

**ENVIRONMENT IMPACT ASSESSMENT
REPORT ON**

INVESTMENT PROPOSAL

**CONSTRUCTION OF NATIONAL DISPOSAL
FACILITY FOR LOW AND INTERMEDIATE
LEVEL RADIOACTIVE WASTE – NDF**

PART XI & XII

11: EXPERTS' CONCLUSION

**12: DESCRIPTION OF DIFFICULTIES ENCOUNTERED DURING
PREPARATION OF THE EIA REPORT**

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11 EXPERTS' CONCLUSION

The present EIA Report – SE RAW's updated investment proposal for the construction of the NDF, in the village of. Harlets, Kozloduy Municipality, Vratsa District is developed by a team employed by "Eco Energoproekt" Ltd. consisting of independent experts with specialized expertise of impact assessment of individual environmental components and factors, who during the preparation of EIA Report have been guided by the principles for reducing and overcoming the environmental and human-health risk and for ensuring sustainable development, according to the environmental quality standards under the current Bulgarian legislation.

The EIA Report describes and assesses the IP impact on the environment and human health, as it contains a detailed analysis, prognostication and impact assessment of all environmental components and factors, as well as of health-hygienic aspects during the construction, operation, closure and subsequent institutional control period of the NDF.

The EIA Report is prepared in accordance with the requirements under the current legislation. Concrete measures are recommended for reducing, preventing or, if possible, most completely removing the identified impacts on the environment and human health, taking into account the synergistic effects of natural background radiation.

The analyzes and assessments of the IP impact level on the individual components and environmental impact factors comprise the comments received during consultations, the opinions and recommendations expressed by the local population concerned, the competent authorities, agencies and institutions during the meetings held as well as the suggested measures for reducing to a minimum the negative impact of the facility with the purpose of preparing the Updated Tender for the structure and content of the EIA Report and, respectively, the preparation of the EIA Report and the Report on impact level assessment, as an integral part to it.

The EIA Report is prepared on the basis of:

- Updated Terms of Reference on the Scope and Contents of the EIA Report – 2014
- Visual inspections and field observations of the NDF site;
- Researches, designs and other documents;
- Inventory, analysis and assessment of the existing information concerning the report preparation (observations and measurements carried out under real conditions, scientific researches, exploration work, publications, reports, literature survey, etc.);
- Consultations with specialists;
- Legal opinions of the environmental protection agencies, opinions and advice from the authorities and institutions, the local population and managements, environmental non-governmental organizations and others;
- Methodologies for assessing and making prognosis of the site impact which are adopted by the experts with specialized expertise of the respective components of the environment and the factors that affect it;
- Legal documents.

Prognostic assessments of the potential impacts from the NDF during the periods of construction, operation and closure on the environmental components and factors, on the workers on the site and on the population in the region are made and measures for reducing, preventing or, if possible, most completely removing the identified impacts are recommended in compliance with all requirements, the European legislation and with the Convention on Environmental Impact Assessment in a Transboundary Context, Espoo.

An ecological analysis of the alternative technological solutions is performed in the EIA Report, and a number of measures and recommendations are proposed aimed at minimizing the impact of the facility on the environment and for providing the employees and the local population with complete safety guarantees during the periods of construction, operation and closure of the NDF, in both radiation and non-radiation aspects.

In case of efficient management of the NDF no significant negative impacts on the environment are expected and the stipulated safety measures guarantee health risk prevention for the workers on the site and the population in the region.

The impact on the specific environmental components and the factors which have an impact on it is assessed as insignificant in terms of the territorial scope of impact within the IP site boundary and the terrain in the immediate vicinity around it, during construction, normal operation and after the NDF closure.

11.1 IP IMPACTS IN A NON-RADIATION AND RADIATION ASPECT

11.1.1 ATMOSPHERIC AIR

11.1.1.1 IN A NON-RADIATION ASPECT

On the basis of the conducted research of the impact on air quality under the investment proposal for **Construction of a National Disposal Facility for low and intermediate level radioactive waste – NDF**, the following conclusions can be made:

- *During construction* - the site **will generate** additional emission load (cumulative effect) due to traffic on the road network in the area. The impact is negligible, of a very low degree to cause any negative effect for the populated areas and ecosystems; A cumulative impact is not expected in view of other environmental components - soil, plant and animal life, and health-hygienic conditions.
- *During operation and closure* - the site **will not have a lasting negative (in annual aspect) or short-term impact** on the air quality in terms of conventional pollutants and fine dust particles. No negative effect on the populated areas and ecosystems is expected.
- **No transboundary impact is expected.**

Based on the above reasoning, as well as on the fact that there are no serious industrial pollutants in the region, it can be concluded that no air quality deterioration (AQD) is expected in the region during the construction of the National Disposal Facility for low and intermediate level radioactive waste.

