clarity and avoid duplication in determining the scope and character of the information, contained in the documents, they are structured in hierarchical levels, determined according to their function and their area of application. Operating procedures occupy the lowest hierarchical level of the working documents which include specific details, methods and responsibilities for the execution of specific tasks by the staff.

Regulatory review and control activities

ASUNE requires permit authorization for changes leading to a modification of the internal rules of the activities, annexed to the operating licence. The operating licences include an annex, which lists the documents as technical specifications, instructions for emergency response, metal inspection, physical protection, radiation monitoring, organizational documents and operations management. Required permits are issued if the proposed amendments are not contrary to statutory requirements and the conditions of operating licenses.

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 studies and analyses of plant behaviour under accident 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 the 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. The 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 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. Since the beginning of 2012 after a successful process of verification, validation and training of staff are in place the SBEOP at low power and a sealed reactor. Since the beginning of 2013 after a successful process of verification, validation and training of staff are in place for the SBEOP at depressurized reactor.

SBEOP sets includes:

- Diagnostic instruction;
- Instruction for operation at total blackout;
- Instructions for optimal recovery;
- 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, included in the instructions. Important projects are:

- International Nuclear Safety Program (INSP) of the U.S. DOE. Within program framework, which purpose was to develop SBEOP for WWER-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 annalises were used to develop the first and second revision of the SBEOP at power;
- In 2002, in the task "Identification of critical safety functions and their degradation at Kozloduy NPP Units 5 and 6" was completed are were justified the critical safety functions, and their rates of degradation, and the 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. The results of the analyzes are used to justify modifications related to introduction of new protections and interlocks and design changes in the makeup water loop to the SGs and amendments to existing SBEOP.
- In 2011, was completed a project "Extension of symptom-based emergency operating procedures for applicability to all conditions determined by technical specifications (low

power and shutdown unit) for Units 5 and 6 of Kozloduy NPP." Within this project was carried out analytical validation and identified the critical safety functions for the states of "low power performance and sealed reactor "and "shutdown and depressurized reactor." Based on these analyses have been developed SBEOP for these two states.

In addition to SBEOP are prepared also instructions for elimination of violations of normal operation and accidents - these are emergency procedures covering accidents and transients that do not lead to activation of the reactor emergency protection or a safety system and are introduced into operation at the end of 2009.

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 "Study of phenomena and development of guidelines for management of severe accidents", financed by a PHARE project. As a result of the study were defined key strategies for protection against severe accidents, prototypes of SAMGs were developed and technical measures for management of severe accidents were identified. Guides are designed for severe accident management (SAMG) and after successful process of verification, validation and operator training they are put in place by the end of 2012. SAMG consist of two sets - one for the MCR (two-column format) and one for the ERC (in graphical text form – in the form of flow-charts). Introduction of SAMG is preceded by significant analytical work and implemented design changes with respect to severe accidents. Within the implementation of the National Action Plan after the "stress tests" it is forseen in 2014 to complete the implementation of the analyses of the phenomena during a severe accident in the SFP and of a shut down and open reactor and on this basis will be extended the SAMG scope and developped SAMG for SFP and for a shutdown open reactor. It was decided that the project entitled "Study for locating the melt during severe accidents" to refer to the WANO MC to form a unified approach to tackle this issue by all operators of WWER-1000.

Regulatory control and review activities

The 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 documents on which operating licence is issued and are subject to assessment by the NRA. In all cases, in which the licensee applies for modifications to SSC or to operational documents, assessment is made of impact on SBEOP or SAMGs.

The NRA coordinates the implementation of the National Action Plan after the "stress tests." In 2012 and 2013 were performed three inspections to verify the funding and implementation of the measures.

Article 19 (5) Engineering and technical support

General availability of necessary engineering and technical support for construction and operation of nuclear installations

Construction, commissioning and operation of Kozloduy NPP units are carried out by engineering and technical support by Bulgarian and Russian design and engineering organisations and research institutes, as well as the manufacturers of the equipment. General Designer of the units is the OKB "Gidropress", a supervisor is the Kurchatov Institute. The Bulgarian Design Institute "Energoproekt" is the designer of some systems of the secondary circuit and some plant common systems.

In the last two decades in the implementation of programs and measures for the modernization of operating nuclear units and projects for new nuclear facilities among the Russian organizations are used consortia of Western European and American organisations.

Availability of necessary technical support on the site

Kozloduy NPP Power production department consists of three divisions - "Operations", "Maintenance" and "Technical Support". The Technical Support Division concentrates the activities on management of modernization and reconstruction of SSC; design safety analysis and evaluations; analyses and evaluation of safety, projects and research with applied science character, analyses of the results of periodic testing of safety systems and calculation and control of neutron-physical characteristics of the core. All technical support activities are carried out using procedures and instructions, which define the rules, requirements, responsibilities and interactions between internal and external structures.

The Engineering and technical support of maintenance activities is provided by the Maintenance Division. In the case of using external contractors, the division prepares the ToRs, assesses tender documents, carries out supervision during the implementation of maintenance and repair activities. These activities are specified by internal instructions and procedures.

Resources needed to support nuclear installations are planned in the long term.The necessary resources for each year are specified in the previous year and then begins the preparation to supply spare parts, new equipment or selection of contractors for activities for the next year.

Dependence on consultants and contractors for technical support

Specific activities of scientific support, specialized technical assistance or services are performed by specialized organisations and research institutes in Bulgaria, the Chief Designer and The General Designer of the Units. Major repairs 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. There are contracts for service of specific equipment.

Regulatory review and control acctivity

The operating licenses conditions require that licensee shall submit to NRA the 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 issues related to organization, functions and responsibilities, instructions 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 and radiochemistry, control of neutron-physical parameters of the core.

In 2012 an inspection was carried out at Kozloduy NPP to assess the implementation of the investment program of the plant, in terms of measures to improve the safety performance after the stress tests. In 2013, an inspection was carried out to evaluate the selection of contractors in terms of qualification, competence and control over their work on the site.

Article 19 (6) Reporting of incidents significant to safety

Overview of regulatory requirements for reporting incidents significant to safety

Reporting of incidents to the 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. The

form of notification and the contents of related information are specified.For successful implementation of the analysis and evaluation of the event the Regulation specifies requirements for the organization of activities of the Commission and example areas of investigation. The main objectives are to determine what happened, the sequence of events, why it happened, why it has not been prevented and the behaviour of staff without seeking whom to blame. Consequences are clarified – such as radiation protection, attitude to safety (what would happen) and violated legal requirements.
According to the regulation the importance of the event in terms of safety and radiation protection is determined by the IAEA INES scale initially by the licensee and the final assessment is determined by the Chairman of NRA.

The Regulation requires the licencee 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 of the criteria for reporting and reporting procedures

Internal events in Kozloduy NPP are classified into 3 categories:

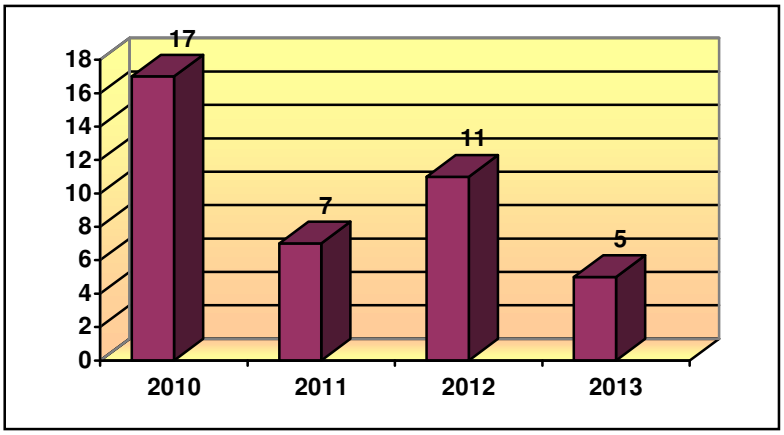
Category I: Significant events to be reported to the NRA. Criteria and procedures for reporting of the events of I category are listed in "Safety Instruction. Procedure for reporting and analysis of operational events in category I in KNPP." and are consistent with those set out in the Regulation on the Conditions and Procedure for Notification of the Nuclear Regulatory Agency of Events at Nuclear Facilities and Sites with Sources of Ionizing Radiation.

Category II: Events not to be reported to NRA - events insignificant in terms of nuclear and radiation safety, but having consequences important to other points of view, like performance of equipment, production, industrial safety, etc. Criteria and procedures for reporting and analysis of events of category II are listed in "Safety Instructions. Procedure for reporting and analysis of operational events Category II in NPP Kozloduy".

Category III: Low-level events and near misses - subject to registration, coding and tracking and trend analysis to identify and correct common causes. Criteria and procedures for reporting and analysis of events of category III are listed in "Safety Instructions. Procedure for reporting and analysis of low-level events and near misses in NPP Kozloduy ".

Statistics of reported events for the past three years

For the last three years, Kozloduy NPP has reported tothe NRA total of 40 events, rated at level "0" on the INES international scale. Distribution is shown below.



During the three-year period, 148 additional low-level events and near misses were analyzed.

They are not of safety significance but have been analyzed in depth in accordance with established instructions for investigation and analysis at Kozloduy NPP.

Documentation and publication of events reported by the license holder and the regulatory body

Documentation

Kozloduy NPP stores all information on deviations, incidents and accidents in a joint elelctronic database (Events database), that provides conditions for 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.

Along with the electronic database information is stored also in paper and standard protocols to which are applied additional materials on which the analysis was performed, including:

- charts of changes in the basic parameters;
- prints registering change of the state of the affected equipment;
- survey data of radiation situation and exposure of personnel;
- written information of participants in the event;
- necessary technological schemes or any part thereof, drawings, sketches, photographs of damaged equipment and the sites of damage, enough to understand the information presented;
- protocols after emergency inspections, results of metallographic and other tests, protocols for opening (revision) of damaged equipment, reports from weather stations, excerpts from the project or estimate and other materials, confirming the findings of the Commission of the reasons for the breach;
- the conclusions of the experts involved in the investigation, if any.

Publication

Events in Kozloduy NPP are published in the domestic network - intranet. The Production Department maintains a Database "Events", for registering and processing defects and failures. The Head of the Department designates officials who can work with the database. For all other staff of Kozloduy NPP, entitled to access the database "Events", the information is available only for reading.

