DISCUSSION OF NATIONAL PROGRAMMES
THAT ARE RELEVANT TO
A SUSTAINABLE NUCLEAR SUPPLY CHAIN
FOR SAFETY OPERATION OF EXISTING REACTORS

Presented
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Introduction

Ensuring of a sustainable and robust nuclear supply chain is very important for:

• successful completion of construction of new NPPs in time and within budget.

• provide quality assurance for safety regulation in the operation and maintenance of the existing nuclear power plants.

The main goal of the presentation is to exchange information on related programs for safety operation and maintenance that are relevant to a sustainable nuclear supply chain.
Introduction

The presentation discusses typical procurement processes used for KNPP operation, maintenance and challenges in the nuclear supply chain.

The new challenges include a shortage of skilled engineers, the shrinking resources of manufacturing bases, shortened product life cycles, emerging new materials, advances in information technology, technological processes and standards, and the globalization of market economies.
Introduction

Bulgaria is a small technology user country with established nuclear program and exchanging information on related programs that are relevant to a sustainable nuclear supply chain is a very important.

The presentation discusses the Bulgarian experience in development of nuclear energy and presents some national programs for enhancing a nuclear energy sustainability.
Bulgarian experience in development of nuclear energy

The last Bulgarian Energy Strategy until 2020 have been approved in 2011. One of the main Energy Strategy priorities is: ensuring the security of energy supplies. This could be achieved by:

- Maintaining a reliable, stable and secure energy system;
- Transparent, efficient and highly professional management of the energy companies.

Regarding nuclear energy, the Bulgarian Energy Strategy foresees preservation of the electrical power share generated from nuclear energy. This strategy will be implemented through long term operation of the existing nuclear units and through new build...
The Bulgarian nuclear energy program was launched in 1974 with the commissioning of the first nuclear power unit of the Kozloduy NPP. Nuclear power in the country is concentrated at the Kozloduy NPP site where six units have been built.

Two WWER-1000 reactors are currently in operation, while four WWER-440 have been shut down for decommissioning. An interim pool type spent fuel storage facility and a dry spent fuel storage facility are also located at the Kozloduy NPP site. A State Owned Facility for treatment and storage of low and intermediate level radioactive waste (RAW) is situated on-site as well.
Based on National Energy Strategy, Bulgaria strongly consider to use nuclear energy based on extending of life of units 5 and 6 and building of new units.

The Parliament of Republic of Bulgaria recently (in June 2018) took a decision to be investigated the capability of the construction of a new nuclear energy unit on the Belene site, including two nuclear power units, equipped with WWER-1000/A92 design reactors.
In March 2012 the Bulgarian Government took a decision to terminate the Belene NPP project, and a month later made a decision to build a new nuclear power unit of the latest generation (Generation III or III+) with installed electric power capacity of approximately 1200 MW at Kozloduy NPP by an international vendor, who will also provide the fuel.

The building of the New Nuclear Unit at KNPP site fully complies with the national priorities in the field of the development of the energy system of Bulgaria.
Concept of a sustainable nuclear energy system

There is no specific national requirements or indicators for sustainability different from the common definition of sustainability.

1. Safety and reliable operation of NPP.
2. Secure and safety management of spent fuel.
4. Safety waste management.
5. Grow up of nuclear system corresponding to economical grow up.
6. Availability of human resources.
7. Proliferation resistance.
Modernization Program - Units 5&6 KNPP The Beginning.

Reasons for initiating the program:

➢ To bring the safety level of 1000 MB Units into compliance with the internationally accepted requirements;

➢ To provide conditions for extension of units operation with 15-30 years beyond their design lifetime;

➢ To guarantee enhancement of the reliability of operation and improvement of the efficiency of the electricity generation;
Reasons for initiating the program:

- Results from the OSART and ASSET missions, conducted by IAEA for Kozloduy NPP in 1991, 1994 and 1997 and in other plants with WWER 1000/B–320;
- Recommendations of the Chief Designer of the Reactor Facility;
- Summarized operational experience;
- Studies for WWER 1000/B - 320 by Bulgarian, French and German institutes;
Modernization Program (MP) Structure.

Structure of MP – a set of 212 measures

✓ Safety-related;
✓ Reliability of equipment;
✓ Operational availability.

[Diagram showing distribution of measures: Safety related 127, Equipment reliability 41, Operational availability 44]
Classification of measures by areas of improvement.

