Licensing of the National Repository for LILW Waste in Bulgaria – 15609

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ABSTRACT

Radioactive waste arises from the operation and decommissioning of the Bulgarian nuclear power plants and from other sources in research, medical applications and industry. The need for building the National Disposal Facility (NDF) is recognized by the Bulgarian government, and described and justified in the Environment Impact Assessment Decision. The Bulgarian State Enterprise for Radioactive Waste Management (SERAW) is endeavoring to build a near-surface repository for short-lived low and intermediate level radioactive waste (SL-LILW). The European Union finances the establishment of the NDF through the Kozloduy International Decommissioning Support Fund. The Bulgarian government has defined the NDF as a Project of National Importance.

At the conclusion of an international tendering process, SERAW awarded the contract for development of the NDF design, including Intermediate Safety Analysis Report (ISAR), to the Consortium of Westinghouse Electric Spain S.A.U, DBE TECHNOLOGY GmbH of Germany, and ENRESA, the Spanish National Waste Management Agency. Two Bulgarian companies also participate in the project as subcontractors; KK–Project and EQE-Bulgaria. The project "Technical Design and ISAR Preparation for the National Disposal Facility at Bulgaria" is identified within SERAW as "R-Project 5". Since obtaining SERAW's approval for the preferred repository design variant, R Project 5 has focused on the development of the Technical Design and on preparation of the ISAR, which demonstrates the safety and suitability of the proposed NDF design.

The Consortium submitted to SERAW the Technical Design for revision on March 2013. SERAW's experts immediately started the review of the design. In addition, SERAW invited independent, highly qualified Bulgarian experts and scientists to participate in the review. In November 2013, SERAW approved the Technical Design. The Consortium submitted the Intermediate Safety Analysis Report to SERAW for review following a similar process in July 2014. Both documents were meanwhile handed over to the appropriate Bulgarian licensing authorities. SERAW's goal is to receive a license for construction of the NDF in early 2015.

INTRODUCTION

In the framework of the treaty of accession to the European Union, the Republic of Bulgaria committed itself to the early decommissioning of the four WWER 440-V230 reactors located at the Kozloduy Nuclear Power Plant (KNPP). Due to this early decommissioning, large amounts of low and intermediate radioactive waste will arise much earlier than initially scheduled. In order to manage the radioactive waste from the early decommissioning, Bulgaria has intensified its efforts to provide a near-surface disposal facility for low and intermediate level waste at the Radiana Site with the required capacity. A compensation mechanism established by the European Union, the "Kozloduy International Decommissioning Support Fund (KIDSF)" to alleviate the significant impact of the early phase out of the NPP on Bulgaria's economy supports the country in this endeavor. On behalf of the European Union, the European Bank for Reconstruction and Development (EBRD) manages the fund.

In a series of projects, the State Enterprise for Radioactive Waste (SERAW) selected the Radiana Site for the National Disposal Facility (NDF) located near the KNPP. SERAW also specified Enresa's repository at

El Cabril as the reference design for the NDF. In 2011 a further project was launched and assigned in international competition to the Consortium of Westinghouse Electric Spain S.A.U, DBE TECHNOLOGY GmbH of Germany, and ENRESA, the Spanish National Waste Management Agency to provide the complete technical planning package for the facility, including the preparation of the Intermediate Safety Assessment Report. Two Bulgarian subcontractors, KK–Project and EQE-Bulgaria AD, familiar with the relevant Bulgarian engineering codes and standards, assist the Consortium in the design effort.

The NDF design work began in October 2011 with an initial focus on developing two alternative repository conceptual designs. Based on a comprehensive study of the submitted designs and the multivariate analysis of the pros and cons associated with each design, SERAW approved the favored design on December 2012. Immediately upon their acceptance of the conceptual design, SERAW authorized the Consortium to begin work on further elaborating the design into the level of detail needed for a Technical Design as prescribed by Bulgarian Ordinance Number 4 concerning the scope and content requirements for investment projects. The Technical Design work has since been completed and submitted to the pertinent Bulgarian regulatory authorities, including both the Bulgarian Nuclear Regulatory Agency (BNRA) and the Ministry of Regional Development and Public Works (MRDPW) for licensing approval.