11.1.1.2 IN A RADIATION ASPECT

11.1.1.2.1 DURING CONSTRUCTION

The NDF site is clean – therefore, the contamination of the atmospheric air with radioactive substances is not possible, which applies to the both disposal technologies.

11.1.1.2.2 DURING OPERATION

Conditioned radioactive waste is disposed - immobilized in a solid matrix and packed in reinforced concrete containers (RCC), which are not a source of radionuclides in gaseous form or in the form of aerosols.

The site is not designed for treatment of radioactive substances, solids or liquids, which may represent a potential source of radionuclides in form of gases or aerosols.

11.1.1.2.3 DURING CLOSURE

The closure of a trench-type disposal facility and a tunnel-type disposal facility is not a source of radionuclides in gaseous form or in the form of aerosols - because the closure-related activities do not entail damage to the package containing the immobilization matrix for radioactive waste.

During the institutional control period the disposed radioactive waste is located within the structure of the disposal facility (reinforced concrete cells in case of the trench-type disposal facility or concrete tunnel linings in case of tunnel-type disposal facility) and is covered with a protective multi-barrier cover and with reverse backfill done with the loess from the site in case of trench-type disposal facility or with the natural massif of the geological environment in case of tunnel-type disposal facility, which prevents the diffusion of radionuclides in gaseous form or in the form of aerosols into the atmosphere.

11.1.1.2.4 CONCLUSION

No impacts on radio-ecological conditions are expected due to the IP implementation, both at the construction phase and during the operational period of the disposal facility. The conditioned radioactive waste package (RCC) and the other engineering barriers of the NDF, ensure that the radioactive substances are not spread and that the environment will be protected from radioactive contamination. No change in the background gamma radiation level and in the atmospheric radioactivity is expected in the area due to the construction of the NDF.

The IP implementation of the NDF on the Radiana site is not a source of radioactive contamination of air, both in case of a "tunnel-type" and the "trench-type" disposal facility.

11.1.2 WATER

11.1.2.1 SURFACE WATER

11.1.2.1.1 IN A NON-RADIATION ASPECT

On the basis of the conducted research investigating in a non-radiation aspect the impact on surface water and wastewater from the investment proposal for the **Construction of a National Disposal Facility for low and intermediate level radioactive waste – NDF**, during operation, the following conclusions can be drawn:

Impact range – local.

Impact type - direct, negative, with a very low level of impact, limited under compliance with the legal requirements and the recommended measures.

Impact characteristics– permanent, long-term, having a non-cumulative effect, regionally sensitive, reversible.

A firm conclusion can be based on the impacts, put under review, of the IP for the NDF, that the impacts from radioactive wastewater on the receiving water body the Danube River during the operation will be local, permanent, reversible, but negligible.

The following prognoses can be made for the closure period and institutional control period:

Impact range – local.

Impact type – direct, negative, with a very low level of impact.

Impact characteristics – permanent, long-term, reversible after the closure.

In a *radiation aspect*, no negative impacts on the aquatic ecosystem in the region and, respectively, on the receiving water body the Danube River are expected during the construction period, the normal operation and the closure of the NDF, in view of the technical solutions proposed for ensuring safety.

11.1.2.1.2 IN A RADIATION ASPECT

➤ DURING CONSTRUCTION

The absence of radioactive sources during construction *rules out possible radiation effect on surface water*.

➤ DURING OPERATION

During the operation of the NDF, non-proliferation of radioactive substances and the environmental protection, the surface water also included, is guaranteed, under the design, by:

- the conditioned radioactive waste package and the other engineering barriers that preserve their integrity and design features regardless of the type of disposal facility- trench-type or tunnel-type;
- the construction of cells for radioactive waste with loess-cement cushion beneath them in case of trench-type disposal facility and the support of the mine pillars in case of tunnel-type disposal facility that are practically water resistant and protected against radiation spread;
- the constructed drainage systems close to the cells that store the radioactive waste containers in case of trench-type disposal facility and the underground pillars in case of tunnel-type disposal facility and tanks to collect water from the drainages on the premises for storage and management of radioactive waste in the General Service Building, in Waste Reception and Buffer Storage Building and etc.