1. Safety enhancement related to the design changes.
2. Studies and additional analysis.
3. Equipment reliability enhancement.
4. Operational conditions enhancement.
5. Preparation for equipment decommissioning.
Stages of implementation of MP contracts:

**Phase 1**
- Basic Engineering Phase (BEP)

**Phase 2**
- Implementation - Main Contract (MC)

**Phase 1**
Scope of activities: Preparation /submitting of input data;
Development of Terms of Reference; Development of Technical Project and engineering reports from the analysis.
Completion of the first stage under the contracts with ECK and Westinghouse in 2000.
Based on the results from the first phase, the scope of works for the PHASE II was determined.

**Phase 2**: Contracts startup - June 2001

Scope of activities:
1. Development of detail designs;
2. Development of delivery documentation;
3. Equipment manufacture and procurement;
4. Installation of equipment;
5. Testing new systems;
6. Licensing;
7. Commissioning.
Modernization Program Unified approach to Safety.

Compliance with the obligatory national and international standards for designing the improvements

Trilateral verification of the proposed modifications by:

- KNPP specialists in the respective areas;
- Project technical consultant – Worley Parsons Europe Energy Services Ltd;
- BNRA and their subcontractors from Riskaudit;

Three-stage approach to licensing of the unit design changes:

- Permission for engaging the selected contractors based on their experience and certification;
- Permission for detailed design development and delivery on the basis of technical projects and equipment specifications;
- Licensing the implemented design changes.
Modernization Program measures

Distribution per contractors.
Secure and safety management of spent fuel.

- The study is based on the National Reports on the Joint Convention and the Strategy for SF and RAW Management until 2030, adopted by the Council of Ministers in January 2011.

- The policy of the Republic of Bulgaria regarding the management of SF and RAW is defined in the national legislation (mainly ASUNE, Environmental Protection Act, Health Act, and regulations for their application.).

- The policy is based on the moral principle of avoidance of undue burden on future generations. In the strategy are defined the long-term specific policies and the main directions until 2030 regarding the management of Spent Fuel and High Level Waste.
The SF generated within the country is a material containing useful components. This material should be re-processed in the country of origin or in a third country in an internationally acceptable and mutually beneficial economic, technological, and environmental friendly, manner;

The SF whose reprocessing has been proven economically inappropriate, shall be defined as radioactive waste as per the procedure of the ASUNE, and may be managed under the concept of “deferred decision for subsequent use”, if it is stored in a manner allowing its recovery;
In the case of long-term storage under the “deferred decision” scenario, the SF shall be stored using the dry storage technology;

The deep geological repository is accepted to be the most suitable option for durably guaranteed safety in the isolation of high level activity and long lived RAW;

The country’s involvement in regional and international projects for deep geological repository is deemed expedient while the search for international solutions should not jeopardize the current national program.
Practices regarding the SF Management.

- The only facility, which generates spent nuclear fuel in Bulgaria, is the Kozloduy NPP.
- Until 1988 Bulgaria was sending back spent nuclear fuel to Russia (Soviet Union) without further engagement.
- Since 1990 Bulgaria is returning spent nuclear fuel for temporarily storing and reprocessing in Russia with further returning to Bulgaria of radioactive materials.
- Due to increasing the time for keeping spent fuel in wet storage from 3 to 5 years it was taken decision for construction of wet spent fuel storage in addition to wet storage which is insight of the containment for temporarily storing. It is in operation since 2002.
Bulgaria has no capability to conduct a full NFC. Concerning the SF, the National strategy does not exclude a prior discussion of any three possible options:

1. Dispatch to other countries having the potential to extract from SNF components for reuse in reactors without return of the high active waste for disposal.

2. Disposal of SNF within the country.

3. Dispatch to other countries having the potential to extract from SNF components for reuse in reactors then return the high active waste for disposal.

In the Strategy for SF and RAW Management until 2030 is pointed out that in the long term, taking into account the European consensus; the deep geological repository is the best option that ensures long-term safety in the isolation of high-activity and long-living radioactive waste.
Conclusion

Ensuring of a sustainable and robust nuclear supply chain is a very important for providing quality assurance in the operation and maintenance of the existing nuclear power plants.

Recognizing that safety and reliable operation of NPP as well as a safe management of spent nuclear fuel and radioactive waste is a complicated and complex problem.
Thank you for your attention!