In order to share operational experience, the event report is distributed to the organizational units of Kozloduy NPP, which had not participated in the elaboration of the report, to Production Division and to the Training Centre. Event reports are given to various engineering organisations as input data, depending on the projects to be implemented.

Notification of the World Association of Nuclear Operators (WANO) for registered and analyzed events in the Kozloduy NPP, is carried out by "Procedure for the exchange of WANO operational events ".

ASUNE and the Regulation on notification oblige NRA to provide information on events at nuclear facilities to the specialized international organizations, state bodies, legal entities and citizens. The NRA has an internal procedure, which defines the duties and responsibilities, for the publication of notices of events at nuclear facilities on the site of the agency. It is a rule the message to be published in Bulgarian and English on the day of receipt by the licensee. The NRA publishes the Event Reports in its official website, as well as in the international system for reporting of events IRS.

Policy for use of INES scale

For assessment of the events' consequences in Kozloduy NPP is used the International Nuclear Event Scale INES (2008 edition). Using the INES scale is a legal requirement. For assessment of

events in terms of safety is used the criteria, practical examples and attachments to the INES User Manual.

Algorithm to determine the level on INES (block diagram of the manual) is entered into an electronic database for analysis of events. Each record of a report includes a standard form with a brief description of the event, reflecting on the INES assessment and additional information, such as impact on the site and the environment, degradation of defense in depth. The events distribution according to the INES scale is used as one of the main indicators for safe operation of the plant. Preliminary assessment of an event on INES is done by Kozloduy NPP and the final evaluation of the event is done by the NRA.

Regulatory review and control activities

The NRA carries out its own assessment of selected operational events. Group for Events Analysis is established at the NRA with the task to periodically evaluate event analyses and the safety consequences. The regulatory inspections before unit start-up after annual outage verify the implementation of corrective measures for events from the previous fuel cycle. In some cases, the NRA inspectors check on-site the circumstances and conduct their own investigation of operational events.

Article 19 (7) Operational experience feedback

Regulatory requirements to the licensee to collect, analyze and share operational 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 the 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, in order to identify the good operational practice as well as events, deviations and trends that decrease the level of safety or reduce the identified safety margins and take corrective measures.

The Regulation on the Conditions and the Procedure for Notification of NRA 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 staff and of equipment performance, indicators trends and conclusions and recommendations for improving the operations and equipment. These findings and analyses are used to improve staff training and management of operational activities.

Overview of licensee programs for the feedback of own and others operational experience

In 2012 was performed a reorganization of the system of feedback from operational experience due to recognized reduced efficiency and duplication of functions on operating experience in Electricity Production-2 and the "Operational experience and self-assessment indicators" sector in Operations Division.

The procedures for reporting and analysis of operational events are united into one common procedure of the Production Directorate. A Committee to review and assess the feasibility of operating experience (screening) after the initial examination and Council on operational experience were founded.

Requirements, basic principles, responsibilities and obligations in the use of operating experience at Kozloduy NPP are listed in the procedure "Safety rules. Feedback system for operating experience". The feedback system consists of two main programs:

- Program for the use of the internal (own) operating experience;

- Program for the use of external (industry) operating experience.

Program using the internal operational experience

Sources of internal operating experience are the operational events, occurring in Kozloduy NPP, including low-level events and near-misses. The main stages of the program for feedback from internal operating experience include:

- Reporting and recording of the event in the information system;
- Investigation of the event - collection of information needed for the analysis;
- Analysis of causes - definition of direct, indirect and root causes (for events of the first and second category);
- Analysis of trends in low-level events and near misses and establishing common reasons (program and organizational);
- Determining the appropriate corrective actions to prevent recurrence of similar events (for 1st and 2nd category) and reducing the frequency of such events (for the third category);
- Implementation and reporting on the corrective measures;
- Evaluation of the effectiveness of implemented corrective measures;
- Periodic review of the effectiveness of the program, using internal operational experience, including independent external evaluations (NRA, IAEA, WANO).

The events of the first and second categories are subject to root cause analysis. The events of the third category are subject to screening, classifying, coding, tracking and trend analysis.

Program using the external operational experience

Sources of external operating experience are operational events published in the information networks of WANO and IRS-IAEA, and also the established good international practices. The main stages in the program for feedback from external operating experience include:

- Initial examination (screening) of the applicability of the information published in relevant international information networks (WANO, IRS-IAEA);
- Review of feasibility of selected information by the Committee for review and evaluation of operating experience (Screening Committee) and identification of relevant activities on the basis of the applicable external operating experience;
- Implementation and reporting on the implementation of remedial measures based on the external operating experience, to prevent similar events in Kozloduy NPP;
- Evaluation of the effectiveness of corrective measures and of the program for using external operating experience.

Evaluation of the effectiveness of the programs for operating experience feedback is done using a system of indicators.

Procedures to analyse domestic and international events

Procedures for the analysis of internal events

As stated in the text of Art. 19 (6) events in Kozloduy NPP are classified into three categories, for each category there is a separate procedure that determines the way for reporting and analysis. For analysis of events I and II categories is used the approved ASSET methodology and some techniques from the HPES system. ASSET methodology and HPES techniques are described in "Method for analysis of events and operating experience." The analysis is carried out by established for each event committee, which obligatory involves a root cause analysis expert.

Statutory deadlines for the analysis are respectively 25 days for the events of category I and 45 days for the events of II category.

Events of category III (low-level events and near-misses) are subject to daily review (screening), classification and coding. Keeping up with trends is done monthly and trend analysis on the code categories is done on a yearly basis.

Procedures for the analysis of external events

Review (screening) and analysis of external events in Kozloduy NPP is carried out according to the "Procedure for exchange and dissemination of operating experience." The main evaluation criteria for the applicability of external operating experience, which is carried out by the Committee for review and evaluation of operating experience are:

- Kozloduy NPP uses the same equipment and components;
- the same project is used (if the project is defined as a major factor in the problem);
- working methods increase the likelihood of a similar problem in Kozloduy NPP;
- probability of occurrence of events in similar circumstances, such as water resources, algae, adverse weather conditions or critical ambient temperatures;
- such an event has already happened in Kozloduy NPP;
- similar methods of management, staff behavior or processes are observed in Kozloduy NPP.

Procedures for extracting and applying useful experience

Kozloduy NPP has established a system for the use of operating experience, which is documented in the "Procedure for the use and dissemination of operational experience." The procedure is based on the guidelines of the IAEA and WANO (GL_2003-01 Guidelines for Operating Experience at NPP and NS-G-2.11 A System for the Feedback of Experience from Events in Nuclear Installations). The review of operating experience also includes materials coming from the personnel taking part in missions, seminars and conferences. Corrective measures are aimed at restoring, enhancing or creating new technical and/or administrative barriers in order to prevent significant events and their recurrence.

Information from operating experience (both internal and external) is distributed among the staff of Kozloduy NPP following the above-mentioned procedure. Significant internal events (I and II category) and operating experience from external events translated into Bulgarian language are published in the internal information system of Kozloduy NPP and are available to all personnel of the plant.

Information from internal and external operating experience (basic event information) is included in pro-job briefings, in a periodic and refresher training programs and simulator sessions of FSS-1000.

Best practices identified during internal audits and self-assessments of individual structural units are distributed among the other organizational units for acquaintance.

Mechanisms for sharing experience with other organisations

Dissemination of operational experience outside the Kozloduy NPP is specified by the procedure “Exchange and dissemination of operational experience”. The criteria for dissemination of information are set in accordance with WANO “Operating Experience Program Guideline - WANO/WPG02” and “GL 2003-01 Guidelines for Operating Experience at Nuclear Power Plants”.

The main mechanisms for sharing important operating experience with other operating organisations are:

- Providing information to the WANO Moscow Centre for significant events in Kozloduy NPP to be published in the information system of WANO;
- Publication of events occurring at Kozloduy NPP in the information system of the IAEA - IRS (submission of information is done by the national coordinator in NRA);
- Provision of information on issues through the system for technical inquiries of WANO Moscow Centre;
- Presentation of information on operating experience (presentations) during international workshops and technical meetings to exchange experience (benchmarking) with operators of such reactors;
- Exchange of experience and information through participation in missions of the IAEA and WANO.

Use of international databases on operational experience

Kozloduy NPP has organized access to information databases, which store information about shared operational experience of nuclear power plants, namely:

- Database of WANO;
- Database of IAEA - IRS.

Access to the WANO database is done from the contact person of the plant with the association in connection with the program of operating experience. Access is organized through a special VPN channel. Access to the IRS database have more than 10 people.

Reports on significant operational experience of types SOER (Significant Operating Experience Report) and SER (Significant Event Report) are reviewed in the shortest possible period after their publication. Reports of significant operating experience of the type SER and SOER of WANO, and information about target instructions (JIT - Just-in-Time) are obligatory translated into Bulgarian. The other reports are used in Russian or English. At least once a month is performed a screening of newly published information.

Use of information is regulated in the Procedure for Exchange and Dissemination of Operating Experience. The procedure regulates the activities of seeking information from external sources, responsible for the initial processing of this information and determines the priorities for processing.

Regulatory review and activities for licensee programs and procedures

Periodically, subject to regulatory inspection is the operating experience feedback system, when are commented instructions and procedures at a corporate level. A review is performed of arrangements for use of foreign experience and connections to exchange information with international organizations (IAEA and WANO). The structure and the effectiveness of the operating experience feedback system is evaluated. Topics for inspection in the application of feedback are described in Annex 1 of the Procedure for inspection of nuclear facilities.

The latest inspection of the NRA on this topic at Kozloduy NPP was performed in 2013.

The licensee submits to NRA every three months data on trends in some indicators agreed with the agency. More extensive information on the indicators for safe operation is contained in the annual report of the NPP.

Feedback activities at the Regulatory body

In order to increase the objectivity of independent regulatory assessment of events, the 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 analysis group are:

- Conducting an independent analysis of the root causes of significant events and definition of the appropriateness of proposed corrective measures;
- Dissemination of the national operating experience to international organizations, as well as screening of the external operational experience and its distribution inside the country;
- Conducting extra 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 handling of SF and RAW

According to the ASUNE, the management of radioactive waste and spent fuel is carried out by legal entities, after receiving of the respective permit and/or licence for the safe implementation of the activity. The Regulation on Ensuring the Safety of Spent Nuclear Fuel specifies 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 on the Safety of Radioactive Waste Management requires that persons whose activities generate RAW shall develop RAW Management Programs, which describe and justify the actions taken and planned for the management of all generated RAW, till their 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, SF is stored under water in the reactor spent fuel pools of each nuclear unit for a certain period of time, as required by the supplier, which is reflected in the Technical Specification and the operating instructions, and then in a special "wet" type storage facility (Wet SFSF). The requirements for storage of spent fuel concern keeping the operating conditions in terms of chemical indicators, activity, leakage and temperature of the cooling medium. Control of the operating conditions is performed by the operating staff of Kozloduy NPP.