It may be concluded from the stated above that during the operation of the NDF, both in case of trench-type and tunnel-type disposal facility, no change in the radiation indicators of surface water is expected beyond the typical background levels for the region.

➤ DURING CLOSURE

In a radiation aspect there is a long-run difference between the two types of disposal facilities in the post-closure period in terms of the filtration and infiltration coefficients.

- Trench-type – the artificial multi-barrier protective cover is characterized by a very low filtration coefficient of 10^{-9} m/s and extremely low rates of infiltration - below 1.5 L/m^2 per year. These are the design characteristics of the protective covers and of other up-to-date disposal facilities which are currently under operation, as these are also the natural characteristics of already closed disposal facilities.
- Tunnel-type - the natural barrier is characterized by filtration coefficient within the range 10^{-5} - 10^{-6} m/s, which is high enough to let through the infiltration hydraulic flow with hydraulic inflow rate within a minimum of 50 L/m^2 per year, which corresponds to vertical infiltration of 8.7% of the average annual rainfall. The water quantity that can reach the radioactive waste packages is 30 times greater compared to the quantity in case of the trench-type disposal facility.

These characteristics of trench-type disposal facility are also subject to control during the institutional control period and, therefore, no change is expected in the radiation indicators of surface water beyond the typical background levels for the region, as the loss of functionality and the wearing out of the radioactive waste packages, of the engineering barriers and of the concrete structures, prevents radionuclides leak and migration in the geosphere, respectively, also in

groundwater and from there into the receiving water body the Danube River, under the development of normal evolution scenario during the closure of the NDF.

➤ CONCLUSION

In a radiation aspect no change in the qualitative composition of the waters of the receiving water body the Danube River is expected during the construction, operation and closure of the NDF. This applies both at the construction phase and during the life-time of the disposal facility. The conditioned radioactive waste package (RCC) and the other engineering barriers of the NDF, ensure that the radioactive substances are not spread and that the environment will be protected from radioactive contamination. The water quality of the receiving water body- the Danube River and of other reservoirs in the region will remain unchanged, with typical background concentrations.

The IP implementation of the NDF on the Radiana site is not a source of radioactive contamination of surface water, in both cases of "tunnel-type" and the "trench-type" disposal facility.

11.1.2.2 GROUNDWATER

11.1.2.2.1 GROUNDWATER

11.1.2.2.2 IN A NON-RADIATION ASPECT

No impact is expected on the groundwater, including on the sources for potable water supply for domestic purpose for the town of Kozloduy, Kozloduy NPP and for the settlements in the area during construction, during normal operation and after closure of the NDF, since:

- ✓ Possible infiltration of relatively small volumes of domestic wastewater and rain waters containing undissolved substances and contaminants (accidental release of oils, fuel and other pollutants) will be limited to partial penetration through the unsaturated zone under disposal facility, which consists of practically water resistant clayey sediments, but not reaching the groundwater level.
- ✓ The construction of new water abstraction facilities to supply water for the NDF is not envisaged.
- ✓ The implementation of the investment proposal does not affect the natural hydrodynamic regime of the groundwater, i.e. the direction of the filtration flow is not changed. The closest to the Radiana site water abstraction facilities for drinking and household water supply which are located at large distances from it and far away from the direction of groundwater flow (Kozloduy water intake system at about 10 km north-west, water intake facilities near the villages of Harlets, Glozhene, Butan, Kriva Bara, etc. 2÷13 m away south-east and south).

11.1.2.2.3 IN A RADIATION ASPECT

The researches on the groundwater, including the potable water, conducted by Kozloduy NPP, NCRRP and EEA, as well as the results from the predisposal hydrogeological and radiological monitoring on groundwater, carried out in the framework of monitoring program, indicate that:

- The potable water for the town of Kozloduy, Kozloduy NPP and the villages of Harlets and Glozhene is considered to be of good chemical status. Its radiation status is not affected by the operation of the Kozloduy NPP and completely meets the quality standards set by Regulation No 9 of 2001 on the quality of water intended for drinking and household purposes (last amended SG.15/ 21 Feb 2012);
- The impact on the radiation status of groundwater on the site of Kozloduy NPP is only local within certain areas;

- There is no estimable technogenic impact on the radiation status of groundwater outside the site boundary of Kozloduy NPP. The results are within the normal range compared to the norms established by Ordinance No 1/10.10.2007 of the MOEW on groundwater survey, use and preservation (last amended and supplemented SG 28 of 2013);
- No radioactive impact on groundwater is registered within the area of the Radiana site suggested to be the NDF location. All tested radionuclides in the radionuclide inventory under the Pre-disposal Radiological Monitoring Programme have typical background levels.

