Annex No.2 to ar.6 of REGULATION for
conditions and order of EIA implementation
(promulgated SG, issue 25 of 18/03/2003).

Information about the EIA need assessment.
Investment proposal: "Extension of Kozloduy NPP
Units 5, 6 operational life"

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II. Investment proposal characteristics:

1. Summary of the proposal:

The purpose of the investment proposal is to provide conditions for Kozloduy NPP Units 5, 6 operational life extension (OLE). Therefore, deadlines need to be justified and necessary measures - implemented to provide for the lifetime of structures, systems and components (SSC) until expiration of the current Operating Licenses, and in perspective of the long-term operation for yet another 20 years. No constructional modifications of reactor facility have been envisaged during the implementation of the investment proposal. The usage of the reliable and efficient technology of the nuclear water-water reactors for electricity generation shall continue by using the capacity of the utilities available at Kozloduy NPP site, and the experienced and highly qualified personnel of the company.

The prerequisites that facilitated the acceptance of the decision made for Kozloduy NPP Units 5, 6 OLE are as follows:

- the reliable operation of the energy units for the elapsed operational period;
- the implemented and planned for implementation scopes of activities for safety and reliability enhancement;
- the worldwide beneficial experience from operational life extension of reactor facilities of a given type;
- the economic expedience of operational life extension;
- the preliminary positive forecast for the rest lifetime of Kozloduy NPP Units 5, 6 main components, received as outcomes from the complex assessment of the condition and rest lifetime assessment of structures, systems and components of Kozloduy NPP Units 5, 6.

2. Justification of the need of the investment proposal.

Currently, more than 25% of the operating energy units in the world have been operated for more than 30 years. All leading countries in the field of nuclear energy implement or plan different programmes for operational lifetime extension up to 40, 50 or 60 years. The implementation of such programmes is

a prerequisite for receiving respective operating licences.
Kozloduy NPP Units 5, 6 operational lifetime is specified for 30 years in the design documentation, and it will expire in 2017 for Unit 5, and respectively in 2021 for Unit 6.
Kozloduy NPP Unit 5 is operated in compliance with Licence Series: E, registration No.03000, issued on 02.10.2009, with validity period by 05.11.2017.
Kozloduy NPP Unit 6 is operated in compliance with Licence Series: E, registration No.03001, issued on 02.10.2009, with validity period by 02.10.2019. It is necessary to renew Unit 6 operating licence in 2021 to extend the time for the implementation of the activity until the expiry of its lifetime. Therefore, in its capacity of a licensee, Kozloduy NPP needs to apply for licence renewal before the BNRA in compliance with the regulatory requirements.
The implementation of Kozloduy NPP intention to operate Units 5, 6 beyond their lifetime expiry date shall depend on meeting the requirements as specified by the Bulgarian Nuclear Regulatory Agency for the respective Unit. These requirements set the need to perform a complex assessment of the actual condition of the respective unit for the purpose of:

- to identify the residual life of structures, systems and components (SSC) which remain in operations and the needed SSC which need to be replaced with new ones;
- justification of the new operational life;
- development and implementation of a programme for preparation of the respective unit for operational life extension.

The condition for renewal of Units 5, 6 operating licences upon expiry of their design lives, Kozloduy NPP needs to apply for renewal according to the regulations of the Safe Use of Nuclear Energy Act, which also includes available and approved by the Ministry of Environment and Waters Environmental Impact Assessment Report or a statement declaring that such an assessment is not necessary.

3. Connection with other activities - existing and approved by a development or another plan.
None.

4. Similar information for considered alternatives.
The investment intention is analysed to justify the expediency of the investment expenditure for the assessment and implementation of measures for Kozloduy NPP Units 5, 6 operational life extension. In order to assess the project expediency, the investment is compared as considered in three options, and by comparing the advantages in a costs-benefit analysis. The following options were considered:

- operational life extension with 20+10 years,
- operational life extension with 20+10 years,
- alternative option - shutdown of Unit 5 and Unit 6 upon operational life expiry.

Operational life extension of Units 5, 6 with 20+10 years.
Units 5, 6 operational life extension is an issue of great public importance which requires considerable finance on one hand, and on the other - a longer period for implementation.
The effective implementation of the measures, deriving from the actual condition and rest lifetime assessment of Units 5, 6 equipment and facilities shall be the reason for Kozloduy NPP Units 5, 6 operating licenses renewal which will ensure a considerable growth of electricity generation and economic benefits for the company and end users for a long period of time (at least for 20 years).
This option is based on the idea that upon making the investments, the operational life of Units 5 and 6 can be extended with 30 years (20+10). The implication here is that once conditions for extension of Units 5, 6 design life with 20 years, the plant can make investments to extend the operational life of these units with another 10 years.
This option is based on Kozloduy NPP Units 5, 6 optimization of production (power uprate to 104%), extension of their operational life with 20+10 years and the volumes of production associated with that, earnings and expenditures in a long-term perspective by year 2051.
Advantages of this option, if selected:

- Possibility to provide for the production of 480 713 GWh electric power for the period after the

extension of units operational life (2018-2047 for Unit 5 and 2022-2051 for Unit 6). For the purpose of comparison - the electric power produced by Units 5 and 6 from their commissioning to 31.12.2012 is 253 650 GWh.

- It will decrease the social consequences of Kozloduy NPP plc Units 5, 6 shutdown - in terms of compensatory payments and secondary unemployment in the region;
- Liabilities under the credit, guaranteed by the state, for Units 5, 6 Modernization by year 2021 are served. The company will be able to pay the instalments due under the credits for modernization, and the risks for the state to pay the debts as a guarantor are limited when the facilities are in operation.
- Accumulation of means in the funds Radioactive Waste and Nuclear Facility Decommissioning from the instalments deducted from Kozloduy NPP plc.
- The commitments related to the provision of the needed means for spent fuel management are pursued in compliance with the approved by the Council of Ministers "Strategy for Spent Nuclear Fuel and Radioactive Waste Management by Year 2030."
- The principle of not burdening the future generations by transferring considerable financial obligations on them is observed.
- The objectives set in the energy strategy of Bulgaria by 2020 are met.
- The role of Kozloduy NPP plc as major employer in the region and the largest contracting authority under the Public Procurement Act.

Operational life extension of Units 5, 6 with 20 years.

Option 2 is based on Kozloduy NPP Units 5, 6 optimization of production (power uprate to 104%), extension of their operational life with 20 years and the volumes of production associated with that, earnings and expenditures in a long-term perspective by year 2041.

The advantages of this option are identical with the ones of the previous option.

- Possibility to provide for the production of 326 000 GWh electric power for the period after the extension of units operational life (2018-2037 for Unit 5 and 2022-2041 for Unit 6).

Shutdown of Unit 5 and Unit 6 upon operational life expiry.

In case of a failure to implement the envisaged activities, Kozloduy NPP will not obtain licenses for the operation of Units 5, 6. In that case Unit 5 will be operated by year 2017, and Unit 6 - by year 2021 on the condition that the operational license is extended for the period 2019-2021.