Concurrent to the preparation of the Technical Design for the NDF, the Consortium also developed the Intermediate Safety Analysis Report (ISAR). The ISAR documents the safety evaluation conducted for the NDF in terms of both operational as well as post-closure safety. The ISAR demonstrates that the Technical Design, including the planned operation of the facility, will comply with all the applicable regulations.

DEVELOPMENT OF THE TECHNICAL DESIGN

In order to meet SERAWs project schedule development of the Technical Design was initiated before final approval of the Conceptual Design was received in December 2012. As a result, the final design of several required components was completed as part of the Technical Design development (e.g. requirements on the design for physical protection of the NDF). Additionally, the Technical Design had to incorporate requirements from a number of Bulgarian authorities resulting from the review of the Conceptual Design.

The Technical Design is structured following Bulgarian requirements for investment projects into 19 separate Design Parts as identified in Table 1. Additionally, each Design Part of the Technical Design documentation may be further subdivided into the corresponding structure, system or component of the facility, as described in General Layout Plan (GPL), resulting in up to 23 separate subparts per Design Part (Note Subpart 16 was not used in the design).

The use of sub-parts is optional within each Design Part and they are only considered as applicable to each part. For example, for Design Part Architecture 19 of the possible 23 subparts are provided to address description needs in terms of architectural detail, i.e., to describe the fundamental connections and parameters of the premises and the common areas, while for Design Part Geodesy only one subpart is required to provide the topographical base for the project. Design Part Structural addresses all but one of the subparts, which is addressed separately as Subpart 13, Rainwater Collection Pond, in Design Part Water Supply and Sewerage and Subpart. In total, the Technical Design documentation prepared by the Consortium fills approximately 50 binders with more than 10,000 pages and some 1000 large plans and drawings.

Table 1: Design Parts of the Technical Design

Design Part	**Description**
General	Summary of the Technical Design solution
General Layout Plan	Basic principles, design parameters and interconnection of the

	facilities and common areas
Geodesy	Layout plan of the Radiana Site at 1:1000 scale Project vertical planning, project monitoring of settlements in buildings and facilities, setting-out plan and excavation plan
Roads	Traffic and parking for motor vehicles, maneuvering for fire safety vehicles and pedestrian movements
Technology	Summary of technological process for acceptance of radioactive waste packages into the site and emplacement in the disposal cells Circulation of vehicles and personnel for facility operation Organization and assignment of functions and operational use
Architecture	Above-ground site structures Fundamental connections and parameters of the premises and the common areas Structural elements, external walls, internal partition, suspended ceiling and roof details Bulgarian fire safety codes, functional and technical requirements
Building Structures	General arrangement and construction details of buildings and facilities Detailed drawings and specifications for structures
Power Supply and Electrical Systems	Electrical systems and structures General control configuration and criteria for the electrical systems Power, control, instrumentation and communication cables, and race-ways (trays and conduits) Power supply of the disposal platform and lighting systems NDF earthling system Lighting protection system and communications system Specific Bulgarian electrical standards and the features for equipment available on the market
Control and Management Systems Radiation Monitoring	Structure of control and management systems Radiological control and monitoring systems Specifications for fire detection systems
Water Supply and Sewerage	External and building water supply systems for potable water and other requirements Sewerage for domestic water use Storm water drainage Rainwater collection pond
Heating, Ventilation and Air-conditioning (HVAC)	Air conditioning systems for auxiliary buildings Designs of heating and cooling systems Ventilation and air-conditioning system diagrams Forced ventilation system for the Infiltration Control Network Galleries
Energy Efficiency	Demonstration of compliance with energy efficiency requirements
Fire Protection	Design criteria and technical solutions for Fire Protection System
Physical Protection	Detect and impede deliberate acts, originating from inside or outside the facility, directed to causing damage to the installation, or the unauthorized removal of nuclear material, the ultimate consequences of which could lead to uncontrolled and unacceptable contamination of the environment and the general

	public
Health and Safety Plan	Demonstration of compliance with requirements for health and safety at work during construction and installation activities
Organization and Execution of Construction	NDF construction activities and their execution sequence Management of excavated materials during construction Construction details for the development of the loess-cement cushion
Cost Estimate Documentation	Cost estimate reflecting the indicative quantities of required materials and components

SERAW approved Revision 1 of the NDF Technical Design on April 19, 2013. The acceptance included comments from both SERAW and their Expert Technical Council. Subsequently Revision 2 of the Technical Design was prepared both to address the comments from Revision 1 and for submittal to the Bulgarian Nuclear Regulatory Agency (BNRA) and the Ministry of Regional Development and Public Works (MRDPW) for approval. The Consortium handed over the English version of the Technical Design Revision 2 to SERAW on October 11, 2013. A Bulgarian language version of the Technical Design Revision 2 was submitted to the Bulgarian Regulatory Authorities on September 2014.