11.1.2.2.4 CONCLUSION

The Implementation of the Investment Proposal for the NDF construction on the Radiana site will not lead to a significant change in the values of the radiation indicators of groundwater beyond the typical background levels for the region. No significant negative impacts in a radiation aspect are expected in view of the proposed engineering barriers, impeding the radionuclide transfer in the environment and the existing unsaturated zone between the disposal facility and the saturation zone (the aquifer). This is confirmed by the results of mathematical models designed to assess the migration of radioactivity into groundwater by applying modelling of the radionuclide migration in groundwater in the area of the NDF.

11.1.3 SUBSOIL

11.1.3.1.1 IN A NON-RADIATION ASPECT

During the construction period the impact on the subsoil is of low to moderate significance, but it is objectively inevitable. It will be in the form of excavation and fill activities during the construction of the NDF and the auxiliary buildings and facilities. Its territorial scope is within the site boundary as stated in the Investment Proposal. No cumulative and transboundary impact is expected.

11.1.3.1.2 IN A RADIATION ASPECT

During the construction no impact on the subsoil is expected, because of the absence of radioactive sources on the site of the Investment Proposal.

The non-proliferation of radioactive substances and the protection of subsoil and of groundwater according to the design is guaranteed by the erected engineering barriers. Therefore, during the periods of operation and closure of the NDF no radioactive impact on the subsoil is expected.

11.1.4 LAND AND SOIL

11.1.4.1 IN A NON-RADIATION ASPECT

An impact on soil is expected during *the construction* taking place on the site where the facility of the NDF will be built, although this area has not been expediently used before the construction for agricultural purposes. The slope is afforested as anti-erosion measures for protecting the road near the Kozloduy NPP. During the construction some further contamination of the soil with dust is also expected, but it will be temporary.

During the *normal operation* of the NDF no additional impact on the soil from non-radiation factors is expected. The gas emissions from internal combustion engines of the special transport machines are negligible and they will be elevated over short distances on the adjacent lands. No impacts on soil from wastewater and waste are expected .

During *the closure of the disposal facility* the impact on the soil will be short-term - only during the reclamation of the land and its landscape planning that will improve the state of the soil and green areas will have a positive environmental effect on the entire territory .

In emergency situations an impact in two aspects on soil above and around the NDF is expected – an emergency situation on the territory of the disposal facility and one caused by another facility on the territory of the Kozloduy NPP. In both cases the impact will be temporary, as its level will depend on the magnitude of the emergency situation. In a non-radiation aspect the impact on soils will be in the form of an increase of air/dust emissions precipitated at the soil surface, additional mechanical pollution, waste, etc.

No cumulative and transboundary impact is expected.

11.1.4.2 IN A RADIATION ASPECT

11.1.4.2.1 DURING CONSTRUCTION

No impact is expected.

11.1.4.2.2 DURING NORMAL OPERATION AND IN CASE OF OCCURRENCE OF EMERGENCY SITUATIONS

No impacts on the radiation status of the soils within the area of the Radiana site is expected as a result of the IP implementation during the life-time of the disposal facility. The multi-barrier protection of the NDF precludes the radiological impact and the migration of radionuclides in soil cover. The conditioned radioactive waste package (RCC) and other engineering barriers of the NDF, ensure non-proliferation of radioactive substances and environmental protection from radioactive contamination. No change is expected in the values of the radiological indicators of soil beyond the typical background levels for the region due to the implementation of the NDF.

11.1.4.2.3 DURING CLOSURE

No impact is expected.

11.1.5 BIODIVERSITY

11.1.5.1 FLORA

11.1.5.1.1 IN A NON-RADIATION ASPECT

As a result of the performed analysis in the EIA Report regarding the potential impact on the plant life in the area, it can be concluded that, in a negative aspect, it will occur mainly during the construction of the NDF since then the vegetation cover, falling within of areas envisaged to be built up with buildings, facilities and infrastructure, will be removed. During the performed terrain inspections and researches it was found out that the composition of this vegetation structure consists of widespread and well represented throughout the country plant species of no conservation value. **The IP implementation is not associated with a loss of any valuable and rare plant species and with a damage to specific and valuable plant habitats in the country** as it affects forest plantations of artificial origin, among which the main dominant species is the acacia, which is introduced species for our country.