Economic arguments firmly support the extension of Kozloduy NPP Units 5, 6 operations. Direct losses for the State Budget and electricity consumers are expressed in the following:

- Shutdown of Units 5, 6 which are the largest facilities for production of electricity of the lowest prime cost shall result in a serious drop of electricity production in Bulgaria with ~ 16 TWh on an annual basis which constitutes 30-35% of the total electricity generation in the country.
- The electric power balance of the country and the region will get worse, since Units 5 and 6 provide the main quota of the electricity export.
- It will seriously compromise the achievement of the objectives set in the Energy Strategy of Bulgaria by 2020 by: jeopardizing the security of energy supplies, making difficult the maintenance of safe, sustainable and reliable energy system, a downtrend the competitiveness of the national energy industry both on the regional and the future integrated European energy market, making it impossible to achieve a 20-per cent decrease of harmful greenhouse gas emissions as of 1990.
- Deterioration in the business environment and investment climate due to electricity price increase.
- Direct losses for the State Budget - undertaking the expenses for radioactive waste management and decommissioning of Units 5 and 6.
- Less revenues in the State Budget from taxes on the incomes, dividends, health, social and labour insurance funds, VAT to the price of goods and services, etc.
- Risk of failure to attain the objectives set in the Updated Strategy for Spent Nuclear Fuel and Radioactive Waste Management by Year 2030 due to lack of resources.
- The increase of the costs for radioactive waste management and the related increase of the weight on the national budget in long-term aspect (more than 40 years).

- The electricity price for the protected consumers will raise significantly after the removal of the only cheap and price-acceptable balancing capacity as Kozloduy NPP plc and the increase of the share of the electricity generated by the Renewable Energy Sources in the national energy mix shall result in the occurrence of serious social and economic consequences. Units 5 and 6 shutdown will directly affect all consumers through electricity price raising and through the supply chain will reach the end user which will directly affect both people and prices of the other products which prime cost considerably includes the electricity price. On a later stage, the lack of resources for decommissioning shall be covered by the State Budget which will again affect the Bulgarian taxpayer.
- From ecological point of view, Units 5 and 6 shutdowns will result in the increase of greenhouse gases and will deteriorate the energy mix due to the share of the electricity generated by Kozloduy NPP - non-emission electricity generation.

The discussed main versions consider not only the financial benefits for the company and budget but also the benefits for the public. In this regard, the expected benefits and results of the investment realization justify the expenses to be incurred.
The Bulgarian nuclear energy section is a key section for ensuring the future electricity supply for both the national and regional economies. The safe operation and economic parameters ensure the positive economic, social and ecological effect for the country.

5. Site location including the area required for temporary activities to be performed during construction.
No construction activities will be performed. The replacement and modifications of conventional equipment will be performed on the Kozloduy NPP site and no other areas will be needed.

6. Description of main processes (design data), capacity.
With regard to the implementation of the investment intention, the activities planned by Kozloduy NPP on Units 5 and 6 lifetime extension will be performed in two stages:
First Stage: A complex assessment of the actual condition of the respective unit for the purpose of:

- Developing a set of organizational, technical and methodological measures to extend the operational lifetime of Units 5 and 6 and ensure the compliance with the up-to-date regulatory and technical requirements for the nuclear power plants in operation.
- Justifying the terms and measures required for the provision of SSC lifetime up to the expiry date of the existing Licences in 2017 - for Unit 5 and 2019 - for Unit 6 respectively, putting the long-term operation for the next 20 year for each unit in perspective.

Second Stage: Implementation of the Programme for Preparations for Plant Life Extension (PLEX).

- The programme for preparations for plant life extension (PLEX) is a condition set in the Units 5 and 6 Operating Licences and is prepared following completion of the complex assessment of the actual condition and rest lifetime assessment.
- Following approval of the Programme by the BNRA, it is launched and its deadline is 2016 - for Unit 5 and 2018 - for Unit 6. The Programme implementation will include replacement of the determined main components. This is connected with the provision of supplies and services in compliance with the regulatory procedures and with the relevant financial and time resources.

Following completion of the Programme for preparations of Units 5 and 6 life extension and prior submittal of an application for the issuance of a new operating licence, the following activities shall be performed in addition:

- Detailed Periodic Safety Review (PSR) will be performed in connection with Units 5 and 6 operating licence renewal;
- Preparation and submittal to the BNRA a Safety Analysis Report confirming the possibility for operating the units within the justified period of time;
- Preparation of the documentation for licence renewal;
- Submittal of an application for Units 5 and 6 operating licences renewal;
- Units 5 and 6 licence renewal.

7. Layout of a new or change in the existing transport infrastructure.
The transport infrastructure is not planned to be changed.

8. Time Schedule including construction, operation, phases of shutdown, restoration and further usage.
In order to provide for the conditions for Units 5 and 6 lifetime extension, the activities included in the Programme for preparations for the plant life extension, ID. No. PLEX-DQA-KNPP-0003-01 are implemented.
Kozloduy NPP plc has administrative structures established with specified statute, assigned functions, clearly distributed rights, obligations and responsibilities, which are stipulated by the relevant documents related to the environmental aspects during and following implementation of the investment proposal.

9. Proposed construction methods.
The implementation of the investment intention is not related with construction works.

10. Natural resources to be used during construction and operation.
The implementation of the investment proposal is not related with the use of natural resources in quantities larger than the ones used up to now.
The quantity of the service water used is not expected to be increased following Units 5 and 6 operational life extensions.
Construction of new water discharge and water intake facilities is not planned.
The volumes of cooling, industrial and sewage waters to be used during the extended operation of the units shall not exceed the regulatory volumes specified for Kozloduy NPP plc pursuant to the Water Act. In this regard, Kozloduy NPP has the following permits:
Permit No.0562/01.10.2001 for using the water from the Danube (cooling and demineralized water). Permitted water flow rate - up to 180 m^3/sec; 179,84 m/sec of which - for cooling and 0,16 m/sec - for deminieralized water treatment. Water usage limit - up to 5000 million m^3/y 4997 million m^3/y of which - for cooling and 2,68 million m^3/y for demineralized water treatment.Expiry date: 14 March 2015.
Permit No. 13120037/22.11.2010 г. for discharge HC 1 and HC 2 of the Danube (mainly cooling water) maximum permitted water flow rate up to 3280 million m^3 /y. Expiry date: 15 December 2015.
Permit No. 13750001/20.04.2007 with a Decision for amendment No.1132/05.08.2013 г for sewage water discharge in the Main drainage canal (MDC) (site combined sewage water). Expiry date: 20 April 2016.
Maximum permitted water flow rate discharged in the MDC - up to 3 948 672 m^3/y.
The water volumes of the used and discharged waters by Kozloduy NPP for the past three years are as follows:

Year	**Intake water from the Danube, m^3**	**Discharged water in the Danube (using HC-1 and HC-2), m^3**	**Discharged water in the Main Drainage Canal, m^3**
2010	2 529 653 036	2 416 455 618	2 664 576
2011	2 660 788 410	2 524 466 338	2 591 049
2012	2 415 902 580	2 344 520 203	2 910 441

11. Waste expected to be generated - types, quantities and treatment
The activities planned by Kozloduy NPP on the implementation of the investment proposal will be performed in two main stages. The first stage includes a complex assessment of the actual condition of the respective unit for the purpose of developing a set of organizational, technical and methodological measures to extend the operational lifetime of Units 5 and 6.
The results of the complex assessment (documentation review, operating history, ageing mechanisms, defects and failures, established maintenance and repair system (M&R), water chemistry, visual

inspection) allow to draw the conclusion that the technical condition of the SSC of the systems, civil structures, buildings and facilities comply with the requirements of the existing plant operating, design and construction, and regulatory documentation.

