Regional Workshop on Safety of Research Reactors
"Decommissioning Activities: Cost estimates"
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THE LEGAL/REGULATORY FRAMEWORK AND THE DECOMMOSSIONING PLANS FOR THE DALAT NUCLEAR RESEARCH REACTOR

Pham Van Lam and Pham Hoai Phuong

NUCLEAR RESEARCH INSTITUTE, VAEC

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- Brief Overview of DNRR
- Legal and Regulatory Framework in Vietnam related to the Decommissioning of Nuclear Facilities.
- Preparation for a Decommissioning Plan of the DNRR
- Summary

BRIFT OVERVIEW OF DNRR (1)

- **Early 1960 - Construction of the TRIGA Mark II reactor started**
- **26/2/1963 - First criticality of the TRIGA reactor**
- **4/3/1963 - Official inauguration of TRIGA reactor with the nominal power of 250 kW**
- **1963-1968 - Reactor operated with the 3 main purposes: Training, Research and Isotope Production**
- **1968-1975 - Reactor was in extended shutdown**
- **1975 - Fuels were unloaded and shipped back to USA**

BRIFT OVERVIEW OF DNRR (2)

- **15/3/1982 - The project for reconstructing and upgrading of the reactor started.**
- **01/11/1983 - First criticality of the IVV-9 reactor**
- **20/3/1984 - Official inauguration of the IVV-9 reactor with the nominal power of 500 kW.**
- **3/1984 to present - Reactor has operated for**
  - Radioisotopes production;
  - Neutron activation analysis;
  - Basic and applied research in nuclear physics;
  - Personnel training.

BRIFT OVERVIEW OF DNRR (3)

MAIN CHARACTERISTICS:

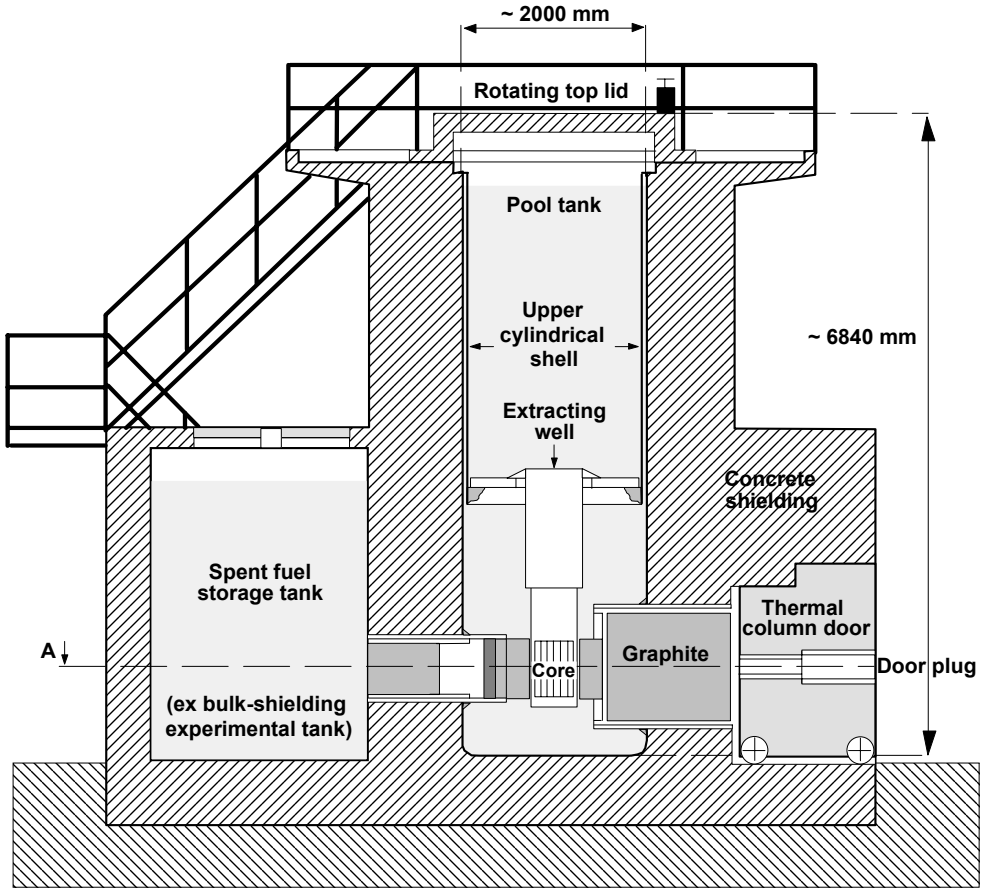
- **Thermal power:** 500 kW
- **Coolant and moderator:** Light water
- **Core configuration:** Cylindrical core of about 44.2cm diameter and 60cm height.
- **Core cooling mechanism:** Natural convection
- **Number of fuel assemblies in the core:**