11.1.5.1.2 IN A NON-RADIATION ASPECT

During the implementation of the investment proposal no significant negative impacts are expected to occur on the widespread natural vegetation cover in the region, including agricultural production, as the NDF will be designed and constructed in compliance with the safety requirements laid down by the legislation and with the IAEA recommendations, using the defense in-depth principle and the NDF construction as a multi-barrier engineering facility hampering the radionuclide distribution in the environment, as well as managing the disposal facility according to the principles and rules for safe management of facilities for radioactive waste management. Only a local impact is expected on a limited area associated with the removal of the plant species growing within the construction site

boundary and in the immediate vicinity of it. As of today, there is no identified species among them which is put under special protection regime under the Biodiversity Act.

No impacts on the radiation status of the vegetation and agricultural production within the area of the Radiana site is expected as a result of the IP implementation during the life-time of the disposal facility. The conditioned radioactive waste package (RCC) and other engineering barriers of the NDF, ensure non-proliferation of radioactive substances and environmental protection from radioactive contamination. No change is expected in the values of the radiation indicators of flora within the area beyond the typical background levels for the region due to the construction of the NDF. The potential radiation impact on the flora will be **negligible**.

11.1.5.2 FAUNA

11.1.5.2.1 IN A NON-RADIATION ASPECT

As a result of the performed analysis in the EIA Report regarding the expected impact on the fauna, it can be concluded that, in a negative aspect, it will occur mainly during the construction of the NDF as it will be **direct** primarily **affecting the less mobile invertebrate species** within the boundaries of construction ranges as well as a small number of amphibian and reptile species of the vertebrate fauna if there are such species on the site, *secondary* during the expulsion of *mammal fauna and birds*, and *indirect regarding individual specimens from some taxa*, distributed in the areas in the immediate vicinity of the Radiana site.

The implementation of the measures as recommended in the EIA Report for the protection of biodiversity will lead to **weak** impact degree, **an insignificant change in the number** of the fauna complexes in the area and an **insignificant fragmentation of habitats**, since such process is also observed to a certain degree at the moment.

To a significant extent the impact is reversible after execution of planting and grassing activities within the site boundary after the completion of construction works, as well as after technical and biological reclamation after exhausting the disposal capacity of the facility regarding the packages with low and intermediate level radioactive waste and its closure.

11.1.5.2.2 IN A RADIATION ASPECT

The impacts on the fauna distributed in this area during the site construction under the investment proposal will have highly limited local character in terms of territorial range - within the site boundary and in immediate vicinity of it, direct way of influence, weaker impact degree, temporary and middle-term duration without any cumulative effect due to the absence of IP for other large-scale facilities in the area.

During the implementation of the investment plan and its post-operation period no significant negative impacts are expected to occur on the animal species in the region, including livestock production in the area, as the NDF will be designed and constructed in compliance with the safety requirements laid down by the legislation and with the IAEA recommendations, using the defense in-depth principle and the NDF construction as a multi-barrier engineering facility hampering the radionuclide distribution in the environment, as well as operating the disposal facility according to the principles and rules for safe management of facilities for radioactive waste management. The expected radiation impact on the fauna will be **negligible**.

11.1.6 LANDSCAPE

→ At the construction phase of the investment proposal significant changes in the landscape structure will occur. The landscape components geological foundation, soil and vegetation will be directly affected. The component geological foundation will be directly affected as a result of excavation work. The impact is assessed to be **direct, long-term, constant, but insignificant** in territorial scope within the construction site boundary under the investment

proposal. During construction, changes in the visual perception of the landscape occur- in aesthetic and volumetric spatial aspects, within the construction site boundary. There will be new anthropogenic elements in the landscape structure. By carrying out recultivation of particular areas under a drawn out landscape project the site is expected to fit into the surrounding environment.

- The life-time of the investment proposal **is not associated with any negative impact** on the landscape components.
- In the event of unforeseen accidents local contamination of soil and vegetation components are possible.

11.1.7 WASTE

11.1.7.1 NON-RADIOACTIVE WASTE

The non-radioactive waste generated by the implementation of **IP** for Construction of a National Disposal Facility for low and intermediate level radioactive waste – NDF, during construction, operation and closure **will not have significant negative impact** on the particular environmental components and factors in case of strict control and effective management. **No cumulative and transboundary impact is expected.**

Impact type - direct, negative (mainly during the construction period), with a low level of impact, limited in case of compliance with the legal requirements and the envisaged measures.

Impact characteristics– permanent, long-term, having a non-cumulative effect.