The next stage if the investment proposal implementation is the Programme for Preparations for Plant Life Extension. The Programme for Preparations for Plant Life Extension (PLEX) is prepared following completion of the complex assessment of the actual condition and rest lifetime assessment of the structures, systems and components (SSC) of the power units. Depending on the character of the tasks set, 280 activities grouped as follows shall be implemented:

- SSC replacement;
- SSC modification or reconstruction;
- Rest lifetime quantitative assessment and additional analysis performance;
- Maintenance and repair activities;
- Life characteristics management through change in the operating modes in the period of PLEX.

In accordance with the programme prepared, SSC replacement or modification presents about 15% of the activities set in the programme. In the course of programme implementation, insignificant quantity of waste as a result of equipment replacement or modification (mechanical, electrical, I&C) is expected to be generated. The other activities included in the programme are mainly related to analysis performance, update of operating documentation, technical support optimization through long-term planning of maintenance and repair activities, use of component condition diagnostic systems, use of developed documentation for certain types of equipment, insulation and restoration of corrosion-resistant coating, etc. The following types of waste are expected to be generated in the course of programme implementation:

- waste immobilized in landfills for non-hazardous waste - non-hazardous substance bearing construction waste;
- widespread residues - metal, plastic and glass packages;
- treated substances and mixtures - greases and lubricants;
- write-off and/or dismantled equipment - waste of ferrous and non-ferrous metals, plastics, disused electrical and electronic equipment and components, turnings and cuttings of ferrous and non-ferrous metals.

The Company has available the required facilities, equipment and sufficient competent personnel to accomplish the environmental policies and objectives.

Changes in the quantities of non-radioactive and radioactive (solid and liquid) waste as well as the quantities of gaseous and liquid (non-radioactive and radioactive) emissions receiving up to now are not expected during the extended lifetime of Kozloduy NPP Units 5 and 6. This depends on the fact that changes of the main operational sequences and processes are not envisaged as well as increase of the nuclear fuel quantity in the course of units' lifetime extension.

The activities that have been implemented by now and shall be implemented in the course of units' lifetime extension shall comply with the regulatory requirements and terms and conditions of the licences issued to the Company by the competent environmental authorities. The use of appropriate procedures, competent personnel, good practices, materials and products which prevent, limit and/or reduce the harmful impact on the environment will be given an overriding priority while managing the Company.

The quantities and treatment of Kozloduy NPP waste and emissions for the past three years are discussed below in this paragraph.

Non-radioactive waste treatment

Depending on the specifics of the production activity, the following waste categories are included in the scope of control:

- non-hazardous waste to be immobilized in landfills;
- widespread residues;
- treated chemical substances and mixtures including greases and lubricants;
- waste oils and contaminated oil product waste;
- write-off assets and dismantled spare parts and equipment;
- write-off unused materials including materials with expired shelf life.

The non-radioactive waste is collected separately at the plant. The hazardous waste and utilization industrial waste following release from radiation control shall be handed over for further treatment off-site.
The waste that could not be utilized and do not have hazardous features are immobilized in landfills - in the plant own Non-Radioactive Household and Industrial Waste Landfill when the waste have been generated in the Kozloduy NPP protected area and in the municipal landfill of the town of Oryahovo (or another landfill for non-hazardous waste) which have been generated outside this area. A non-radiological monitoring programme is implemented in the course of the Non-Radioactive Household and Industrial Waste Landfill operation:

- Monitoring of waste and underground waters in the Non-Radioactive Household and Industrial Waste Landfill area;
- Monitoring the condition of landfill cells;
- Meteorological monitoring.

Amongst the main objectives of radiation protection is maintaining the harmful impact of ionizing radiation on the public and environment as low as reasonably achievable. Kozloduy NPP plc, in this regard, aims to strictly control the technological processes, prevent the uncontrolled release of radioactive substances to the environment and perform reliable and comprehensive monitoring of the liquid and gaseous discharges to the environment.

Liquid and gaseous radioactive discharges

The exhaust air at KNPP premises in units 5&6 and AB-3 is filtered in order to remove the radioactive substances to levels below the permissible ones, and then it is discharged through the ventilation stacks. The filters that have captured radioactive substances are replaced once they have exhausted their lifetime (manifested as poor purification efficiency or decreased filter permeability). The replaced filters are treated as solid radioactive waste. Releases of exhaust air from units 5 and 6 is organised through the ventilation stacks.

The release of radioactive substances via waste water is performed in a controlled and organised manner. Liquid discharges from Kozloduy NPP are mainly generated from:

- Technology cycle waste water;
- Household waste water, where there is a possibility of radioactive contamination.

Liquid discharges from Kozloduy NPP are monitored as per two parameters:

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

The regulatory limit on public dose exposure due to emissions to the environment is 250 mSv in terms of annual individual effective dose. In order to optimise the radiation protection at Kozloduy NPP, reference levels have been established (50 mSv for liquid, and 50 mSv for gaseous discharges). In compliance with those reference levels, the permissible values for content of radioactive substances in the plant exhaust air and waste waters have been established, and later approved by the BNRA, and agreed by the Ministry of Healthcare and Ministry of Environment and Waters.

In recent years, Kozloduy NPP has successfully implemented several projects with respect to enhancement of the radiation monitoring of liquid and gaseous discharges. Currently, an on-line sampling and reliable measurement of all the radiologically important items is supported at the plant.

Since the accession of Bulgaria to the European Union, the data on the discharges throughout the year have been reported to the European Commission.

Liquid and gas-aerosol emissions to the environment for the period 2010 – 2012

	Aerosols		I-131		RNG		Liquid emissions, excluding tritium	
	MBq	% of reference level	MBq	% of reference level	TBq	% of reference level	MBq	% of reference level
2010	27.9	0.07	65.7	0.2	6.43	0.18	269	0.18
2011	8.42	0.02	120	0.31	7.8	0.21	246	0.17
2012	18.4	0.05	0.12	0.003	0.92	0.02	183	0.13

Note:

In the table with gaseous and liquid discharges, the reference values are those determined by an internal administrative act of the KNPP management, and they have always been more severe than the permissible values defined by the regulatory body.

RADWASTE MANAGEMENT

Radwaste (RAW) management at KNPP covers almost all the activities from RAW generation, through processing, storage, transport and interim storage on-site, except for their transportation off-site the nuclear facility.

