

**ENGINEERING SERVICES ASSOCIATED WITH DISMANTLING OF IGNALINA  
NUCLEAR POWER PLANT REACTOR CORES**

**ANNEX S1-2**

**Conceptual Design outline**

## INTRODUCTION

The Conceptual Design is for the benefit of the Client and Stakeholders and must contain information, sufficient for final decision making by the stakeholders concerning further project development. However, such a document is not defined in legal framework of the Republic of Lithuania: there are no regulations or requirements which determine its content or structure.

However, if the project is developed further, the Conceptual Design will be followed by formal licensing activities; therefore, it should be consistent with the requisite licensing documents. In the context of decommissioning engineering and licensing, there are two key documents to be developed and coordinated with nuclear regulatory authority:

- A. Description of the project (i.e. Technological Design for dismantling works) **and**
- B. Safety analysis report for decommissioning project.

Requirements for both documents in general are defined in nuclear safety requirements BSR-1.5.1-2019 “Decommissioning of nuclear facilities”, in particular chapter XVI, sections 1 (for Project Description) and section 2 (for Safety Analysis Report). During INPP decommissioning several such documents have already been prepared and agreed by VATESI, the structure and content of such documents are well-established.

In the context of the Reactor Waste Interim Storage Facility (RWISF), the first engineering and licensing documents to be developed and coordinated with the relevant authorities depend on whether the RWISF will entail construction of new nuclear facility, or reconstruction / modification of existing nuclear facility.

In the case of new nuclear facility construction, the following documents must be developed:

- C. Site evaluation report prepared in accordance with BSR 3.1.2-2017 “Pre-disposal Management of Radioactive Waste at Nuclear Facilities” (in particular chapter XV, section 2) and then
- D. Technical Specification for that facility prepared in accordance with nuclear safety requirements BSR 1.8.3-2017 “Technical specification for nuclear installation”.

In the case of RWISF creation by reconstruction / modification of existing facility, the following document must be developed:

- E. Technical Decision for modification prepared in accordance with nuclear safety requirements BSR 1.8.2-2015 “Categories of modifications of the nuclear facilities and description of the modification procedure”.

At INPP, there are decommissioning-related precedents for new nuclear installation construction; however, the initial stages of project development took place many years ago and in a quite different licensing framework. By contrast, the modification procedure is well-established and in ongoing use. From a licensing point of view, the modification option is preferable in comparison to new construction because it allows to omit the site evaluation stage and to use some engineering and licensing work done before. The RWISF may be considered as extension (i.e. modification) of Facility B3/4 if it is created by constructing additional modules since this possibility was envisaged at the time of B3/4 project development and at the B3/4 “nuclear site” a dedicated land plot is provided.

RWISF development is regulated not only by “nuclear” legislation, but also by civil construction legislation. Construction legislation envisages development of the following document:

- F. Design Proposals, which may be prepared in accordance with STR 1.04.04:2017 “Building Design, Design Expertise” (in particular Annex 13 “Design proposals”).

To ensure consistency with future engineering and licensing documents, the content of the Conceptual Design must be in line with the requirements listed above; however, the level of the detail may be lower than that needed for engineering and licensing documents A, B, C+D or E and F.

In order to facilitate further development of Conceptual Design, an outline of the documents is proposed. Consultant may exercise discretion in its use, but deviation from this outline must be justified and agreed with the Client.

## **Executive / non-technical summary**

### **PART I. Zone R3 dismantling and waste management**

#### **1. General information**

##### ***1.1. Description of the Dismantling Object***

- 1.1.1. Structures, systems and components to be dismantled
- 1.1.2. Initial status of items to be dismantled (radiological and physical properties)
- 1.1.3. Dual purpose items

##### ***1.2. Primary inventory of materials / waste***

- 1.2.1. Waste distribution by class
- 1.2.2. Scaling factors for waste characterization
- 1.2.3. Hazardous waste

##### ***1.3. Systems, facilities and premises to be used for project purposes***

- 1.3.1. Buildings and premises to be used
- 1.3.2. Existing auxiliary systems, utilities and equipment to be used

##### ***1.4. Normative documents and recommendations applied***

- 1.4.1. Lithuanian regulations
- 1.4.2. IAEA recommendations
- 1.4.3. Regulations and recommendations from country of origin (list and short description how it is used in the context of R3D)
- 1.4.4. Proven engineering practices applicable for RBMK reactors dismantling and associated waste management

#### **2. Preparatory works**

##### ***2.1. Access gaining***

##### ***2.2. Isolation of systems and equipment to be dismantled***

##### ***2.3. Protection of systems and equipment remaining in operation***

##### ***2.4. Organisation of waste pre-treatment workshops***

##### ***2.5. Organisation of buffer / temporary storages***

##### ***2.6. Creation of transport routes and transport openings***

##### ***2.7. Organisation of personnel premises, entrances and exits***

##### ***2.8. New auxiliary systems and equipment and associated technical requirements***

##### ***2.9. Safety issues to be considered***

#### **3. Dismantling works**

##### ***3.1. Guidelines for organisation and performance of work***

##### ***3.2. Definition of work zones and dismantling sequence***

##### ***3.3. Dismantling technologies***

##### ***3.4. Tools and equipment***

- 3.4.1. List of on-the-market tools to be procured and associated specific requirements
- 3.4.2. List of custom-designed tools and main technical requirements