11.1.7.2 RAW

No impact during the *construction* and the closure of the NDF is expected, since radioactive waste is not to be generated on the site of the NDF.

No impact is expected also during the operation of the NDF provided that the proposed technical solutions, rigorous control and effective management of the facility are executed. No risk to the environment and working conditions and to the local population in the area is expected.

11.1.8 HAZARDOUS SUBSTANCES

No risk to the health of the workers, local population and to the environment **is expected** in case of strict compliance with the HES instructions on work and storage associated with chemical substances and mixtures classified as hazardous substances (mandatory use of personal protective equipment and other measures).

11.1.9 HARMFUL PHYSICAL FACTORS

11.1.9.1 NOISE

Due to the sufficient distance between the site of the disposal facility and the objects with statutory noise level requirements (settlements), the activities for its construction, operation and closure **will not be a source of noise** for them.

The service transport during the construction of the disposal facility and its normal operation, depending on the traffic route choice using the road network in the area, will deteriorate the acoustic environment of the land around it, by passing through the settlements. The impact lasts only in daytime, for a limited period of time - until the completion of the construction work.

The service specialized transport for RCC transportation during the operation of the NDF will not pass through the territories of the nearby settlements.

No excessive noise levels at the site's borders of the disposal facility for radioactive waste **are expected**.

11.1.9.2 VIBRATIONS

11.1.9.2.1 DURING CONSTRUCTION

The used construction equipment **will not be a source of vibrations in the environment**. Vibrations are a factor of the working environment when working with certain types of machines. The vibrations are typical for large-sized machine parts at high speeds of rotation. Putting limits on the spread of vibration outside its source in case of machines and equipment is achieved by implementing specific technical requirements during their installation: anti-vibration treatment of their roots (foundation) by means of rubber pads, insulating joints, vibration damping materials, removal of the solid coupling between the vibrating platforms and the structural elements of the premises, etc.

11.1.9.2.2 DURING NORMAL OPERATION AND IN CASE OF EMERGENCY SITUATIONS

The design does not imply that the future technological equipment will be a source of vibrations in the environment. The transport vehicles servicing the NDF operation are not expected to be sources of vibration in the environment. They will travel on Class II main roads of the national road network, consistent according to the design with the relevant traffic category as the vibrations from the heavy goods vehicles attenuate over a short distance around the traffic route.

11.1.9.2.3 DURING CLOSURE

The used equipment is similar to the one used at the construction phase and it is not a source of vibrations in the environment. The assessment is analogous to that for the construction phase.

11.1.9.3 IONIZING RADIATION

11.1.9.3.1 DURING CONSTRUCTION

During the construction of the NDF no ionizing radiation is generated by the construction work. If control is exerted on the metal welding, this activity is episodic and brief and it is carried out under special dosimetry and radiation control on the personnel performing the activity.

11.1.9.3.2 DURING NORMAL OPERATION AND IN CASE OF EMERGENCY SITUATIONS

The main source of ionizing radiation, posing a radiation risk during the operation of the NDF, is the primary packages - radioactive waste containers, from the moment of their transportation to the NDF and disposal into the cells until they are finally covered with earth mass.

11.1.9.3.3 DURING CLOSURE

The closure of the NDF is set out to occur after filling-up of the cells according to the container-specific scheme (60 years of operation). At the closure phase multi-layer protective cover is planned to be built and those buildings that are not necessary for the subsequent institutional control are to be put out of operation.

On-site monitoring will be provided during the institutional control period. No other activities are envisaged, unless it becomes necessary, except for possible minimal technical maintenance or repairs. After this period, the conservation activity is limited to authorization of the site exploitation without any radiological restrictions.

No impact of ionizing radiation from the disposed RAW containers over the permissible radiological criteria (0.1 mSv/a) **is expected**. The ground-level dose rate on the surface will be within the fluctuation range of the natural gamma background radiation in the area.

11.1.10 HEALTH AND HYGIENE ASPECTS OF ENVIRONMENT AND RISK FOR HUMAN HEALTH

The implementation of the NDF on the Radiana site and its exploitation as a nuclear facility is in compliance with the regulations of the relevant institutions as listed in the EIA Report and the impact level is far below the statutory dose limits stated in BSRP-2012, which are associated with acceptable health risk for the personnel and for the critical population group. The issuance of a license for operation is carried out in compliance with the fundamental principles of the Radiation protection and provided that the benefits of the activity are assumed to be greater than the potential risk to humans from the performed activity.

In this context, it is concluded that **the activity is acceptable and does not affect the health** of the workers and the local population, according to the statutory basic safety standards for radiation protection and health risk.