Solid RAW

Pursuant to the Regulation on Safety in Radioactive Waste Management, the radioactive wastes generated from the RCA of units 5&6 are assigned category 2. In view of the specificities of the methods employed in RAW treatment, and pursuant to article 7 of the Regulation, additional RAW categories have been introduced by KNPP, in relation to operatively measurable parameters:

- Category 2-I – with equivalent gamma radiation dose rate from 1 μSv/h to 0.3 mSv/h, measured at 0.1 m distance from the surface of the waste;
- Category 2-II – with equivalent gamma radiation dose rate from 0.3 mSv/h to 10 mSv/h, measured at 0.1 m distance from the surface of the waste;
- Category 2-III – with equivalent gamma radiation dose rate exceeding 10 mSv/h, measured at 0.1 m distance from the surface of the waste.

Solid RAW from units 5 and 6 consist of:

- radwaste generated during the daily operation of the units;
- historical RAW, stored at an interim storage facility, located at AB-3.

The Kozloduy NPP approach, adopted since 2005, is focused on transfer for processing by SERAW of all category 2-1 and 2-II RAW currently generated and gradual removal from the storage facilities of the historical RAW backlog. The RAW treatment technology includes compaction, immobilising in a cement matrix and packaging in reinforced concrete containers. In accordance with the treatment technology, the radwaste is divided in compactible and noncompactible waste. The annually generated quantities RAW of category 2-III,

do not exceed 1 m^3, compactible RAW categories 2-I and 2-II - from 400 to 700m^3, and metals - from 10 to 40 t.

The Kozloduy - RAW Specialised Division of the State Enterprise for Radioactive Waste (SE RAW) receives radioactive waste in conformity with acceptance criteria approved by the Bulgarian Nuclear Regulatory Agency (BNRA).

RAW management activities are carried out by administrative structures established with clearly defined statute, functions and tasks, clear allocation of rights, obligations and responsibilities of the two operators on the site (SE RAW and Kozloduy NPP).

Liquid RAW

Pursuant to the provisions of the Regulation on Safety in Radioactive Waste Management, the EP-2 liquid wastes are assigned category 2.

Additional categories have been introduced in connection with the implemented methods for monitoring and treatment of liquid RAW:

- Category 2 - H - with activity up to 3.7E+5 Bq/l.
- Category 2-C - with activity from 3.7E+5 Bq/l to 7.2E+7 Bq/l
- Category 2 - B - with activity exceeding 7.7E+7 Bq/l.

The liquid RAW from KNPP units 5&6 are collected, treated (through evaporation) and stored in tanks. The radioactive evaporation concentrate is stored in 7 tanks made of stainless steel, with a total net volume of 3600 t^3. These tanks are located in AB-3.

Since 2004, evaporate concentrate has been periodically pumped out of the tanks and transferred for treatment, along a pipeline, to the Kozloduy - RAW Specialised Division of SE RAW, located on the units 5&6 site. The evaporate concentrate is treated through cementing, and packaged in a cement matrix inside reinforced concrete containers.

The main document that regulates the management of liquid and solid RAW is the Complex Programme for Management of RAW at KNPP, ДОД.ЕД.ПМ.387. The actions to minimise the generation of liquid and solid RAW are covered by the Programme for Minimisation of Radwaste at KNPP EP-2, 30.РАО.00.ПР.23.

Radioactive waste management facilities

The major facilities for management of non radioactive waste and radioactive waste, as well as of spent nuclear fuel (SNF) that are operated on the KNPP site are as follows:

- Wet Spent Fuel Storage Facility (WSF)
- Dry Spent Fuel Storage Facility (DSF)
- Radioactive waste treatment workshop and radioactive waste storage premises;
- Nonradioactive Household and Industrial Waste Depot (NRHIWD);
- Depots and areas for transitional nonradioactive waste (hazardous and reusable industrial waste) - metal, wood, obsolete electrical and electronic equipment, etc.;

12. Information on the measures considered to reduce the adverse environmental impacts

All the activities while the units are in operation are performed in conformity with the regulatory requirements, the KNPP internal rules, and the good practices in nuclear industry worldwide. The nuclear facilities are operated in accordance with modern standards, criteria and experience of nuclear energy worldwide. To this end, organisational and engineering measures have been envisaged that ensure effective protection of the personnel, public and environment from the harmful impact of ionising radiation.
Kozloduy NPP has introduced, maintained and enhanced a system of activities, actions, and facilities that effectively prevent, restrict and/or mitigate the impacts from the nuclear power plant on the environment, both in radiation and nonradiation aspect.

13. Other activities related to the investment proposal (such as building materials mining, new water mains, energy generation and transfer, residential development, waste water treatment).
No similar types of activities are envisaged.

14. Need for other permits related to the investment proposal.
The investment proposal will be implemented following the issuance of the respective permits of the Bulgarian Nuclear Regulatory Agency (BNRA) as per article 15 of the Act on the Safe Use of Nuclear Energy (ASUNE).
Pursuant to article 15, para 4, section 5 of ASUNE, the BNRA will issue as follows:

- Permit for implementation of the technical modernisations / modifications on the reactor unit related facilities and systems important to safety - individual permits for implementation of the respective technical decisions;
- Permit for introducing of changes to documents that define the internal rules for implementing of activities by the licence-holder, including procedures, programmes, technical specifications and others, as applied to the operating licences for units 5&6.

15. Environmental pollution and discomfort
During the implementation of the investment proposal no environmental pollution or discomfort is expected.

16. Risk of incidents
The licence validity time will be extended in conformity with the ASUNE, on the grounds of the nuclear safety and radiation protection assessments, and the evaluation of the actual status of KNPP units 5&6. To this end, a Safety Assessment Report (SAR) will be developed to confirm the operating capacity of units 5&6 over the new time period claimed for their operating life extension. The report shall be prepared on the basis of the results of the complex assessment of the respective unit, and completion of the actions identified in the programmes for plant life extension.

III. Location of the investment proposal

1. A layout plan, maps and photos, showing the investment proposal boundaries, providing information on the physical, natural and anthropogenic characteristics as well as on the nearby located elements of the National Ecological Network, and the closest lying sites subject to health protection, together with the stand-off distances to them.

The investment proposal will be implemented within the boundaries of the operating power units on-site of KNPP, and, therefore, does not presume any extension of the site area or increase of the plant environmental impact.

A cadastral plan digital model has been attached to show the boundaries of the investment proposal (EP-2 site area).

2. Current land users and their adaptation to the investment proposal site route and planned future land users.

The investment proposal will be implemented within the KNPP site boundaries (land property № 218 as per the map of restored property in the village of Hurlets, Kozloduy Municipality, Vratsa District) and land use outside these boundaries is not envisaged.

3. Zoning or land usage - according to approved plans.

No land usage has been envisaged.

4. Sensitive areas, including sensitive zones, susceptible zones, protected zones, sanitary protection zones surrounding water sources and facilities for drinking and household water supplies, and around mineral water sources used for medical, prophylactic, drinking and hygiene purposes; National ecological network.