From the Wet SFSF, SF is sent for processing or storage in a special "dry" storage of container type. The constructed dry storage facility at the site is in the process of commissioning in accordance with the licensing procedure of the NRA by an approved programme. By June 2013, two containers are located in the Wet SFSF.

Treatment, conditioning and storage of RAW

RAW 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. The operational RAW is stored in dedicated locations in unprocessed or processed form, which does not have limited options for their subsequent treatment, release from regulatory control or disposal. The activities are carried out under the administrative dose limits, set out in internal documents, programs for radiation protection, dose forecast budgets and other restrictions related to dose control.

The Kozloduy NPP approach, adopted since 2005, is directed to transfer for processing by SERAW of all currently generated RAW and gradual release of accumulated historical RAW from the storage facilities.

RAW management activities are carried out on the basis of administrative structures, having clearly defined statute, functions and tasks and clear allocation of rights, obligations and responsibilities of the two operators at the site (Kozloduy NPP and SERAW).

Activities to keep the amount of waste generated to the minimum practicable both activity and volume

To minimize the generated RAW, organizational and technical measures are provided in the following directions - minimizing the quantities of generated RAW by the source and by secondary RAW; prevention of undue radioactive contamination of clean materials; providing a direct link between RAW generation and subsequent RAW management stages.

The following activities are implemented at 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 related to planning, improvements in procedures, respecting the safety culture in operation, training of staff, analysis of results;
- Technical measures - control of the status of purification installations, separation of oil fractions, maintaining cleanliness in the premises, regeneration of boric acid.

Established procedures for clearance of radioactive waste

New methodologies and procedures for the release of materials from regulatory control are being developed by Kozloduy NPP for RAW from the operation of Units 5 and 6. This includes: radiological characterization of the various streams of 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.

For Units 1-4, which are in preparation for decommissioning, procedures have been developed for the release of large amounts of metals from regulation. As a result of these procedures are exempt from regulation 2 batches of metals obtained during dismantling of equipment from the secondary circuit of Units 1 and 2 of Kozloduy NPP.

A program is implemented to determine the radionuclide composition and specific activities of charcoal from the iodine filters of the ventilation systems and non-used ion exchange resins in the filters of the water purification systems. The results of the programme completion are submitted to the NRA to evaluate compliance with the release levels.

Regulatory review and control activities

The management of SF and RAW is subject to continuous review by the NRA inspectors at the site of Kozloduy NPP. The NRA Annual inspection plan includes inspections on topics related to safe management of spent fuel and RAW. The periodic information, submitted to the NRA under the conditions of the operating licenses is analyzed and evaluated.

Annex 1

List of operational events reported for the period 2010-2013

Date	Title	INES level
10.01.2010	Decreasing the unit power due to loss of signal for the position of one control rod of Unit 5.	0
13.02.2010	Decreasing the unit power due to loss of signal for the position of one control rod of Unit 5.	0
21.03.2010	Reactor SCRAM on Unit 6.	0
01.06.2010	Unplanned actuation of the automatic staggered start-up of the safety systems third train of Unit 5	0
06.06.2010	Failure of the Computerized Information Management System during start-up operations at Unit 5.	0
13.06.2010	Decreasing the unit power due to loss of signal for the position of one control rod of Unit 5.	0
29.06.2010	Power reduction of Unit 5 due to trip of one main circulation pump.	0
02.07.2010	Taking out of stand-by mode of the diesel generator from one of the channels of the safety systems at Unit 5	0
22.07.2010	Loss of the position indication of one of the control rods of the reactivity control and protection system of Unit 5.	0
04.08.2010	Power reduction of Unit 5 due to worsening of the water chemistry in the steam generators (SG) secondary circuit outlet water	0
18.09.2010	During Functionality Tests, two Control Rods from the reactor reactivity control system drop to lower terminal switch instead to mechanical stay..	0
28.09.2010	Cracks detected in the housing of 3 control rod drives of Unit 6.	0
19.10.2010	Failure of a breaker to switch off during planned functional testing of the third channel of the safety systems of Unit 5.	0
24.10.2010	Misplacement of one Fuel Assembly in the Core of Unit 6 during refueling.	0
25.11.2010	Punmp valve from the tirth channel of the safety systems stays with a double position indication during tests of Unit 6.	0

Date	Title	INES level
27.12.2010	Loss of the position indication of one of the control rods of Unit 5.	0
27.12.2010	The electromagnet of one main circulation pump at Unit 5 swith off.	0
21.02.2011	Loss of the position indication of one of the control rods of Unit 5.	0
20.04.2011	Decrease of the boron acid concentration in the face seals of a low pressure pump from the Second Train of the Safety Systems at Unit 5.	0
26.04.2011	Increased inflow of Radioactive Noble Gases (RNG) in the containment of Unit 5.	0
01.08.2011	Taking out of the Diesel Generator of the first train of the Safety Systems from a stand-by mode at Unit 6.	0
07.09.2011	Taking out of the Diesel Generator of the first train of the Safety Systems from a stand-by mode at Unit 6.	0
15.11.2011	Loss of reliable power supply of the Unit 5 Safety Systems second train.	0
31.10.2011	Trip of one main circulation pump at Unit 6 due to water coolant leakage from the motor cooler.	0
16.03.2012	Taking out of the diesel generator of the third train of the safety systems at Unit 5 from a stand-by mode due to a water leakage from the coolant.	0
11.04.2012	Taking out of the diesel generator of the second train of the safety systems at Unit 6 from a stand-by mode due to mechanical failure of the control valve for the cooling water.	0
23.04.2012	Taking out of the Second Train of the Safety Systems at Unit 6 from stand-by mode due to a leak from a discharge pipeline of the cooling water system for the consumers.	0
26.05.2012	Switch-off of the turbine generator at Unit 6 from the electrical power grid.	0
28.05.2012	False position indications of one of the control rods of Unit 5.	0
07.07.2012	Switch-off of the turbine generator at Unit 6 from the electrical power grid.	0
20.07.2012	Taking out of the Diesel Generator from the third train of the Safety Systems from a stand-by mode at Unit 6, due to a failure of the rotation speed sensors.	0

Date	Title	INES level
07.08.2012	Switch-off of a fire pump of the fire protection system in train one of the safety systems at Unit 5, due to a leakage from the discharge pipeline.	0
09.10.2012	Taking out from a stand-by mode a fire extinguishing pump in the first train of the Unit 5 Safety Systems, due to an internal leak of the discharge pipeline.	0
23.10.2012	Switch-off of the turbine generator at Unit 6 from the electrical power grid resulting in the activation of the reactor scram and the automatic start-up of the safety systems.	0
19.12.2012	Switch-off of one main circulation pump at Unit 6 from electrical protection.	0
31.01.2013	Faulty electronic integral plate in train one of the safety system for control of a valve on the secondary circuit of Unit 6.	0
09.02.2013	Automatic trip of a main circulation pump at Unit 6 as a consequence of the closure of the fast acting steam isolation valve of the steam generator.	0
13.02.2013	Machanical fault in a pump's breaker from the first train of the system for emergency feed water supply to the SGs at unit 6..	0
14.04.2013	Disconnection of the turbinegenerator of Unit 5 from the electrical power grid due to leak of hydrogen.	0
28.05.2013	Planned disconnection of Unit 6 from the national power grid to eliminate a leak form a welding joint of impulse line to a pressure sensor.	0

Annex 2

Secondary legislation related to ASUNE application

- **Rules of Procedure of the Nuclear Regulatory Agency** – adopted by CM Decree № 199 of 29.08.2002, promulgated in SG 86 of 10.09.2002, in force as of 10.09.2002, amended SG 46 of 3.06.2005, amended SG 78 of 30.09.2005, in force as of 1.10.2005, amended SG 48 of 13.06.2006, in force as of 1.05.2006, SG 63 of 3.08.2007, in force as of 3.08.2007, amended SG 93 of 24.11.2009, in force as of 24.11.2009, amended SG 74 of 28.09.2012
- **Regulation on the Procedure for Issuing Licences and Permits for Safe Use of Nuclear Energy** – adopted by CM Decree Nr.93 of 4.05.2004, promulgated in SG 41 as of 18.05.2004, amended SG 78 of 30.09.2005, in force as of 1.10.2005, SG 93 of 24.11.2009, in force as of 24.11.2009, amended SG 76 of 5.10.2012
- **Regulation on the Terms and Procedure for Delivery of Radioactive Waste to the State Enterprise Radioactive Waste –** adopted by CM Decree № 164 of 14.07.2004, amended SG 64 of 23.07.2004
- **Regulation on Ensuring the Safety of Nuclear Power Plants -** adopted by CM Decree Nr. 172 of 19.07.2004, promulgated in SG 66 of 30.07.2004, amended SG 46 of 12.06.2007, in force as of 12.06.2007, SG 53 of 10.06.2008, SG 5 of 19.01.2010
- **Regulation on Ensuring the Safety of Research Nuclear Installations** – adopted by CM Decree № 231 of 2.09.2004, promulgated in SG 80 of 14.09.2004
- **Regulation on radiation protection in activities with sources of ionizing radiation –** adopted by CM Decree Nr.200 of 4.08.2004, promulgated in SG 74 of 24.08.2004, amdended SG 74 of 8.09.2006, in force as of 1.01.2007, amended SG 46 of 12.06.2007, in force as of 12.06.2007, SG 5 of 19.01.2010, SG 7 of 21.01.2011, amended SG 76 of 5.10.2012
- **Regulation on the Terms and Procedure for Notification of the Nuclear Regulatory Agency about Events in Nuclear Facilities and Sites with Sources of Ionizing Radiation –** adopted by MC Decree Nr. 188 of 30.07.2004, promulgated in SG 71 of 13.08.2004, amended SG 46 of 12.06.2007, in force as of 12.06.2007, SG 5 of 19.01.2010, SG 7 of 21.01.2011
- **Regulation on the Terms and Procedures for Exemption of Small Quantities of Nuclear Material by application of Vienna Convention on Civil Liability for Nuclear Damage** – adopted by CM Decree № 201 of 4.08.2004, promulgated in SG 72 of 17.08.2004
- **Regulation on Safety in Spent Fuel Management** – adopted by CM Decree № 196 of 2.08.2004, promulgated in SG 71 of 13.08.2004
- **Regulation on Safe Management of Radioactive Waste –** adopted by CM Decree № 198 of 3.08.2004, promulgated in SG 72 of 17.08.2004
- **Regulation on the Conditions and Procedure for Acquiring Professional Qualification and on the Procedure for Issuing Licenses for Specialized Training and Individual Licences for Use of Nuclear Power –** adopted by CM Decree № 209 of 6.08.2004, promulgated in SG 74 of 24.08.2004, amended SG 46 of 12.06.2007, in force as of 12.06.2007
- **Regulation on Emergency Planning and Emergency Preparedness in Case of Nuclear and Radiological Emergencies** – adopted by CM Decree Nr. 313 of 22.11.2011, promulgated in SG 94 of 29.11.2011, in force as of 29.11.2011