Concurrent with the Bulgarian Authorities first review of the Technical Design (Revision 2), SERAW engaged an independent consultant to conduct review to assess the designs conformity with requirements of the Bulgarian Territory Arrangement Act. The main objective of this additional review was to assess the Technical Design in terms of compliance with the Detailed Spatial Plan, evaluate consistency between the separate design parts of the project, verify the engineering calculations, and assess compliance with the subsidiary Bulgarian requirements including among others requirements related to constructability and operational safety.

DESIGN BASIS

The Radiana Site, with a surface area of approximately 46 hectares, has a roughly rectangular shape with maximum dimensions of 470 m in the north-south direction and 1250 m in the east-west direction. The site is located between two roads; one to the north controlled by KNPP (the KNPP Administration Road) which is an interplant road connecting the town of Kozloduy with the NPP, and a public road to the south, Road No 11, which connects the village of Harlets to the town of Kozloduy. With respect to its geographic location the site lies between the second and sixth loess terraces from the River Danube, the elevation between the terraces being approximately 55 m (from elevation +40 m to elevation +95 m).

The NDF shall be able to accept and dispose of all Category 2a radioactive waste arising in Bulgaria from the operation and dismantling of the national nuclear facilities, where Category 2a waste refers to short-lived, low and intermediate-level waste (SL-LILW). According to present forecasts, the NDF will receive conditioned waste packaged in 18,615 cubic-shaped concrete containers (i.e., waste packages). The waste packages have a side length of 1.95 m and a weight of 20 tons. The total volume occupied by these waste packages will be 138,200 m^3. The radionuclide inventory is limited by the waste acceptance criteria defined in the ISAR limits the acceptable radionuclide inventory, which is expected to be approximately 2.4×10^{14} Bq.

Figure 1: General Site Location

The repository design philosophy intends to ensure the isolation of radionuclides contained in the waste from the public and the environment for as long as the waste remains a hazard. To ensure that the design meets this goal the design incorporates a multiple barrier containment system in combination with a defense-in-depth approach, as required by Bulgarian regulation. For the NDF the multi-barrier system consists of the following elements

Table 2: Multi-Barrier System as Defined for the NDF

Sequence	Type	Name	Description
First Barrier	Engineered	Waste Form	Some of the waste will be conditioned into primary containers, such as steel drums. Others will be placed in directly into the concrete container and fixed with a cement mortar. Liquid waste can be solidified with cement and placed directly into the container. In any case the cement used to solidify or to affix the waste will provide radionuclide retention by adsorption. Primary packaging, if used, will be an additional barrier. As a whole, the conditioned content of the concrete cask, here called waste form, will be a first retention barrier
Second Barrier	Engineered	Waste Package (WP)	The WP is a cubic-shaped reinforced concrete cask in which the waste is placed and the remaining void space is filled with mortar to completely embed the waste in a cement matrix. The concrete cask together with the waste form and sealed with a concrete lid is the WP. The WP