4a. Quality and regenerative potential of natural resources.

No impact is expected on the quality and regenerative potential of natural resources.

5. Detailed information about all considered location options

There are no alternatives regarding site selection.

IV. Characteristics of the potential impact (brief description of the possible impacts, resulting from the investment proposal implementation)

1. Impacts on people, their health, land use, material assets, atmospheric air, waters, soil, earth's interior, landscape, natural sites, mineral kingdom, biological variety and its elements, protected areas and single and group immovable cultural values, as well as the expected impact from natural and anthropogenous substances and processes various types of waste and its site locations, risk energy sources, such as noises, vibrations, radiation, and also some GMOs.

The activities envisaged in the investment project include mainly modernisation / replacement of equipment of the same type, and adjustments of part of the equipment connected to the reactor installation. No design changes have been envisaged for the reactor unit. All the modernisations / modifications of the structures, systems and components (SSCs) will be performed following the issuance of respective permits on behalf of the Bulgarian Nuclear Regulatory Agency (BNRA) pursuant to article 15 of the ASUNE (separate permits will be issued for the implementation of individual technical decisions).

This investment proposal is not associated with changes to the design technology schemes and processes.

This investment proposal is not related to increase of the nuclear fuel used.

No construction activities will be conducted. Building of new facilities for water use or waste water drain connection is not envisaged. Building of new waste treatment facilities is not envisaged.

In the course of implementing of the investment project, generation of metal waste is expected from the equipment replacement activity.

In the long-term operation of units 5 and 6, the strengths identified in the KNPP radioactive waste management practices will be implemented, such as:

- availability of own depot for household and industrial waste;
- implementation of programmes for radiation and non-radiation environmental monitoring in the depot area;
- separate collecting and treatment of various waste types (fluorescent lamps, paper, obsolescent disused electronic and electrical equipment, metal wastes, etc.);
- accountability (waste classification, filling in various reporting papers, issuance of periodic and annual reports).

The long-term operation of the units is not expected to cause any changes in the emissions to air and water, or in the generation of liquid and solid radioactive wastes. The current operating experience in long-term operation shows that LTO does not increase service water quantities needed, or the waste waters, and also that there are no additionally generated emissions or radioactive wastes.

During the investment project implementation and afterwards, no changes are expected in terms of KNPP environmental impact aspects, or their quantitative values, and, therefore, there will not be any change in the degree of impact of the plant on the environmental components. Data from KNPP long-term environmental radiation monitoring demonstrate that the registered levels of man-made activity have remained many times below the permissible limits for the respective indicators and sites.

Currently, the environmental radiation monitoring performed at Kozloduy NPP covers all main environmental components such as air, waters, soil, plant vegetation, milk, fish, agricultural crops, etc., within a 100-km radius around the plant, on the Bulgarian territory. The scope and extent of the environmental radiation monitoring together with the monitored parameters have been regulated in a long-term programme that has been agreed with the national control and supervision authorities – BNRA, the National Centre for Radiobiology and Radiation Protection (NCRRP) at the Ministry of Healthcare (MH), and the Environmental Executive Agency (EEA) at the Ministry of Environment and

Waters (MEW). The programme fully meets the national and European normative requirements in the field, including article 35 of the EURATOM Treaty, Recommendations to the EU 2000/473/EURATOM and 2004/2/EURATOM. The annual monitoring scope over the past three years exceeds the respective scope of work of a number of similar laboratories of member-countries of the European Union and other countries across the world. The results regarding the radiation indicators of the analysed environmental samples in the vicinity of the plant are within the background levels. No adverse effects of the nuclear power plant operation have been detected. The human-induced activity levels detected are much below the permissible limits for the relevant indicators and sites. The radiation situation is completely favourable. Facilities from the industrial site of the Kozloduy NPP are also subject to a comprehensive environmental radiation monitoring - ground waters, aerosols, atmospheric depositions, soils, bottom sediments, etc. A comprehensive annual report on the environmental radiation monitoring including an analysis of all the results obtained throughout the year is submitted to the BNRA, NCRRP-MH, and EEA-MEW. The results of the internal radiation monitoring are verified with the independent radioecological studies under programmes of the MEW and NCRRP-MH.

The gamma background levels at the measurement points of the plant industrial site and the measurement points within the 100-km zone taken over the years are fully comparable with, and do not differ from the natural gamma background specific for the area.

Over the years, the atmospheric air man-made activity has had values close to the background ones and very much below the permissible limits according to the Basic Norms for Radiation Protection (BNRP) Regulation of 2012.

The average annual values for total beta activity of the airborne depositions in the monitoring area surrounding Kozloduy NPP are comparable with those of preceding years, and remain within the natural limit range for this parameter.

The monitoring of the radioactive discharges is aimed at preventing the harmful impacts of ionising radiation on the population and the environment. The data from monitoring of the liquid and gaseous discharges to the environment show preservation of the trend for the amount of released radioactive material to the environment to be much less than the regulatory limits.

2. Impacts on the elements of the National Ecological Network, including these located in the vicinity of the investment proposal site

No such impact expected.

3. Impact type (direct, indirect, secondary, cumulative, short-term, medium-term and long-term, permanent and temporary, positive and negative)

No such impact is expected, inclusive of cumulative effect together with other proposals that are at different stages of completion, operation and/or in the process of an EIA procedure.

4. Coverage of the impact – geographic area; affected population; settlements (name, type – town, village, resort; number of inhabitants, etc.)

No such impact expected.

5. Probability of impact occurrence

No such impact expected.

6. Duration, frequency and reversibility of impact

No such impact expected.

7. Measures, needed to be included in the investment proposal for the purpose of prevention, mitigation or compensation of substantial negative impacts on the environment or public health

No adverse impacts expected on the environment or public health.

All the modernisations / modifications of the structures, systems and components (SSCs) will be performed following the issuance of respective permits on behalf of the Bulgarian Nuclear Regulatory Agency (BNRA) pursuant to article 15 of the ASUNE, and pursuant to Section V of the Ordinance on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy.

8. Transboundary Impact of Kozloduy NPP

Kozloduy NPP is a nuclear power plant with a 40-year history. There has been no negative transboundary impact on the territory of the Republic of Romania resulting from the operation of the existing Units 5&6, as well as the operation of Units 1 to 4.

The works of the current investment proposal are to be completely performed within the Republic of Bulgaria. No construction activities will be performed during its implementation. The operational lifetime extension of the two units involves only maintenance activities performed in the existing buildings.

When performing the planned activities, no impact on the environmental components and factors in the Republic of Romania is expected. The requirements of the Bulgarian regulations as well as the European regulations will be followed.

In Kozloduy NPP, there is a set of technical, physical, sanitary and hygiene, and organizational and administrative measures that will be implemented at each stage of the operational lifetime extension and these will be included in all the applicable programmes, measures and systems of Kozloduy NNP in order to provide for and ensure safety of the personnel and the population through minimizing the allowable exposure as much as possible to the lowest acceptable levels.

The industrial site of Kozloduy NPP is located at the distance of 2 km from the bank of the distributory branch of the Danube River and at approximately 3 km from the bank of the water border with the Republic of Romania.