- **Regulation on Providing Physical Protection of Nuclear Facilities, Nuclear Material and Radioactive Substances –** adopted by CM Decree № 224 of 25.08.2004, promulgated in SG 77 of 3.09.2004, amended SG 96 of 30.11.2005, in force as of 1.12.2005, amended SG 44 of 9.05.2008
- **Regulation on the Basic Norms for Radiation Protection** – adopted by CM Decree Nr. 229 of 25.09.2012, promulgated in SG 76 of 5.10.2012
- **Regulation on the Terms and Procedure for Establishing of Special Statute Zones around Nuclear Facilities and Facilities with Sources of Ionizing Radiation** - adopted by CM Decree Nr. 187 of 28.07.2004, promulgated in SG 69 of 6.08.2004, amended SG 46 of 12.06.2007, in force as of 12.06.2007, SG 53 of 10.06.2008, SG 5 of 19.01.2010
- **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 –** adopted by CM Decree № 210 of 6.08.2004, promulgated in SG 74 of 24.08.2004
- **Regulation on Safety During Decommissioning of Nuclear Facilities –** adopted by CM Decree № 204 of 5.08.2004, promulgated in SG 73 of 20.08.2004
- **Regulation on the Procedure for Payment of the Fees Collected Pursuant to the Safe Use of Nuclear Energy Act –** Attachment № 1 to art. 1 from CMD № 206 of 17.09.2003, promulgated in SG 85 of 26.09.2003
- **Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the Nuclear facilities decommissioning Fund –** adopted by CM Decree Nr. 300 of 17.12.2003, promulgated in SG 112 of 23.12.2003, in force as of 1.01.2004, amended SG 78 of 30.09.2005, in forces as of 1.10.2005, amended SG 20 of 7.03.2006, SG 110 of 21.12.2007, in force as of 12.12.2007, amended SG 93 of 24.11.2009, in force as of 24.11.2009, amended SG 19 of 8.03.2011, corr. SG 26 of 29.03.2011, amended SG 47 of 22.06.2012, SG 75 of 2.10.2012
- **Regulation for the procedure for assessment, collection, spending and control of the financial resources and definition of the amount of contributions due on the Radioactive waste Fund –** adopted by CMD № 301 of 17.12. 2003, promulgated in SG 112 of 23.12.2003, in force as of 1.01.2004, amended SG 13 of 17.02.2004, amended SG 78 of 30.09.2005, in force as of 1.10.2005, amended SG 105 of 22.12.2006, SG 3 of 11.01.2008, amended SG 93 of 24.11.2009, in force as of 24.11.2009, amended SG 19 of 8.03.2011, corr. SG 26 of 29.03.2011, amended SG 47 of 22.06.2012
- **Regulation on the Terms and Procedure of Transport of Radioactive Materials** – adopted by CM Decree № 156 of 13.07.2005, promulgated in SG 60 of 22.07.2005
- **Regulation on Radiation Protection in Activities with Radiation Defectoscopes –** adopted by CM Decree № 93 of 15.04.2013, promulgated in SG 38 of 23.04.2013
- **Regulation on Radiation Protection in Activities with Materials with Increased Content of Natural Radionuclides** – adopted by CM Decree № 229 of 25.09.2012, promulgated in SG 76 of 5.10.2012
- **Tariff on the Fees Collected by the Nuclear Regulatory Agency pursuant to the Safe Use of Nuclear Energy Act** - Attachment № 2 to art. 2 of CMD № 206 of 17.09.2003, promulgated in SG 85 of 26.09.2003

Annex 3

List of peer reviews carried out in Bulgaria

1. IAEA mission for operational events review (ASSET), Kozloduy NPP units 1-4, November 1990.
2. IAEA mission for operational safety and design review (SRM), Kozloduy NPP units 1-4, June 1991.
3. IAEA mission for operational safety review (OSART), Kozloduy NPP units 5 and 6, July 1991.
4. IAEA mission for operational events review (ASSET), Kozloduy NPP units 1-4, November 1992.
5. IAEA follow-up mission for operational safety and design review (SRM Follow-up), Kozloduy NPP units 1-4, April 1993.
6. IAEA final mission for operational events review (ASSET Final), Kozloduy NPP units 1-4, September 1993.
7. IAEA mission for operational events review (ASSET), Kozloduy NPP units 5-6, November 1994.
8. IAEA mission for design review (SRM) - Modernization programme, Kozloduy NPP units 5-6, June 1995.
9. World Association of Nuclear Operators (WANO) Peer Review - Kozloduy NPP units 5-6, November 1995.
10. IAEA mission for nuclear facilities physical protection review (IPPAS), November 1996.
11. IAEA mission for nuclear safety and radiation protection regulatory infrastructure review (IRRT), NRA, November 1997.
12. IAEA mission for operational events review (ASSET), Kozloduy NPP units 5-6, November 1997.
13. Mission under the PHARE programme for review of the activities related to Probabilistic Safety Analyses, level 1 (PSA level 1), Kozloduy NPP units 5-6, November 1998.
14. IAEA mission for operational safety review (OSART), Kozloduy NPP units 1-4, January 1999.
15. IAEA mission for development, validation and verification of emergency procedures, Kozloduy NPP units 5-6, August 1999.
16. Targeted review by the Western European Nuclear Regulators of the European Commission (WENRA, EC), Kozloduy NPP units 1-4, October 1999.
17. IAEA mission for design review (SRM) - Modernization programme, Kozloduy NPP units 5-6, July 2000.
18. IAEA mission for design review (SRM) - Modernization programme, Kozloduy NPP units 1-4, October 2000.
19. IAEA follow-up mission for operational safety review (OSART Follow-up), Kozloduy NPP units 1-4, January 2001.

20. IAEA follow-up mission for nuclear facilities physical protection review (IPPAS Follow-up), February 2002.
21. IAEA follow-up mission for design review (SRM Follow-up) - Modernization programme, Kozloduy NPP units 3-4, October 2000.
22. IAEA mission for nuclear safety and radiation protection regulatory infrastructure review (IRRT), NRA, June 2003.
23. World Association of Nuclear Operators (WANO) Peer Review - Kozloduy NPP units 3-4, November 2003.
24. Atomic Questions Group within the European Commission (EC AQG) Peer Review - Kozloduy NPP units 3-4, November 2003.
25. World Association of Nuclear Operators (WANO) Peer Review - Kozloduy NPP units 5-6, June 2009.
26. World Association of Nuclear Operators (WANO) Follow-up Peer Review - Kozloduy NPP units 5-6, November-December 2011.
27. World Association of Nuclear Operators (WANO) Technical support mission in preparation for the OSART mission - Kozloduy NPP units 5-6, February-March 2012.
28. IAEA mission for operational safety review (OSART), Kozloduy NPP units 5-6, November 2012.
29. IAEA mission for nuclear safety and radiation protection regulatory infrastructure review (IRRS), NRA, April 2013.
30. IAEA mission on the issues of the probabilistic safety analysis (IPSART), Kozloduy NPP units 5-6, June 2013.

Annex 4

Topics from the summary of the Report on the 2nd extraordinary meeting on the CNS

Topic 1: External events

1.1. Results of revaluation of external hazards

In accordance with the specification of ENSREG and the requirements of NRA, in 2011 Kozloduy NPP conducted "stress tests" of the nuclear facilities at the plant site. At the end of 2011, the NRA reviewed and assessed the report of Kozloduy NPP stress tests, supplemented the provided corrective measures, agreed them with the plant and submited to ENSREG the National Report of the Republic of Bulgaria for stress tests at Kozloduy NPP. In May 2012 NRA submitted to IAEA the National Report of the Republic of Bulgaria for the 2nd extraordinary meeting on the CNS, which also contains the results of the stress tests at Kozloduy NPP.

The two national reports present the results of the targeted reassessment of the hazards, caused by external events such as earthquakes, floods and extreme weather conditions.

Earthquakes

During the stress tests has been carried out an analysis of the seismic resistance of structures, systems and components (SSC) of Kozloduy NPP, important to safety that are involved in emergency scenarios. Consistently are analyzed all ranges of seismic effects, for each range are defined the SSC important safety which fail. Equipment, which is important for safety and participates in emergency scenarios is analyzed in terms of its seismic resistance, and the parameters of the functions describing its conditional probability of failure (fragility curves) are defined. Margins and boundary effects associated with seismic impact on SSC are determined. For this purpose are set the limits of seismic accelerations which any nuclear facility on site can tolerate without getting to severe fuel damage and release of radioactive substances into the environment. The assessed within the stress tests accelerations of seismic impact (PGA), at which is expected fuel damage are PGA = 0.33g for Units 5 & 6 and respectively PGA = 0.36g for the SFSF. The results show that the seismic margin of Units 5 and 6 represents 0,13g or 65% compared to DBE SL-2 (PGA = 0,2 g), ie the units can withstand without damage to the fuel an earthquake 1.65 times greater than SL-2. Accordingly the seismic margin of the SFSF constitutes 0,16 g or 80% compared to SL-2.

Seismic stability analysis is conservative enough and shows that seismically the SSC of Kozloduy NPP are able to ensure the safety of the plant above the maximum possible for the site seismic impacts, well beyond the current design basis.