11.1.10.1 DURING CONSTRUCTION

Non-radiation impacts on the population are not expected beyond the construction site boundary. The health risk to the construction workers is temporary, short-term, without a cumulative effect, reversible and controllable.

During the construction no impact from radiation factors related to the investment proposal is expected in the absence of significant, constant and unregulated radioactive sources.

11.1.10.2 DURING OPERATION

In a *non-radiation aspect* the operation of the NDF for its life-time **will not have a negative impact** on the personnel and on the population within the 2- and 30-kilometer zones around the site;

In a *radiation aspect* the normal operation of the NDF under compliance with all recommended measures **will have no impact on the health status** of the population within the 30 km zone around the NDF. The potential radiation impact on the personnel of the NDF is expected to be within the design requirements set out in the Investment Proposal.

11.1.10.3 DURING CLOSURE

No negative non-radiation and radiation impact is expected during the closure of the NDF under compliance with the closure plans and with all Bulgarian and international legal requirements and practices.

11.1.11 TANGIBLE CULTURAL HERITAGE

After the carried out researches and recommended measures for the protection of the existing tangible cultural heritage located on the site, and with a view to abidance by the effective legislation in the Republic of Bulgaria (the Cultural Heritage Act /CHA/) **no negative impact is expected** during construction, operation and closure, both on the site and in transboundary aspect.

11.2 CONCLUSION

No significant non-radiation negative impact on the environmental components and factors is expected when taking into account the proposed measures.

No radiation impacts are expected on water, land and soil, geological environment, subsoil, land use, mineral diversity, biodiversity, historical and cultural monuments, sites protected under international or national law, as well as on the health of the personnel and the local population within the 30 km zone.

The results of the assessment of the doses during the post-closure period stated in the Interim Safety Assessment indicate that under normal operation, the individual effective dose per individual of the population does not exceed the limit of 0.1 mSv/a, as stipulated by the nuclear legislation and the

ICRP's recommendations. The individual dose is even below 0.01 mSv/a. Under Article 10 of the Regulation on the Safe Management of Radioactive Waste, this means that **the best possible measures for radioactive waste management are used and the radiation exposure of workers and the local population is kept as low as reasonably achievable.**

The NDF should ensure effective protection of the public health and the environment from the potential impact of the disposed radioactive waste after its closure, by preventing uncontrolled spread of radioactive substances in the biosphere, by means of multi-barrier biosphere protection and a combination of technological and administrative measures.

Nine IAEA formulated Safety Fundamentals on the Principles of Radioactive Waste Management are applied during the construction of the NDF:

- Principle 1: Protection of human health;
- Principle 2: Protection of the environment;
- Principle 3: Protection beyond national borders;
- Principle 4: Protection of future generations;
- Principle 5: Burdens on future generations;
- Principle 6: National legal framework;
- Principle 7: Control of radioactive waste generation;
- Principle 8: Radioactive waste generation and management interdependencies;
- Principle 9: Safety of facility.

Safety assessment for near-surface disposal facilities is carried out, which is a procedure for providing an understanding of the behavior of the disposal facility and, in particular, its potential radiological impact on human health and on the environment. During the safety assessment the radionuclide migration pathways to the environment are defined and potential health effects are evaluated.

In this sense, the final point of the analysis in the EIA Report is the **limit of the annual individual effective dose for a critical population group.**

The EIA Report demonstrates that personnel radiation exposure during the operation will not exceed the dose limits as specified in BSRP-2012 and the Regulation on the Safe Management of Radioactive Waste and, practically, it will be significantly lower, in compliance with the ALARA principle.

The pre-disposal monitoring provides basic level data for detection of any subsequent changes to the environment that may be associated with discharges from the disposal facility.

Disposal site monitoring and *post-disposal monitoring* during operation is intended to indicate that the on-site environment measurements don't negate the safety assessment, assumptions and prognoses.

No significant migration of radioactive substances from the disposal facility is expected, at least during the operation and after its closure during the institutional control period. Monitoring maintenance ensures detection of specific radionuclides and the absence of statistically significant changes in the levels of the other pollutants.

In case of possible deviations from the normal operation, which under strict control and management are minimized, insignificant or absent - *dose criterion for normal operation* is met. Measures are taken so that the NDF could withstand, without any loss of systems, structures and components accidents covered by the design, the so called design basis accidents. These events are

very unlikely due to preventive and administrative measures, but radiological consequences are expected under which the dose limit per member of the population is defined up to 1 mSv/a.