  89 (1984-1994), 100 (1994-3/2002), 104 (3/2002-10/2006), 106 (from 11/2006-9/2007), 104(from 9/2007)

- **Seven control rods including:**
  - + Two safety rods: 5.37$
  - + Four shim rods: 10.78$
  - + One automatic regulating rod: 0.56$
- **Beryllium and graphite reflectors surrounding the core.**

BRIFT OVERVIEW OF DNRR (4)

MAIN CHARACTERISTICS *(Cont'd)*



☞ **Cooling system:**

+ Flow rate of primary loop: 50 m^3/hr

+ Temperature of primary loop:

- At inlet of the heat exchanger: 34-37 ^oC

- At outlet of the heat exchanger: 25-28 ^oC

+ Flow rate of 2nd loop: 90 m^3/hr

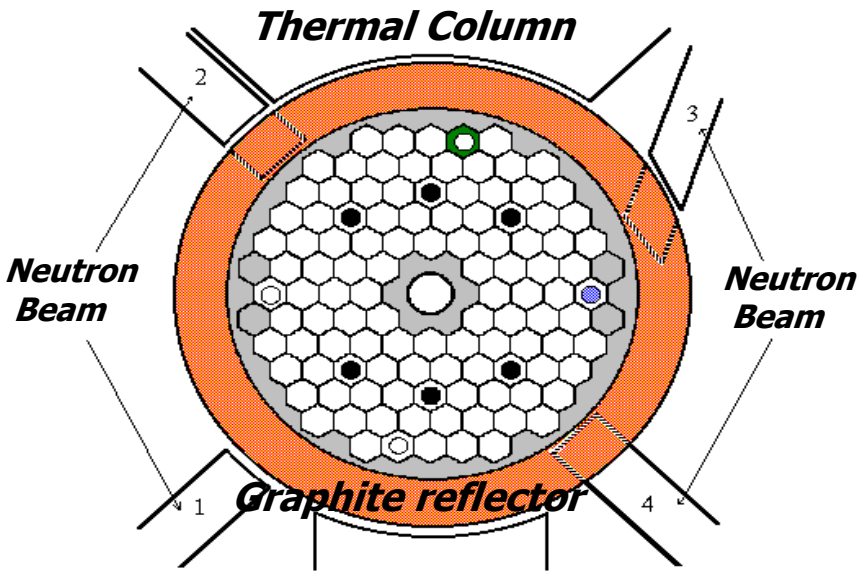
+ Temperature of 2nd loop:

- At inlet of the heat exchanger: 17-20 ^oC

- At outlet of the heat exchanger: 22-25 ^oC

BRIFT OVERVIEW OF DNRR (5)

MAIN CHARACTERISTICS *(Cont'd)*



☞ **Vertical irradiation channels and thermal neutron flux: n.cm^{-2}.s^{-1}**

+ Wet channels:

- Neutron trap at the core center:
2.21×10^{13}

- Irradiation hole at cell 1-4:
1.2×10^{13}

- 40 holes at rotary specimen rack:
4.2×10^{12}

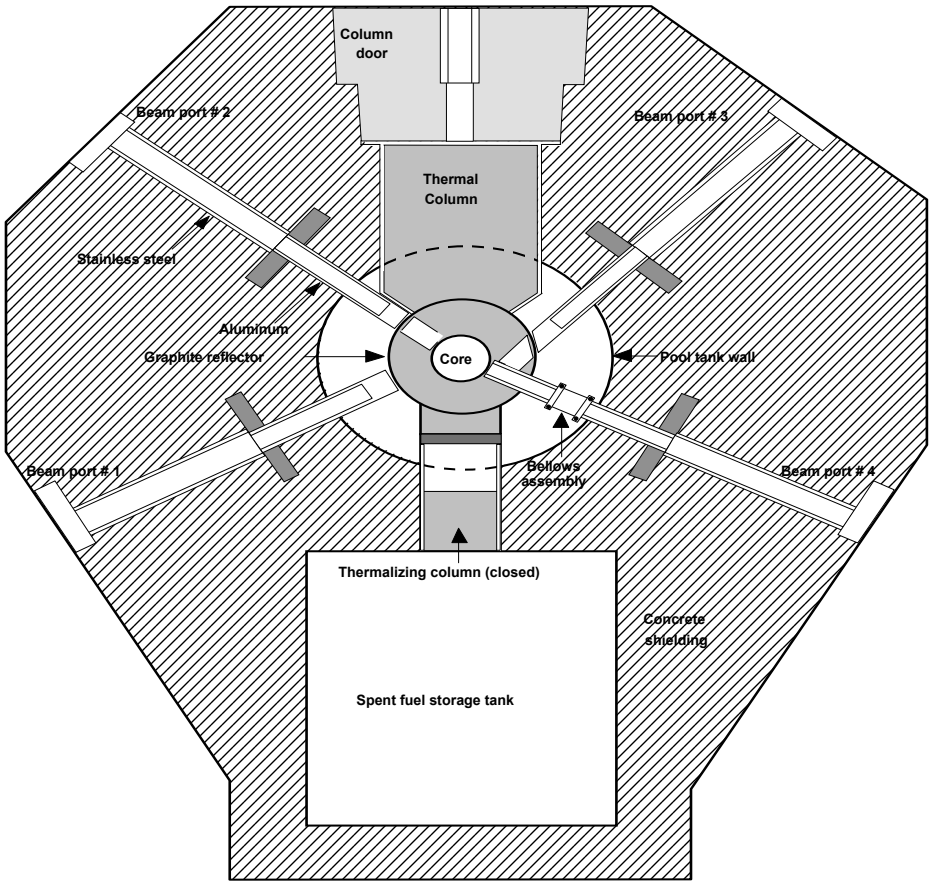
+ Dry channels:

- Pneumatic transfer tube at cell 7-1:
4.5×10^{12}

- Pneumatic transfer tube at 13-2:
4.6×10^{12}

BRIFT OVERVIEW OF DNRR (6)