As a result of the review of the licensee reassessment of the margins of the facilities during earthquakes, the NRA considers to be correctly identified the strengths and weaknesses and accepts the proposals to further improve the robustness of the plant in an earthquake.

Floods

For the purpose of stress tests is defined the maximum water level (MWL) and its duration, investigated is the possibility of blocking the Danube by ice and is evaluated the possibility of combination of MWL with other hazards. The new MWL for Kozloduy NPP site (32.93 meters) is determined by taking into account the maximum water level of the Danube with provision of 0.01% (once every 10 000 years), failure of Hydro System “Zhelezni vrata” and maximum values for wind and rain. A probabilistic assessment of combination with two events - natural extreme

water levels with small probabilities (10^{-5} to 10^{-7}) and rupture of the Hydro System "Zhelezni Vrata" 1 and 2 is analyzed. The results confirm that the Kozloduy NPP site located at elevation 35.00 m is not floodable, indicating that the plant has the necessary resistance to floods.

The analysis identified no buildings or facilities, whose flooding will directly affect the safety functions of the plant. At the same time were found some weaknesses, mainly related to the potential for flooding of buildings and facilities on site through the sewage system of the plant as a secondary effect of external flooding with MWL. Following the identification of plant weaknesses, were suggested measures to improve and ensure the robustness of the plant against external flooding with MWL = 32.93 m.

As a result of the review of the licensee margins reassessment, the NRA considers that strengths and weaknesses are correctly identified and accepts the proposals to further improve the robustness of the plant in a flood.

Extreme weather conditions

For the purpose of the stress an analysis of the technical condition of structures is made and an expert assessment of the current workloads of the structures, due to the effects of extreme weather conditions is performed. Combinations are considered of some extreme weather conditions, such as temperature, wind, humidity, precipitation, low level of the Danube.

The assessment of typical for the region extreme weather conditions (extreme winds, tornado, snow and ice, extreme temperatures, extreme rainfall) and the analysis of the technical condition of the structures, as well as the organizational and technical measures to ensure power supply to consumers and cooling of the nuclear fuel shows that the plant has the necessary resistance to extreme weather conditions.

1.2. Peer reviews and their results

In the period from February to March 2012, all National Reports on stress tests of EU countries with nuclear power plants were under review, discussion and peer review by ENSREG. The Topical review of the National Report of the Republic of Bulgaria took place in early February 2012 in Luxembourg. Presentations on different topics of the report were made by NRA, and in the discussion were included experts from Kozloduy NPP and engineering organisations that had performed the analyses of the stress tests. Additionally the peer review included visits to each of the countries participating in the process. Visit to Bulgaria was held from 12 to 15 March 2012, as it involved experts from Greece, Hungary, Ukraine, Finland, France and the European Commission. The questions, comments and recommendations from the topical review of the National Report of the Republic of Bulgaria were discussed and was made a walkdown to the facilities of Kozloduy NPP. The EC Country Report on the stress tests of nuclear facilities in Bulgaria was finalized, which contains an assessment of the existing situation and the degree of resistance of Kozloduy NPP, assessment of threshold effects and safety margins in external events of natural origin and establishment of the advantages, weaknesses and possible improvements at a loss of safety functions and severe accident management.

The report of the peer review gives some recommendations for the implementation of additional measures related to external events that were subsequently included in the National Action Plan (NAP) following the Fukushima Dai-ichi NPP accident . These recommendations relate to:

- Provision of adequate protection to additional mobile diesel generators against external beyond design basis impacts;
- Combinations of extreme weather conditions shall be considered and analyzed;
- The impact on the severe accidents management by possible damages on the regional road infrastructure, as a result of earthquakes, shall be further assessed;

1.3. Additional improvements taken or planned as a result of the reassessment

As a result of the stress tests at Kozloduy NPP has been revised and approved the National Action Plan of the Republic of Bulgaria, which combines all the technical and organizational measures and joint actions arising from the reassessment of safety of the nuclear facilities at the site of Kozloduy NPP. The Plan includes deadlines of implementation, the responsibilities of the operating organization and the line organizations and ministries, taking into account the findings, recommendations of assigned responsibilities contained in:

- The National Report of Bulgaria for the stress tests at Kozloduy NPP;
- The ENSREG Country Report on Bulgaria;
- The ENSREG compilation of recommendations and suggestions;
- The ENSREG Action Plan;
- the National Report for the Second Extraordinary Meeting under the Convention on Nuclear Safety;
- The decisions and conclusions resulting from the Second Extraordinary Meeting under the Convention on Nuclear Safety.

The National Action Plan is structured in accordance with the recommendations of ENSREG and provides a total of 63 measures and activities, the majority of them are planned to be completed by the end of 2014. The implementation of some long-term measures is planned for the period 2015-2017.

Kozloduy NPP submits to the NRA quarterly reports on the implementation of the National Action Plan, and after the implementation of all measures will be sent a final report for the entire plan. The NRA inspectors monitor the implementation of the National Action Plan by performing periodic inspections on the status of individual measures.

With regard to external initiating events in the National Action Plan are planned the following measures:

Earthquakes

Despite considerable resources in terms of seismic stability of safety important equipment for Units 5 and 6 are planned the following additional measures that were subsequently included in the National Plan of Action:

- Provision of mobile diesel generator for each Unit;
- Investigate possibile alternatives for residual heat removal in case of loss of service water system using the Units 3,4 additional emergency feedwater makeup system for steam generators, for the needs of Units 5 and 6;
- Ensuring the availability of at least one tank of the emergency feedwater to the steam generators at shutdown mode as an alternative for residual heat removal.

Floods

After the identification of plant weaknesses are envisaged the following measures to increase robustness against external flooding with MWL = 32,93 m:

- Development of an emergency response procedure for the operating personnel in case of damage of water power system "Iron Gate 1" and "Iron Gate 2"
- Explore the possibilities for equipment protection at Bank Pump Stations 2 and 3 against external flooding with MWL = 32,93 m;

- Development of measures to prevent the entry of water into the plant sewage system in case of valley flooding;
- Modernization of the sewage and drain pump system;
- Initiate actions to improve the condition and the protective functions of the state dike in the region of the Kozloduy valley.

Extreme weather conditions

The following additional measures are provided to increase robustness of the plant in extreme weather conditions:

- Assessment of possible damage to the regional road infrastructure around the plant under extreme external impacts and assessment of the reliability of routes providing access to equipment, supplies and personnel access to the plant;
- Analysis of the extreme weather conditions of the Kozloduy site using probabilistic methods in the IAEA methodology by exploring combinations of extreme weather conditions.

1.4. Regulating activities related to external events

Kozloduy NPP sends to the NRA quarterly reports on the implementation of the National Action Plan, and after all the measures implementation a final report shall be submitted on the entire plan. The NRA inspectors monitor the implementation of the National Plan, including the measures related to external initiating events by performing periodic inspections on the status of implementation of individual measures.

Revision is planned of the regulatory framework and regulatory requirements and guidelines to include requirements for the methods of analysis and assessment of external events (earthquakes, floods and extreme weather conditions) to be applied in the periodic safety review of the existing nuclear plants and also at different stages of licensing of new nuclear power plants.

Topic 2: Design issues

Subject to assessments under this topic are design solutions to prevent the occurrence of events with loss of power and loss of ultimate heat sink and to the reaction of the facilities at a subsequent degradation of the safety functions. Special attention is paid to safety margins in case of events with loss of safety functions that lead to severe accidents in nuclear reactors and spent fuel pools of Units 5 and 6; spent fuel pools of Units 3 and 4 and the storage facility for spent nuclear fuel (SFS) of Kozloduy NPP. The reassessment is based on the safety analysis performed using a deterministic approach.

Although the results of the analysis of events with loss of power and loss of ultimate heat sink showed a very good resistance of the facilities and adequate supplies of time to take protective measures, are planned activities for consideration of additional options to increase the autonomy of the nuclear facilities at the site of Kozloduy NPP. These activities are included in the National Action Plan and their implementation shall be subject to ongoing regulatory control. At the time of the report preparation, many of these activities have been implemented, but there are measures with a longer implementation period due to the need of feasibility studies, engineering activities on the design and/or implementation of procedures for selecting a contractor. The status of implementation of key measures related to design decisions are summarized below in the following groups:

1. Measures aimed at improving the safety systems or installing new equipment to enhance the plant's ability to withstand unexpected external impacts without access to external electric grid for an extended period of time, including events affecting all the units on the site:

- Provision of two mobile diesel generators (one for each of Units 5 and 6) - completed;
- Implementation of power supply for charging one of the batteries of the safety systems by a mobile diesel generator - in progress;
- Research and implementation of measures to increase the stability of service wate systemr under extreme external impacts - in progress;
- Study the possibilities of alternative residual heat removal in case of failure of service water system – completed, project implementation is planned;
- Ensuring the availability of at least one tank of the SG Emergency Feedwater System, to guarantee it can be used as an alternative for residual heat removal, in unit shutdown mode - completed;
- Power supply of mobile diesel generator systems, providing heat removal from the reactor coolant or make up at cold state with depressurized reactor - in progress;
- Provision of possibility for feeding the primary circuit at cold state of the reactor and failure of emergency diesel generators – completed.

2. Measures to install additional equipment and instrumentation for the spent fuel pools to provide and maintain their cooling in all emergency conditions or perform assessments to determine the need for additional equipment and instrumentation:
   - Ensure power supply through the mobile DG for the SFP cooling systems, or for feeding the SFP - completed;
   - Analyse the possibility to install in the SFSF an autonomous water cooling system with an independent power supply - in progress.

3. Regulatory activities of updating the legal framework on nuclear safety:
   - revision is planned of the regulatory framework and regulatory requirements and guidelines to include requirements for the systems and equipment that are used for accident management as part of the extended design bases.