Consequences of accidents are considered and analyzed, as the characteristics of the waste package and the shape type are taken into account as well as the stipulated activities that should be performed during operation. The most likely accident with radiological consequences is dropping, falling of a container. The ISAR contains a detailed analysis of this design basis accident in view of the maximum permitted levels of various radionuclides in the RAW package.

Design basis accidents are to be controlled over time and the appropriate protective measures which would actually lead to significant reduction in the conservatively estimated individual dose are to be applied. The potential surface radioactive contamination is also totally under control in case of any design basis accident.

Despite the excessive conservatism, the results of the dose assessment during the post-closure period indicate that under normal evolution, the individual effective dose for the population does not exceed 0.01 mSv/a, i.e. the principle of best practice is applied.

Bearing in mind the existing radiation characteristics of radioactive waste packages which will be disposed in the NDF and the presented environmental impact assessments of the Kozloduy NPP, based on expert judgment, **no cumulative effect is expected** within the Precautionary Action Zone (PAZ) of the two sites. Therefore it follows, as a natural conclusion, because no direct gaseous and liquid discharges occur during the life-time of the NDF and the post-closure period.

Events (beyond design basis accidents), which are not under review in the design, are analyzed so that the ability of the facility to withstand such an event could be comprehended and assessed according to the design.

Based on the analyses and impact assessment for all environmental components and factors, including the conservation of biodiversity from the implementation of the Investment Proposal "*Construction of a National Disposal Facility for low and intermediate level radioactive waste – NDF*" **priority selection the disposal technology is the TRENCH-TYPE disposal facility, since it ensures greater safety.**

In view of the drawn up conclusions and of the measures as recommended by the experts in the EIA Report for reducing, preventing, or removing as completely as possible the identified impacts on the environment and on human health, as reviewed in detail in Chapter 9 of the EIA Report, which ensure strict compliance with the environmental quality standards under the **Bulgarian and the European legislation** and prevent the negative impacts on public and personnel health, as well as the IP compatibility assessment with the objective and purpose of conserving the protected areas, we submit the Investment Proposal "**Construction of a National Disposal Facility for low and intermediate level radioactive waste – NDF**" to the honorable Supreme Expert Environmental Council of the Ministry of Environment and Water to ratify its implementation.

12 DESCRIPTION OF DIFFICULTIES ENCOUNTERED DURING THE PREPARATION OF THE EIA REPORT

The difficulties encountered during the preparation of the EIA Report are mainly due to:

- Analysis of a large amount of information (in two languages), provided by the Beneficiary in connection with the researches that have been carried out over a long time (from 2008 to 2014) of various potential sites prior to the selection of the Radiana site and the selection of the technical option for radioactive waste disposal.
- Insufficient consistency of the input data and information on the quality indicators in a quantitative aspect for some of the environmental components. The data from the various sources is not always comparable, due to the lack of systematization of the data and of the information obtained from each of its owners, thus making it difficult to process.
- Indispensability for the newest and updated data and information in order to achieve the required accuracy in the analysis and conclusions.
- The specificity of the activity and the great level of responsibility for decision making regarding the priority selection of the available options and, respectively, the environmental impact assessment provided by the individual experts of the team who prepared the EIA Report, taking into account the national significance of the site and the obligations undertaken by the Bulgarian government regarding Kozloduy NPP units 1-4 decommissioning.

Difficulties were overcome by means of:

- Detailed analysis of the difficulties encountered by the independent experts and use of their professional experience to obtain certain information so that the required accuracy in the preparation of analyzes and conclusions is achieved; Active and continuous cooperation from the Investor by providing own data as well as data and information from other sources.
- For the purposes of the EIA Report a huge amount of both historical and current information has been collected. A continuous and gradual process of data and information transfer between the Consultant and the Investor has been established;
- The team of experts has made the necessary efforts to raise additional necessary information through research from various public sources and field work performed by particular expert teams;
- Making additional efforts by the Consultant and the Investor to raise a larger amount of recent data, whose analysis, after being done, will allow forming of expert opinions and conclusions;
- Making additional efforts by the expert team to process further and systematize the available data, so that subsequent analysis could be possible.

12.1 CONCLUSION

Despite the difficulties that accompanied the preparation of the EIA Report, they were overcome, by finding out correct and working solutions.

The present Environmental Impact Assessment Report of the Investment Proposal is prepared by the expert team on the basis of data and information which are sufficient, systematized and evaluated in terms of reliability and consistency.