			ready for disposal is the unit delivered to the NDF. It shall allow a safe retrieval of the waste during all the period until the final closure of the NDF, in compliance with a regulatory requirement. Correspondingly, the safety function assigned to the WP is to ensure the full retention of the radionuclides by maintaining its mechanical integrity and retention properties throughout the operational period that will lasts approximately 60 years.
Third Barrier	Engineered	Disposal Cell	This barrier consists of the filled and closed reinforced concrete Disposal Cell (including the Disposal Cells' foundation and closure slabs). The safety function assigned to the Disposal Cell is the virtual complete retention of potential radionuclide releases from the WPs by maintaining Disposal Cell integrity to the extent reasonably achievable through a period of 300 years after the NDF closure.
Forth Barrier	Engineered	Engineered Fill	Engineered fill, consisting of both the Multilayer Cover and the Loess-Cement Cushion beneath the Disposal Cells, represents the forth barrier. The Loess-Cement Cushion installed beneath the Disposal Cells functions to greatly reduce the risk of settlement crack development in the reinforced concrete of the Disposal Cells thus greatly reducing the risk of a release of potentially contaminated water from the Disposal Cells. The Loess-Cement Cushion also provides separation between the base of the Disposal Cells and the top of the groundwater table, thus increasing the travel distance and delaying the arrival of potentially impacted waters released from the Disposal Cells to the groundwater horizon. The multi-layer protective cover will be constructed using primarily natural materials as clay, sand, and gravel, and fulfills the following safety functions: - Limits the infiltration of water to the Disposal Cells; - Serves as a barrier against external intrusion by humans, animals or plants; - Provide protection against long-term erosion agents such as rainfall and wind.
Fifth Barrier	Natural	Site Location	The fifth barriers is the nature of the repository site comprising all of the favorable site characteristics and properties that make it a suitable location for a repository, mainly the geological setting of the location and its vicinity. The sloping surface of the Site functions to provide drainage of rainwater during storm events away from the Disposal Zone. It thus precludes the accumulation of floodwaters at the site that could potentially damage the waste containment system and provide enhanced radionuclide transport through unsaturated soils. Additionally, low permeability clay layers in the subsurface will act to slow the transport of radionuclides.

The first two barriers, i.e., the waste form and waste package, working together and in conjunction with the waste acceptance criteria (WAC), provide radionuclide containment and adsorption capability ensuring repository safety during its operational period as well as compliance with retrievability requirements.

The other three barriers, i.e. the disposal cells, the engineered fill, and the repository site, complemented by the specific activity limitation prescribed by the WAC and by the institutional control measures that exclude inadvertent intrusion into the barriers, are instrumental for achieving the required NDF long-term safety.

In conjunction with the multiple barrier system design, the defense-in-depth concept also utilizes administrative measures to further enhance safety. Combined this approach leads to a design for the NDF that prevents:

- Creation of conditions leading to a break in the integrity of physical barriers
- Failure of a physical barrier in the case of the above conditions
- Failure of a physical barrier as a result of the failure of another physical barrier

Radiological safety is of paramount importance in the repository facility. In line with the applicable regulations, any unavoidable exposure of the staff and the public must be kept as low as reasonably achievable (ALARA). The design of the NDF ensures that it will maintain its function and that unavoidable radiation exposures will not exceed dose limits under normal operating conditions. This is achieved by defining the necessary design limits; operational states; safety classification of systems, structures and components (SSCs); and important design assumptions.

The SSCs of the facility were classified consistent with their importance to nuclear safety and radiological protection requirements at the NDF as either being Safety Class (SC) and Non-Safety Class (NSC). Furthermore, as all of Bulgaria is in an earthquake-prone area, the SSCs were also classified in accordance to their seismic category as being Category 1 (C1) or Category 2 (C2) or as the Non-Seismic Category (NC).

Additionally, all elements of the NDF were classified according to assigned Quality Levels, which are to be taken into account during the design, construction, operation and institutional control of the facility. The proposed classification is consistent with the Safety Classes and Seismic Categories. The quality classification also introduces additional quality requirements including measures deemed necessary by SERAW to ensure the quality of all activities at the NDF.

REPOSITORY CONCEPT

Repository Design

For practical and operational-safety reasons, the repository facilities have been grouped into two zones:

- Disposal zone, in which the disposal cells are located
- Buildings zone, in which the Waste Reception and Buffer Storage (WRBS) Building, the site administration, the control room and ancillary and support buildings are located

Figure 2 shows the general site layout.

To ensure operational safety, and to optimize public protection, it is necessary to consider the effects of direct radiation from the waste packages. The establishment of special-statutory areas around the facilities and buildings of the NDF addresses these concerns. This approach allows implementing appropriate radiation monitoring to limit staff exposure and ensure public protection from radiation exposure during normal operations as well as in the event of design basis accidents.

The areas inside the outer fence of the NDF are subdivided based on the following criteria:

Radiation Protection Area:

- Areas where dose rate levels exceed 0.05 µSv/h, based on a dose limit of 0.1 mSv per year as the limit for persons with a presence of 2000 hours per year in the area, corresponding to the limit for non-radiation-exposed workers (i.e., "collocated" workers).
- Areas where the consequences of the design basis accident may exceed 5 mSv.