##### ***3.5. Waste fragmentation in the dismantling work zone***

## **4. Waste management**

- 4.1. *Guidelines for organisation and performance of work***
- 4.2. *Waste transportation***
- 4.3. *Usage of existing waste management facilities and established waste management routes***
- 4.4. *Development of new waste management facilities and waste management routes***
- 4.5. *Fragmentation and waste size reduction in workshops***
- 4.6. *Decontamination***
- 4.7. *Waste sorting and packaging***
- 4.8. *Waste packages transportation***
- 4.9. *Secondary waste management***
- 4.10. *Waste identification and registration***
- 4.11. *Waste quantity evaluation***
- 4.12. *Safety issues to be considered***

## **5. Clean up and final works**

- 5.1. *Scope of work and its general description***
- 5.2. *Final conditions to be achieved***

## **6. Safety and security**

- 6.1. *Radiation protection***
  - 6.1.1. Guidelines for Radiation Protection
  - 6.1.2. Radiation conditions by the Work Zones,
  - 6.1.3. Collective and Individual Doses of the Personnel
  - 6.1.4. Radiation Monitoring
  - 6.1.5. ALARA principles implementation
- 6.2. *Industrial health and safety***
  - 6.2.1. General safety requirements for carrying out of works
  - 6.2.2. Risk analysis and evaluation
  - 6.2.3. Personnel qualification and training
- 6.3. *Fire safety and emergency preparedness***
  - 6.3.1. Provisions for fire safety
  - 6.3.2. Fire risk analysis and evaluation
  - 6.3.3. Emergency preparedness
- 6.4. *Physical security***
  - 6.4.1. General requirements
  - 6.4.2. Specific issues to be considered
- 6.5. *Systems, structures and components important for safety***
  - 6.5.1. Engineering evaluation of systems, structures and components;
  - 6.5.2. Functional analysis
  - 6.5.3. Risk identification and analysis
  - 6.5.4. Design basis accidents
  - 6.5.5. Safety limits and acceptance criteria
  - 6.5.6. Safety classification of systems, structures and components

## **7. Need for mock-ups**

- 7.1. First-of-kind equipment, tools and methods*
- 7.2. Identification of needed mock-ups*
- 7.3. Conceptual designs of mock-ups*

## **8. D&D planning and cost estimation**

- 8.1. Guidelines for planning and cost estimation*
- 8.2. Sequence and duration of working activities*
- 8.3. Human resource requirements*
- 8.4. Evaluation of risks (risk register) and uncertainties*
- 8.5. Cost estimation*

## **PART II. RWISF solution**

### **1. General information**

- 1.1. Functions to be performed*
- 1.2. An estimate of the volume of waste*
- 1.3. Preliminary waste acceptance criteria and specification of packages*
- 1.4. List of modifications to be implemented in existing infrastructure*

### **2. Site description (as per Annex 3 of BSR 3.1.2-2017)**

- 2.1. Site description*
- 2.2. Site evaluation*
- 2.3. Site layout and interconnections to other facilities*
- 2.4. Necessary site investigations*
- 2.5. Conclusions regarding site suitability*

### **3. Design proposals (as per Annex 13 of STR 1.04.04:2017)**

- 3.1. Explanatory note*
- 3.2. Graphic part (main drawings)*
- 3.3. 3D visualization*

### **4. Facility description and associated requirements**

- 4.1. Operation and maintenance areas*
- 4.2. Waste treatment facilities (if any)*
- 4.3. Lifting and transporting equipment inside*
- 4.4. Shared and interrelated systems of RWISF and existing facilities*
- 4.5. First-of-kind equipment, tools and methods*
- 4.6. General equipment and tools*
- 4.7. Auxiliary systems and utilities*
- 4.8. Connections to electricity and other technical media*
- 4.9. External transport routes*
- 4.10. Waste package identification and tracking*
- 4.11. Waste package characterization*

*4.12. Physical security*

*4.13. Monitoring and control*

*4.14. Personnel premises, entrances and exits*

*4.15. Safety issues to be considered*

**5. RWISF planning and cost estimation**

*5.1. Sequence and duration of tasks*

*5.2. Evaluation of risks (risk register) and uncertainties*

*5.3. Cost estimation*

**PART III. Integrated planning for D&D and RWISF**

**1. Schedule scenarios to be considered**

**2. Evaluation of risks and uncertainties**

**3. Project cost estimation**

**4. Conclusions and recommendations**