8.1. Non-radiation Aspects

- **Green Gas Emissions to the Atmosphere**

Harmful gas emissions to the atmosphere from Kozloduy NPP are generated when testing diesel generator stations and diesel pumps, equipment is designed for emergency power supply.

Kozloduy NPP has a permission issued by Executive Environment Agency, which is the competent environment authority, for the amount of generated harmful emissions.

Considering the periodicity and duration of diesel installation testing, during the plant operation these emissions can be considered as negligibly low. Over the past three years, the green gas emissions have been as follows:

	2011	2012	2013
Carbon Dioxide Emissions CO_2, t	369	290	230

During the activities for operational lifetime extension of Units 5&6, as well as the extended operation, no significant change in the amount of harmful gases released to the atmosphere is expected.

The amount of the harmful gases discharged to the atmosphere is negligibly low and may have only local impact on the plant site.

- **Water Protection and Management**

Kozloduy NPP uses water for cooling, industrial and other purpose. For any purpose of water usage and usage of water body, Kozlduy NPP has permissions which are issued by the Danube River Basin Directorate for water management in the Danube Region with centre in Pleven according to the requirements of Water Law.

The main water source providing for cooling water and industrial waters for Kozloduy NPP is the Danube River. The annual amount of consumed water is as follows:

Water Consumption (cubic meters):	**2011**	**2012**	**2013**
Cooling Waters	2,660,788	2,415,903	2,244,608
Industrial Waters	2680	1564	1,463

The following facilities are constructed on the plant site:

- Wastewater Treatment Plant;
- Oil Mud Separator for treatment of the waters potentially containing oil products.

The ultimate water intake of all waste waters from Kozlduy NPP is the Danube River. The quality of waste waters is monitored in compliance with the plant non-radiation monitoring programmes independently from the environmental protection regulatory bodies.

The plant monitoring results of 2013 show values of contamination which are lower or equal to those of the water intake.

Parameter	**Unit**	**IER***	**Hot channel 1**	**Hot channel 2**	**Cold channel**
			Average Annual Value	**Average Annual Value**	**Average Annual Value**
Active Response	PH	6,0,-9,0	8,04	7,94	7,84
Total Beta Activity	mBq/l	750	27,25	40,75	-
Non-dissolved Substances	mg/ l	100	22,5	21	23,25
Chemical Oxygen Demand (COD) biochromatic	mgO2/ l	100	9,95	9,07	9,2
Oil Products	mg/ l	0,5	< 0.1	< 0.1	< 0.1
Total Nitrogen	mg/ l	15	1,31	1.3	1,32
Boron	µg/ l	1000	28,22	27,84	28,54
Iron	µg/ l	5000	65,13	40,38	74,74
Zinc	µg/ l	10000	1,83	2,11	1,92
Cobalt	µg/ l	500	< 0.46	< 0.46	< 0.46

**IER – Individual emission restriction for the corresponding parameter according to the permission for waste water discharge from Kozloduy NPP to the Danube River.*

No increase in the water consumption for any purpose is expected for the entire process of operational lifetime extension and extended operation. Increase in the water contamination is not expected. Increase in the waste water amounts is also not expected.

Construction of new waste water discharge facilities is not intended during the implementation of the investment proposal.

Change in the impact of the utilization of the Danube River waters within the Republic of Romania is not expected.

- **Soil**

The activities will be performed within the real estate, a property of Kozloduy NPP, for which there is a state property certificate issued. Therefore, no impact on the land utilization is expected. For the needs of the current investment proposal, the land expropriation or changing the land category is not required. The use of land for the new infrastructure (road, etc.) is not required since the existing infrastructure will be used.

Impact on the soils in the Republic of Romania is not expected.

- **Landscape, Earth's Layers, Natural Monuments, Mineral Variety, Protected Areas, Cultural Heritage**

Since there will be no construction activities during the implementation of the investment proposal for the operational lifetime extension of Units 5&6ll and extended operation, no impact on the landscape, earth's layers, mineral diversity and cultural heritage, and the other environmental components both within Bulgaria and Romania is expected.

- **Population and Human Health**

Negative non-radiation impact on the personnel and part of the environment as a result of general industrial damages and noise is possible to occur. For this type of activities, all techniques and procedures approved at Kozloduy NPP will be applied. A similar impact on the population outside the site of Kozloduy NPP including the Romanian territory is not expected.

8.2. Radiation Aspects

There are two monitoring zones having different radii and surrounding the plant: Precautionary Action Zone - PAZ /2 km (entirely within the Republic of Bulgaria) and Surveillance Zone - SZ/30 km (approximately one third of the area is within the Republic of Romania). Additionally, the reference points within the 100 km area surrounding Kozloduy NPP are monitored, where the impact of the plant operation is not expected. Based on the data from the National Statistics Institute (NSI) as of 1 February 2011 65, 994 people live in the Bulgarian section of the Surveillance Zone, and 75 150 people live in the Romanian section of the Surveillance Zone (Letter of Romanian Environment and Forest Ministry, No. 2830/RP/31-07-2012).

8.2.1. Operation

During the operation of Kozloduy NPP a systematic laboratory and on-line monitoring of the environmental components is carried out.

- **Laboratory Radiation Monitoring**

There are 36 monitored points in total in the Bulgarian section of the Surveillance Zone for the terrestrial ecosystem and 7 monitored points for the aquatic ecosystem, where sampling for laboratory analysis and measurement of the man-induced radionuclide activity is carried out. Samples of air, soil, vegetation, waters and bottom sediments are analysed; radiation background is measured. In addition, samples of milk, locally grown crops are monitored; monitoring of underground waters and drinking water supplies is carried out.

Apart from the plant radiation control, an additional control by the Environment Executive Agency (Ministry of Environment and Waters) and National Radiobiology Radiation Protection Centre (Ministry of Health) is performed.

The measurements and laboratory analyses for radioecological monitoring are carried out in the accredited laboratories according to the ISO 17025 standard and control centres according to the ISO 17020 standard.

Surface Air and Atmospheric Deposits

The radioactivity of the surface air in the radius of 100 km surrounding the plant is monitored by on-line sampling in 11 aerosol stations, whereas the atmospheric deposits are analysed in all the 36 monitored points.

The long year results show that man-induced radioactivity is not detected except for ^{137}Cs and ^{90}Sr, whose radiation background levels are due to the atmospheric nuclear tests and the Chernobyl accident.

Waters

The waters are monitored for the content of total beta activity, tritium, radiocaesium and radiostrontium. Drinking water in the populated areas in the plant vicinity, the town of Kozloduy, village of Harletz and town of Oryahovo is systematically surveyed, as there is no man-induced radioactivity recorded in those areas. The waters of the Danube River (upstream and downstream Kozloduy NPP) as well as other natural water basins (Ogosta River, Shishmanov Val Dam, etc.) do not also contain man-induced radioactivity except for ^{90}Sr, which origin is related the atmospheric nuclear tests.