Monitored area:

- All areas inside the outermost fence and outside the above mentioned radiation protection areas with an associated dose rate less than 0.05 µSv/h.

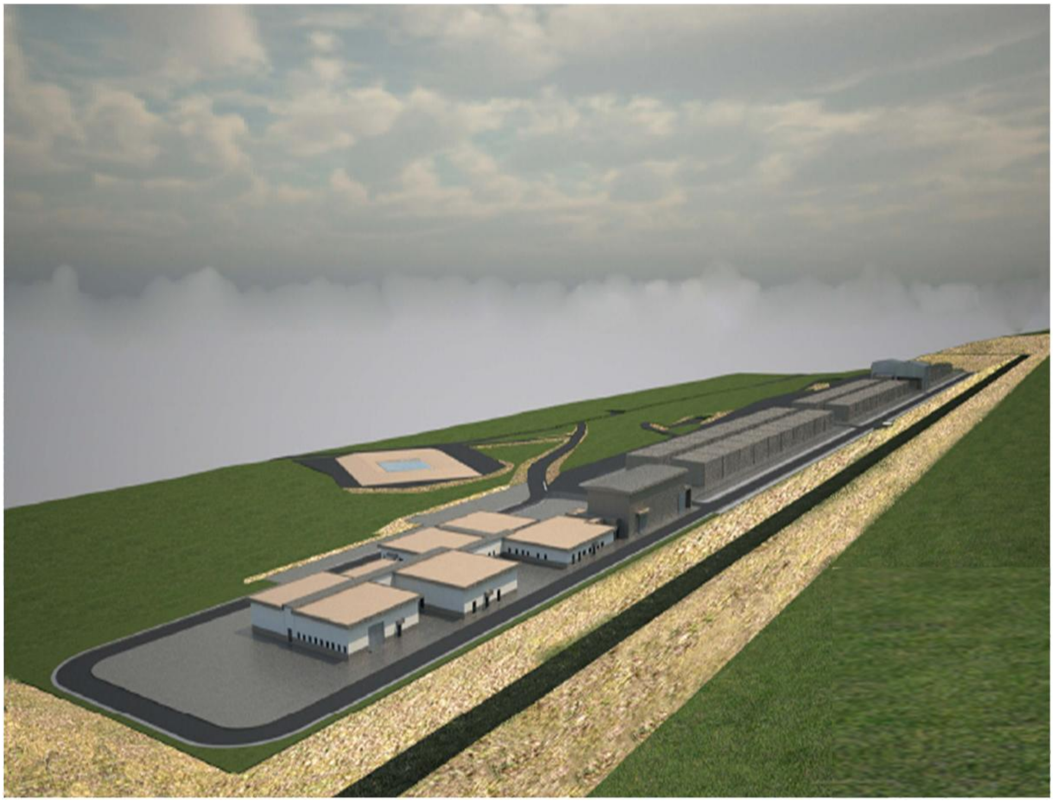

Fig .2: Conceptual Rendering of the NDF

The Radiation Protection Areas of the facility are further subdivided into areas according to their radiological conditions, taking into account the external exposure risks that exist for workers entering these areas, as follows:

- Controlled Area: exposures could be higher than 6 mSv/year (3/10 fraction of the exposure limit for workers)
- Supervised Area: dose rates between 1 and 6 mSv/year, corresponding to the limit for Category B workers

The dose rate assessment carried out for each area considers the layout of the radiation sources and shielding provisions. The criteria for granting access to the different areas is established in line with the radiological protection limits.

The Disposal Zone when completed will have 66 disposal cells for waste package disposal. The Disposal Zone will be constructed in three phases (Phases 1, 2, and 3) each separated by approximately 20 years. Each phase will entail the construction and subsequent operation of the three identical disposal platforms (Platforms 1, 2 and 3). Each platform will include two rows of eleven disposal cells and the associated infrastructure for waste disposal operations and water management. The disposal cells on each platform will be constructed on a massive, 5 m thick loess-cement cushion to provide adequate foundation stability, including under seismic loading. Each platform will host 6,336 waste packages corresponding to about 20 years of repository operation. The total disposal capacity of the NDF will be as previously mentioned 19,008 waste packages.