Topic 3: Severe Accident Management and Recovery

3.1. Improving regulations, guidelines and procedures

Review of the regulatory framework

In the safety reassessment of Kozloduy NPP in connection with the conducted "stress tests" on all nuclear facilities on site, as well as in the preparation of the National Report of the Republic of Bulgaria for the second extraordinary meeting under the CNS were not identified significant shortcomings of the Regulation on Ensuring the safety of Nuclear Power Plants. Nevertheless, with a measure of the National Action Plan (NAP) of 2012 is planned by the end of 2013 the NRA to develop a program to review the regulations, taking into account the lessons learned from the Fukushima Daiichi accident. Upon issuance of new IAEA documents, taking into account the consequences of the accident a timely review of the existing regulations is scheduled to be performed . In connection with the expert provision of the above two activities is provided another measure, that aims to ensure the active participation of Bulgarian experts in the review of the IAEA standards and the issuing of new ones. With a view to maintaine and update the regulatory guides is scheduled to be completed by the end of 2014 a review and update of these guidelines, taking into account the experience gained and published new documents to the IAEA and the European Commission.

Improving the emergency operating procedures, guides for management of severe accidents (SAMG) and training

The actions to diagnose Units 5 and 6 in design and beyond design basis accidents to restore or compensate for violated safety functions and prevent or mitigate the consequences of damage to the core are defined in the symptom-based emergency operating procedures (SBEOP). The SBEOP set for work of the reactor at full power was put into operation in 2009. To enhance the safety of the units at shut down state are performed several analyzes and have been developed and put into effect in February 2012 the SBEOP for shut down reactor under pressurized primary circuit. At the end of February 2013 were enacted the SBEOP for shut down reactor under depressurized primary circuit.

For the management of severe accidents at Units 5 and 6 of Kozloduy NPP were developed guidelines (SAMG), which are based on systematic analysis of processes and phenomena in severe accidents, having followed the form of SBEOP. In this connection are set the criteria for transition from SBEOP to SAMG. The SAMG are verified and validated according to the internal procedures of validation in the plant and cover the states, corresponding to full power operation, low power and shut down reactor with a pressurized primary circuit.

The process of implementation of SAMG, according to the internal procedures of Kozloduy NPP includes their validation. The Relations with the available emergency procedures (SBEOP), and as well as the assessment of the applicability of described actions and strategies are validated by a team of independent experts by the "table top" method. The operators training to work with them was held and then in October 2012 they were implemented. It is planned by the end of December 2014 to extend the scope of SAMG for SFPs, and also for the typical state "shut down and depressurized primary circuit", which are not covered by the SAMG introduced in 2012.

Use of PSA

By 2010, PSA level 1 for units 5 and 6 was available, which reflects the state of the units after the completion of the modernization program (2001 to 2008). PSA Level 1 applies to all conditions of the units (operation at nominal power, at low power and shut down state) and covers all internal events (floods, fires, missiles), and from external events it covers only seismic impacts.

In 2006 was developed PSA level 2 , which reflects the state of the units before the start of the modernization program. During the implementation of the program are installed some new safety systems, such as the passive autocatalitic recombiners (PAR) and a passive filter ventilation system of the containment. Some research were carried out related to in-core and ex-core phase of a severe accident development. Currently is beimg developed the update of PSA level 2, which will reflect design changes made and will cover the states of full power, low power and shut down reactor. Its results will be used to determine the specific modes and scenarios depending on their importance in terms of the consequences.

In order to cover the full spectrum of external initiating events the plant intends by the end of 2015 to analyze the extreme weather conditions of the Kozloduy, site using the probabilistic methods in the IAEA methodology, by exploring combinations of extreme weather conditions.

Others (including alternative sources of water, recovery after a severe accident, radiological analyzes)

To provide additional safety margins are planned several measures related to the study and implementation of various schemes for residual heat removal from nuclear facilities at the site.

In this regard, it is envisaged to develop technical means to enable direct water delivery through a mobile fire equipment and facilities in extreme situations:

- to SFP – till the end of December 2013;
- to the core, SG, containment and compartments with SF in the SFSF till December 2014.

In connection with the implementation of the scheme to the SFP, actions have been taken regarding the analysis and evaluation of opportunities for direct water supply to the SFP. At this

stage it is considered and accepted the proposal to amend the project "Ensuring additional supply of boron and water solutions by an external independent source to the SFP".

Terms of reference for design and construction of pipelines with direct makeup of the compartments of the SFSF pool with water by diesel pumps of Fire station 2 and also using a fire truck, has been developed

It is planned by the end of 2014 to be conducted further analyzes of the possibility of deterioration of working conditions of MCR, ECR and EMC because of high levels of contamination (in certain areas) and damage to the equipment at the site and the potential impact on the accessibility and habitability of MCR and auxiliary control panels.

PHARE Project BG.01.10.01: "Investigation of the phenomena and the development of guidelines for management of severe accidents according to the European requirements", implemented in 2005, analyzed the processes related to core meltdown, the degradation of the reactor vessel, pouring of molten core to the foundation of the containment structure and the threats that these processes induce. Strategies are developed in the SAMG for prevention of these phenomena. A project is implemented to close the most vulnerable pathways for pouring molten core outside the containment and prevention of a bypass of the containment structure, which should be completed by the end of December 2014.

3.2. Improvement of systems, components and measuring instruments

Use of mobile equipment

WWER-1000 design decisions provide a steady mode of natural circulation without the need for operator actions in complete loss of internal and external power until the coolant runs out in the volume of the horizontal steam generators. Systems and components that perform protective functions against excessive pressure in the first, second circuit and containment are powered by batteries or operate on a passive principle. To provide additional safety margin and increase the availability of control valves in total blackout is provided by the end of 2013 to be delivered and installed two new additional mobile diesel generators for Units 5 and 6. At present the diesel generators were delivered, and the final phase of the project implementation is in December 2013.

Regardless of the sufficient volume of water available to the WWER-1000, it is intended to be explored alternative schemes for residual heat removal after the failure of the service water system through the use of an additional emergency feedwater system of the steam generators at Units 3 and 4 for the needs of Units 5 and 6. The measure is in progress and is implemented in the terms of reference for a study of opportunities and preparation of a project for commissioning of an additional system for emergency feedwater to the steam generators and cooling the SFP of Units 5 and 6, using the equipment installed on Units 3 and 4.

At each unit are installed 3 batteries - one for each channel of the safety systems and 3 batteries for the normal operation systems. By a real test is established the threshold value of discharge of a battery of the safety systems for over 10 hours. To provide additional margin is planned a measure to charge one of the batteries of the safety systems from a mobile DG. Discussed and defined are the necessary additional technical activities to ensure connecting of MDG and equipment fed by them and the capabilities to power the pumps from one channel of the SS in a blackout mode by an efficient DG of another channel. At present, the diesel generators are delivered and the final phase of the project is in December 2013. The measure associated with providing power to the systems for heat removal or filling of SFP from the mobile DG will be executed within the same project.

The necessity and the possibility to power the motor-valves of the connecting pipelines of the hydroaccumulators of the emergency core cooling system (ECCS) by rechargeable batteries is analyzed, in order to allow for feeding the primary circuit in cold state of the unit at failure of

emergency DGs. At Unit 6 this measure was implemented in 2012 and at Unit 5 has been realized during the 2013 outage.

There is a measure to increase robustness in a severe accident which aims to assess the possible damage to the regional road infrastructure around the plant under extreme external influences and to assess the reliability of routes providing access to equipment, supplies and personnel to the plant. Terms of reference for a feasibility study was approved and was launched an award procedure which is expected to be completed in 2014.

Improving permanently installed systems

As part of the modernization program in the containment of Units 5 and 6 were installed measurement channels for measuring the concentration of hydrogen. Opportunities were also justified of the available measurement channels to be used in a severe accident. It is envisaged installation of measuring channels of the concentration of water vapour and oxygen in the containment structure. Terms of Reference is prepared for design, a procurement procedure has been launched and is expected to be completed in 2014.

For Risk management of hydrogen in design basis accidents, in the containment of Units 5 and 6 are installed PARs. An additional analysis showing that their capacity is sufficient for management of hydrogen from the in-core phase of a severe accident has been developed. To cover the entire time range of a severe accident and to cover an accident in the SFP it is planned to install additional PARs in the containment of Units 5 and 6. A contract for design and installation of additional hydrogen recombiners in the reactor department of reactor 5 and 6, with a deadline February 2013, was signed. Analysis and design that are under consideration and adoption by the NPP were prepared.

In the current design, WWER 1000 reactors of Kozloduy NPP have technical means for reducing the pressure in the primary circuit, to prevent melting of the reactor core at high pressure in the primary circuit (high pressure melt ejection), which are operable in the conditions of a blackout.

As part of the modernization program (2001-2008), in accordance with the recommendations of the IAEA-EBP-WWER-05, Safety Issues and their Ranking For WWER-1000 Model 320 Nuclear Power Plants, March 1996, for pressure management in terms of severe accident at Units 5 and 6 in 2006 were installed filter systems to reduce the pressure, acting on a passive principle.

It is planned to explore the possibility of locating the molten core during severe accidents. Terms of reference is prepared for "Development of a conceptual design of a facility for retention, cooling and stabilization of the melt in the event of a severe accident at Units 5 and 6 of Kozloduy NPP." In 2013 is scheduled to take place a WANO regional workshop on issues related to the possibilities of locating the molten core during severe accidents.

Based on the results of the study of Units 5 and 6 under PHARE Project BG.01.10.01 "Study of phenomena and development of guidelines for management of severe accidents according to the European requirements", are defined strategies for management of severe accidents and the necessary technical means for their implementation. Measurement channels are defined that are used for monitoring the conditions of a severe accident. Criterion for selection of designated SSC is their ability to survive, to restart and operate in severe accident conditions. These devices are located inside the buildings and are not exposed to extreme weather conditions.

Further are designed and implemented SSC for management of severe accidents and preserve the integrity of the containment structure as a passive filter ventilation system to reduce the pressure in the containment, alternative feeding system for SG and PAR inside the containment. The ability of these agents to perform their duties in a severe accident is proved.

3.3. Improvement of structures

The internal emergency plan of Kozloduy NPP provides the necessary resources to protect personnel involved in accident management. These resources are available on the site, they are serviced and maintained. Design decisions of MCR, ECR and the emergency management centre (EMC) provides performance and habitability of the staff in terms of nuclear and radiation accidents, including complete loss of internal and external power supply. At all control panels and EMC is provided uninterrupted redundant Radiation Control, 120% redundancy of personal protective equipment, emergency personnel of the plant, and the team of the fire brigade and police. For the emergency personnel is provided a separate shelter equipped with an autonomous DG and ventilation system.