Soils and Bottom Sediments

The soils within the 100km area of all 36 monitored points, as well as bottom sediments from the natural water basins (the Danube River, Ogosta River, Shismanov Val Dam, etc.) are monitored for their gamma radionuclide and radiostrontium concentration. Traditionally, in all sites low levels of ^{137}Cs and ^{90}Sr are recorded, and their radiation background levels are due to the atmospheric nuclear tests and the Chernobyl accident, and the currently measured values are even lower in comparison with the plant pre-commissioning period (1972 -1974).

Vegetation, Forage Crops and Foodstuffs (Milk, Fish)

The presence of low concentrations of ^{137}Cs and ^{90}Sr in the soils and natural waters which are due to the atmospheric nuclear tests and the Chernobyl accident lead to their natural transfer and their detection in the other items such as vegetation, forage and foodstuff. The lack of other measurable human-induced radionuclides is the evidence for the lack of impact of Kozloduy NPP on these environmental components as well.

The comparison of the recent results and those from the pre-commissioning period of Kozloduy NPP (1972 - 1974) show that there is no impact of Kozloduy NPP on the basic environmental components (minimal impact is localized only within the plant industrial site). Moreover, to date the measured values are lower than those from the pre-commissioning period since a process of "self-decontamination" of natural components is observed (natural radionuclide decay, migration, mixture in the depth, etc.). The detected man-induced radionuclidec in the environment originate from the atmospheric nuclear tests and the Chernobyl accident. This contamination has a comparatively uniform distribution and the concentrations measured in the Bulgarian section should be comparable to those in the Romanian section as long as there is a detected and justified convergence for a large part of the European continent and the Northern Hemisphere in general.

- **On-line Radiation Monitoring**

For the purpose of on-line gamma background radiation monitoring, two systems are established and operated - On-line External Radiation Monitoring System having 10 monitoring stations within the 2 km Precautionary Action Zone and On-line Radiation Monitoring System for the

populated areas with 13 local measurement stations within the Bulgarian section of the 30 km Surveillance Zone. The data are visualised in real time and are sent to the Environment Executive Agency (EEA) in the frames of the National Radiation Monitoring System (NRMS). The NRMS stations are part of the European platform for exchange of radiological data EURDEP and the results from the measurements can be displayed in real time on the Internet).

- **Additional Dose Exposure of the Population within the 30 km zone as a Result of the Kozloduy NPP Operation**

The plant radioactive discharges to the environment are performed in two controlled pathways - through liquid effluent discharges to the Danube River and airborne effluent discharges through the plant ventilation stacks. Since the levels of discharges are comparatively low and comparable to those in the other European nuclear plants having WWER type reactors, the additional doses received by the population within the 30 km zone are negligibly low for both Bulgarian and Romanian sections and these can not be measured by direct instrumentation methods. For this purpose, modelling mathematical methods for assessment of the migration and radionuclide concentrations in the environment are applied. On-line radiation monitoring data at the source (radioactive discharges to the atmospheric and aquatic environments, real meteorological and hydrological data, statistics demographic data, data for consumption of locally grown food and data for electricity generated by Kozloduy NPP for the period of assessment) are used as input data. The applied software is based on the CREAM (Consequences of Releases to the Environment Assessment Methodology) methodology, which is adopted by the European Union (EU) Radiation Protection 72 – Methodology for Assessing the Radiological Consequences of Routine Releases of Radionuclides to the Environment. The contribution of separate airborne components (radioactive noble gases -RBG, long-lived aerosols (LLR), ^{131}I, ^{14}C, ^{3}H) and liquid discharges to the Danube River are considered when assessing the additional individual and collective doses for the population.

The results from the performed modelling mathematical evaluations show that the additional dose exposure to the population in the 30 km zone of the operation of Kozloduy NPP is negligibly low. In 2013, the maximum individual effective dose for the population, total airborne discharges and liquid discharges from Kozloduy NPP to the environment is 4,8 μSv/a. This is only 0.2% of the exposure from the national natural radiation background (2,33 mSv/a), 0,5% below the population limit (1mSv/a) (Basic Radiation Protection Limits of 2012 -Nuclear Regulatory Agency (NRA) and below the clearance limit (10 μSv/a, BRPL of 2012). For the past 5 years the maximum individual effective dose for the population within the 30 km zone ranges from 4 to 7 μSv/a, which is below the clearance level of 10 μSv/a, BRPL of 2012)**.**

Table Additional dose exposure to the population in the Bulgarian section of the 30 km zone from airborne and liquid discharges, 2009-2013

Year	Maximum Individual Effective Dose, [Sv/a]		
	Airborne	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	$1{,}33.10^{-6}$	$4{,}49.10^{-6}$	**$5{,}82.10^{-6}$**
2013	$8{,}77.10^{-7}$	$3{,}87.10^{-6}$	**$4{,}75.10^{-6}$**

The population in the Romanian section of the 30 km zone receives lower individual doses whose specific values will depend on the wind rose, meteorological and microclimatic data for the surveyed area. The winds in the climatic area along the Danube River are oriented mainly towards the river bed. West winds prevail, followed by the north-west winds. The distribution of the individual effective doses in the region surrounding Kozloduy NPP shows that in 2013m, the maximum values are recorded in the south-south eastern direction at the distance of 1,4 km. This is within the 2km Precautionary Action Zone, which is located entirely within Bulgaria.

In 2013, the collective dose for the population in the Bulgarian section of the Surveillance Zone of Kozloduy NPP is 2.0E-2 man.Sv. Considering the demographic factors of the Romanian section of the Surveillance Zone, the collective effective dose for this section is comparable to that of the Bulgarian section. These data are fully comparable to the data from the other PWR reactors worldwide, and are even lower due to the relatively lower density of the population in the region of Kozloduy NPP.

The results of dose exposure to the population are fully comparable to the data from other nuclear power plants in the EU countries, which are published in the European Commission, Radiation Protection No. 176.

With regard to the radiological effects and radiation risk as a result of the operation of Kozloduy NPP there is no risk of development of deterministic effects on the population in the Surveillance Zone of Kozloduy NPP, and the risk of scholastic effects is negligibly low (probability of occurrence of radiation-induced cancer for the whole population is below 5.10^{-8}, and that from the occurrence of genetic deceases is below 2.10^{-9}).

8.2.2. Emergency Situations

Kozloduy NPP has an approved Emergency Plan for operations in response to different emergencies, which plan establishes the emergency organization and arrangements to maintain emergency preparedness, criteria for identification of the emergency situation, emergency planning zones, emergency technical facilities and instrumentation, procedure to take urgent protective actions for the personnel, population and the environment, and interaction with the plant management and local government.

The emergency planning and arrangements to maintain the emergency preparedness at Kozloduy is in compliance with the requirements of the national legislation and international agreements, the Republic of Bulgaria is committed to.