The disposal cells are monolithic, reinforced concrete rectangular boxes with two interior walls dividing each disposal cell into three chambers. A disposal cell has a total capacity of 288 waste packages with each chamber containing 96 waste packages. The waste packages will be emplaced in the chambers in four layers of 8 by 3 WPs. The external dimensions of the disposal cells are 20.15 m long by 17.05 m wide. After filling, the disposal cells will be sealed by a reinforced concrete closure slab. When not in operation the disposal cells are protected by removable, reinforced concrete roof panels. The roof panels also provide radiation protection to workers as each chamber is filled. The height of a disposal cell measured from the foundation level to the top of a full and sealed disposal cell is 9.45 m.

During disposal operations, including construction of the concrete roof slab, the disposal cells will remain covered by a mobile roof equipped with an overhead crane used to emplace the waste packages, handle the roof panels, and in the construction of the closure slab. The mobile roof serves to protect the loading and closing operations from potentially detrimental weather conditions.

A critical component of the disposal system is the Infiltration Control Network. It consists of a pipe system to collect and control the water that could enter a disposal cell after its closure and interact with the waste packages. The pipes are located in an underground gallery, constructed within the loess-cement cushion, which runs below each row of disposal cells; this gallery is accessible by personnel. The system includes a pipe connection coming from each chamber of each disposal cell and a collection tank. Water drainage is solely driven by gravity.

The Building Zone contains the entire management and support infrastructure needed for the efficient and safe operation of the NDF. The most significant structure in the Building Zone is the WRBS Building located at the entrance of the zone within the Controlled Area. The WRBS Building is designed to receive transport vehicles loaded with a radioactive waste package that arrive at the NDF. Each waste package is unloaded in the WRBS Building and inspected, i.e., radiological control is conducted prior to storage in the temporary storage area. The delivery vehicle is also decontaminated if necessary within this building prior to departure. The WRBS Building provides a buffer storage capacity of up to 120 waste packages. This buffer capacity is designed to allow the regulation and optimization of the waste package flow to the disposal cells.

The NDF also includes the following auxiliary buildings and infrastructure necessary during the operational phase of the facility:

- Access Control Building – provides access control for personnel and transport vehicles to and from the NDF site at the site boundary;
- Administrative Building – provides suitable working conditions for NDF personnel;
- Laboratories – provide equipment for carrying out laboratory analyses of samples from contamination tests and environmental samples as required;
- Auxiliary Buildings –garages and various workshops as well as an industrial section containing facilities for power equipment and other auxiliary systems;

- General Services Building – regulates access to the radiologically controlled areas and provides public relations services.

Separate buildings connected via a central corridor that also provides space for piping and cables house the various auxiliary facilities. Access to radiation protection areas are managed at radiological checkpoints. A separate controlled area corridor provides access to the WRBS Building from the General Services Building.

Repository Operation

The NDF has a single main access that links the Kozloduy NPP road with the Building Zone, thus providing the most direct access for the waste packages. Waste packages arriving at the facility have direct access to the WRBS Building in the controlled area after passing through the main security control at the NDF gate.

Waste package disposal operations begin at the WRBS Building in the waste package loading/unloading area. At this location, an internal transport vehicle is loaded with a single waste package. The vehicle travels through an internal route in the radiologically controlled area to the assigned disposal cell. The vehicle enters the mobile roof where an overhead crane lifts the waste package from the truck and moves the waste package to its pre-assigned disposal position inside the disposal cell.

Once the disposal cell has been fully filled with waste packages, the removable roof panels are installed and a reinforced concrete closure slab is constructed to permanently seal the disposal cell. Before the mobile roof is relocated to the next disposal cell position a watertight coating is applied to concrete surface of the disposal cell. The closed disposal cell is the third engineered barrier and is intended to provide a minimum of 300 years of containment.

The final engineered barrier is completed only after all of the disposal cells have been filled and closed. At this point, a long-term multilayer cover is installed over the entire Disposal Zone to prevent or greatly reduce the potential intrusion of water into the disposal cells throughout a mandated 300 surveillance period. The multilayer cover combined with the loess-cement cushion prevents or greatly reduces the likelihood of radionuclides reaching the accessible environment.