EMC provides operability and habitability of the staff in terms of nuclear and radiation accidents, including total blackout. In the EMC are installed 2 autonomous SGs, making the emergency center independent in a complete loss of internal and external power supply and provides air conditioning in the premises. EMC is resourced for continuous operation with communication and information systems with the nuclear facilities at the site, as well as to external organizations, at municipal and national level.

Under seismic impact the operation of the EMC is determined by the secondary seismic effects, as destruction of the aboveground structures will hinder personnel access to the EMC. This problem is considered in the design and provides an independent access to the emergency rooms of the EMC. A measure is also planned for building an off-site EMC by the end of 2016. ToR for the design of the new EMC at a selected site is prepared and is in a process of agreement.

3.4. Simultaneous occurrence of events at all nuclear facilities

The SAMG at Kozloduy NPP are developed on a unit principle, every nuclear facility on site is able to react independently and operatively to symptoms of a severe accident. By the end of 2015, the existing organizational measures and technical means in the event of accidents, involving simultaneous melting of fuel in the nuclear facilities on site will be assessed.

Under the measure envisaged by the NAP was reviewed the external and internal Emergency Plan of Kozloduy NPP to take account of the possible effects of physical isolation caused by external hazards. A new version of the emergency plan is prepared, taking into account all recommendations from the conducted emergency drills. The new version of the action plan was approved on 30.04.2012 and coordinated by line institutions and departments on 29.06.2012.

3.5. Storage pool of spent nuclear fuel

The NAP provided by the end of December 2014 to develop technical means to enable direct water delivery through mobile fire equipment and in extreme situations to the SFP.

It is planned by the end of December 2014 to extend the scope of SAMG for SFP, and for the typical state "shut down and depressurized primary circuit" that are not covered by the introduced SAMG in 2012. Under this measure will be discussed the problem of the generation and accumulation of hydrogen in the spent fuel pool. To date is approved a ToR for "Analysis of the phenomena during a severe accident in the SFP of Units 5 and 6 of Kozloduy NPP".

SFP at Units 5 and 6 are located in the containment structure. In the event of emergency conditions the hydrogen that would be generated will spread to the containment structure and will be recombined by the PARs.

3.6. Human and organizational aspects

In 2012 were revised and updated the internal and external emergency plans of Kozloduy NPP to take account of the possible effects of physical isolation, caused by external events. The updated version of the AP is put in action. The Organization of emergency planning in the country provides upon request by the operator to be ensured external expertise and technical assistance in

case of an emergency. A measure of the NAP includes provision of additional technical assistance from the Regional Crisis Centre of WANO Moscow.

The existing project envisages measures for radiation protection of personnel at the MCR and ECR. As a result of the stress tests is further provided an analysis of the potential degradation of performance due to the high level of contamination (MCR and ECR) and damage to the equipment at the site, including the impact on the accessibility and usability of MCR and auxiliary control panels.

For the management of severe accidents at Units 5 and 6 of Kozloduy NPP are developed guidelines (SAMG), which are verified and validated, and cover conditions of the units corresponding to nominal power operation, low power and shutdown of a pressurized primary circuit. An operator training to work with them was implemented, and then put in force in October 2012. SAMG as a set of instructions for operating activities of operators during severe accidents are part of the emergency plan of Kozloduy NPP. In conducting joint training the teams are trained to work with SBEOP, to make the transition to SAMG and to enter the emergency plan into force. Lecture course is held and on guidelines for management of severe accidents.

Topic 4: National Organisations

4.1. Review and update of nuclear laws, regulations and guidelines

The main instrument in the field of safety of nuclear installations is the Act on the Safe Use of Nuclear Energy. The Act introduces the fundamental safety principles established by the fundamental document of IAEA in the safe use of nuclear energy - IAEA SF-1 "Safety Fundamentals". Basic principles and requirements for safety of ASUNE are developed in more than 20 regulations for its implementation. Regulations (Annex 2) were developed and adopted in 2002-2005.

In its policy statement, the NRA stated that “NRA will update regulations in accordance with the development of international standards and EU legislation and will develop regulatory guidelines and directions in areas where it is needed."

Following the adoption of the amendments to ASUNE in 2010, the NRA developed a program to review all regulations to implement the law. The program includes a review and update of all existing regulations and development of three new ones. In the process of reviewing the regulatory requirements is taken serious attention to the lessons learnt from the accident at Fukushima Dai-ichi NPP. The program is expected to be completed by the end of 2014. In addition, the intentions of the NRA are to review the legal requirements for publication of new documents to the IAEA, considering the lessons from the accident at Fukushima Dai-ichi NPP.

4.2. Changes in the functions and responsibilities of agencies

According to ASUNE, the 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, which is an independent specialized body of the executive power. The regulatory functions performed by the NRA in the service of society, define the mission of the organisation, namely: "Protection of man, society, future generations and the environment from harmful effects of ionizing radiation." To achieve its mission, the NRA is governed by internationally accepted principles of nuclear safety and radiation protection, and constantly strives to improve its efficiency through implementation of internationally recognized good regulatory practices.

Powers and responsibilities of NRA are generally determined in Art. 5 of the Act on safe use of nuclear energy· ASUNE identifies as key functions of NRA licensing activities, implementation of regulatory control, assessments and safety analyses, development of regulatory requirements, maintaining emergency preparedness and international co-operation of Bulgaria in the area of its

competence. In addition, it clarifies that NRA Chairman shall exercise also other powers conferred upon it by legislation.

Analyses of the functions and responsibilities of the NRA made after the accident at Fukushima Daiichi indicate that no actiona are needed to improve the independence of the regulatory body.

4.3. Overview and improvement of aspects

Review of emergency preparedness and response and the corresponding planned improvements are given in theme 5 below. As milestones should be an noted the review and revision of the Regulation on emergency planning and emergency preparedness at nuclear and radiation accident, updating the external emergency plan and updating of the internal emergency plan of Kozloduy NPP.

4.4. Improvement of openness, transparency and communication

The NRA recognizes that an open dialogue with all stakeholders, transparency of our actions and decisions and public access to information are key issues for the effectiveness of regulatory activity. At the website of the NRA can be found much valuable information on nuclear safety and radiation protection, as well as the activities of the NRA. Accessible are public records of licenses and permits for nuclear facilities and activities with sources of ionizing radiation, licenses for specialized training and licenses for activities involving sources of ionizing radiation and operation of nuclear facilities.

The NRA maintains current public information about all events at nuclear facilities and events related to sources of ionizing radiation. The NRA has the task of ensuring the timely information to the media about everything happening in the field of nuclear safety and radiation protection. Improving communication between the expert language of specialists and that of the average person on such an important topic is a challenge. For this purpose, the NRA regularly organizes training seminars for journalists, which traditionally involve representatives of all the national media and experts in public relations of concerned agencies.

Analyses show that so far NRA successfully handle the complicated task of ensuring timely information to the media and public about everything happening in the field of nuclear safety. The ambition of the NRA is to provide the right information and messages and to support their proper understanding of the media and delivery to the public. In addition, it should be noted that the NRA regularly organizes training seminars for journalists, which are traditionally involved as representatives of all the national media and experts in the concerned public relations agencies.

In addition, it should be noted that the IAEA IRRS mission found that: "The NRA has a clear policy of transparency and openness with the public, which includes providing information on safety-related events and the role of the NRA during emergencies."

4.5. Safety reassessment and action plans following the accident at the Fukushima Dai-ichi

Following the nuclear accident at the Fukushima Daiichi, the world community has taken steps to analyze the causes and take lessons learnt from the event. As a member of the European Union, Bulgaria participates in the safety review of all nuclear facilities based on a comprehensive and transparent risk assessment (stress tests). The Results of the safety reassessment and of the extraordinary review on the CNS were merged into the National Action Plan. The National Action Plan for Bulgaria provides 63 measures aimed primarily at increasing the resistance to external impacts, severe accident management and emergency preparedness. It is planned the majority of the measures to be implemented by the end of 2014.

In connection with the control of the plan implementation, at the NRA was established a Task-force-group under the leadership of the Vice-President. The aims of the Task-force-group are: receiving and analyzing objective information on the technical content, the status of implementation and documentation of results of the measures provided for in the plan. The

Implementation of the measures is monitored by the NRA inspectors carrying out different types of inspections relating to control activities of the NRA.

Topic 5: Emergency Planning and Preparedness

5.1. Update of emergency plans

The National Disaster Protection Plan, adopted in 2010, is supplemented with National Emergency Plan on Oil Floods in the Black Sea, adopted in 2011; Part 3: Off-site Emergency Plan for Kozloduy NPP, last amended in 2012; Part 1: Protection During Earthquakes and Part 2: Protection During Floods, adopted 2012.

Following the Fukushima Dai-ichi NPP accident, was made an analysis of the scenarios of severe accidents, which showed the need to extend the scenarios, and include accidents that occur simultaneously to all facilities on the site, combined with natural disasters. Measures are planned in the National Action Plan of the Republic of Bulgaria (2012).

The last update of the on-site Emergency Plan of Kozloduy NPP was conducted in June 2013.

5.2. Planning and conducting national drills

Detailed information on planning and conducting national drills is presented in the text under Article 16.

5.3. Improvements in radiation monitoring and the ability to communicate

Radiation monitoring In the Republic of Bulgaria is performed by 5 departments:

- Environment Agency to the MEW, maintains the National Automated System for Continuous Monitoring of Gamma Background (BULRaMo system);
- National Centre of Radiobiology and Radiation Protection at the Ministry of Health, it carries out the measurement of gamma background;
- General Directorate "Fire Safety and Civil Protection" to the Ministry of Interior, it measures gamma background of 363 posts throughout the country;
- Kozloduy NPP measures gamma background at the site and in the area of precautionary protective action planning zone through an Automated Information System for Off-site Radiation Monitoring (AIS VRK"Berthold"), which is integrated with the BULRaMo system through an Automatic Information System for Radiation Monitoring of Settlements in the Urgent Protevtive Action Planning of NPP;
- Institute for Nuclear Research and Nuclear Energy (INRNE) to the BAS takes measurements of peak Musala (Rila mountain) and on the territory of the institute and the research reactor site.

Following the Fukushima Dai-ichi NPP accident an analysis showed the need to upgrade the efficiency of BulRaMo system. As a result of this analysis is a measure is planned in the National Action Plan of the Republic of Bulgaria (2012).