When developing the emergency plan, engineering analyses of the postulated, design basis, beyond design basis and severe accidents for which radioactive releases to the environment have been modelled are used, and consequences for the personnel and the population in the emergency planning zones are assessed. Those studies have been carried out repeatedly for the purposes of the Units 5&6 Unit EIA Report developed in 1994, and EIA Report for Units 1-6 in 1999, in the Safety Analysis Report of Units 5&6, WWER-1000 (B-320) reactors before and after the implementation of the their modernization programme, projects under the PHARE programme for severe management accidents, etc.

Different emergencies and radiological consequences for standard meteorological conditions like class of the mixing layer of the atmosphere, wind speed, precipitation are analysed in the Safety Analysis Report.

The radiological results of the analysed accidents show the acceptability of the risks for the environment.

During design basis accident the evaluation of the individual effective dose for the distances from 5 km to 30 km for the first year after the accident ranges from 3.12E-09 Sv to 1.55E-06 Sv for dry weather periods.

For rainy meteorological conditions, the evaluation of the individual effective dose for the distances from 5 km to 30 km in the first year after the accident ranges from 4.712E-09 Sv to 1.63E-06 Sv depending on the class of the mixing layer of the atmosphere.

The equivalent dose for the thyroid gland for the first year after the accident in dry weather periods for the distances from 5 km to 30 km range from 3.24E-09 Sv to 1.38 E-06 Sv.

The equivalent doses for thyroid gland in rainy weather conditions for the same distance range from 5.18 E-09 Sv to 1.65 E-06 Sv.

These evaluations are from 3300 to 160000 times lower than the intervention criteria established in the regulation of the Republic of Bulgaria.

The analyses of the different emergencies are performed and verified when developing the emergency drills and exercises.

Licensed software products for modelling and assessment of the radiation consequences for the population and the environment in case of an emergency are used. These are the JRODOS (Real Time On-line Decision Making Support System) Programme developed by the Nuclear Technology Institute in Karlsruhe in Germany, which has been used in 25 countries worldwide, ESTE EU Kozloduy (Emergency Source Term Estimation System) Programme developed by the licensed software company ABmerit, Slovakia, which is used by regulatory bodies of Slovakia, Czech Republic, Hungary and Crisis Centre in Vienna, Austria, Hot Spot programme, provided by the IAEA.

In the case of general emergency, the management and coordination of the protective actions for the whole country is established in the National Emergency Plan, Part 3, Kozloduy NPP Off-site Emergency Plan. The national emergency plan contains the procedure and responsibilities of the state authorities for notification of the IAEA and neighbouring countries, structure and functions of the organization of the Integrated Rescue System consisting of all emergency response teams from all ministries, regional and local structures, and trade companies, the procedure for implementation of the urgent and long-term protective actions for protection of the population and the environment.

The national emergency plan describes the radiation monitoring systems in the event of an accident:

- National On-line Radiation Gamma Background Monitoring System BulRaMo, which consists of 26 local monitoring stations for gamma dose rate measurement. The stations are located all over the country; they are operated in on-line mode and send data to the central station of the Environment Executive Agency;

- On-line Radiation Monitoring Information System (ORMIS) with local measurement stations (LMS) in 13 populated areas of the 30 km zone, and 24 monitored points in total at national level, providing on-line radiation background data is installed in the 30 km zone.. The system data is sent through GPRS to the Emergency Response Centre, Nuclear Regulatory Centre and Ministry of Environment and Waters.

- External On-line Radiation Monitoring Information System (EORMIS) of Kozloduy NPP having 10 stations also designed for operation during emergency as recording the values of radiation gamma background and I-131concentration in the surface air is located in the 2km Precautionary Action Zone. These data are sent to the Emergency Centre of Nuclear Regulatory Agency, Plant Emergency Response Centre and National On-line Radiation Monitoring System of Ministry of Environment and Waters.

- The national system BulRaMo transfers the entire information for radiation background in Bulgaria to the European Radiological Data Exchange System EURODEP. These data are displayed in real time for all the EURODEP member countries.

The national system for early notification of and warning for an emergency for the population whose acoustic points are located in 43 populated areas, is installed in the 30 km Urgent Protective Action Zone surrounding Kozloduy NPP.

For the needs of emergency planning of Kozloduy NPP, a local early notification and warning system surrounding the plant has been established and the notification devices are located on site and in 9 populated areas within the 12 km zone.

8.3. Conclusion

- The radiation status of the monitored radioecological parameters within the Surveillance Zone of Kozloduy NPP complies with the requirements of the regulations. In general, the results show radiation background values which are several times below the allowable limits. A long year monitoring justifies the lack of measurable impact of the nuclear power plant operation.

- The dose exposure received by the population within the Surveillance Zone as a result from the Kozloduy NPP discharges is negligibly low (<10 μSv/a), a thousand times below the natural radiation background (2,4 mSv/a) and statutory limit (1 mSv/a).

- The operational lifetime extension of Units 5&6 will not change essentially the operational regime of the nuclear power plant over the years and will not lead to change in the conclusions for the lack of measurable radioecological impact as well as non-radiation aspect of the Kozloduy NPP operation on the local population and the environment within both Bulgaria and

Romania. Cumulative effect of the radioecologoical impact of the operational lifetime extension of Units 5&6 is not expected.

- The existing analyses for *modelling* the radiological effects of the accidents at Units 5&6 have shown that the values of threshold to take urgent protective actions outside the 2 km Urgent Protection Action Planning Zone of Kozloduy NPP Kozloduy are not exceeded. The long term protective action criteria such as temporary or permanentl migration of the population within the 30 km zone (the threshold value of the dose of 1 mSv will not be exceeded) are not met.

- Approved emergency plans are in place in Kozloduy NPP and the Republic of Bulgaria; the arrangements for management and interaction are established, emergency and technical systems and equipment are provided, which ensures the application of prompt and adequate protective actions in case of an accident.

- The investment proposal for the operational lifetime extension of Kozloduy NPP will not result into changes of the main principles and organization of the emergency preparedness in Kozloduy NPP and the Republic of Bulgaria.

- The operational safety of Kozloduy NPP is highly assessed as having good practices by a number of international missions and reviews such as the IAEA, WANO, WENRA, EURATOM, etc.

- Over the past years a number of assessments of the impact of the plant operation and new facilities at Kozloduy NPP site on the environment and the population have been conducted. The impact of Units 5&6 has been a subject to a number of EIA Reports over the past 20 years - Unit 5&6 Modernization Programme EIA Report of 1998, Kozloduy NPP EIA Report of 1999, Dry Spent Fuel Storage Facility EIA Report, Units 1-4 Decommissioning EIA Report, Plasma Melting Facility EIA Report and currently the most recent EIA Report for construction of a new nuclear unit (NNU) at the site of Kozloduy NPP of 2013 is included.

- The nature of the investment proposal *Operational Lifetime Extension of Units 5&6 at Kozloduy NPP* does not provide for construction a new installation on the plant site; therefore, no change in the assessments of the transboundary impact of Kozlduy NPP is expected. The assessment of the environmental impact of Units 1 to 6 was already a subject to the EIA Report of 1999, and the conclusions for the lack of significant impact are unchanged. Transboundary impact of the operation of Units 5&6 as well as the other facilities at the site of Kozloduy NPP is not expected.