Initially, the NDF will be able to accept up to 800 waste packages per year, i.e., four waste packages per day. When all the waste packages currently stored in the interim storage facility adjacent to the Kozloduy NPP have been disposed of the waste disposal rate will be reduced to generally one waste package per day. The disposal rates assume that the NDF will work single shifts of 7 hours per day, 5 days per week, and about 200 days per year allowing for down time due to severe weather conditions.

PROJECT IMPLEMENTATION

A staggered construction approach has been adopted. The NDF will be built in three phases:

- The auxiliary installations and the first platform of disposal cells will be built during the first phase. This will provide a fully compliant disposal facility, fulfilling all the requirements and design criteria, but without the total number of disposal cells.
- During the second and third phases, the NDF will be expanded to reach its full capacity through the construction of Platform 2 and then Platform 3 and their respective infrastructure.

The design of the NDF takes into consideration the simultaneous construction during the second and third phases with the disposal operations of the primary facility. In order to provide for concurrent operation and construction a separate access from the northeast corner of the site will be used for construction to avoid interference with waste transportation operations. This road will also serve as an emergency escape route should the need arise. Additionally, the security fence surrounding the facility will maintain separation until construction has been completed. Only then will the security fence be relocated to include the new platform.

The overall NDF life cycle is divided into three periods including:

- The Operational Period (during which waste disposal is carried out) spanning 60 years
- The Closure Period assumed to last up to 15 years
- The Institutional Control Period lasting 300 years

During the operation phase, the waste packages are received and emplaced in the disposal cells. Once a disposal cell is full, the disposal cell will be closed with the upper slab and a protective coating.

In the closure phase, the multi-layer cover will be built and the auxiliary buildings and infrastructure not necessary for the further institutional control will be decommissioned.

During the institutional control period, the surveillance of the site will be assured. The only work activities foreseen to be performed will be potential maintenance or repair interventions if determined as necessary. The activity content of the NDF will be limited to permit the use of the site without radiological restrictions after the institutional control phase (i.e., after 300 years post-closure).

ISAR

As a part of the NDF license application, the Bulgarian regulation requires completion of an Intermediate Safety Analysis Report (ISAR). The intent of the safety assessment for the NDF is to assess the behavior of the disposal facility and, in particular, its potential radiological impact on human health and the environment. Potential pathways for release of radionuclides into the environment are defined during the assessment as well as potential health effects.

The scope of the ISAR is to evaluate and demonstrate that the design of the NDF, included in the Technical Design, and the operation of the facility is appropriate in accordance to all the applicable regulations taking into account:

- Characteristics of the site
- Characteristics of the wastes to be disposed of
- Planned activities and personnel involvement
- Characteristics of the risks associated with the NDF

On October 31, 2012, the Consortium submitted a preliminary version of the Intermediate Safety Assessment Report (Revision 0) to SERAW to provide the basis upon which a licensable document could be finalized. Additionally, changes in the regulation required amendments of the ISAR, which turn required some modification to the Technical Design. Even though the consequences were limited in scope, a further revision was unavoidable. On February 17, 2014, the Revision 1 was submitted by the Consortium to SERAW and included changes to address the new regulatory provisions as well as to address comments received on the previous revision. Additional comments were received and additional design changes included that have resulted in the current Revision 2. This revision has been handed over to SERAW for submittal to the BNRA.

CONCLUSIONS

In November 2013, SERAW approved with comments the Technical Design for submittal to the licensing authorities. After a detailed review process between SERAW and the Consortium, the document was determined adequate for the intended purpose and a Bulgarian language version was prepared. This version, as well as a translated version of the ISAR, was submitted during October 2014 to the various Bulgarian authorities and ministries as required for issuing a construction license. The next step will include submission to the BNRA of the Bulgarian language versions of the Technical Design and the Intermediate Safety Analysis Report.

The BNRA will continue the expert review of the submitted documents according to an approved review program. Specialized external consultants are carrying out external expert reviews, namely: RISK-Audit, a joint venture of the French and of the German Technical Support Organizations IRSN and GRS. Their task is to review the ISAR and verify the safety issues and the design.

In parallel, a Technical Specification for Construction is being prepared by the Consortium for SERAW to be able to start the tendering process that will end up with construction permit and the beginning of the construction in the course of 2015.