The Republic of Bulgaria has substantial experience in the use of communications during emergency exercises and actual emergency situations. Under national law communications are provided by the Minister of Transport, Communications and Information Technology (MTCIT). The Ministry of Internal Affairs uses "TETRA" system type for providing communication to the emergency teams, which is different from that provided by the MTCIT. This ensures redundancy of communications. In order to improve the communication and interaction between the operator and national structures in an emergency, the Kozloduy NPP is in the process of implementation of a technical solution to integrate the plant into the national system "TETRA" type.

5.4. Aspects of the recovery phase

The External Emergency Plan of Kozloduy NPP addresses the actions after the accident, i.e. the phase of recovery and return to normal work and life, including radiologic assessment, establishing of criteria and mechanisms for effective decision making for long-term protective measures, control and management of contaminated goods, relocation, communication and information, recovery, compensations and more. The aim is to create an organization to ensure adequate long term actions aimed at restoring the affected areas, imposing the performance of activities of high scope and long duration. The protective measures shall be implemented by long-term protective measures teams that are part of the Integrated Rescue System.

The Management of restoration activities is based on an analysis of possible risks. In advance is not possible to foresee all potential risks, that is why at planning and organizing restoration activities is taken into account the specific situation, i.e. in each case is applied a separate approach (case by case approach).

5.5. Suitability of the centres for emergency response and shelters

The Emergency Management centre (EMC) and the facilities for shelter, located in the emergency planning zone have independent power sources and independent filter ventilation system. The National Action Plan of the Republic of Bulgaria (2012) forsees construction of off-site ERC (outside the KNPP site), protected from external impacts, including radiological ones.

Topic 6 - International cooperation

6.1. Peer reviews

A country's ability to maintain an acceptable level of safety of its nuclear facilities, including a mechanism to overcome or reduce the occurrence of adverse effects contributes to improving safety, including in other countries. Periodic self-assessment and peer reviews are form of international cooperation, aimed at achieving this goal. Bulgaria traditionally has hosted similar forms of cooperation in the operating, as well as in the regulatory practice. National legislation promotes self-assessment and peer reviews. An example is the included in the ASUNE requirement these activities to be conducted at least every ten years, not excluding the possibility to be done in shorter periods. For the period 1990 - 2013 Bulgaria has hosted 30 peer reviews through the IAEA, EU and WANO in the field of the safe operation of nuclear facilities and regulatory activities (Appendix 3 - list of missions).

Meanwhile many Bulgarian experts have participated in IAEA peer reviews in countries in Europe, Asia, Africa and South America as members of the review missions of regulatory practices (IRRT / IRRS), of operational safety (OSART), physical protection of nuclear facilities and nuclear material (IPPAS), radiation safety and protection of sources of ionizing radiation (RaSSIA), preparedness for action against nuclear terrorism (INSServ), emergency planning and preparedness (EPREV).

In the context of the EC and ENSREG requirements after the Fukushima accident, Bulgaria hosted a peer review of stress tests and gave its experts for the same reviews in other countries involved in this process.

6.2. Optimization of the global nuclear safety regime

Bulgaria shares the view expressed during the Second Extraordinary Meeting on the CNS that the increasing number of international meetings, assessments, peer reviews, sets high demands on the existing human resource, which may become counter productive. The need to optimize reviews, to reduce duplication of topics and initiatives is obvious and that is the main task of the management

of the organizations, which provide these services. Meanwhile the coordination of future reviews with the operator will benefit the overall preparation and achievement of goals.

6.3. Strengthening of communication mechanisms through regional and bilateral cooperation

Cooperation agreements on a bilateral or multilateral basis are an important mechanism to communicate with the international community. This mechanism is particularly popular and appropriate to maintain cooperative relations with neighbouring or nearby countries. After the Fukushima accident and in accordance with the conclusions of the extraordinary meeting on the CNS, and the requirements of the IAEA Action Plan on Nuclear Safety, the NRA analyzed the existing cooperation agreements negotiated by the Republic of Bulgaria with almost all neighbouring countries. In order to improve the interaction in emergency situations, regional initiatives have been taken in the preparation and signing of new agreements at the level of regulatory authority with Serbia, Greece and Romania. It is expected that these agreements will be signed in 2013 and 2014. A procedure for the signing of an agreement with the regulatory authority in Russia is ongoing. Similar documents were signed earlier with the regulatory authorities of the United States and Macedonia.

6.4. Effectiveness of feedback mechanisms

The NRA has created a mechanism for analyzing national and international experience in both the operation of nuclear facilities and regulatory practice. The purpose of this activity is to use different sources to identify lessons learned and good experience in activities to improve nuclear safety. As an example may be mentioned the system for reporting the results of the participation of representatives of the regulator in various international forums such as making proposals for the incorporation of international experience in the activities of the NRA. These reports are distributed through the internal website to the staff and by an order of the Chairman of the NRA, in accordance with an internal procedure, is ensured their implementation. This activity was reported as "good practice" by the IAEA IRRS mission to Bulgaria, conducted in April 2013.

In addition, the NRA studies the experience of foreign regulators, operators and other interested parties and together with the documents of the IAEA, EU and the OECD, as well as the international best practices ensures their transposition into national legislation and the governing documents. Information is reported and received through the international networks of the IAEA and EU in operating experience, monitoring of radioactivity and radiological data exchange - IRS, ECURIE, EURDEP.

6.5. Strengthening and extending the use of the IAEA safety standards

Significant parts of the safety standards of the IAEA are incorporated into the Bulgarian legislation. Governmental policy is to monitor and to enforce the requirements of the international documents, including these on safety, and by the Law on Normative Acts to carry out the procedure for their transposition in the legislation. Where necessary amending of the legislation in the field of nuclear and radiation safety should always be considered and accounted with the latest safety requirements of the IAEA. A standard practice and approach in the licensing process is the NRA to monitor whether the licensee (or the applicant for a licence) justifies safety, following the internationally accepted practices reflected in the IAEA standards. In this way, the regulator shall be sure in the operator's ability to maintain a high level of safety. Bulgaria also has been harmonizing its national legislation with the safety references levels developed by WENRA.

It is necessary to note that the Bulgarian experts are members of the Standards Committee of the IAEA in nuclear safety (NUSSC), Radiation Protection (RASSC), Safe Transport of Nuclear Material (TRANSSC) and Radioactive Waste Safety (WASSC). This allows for direct involvement in the preparation of standards on the one hand, and on the other - the timely coverage of new international requirements into national legislation.

LIST OF ABBREVIATIONS

AAPS	Automatic Aerological Probing System
ACP	Auxulliary control panel
ALARA	As Low As Reasonably Achievable
ASUNE	Act on the Safe Use of Nuclear Energy
BAS	Bulgarian Academy of Sciences
BDBA	Beyond Design Basis Accident
BEH	Bulgarian Energy Holding
BNRP	Basic Norms for Radiation Protection
CM	Council of Ministers
CNS	Convention on Nuclear Safety
CPPNM	Convention on Physical Protection of Nuclear Material
CSS	Control Safety Systems
DG	Diesel Generator
DGFSCP	Directorate General Fire Safety and Civil Protection
DGS	Diesel Generator Station
DPA	Disaster Protection Act
DSFSF	Dry Spent Fuel Storage Facility
EC	European Commission
ECURIE	European Community Urgent Radiological Information Exchange
EEA	Executive Environment Agency
EIA	Environmental Impact Assessment
ENSREG	European Nuclear Safety Regulators Group
EO	External Organization
EOP	Emergency operational procedure
EP	Emergency Plan
EP-1	Electricity Production-1 (units 1-4)
EP-2	Electricity Production-2 (units 5 and 6)
EPA	Environment Protection Act
ERC	Emergency Response Centre
EU	European Union
EURDEP	EUropean Radiological Data Exchange Platform
FSS	Full-Scope Simulator
IAEA	International Atomic Energy Agency
IMS	Integrated Management System
INES	International Nuclear Event Scale
IRRS	International Regulatory Review Services
IRS	International Reporting System
KNPP	Kozloduy NPP
LTZ	Long-Term precautionary measures Zone
MCR	Main Control Room
MEE	Ministry of Economy and Energy
MEW	Ministry of Environment and Water
MH	Ministry of Health

MI	Ministry of Interior
MIA	Ministry of Interior Act
MMI	Man-Machine Interface
MMS	Meteorological Monitoring System
MP	Modernization Programme
MS	Management System
MT	Management Team
MWL	Maximum Water Level
NAP	National Action Plan
NCRRP	National centre of radiobiology and radiation protection
NDPP	National Disaster Protection Plan
NEC	National Electricity Company
NF	Nuclear Fuel
NORM	Naturally Ocurring Radioactive Material
NPP	Nuclear Power Plant
NPT	Non-proliferation treaty
NRA	Nuclear Regulation Agency
NS	Nuclear Safety
OLC	Operating Limits and Conditions
OSART	Operational Safety Review Team
PAMS	Post Accident Monitoring System
PAO	Planned Annual Outage
PAZ	Precautionary Action Zone
PIE	Postulated Initiating Events
PSA	Probabilistic Safety Analysis
PSR	Periodical Safety Review
PSS	Plant Shift Supervisor
QA	Quality Assurance
QAS	Quality Assurance System
QMS	Quality Management System
RA	Restricted Area
RAW	Radioactive Waste
RBNRP	Regulation on Basic Norms for Radiation Protection
RG	Regulatory Guides
RI	Reactor Installation
RP	Radiation Protection
RPCMA	Rules of Procedure of the Council of Ministers and its Administration
SALTO	Safe Long Term Operation
SAMG	Severe Accident Management Guides
SAR	Safety Analysis Report
SBEOP	Symptom-Based Emergency Operating Procedures
SC	Safety Culture
SDVC	Steam Dump Valve Controller
SE RAW	State Enterprise Radioactive Waste
SEWRC	State Energy and Water Regulatory Commission
SF	Spent Fuel

SFP	Spent Fuel Pool
SFSF	Spent Fuel Storage Facility
SG	Steam Generator
SIR	Sources of Ionizing Radiation
SP	Supervising Physicist
SPDS	Safety Parameters Display System
SRS	Safety-Related Systems
SS	Safety Systems
SSC	Structures, Systems and Components
TD	Technical Design
TSO	Technical Support Organizations
UPZ	Urgent Protective Action Planning Zone
URS	Unified Rescue System
USC	Ultrasound Control
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulatory Authorities
WWER	Water-Water Energy Reactor