MAIN CHARACTERISTICS *(Cont'd)*



☞ **Horizontal beam tubes and thermal neutron flux n.cm^{-2}.s^{-1}:**

+ Tangential beam port No. 3: 2.3x10^{6}

+ Radial beam port No. 4: 2.1x10^{7}

+ Radial beam ports No. 1&2: not used yet

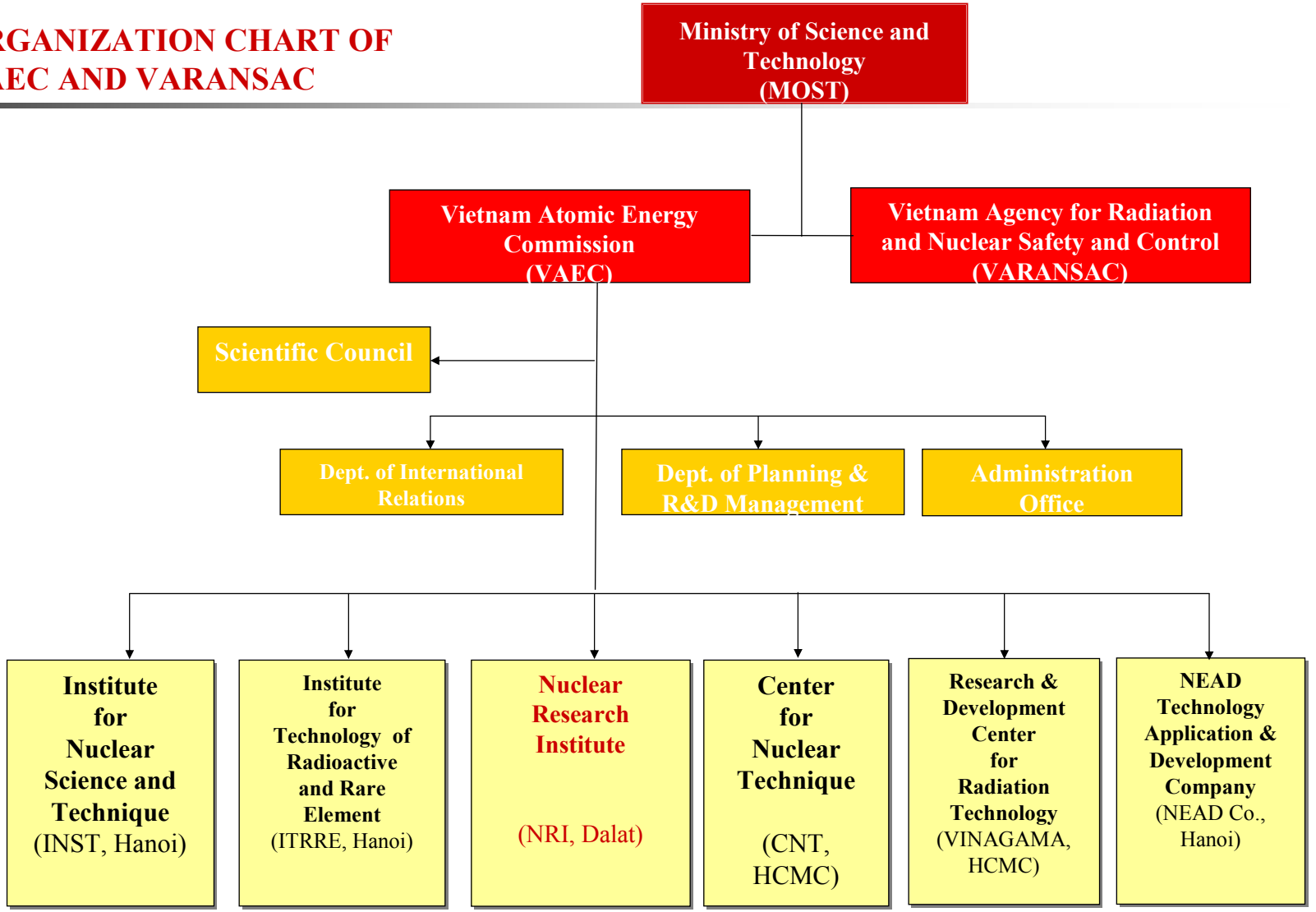
☞ **Thermal column (n.cm-2.s-1): 5.8x10^{9}**

REACTOR OPERATION

- **Operation regime at 500 kW:** **100 hrs/cycle, 1 cycle/month, ➔ 1200 hrs/year**
- **Total operation time from March 1984 to 2008: ➔ about 31,300 hrs at 500 kW**
- **The number of unexpected scrams (1984-2009): 261, mainly due to unstable working of the local electrical supply network (70%), due to equipment failures (20%), and human errors (10%).**

LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (1)

THE ORGANIZATION CHART OF VAEC AND VARANSAC



LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (2)

GENERAL PROVISION

Article 7. **State management on activities in the field of atomic energy**

1. The Government shall unify the State management on activities in the field of atomic energy.
2. The Ministry of Science and Technology shall be responsible before the Government for conducting State management on activities in the field of atomic energy.
3. Ministries, ministerial-level agencies, within their functions and authorities, shall perform the State management on activities in the field of atomic energy in accordance with their responsibilities designated by the Government.
4. Provincial/city People's Committees (hereinafter referred to as provincial level), within their functions and authorities, shall perform the State management on activities in the field of atomic energy in accordance with their responsibilities designated by the Government.

LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (3)

GENERAL PROVISION (cont'd)

Article 8. **Duties and authorities of the Agency for Radiation and Nuclear Safety**

The agency for radiation and nuclear safety is under the Ministry of Science and Technology and has the responsibility to assist the Minister in performing the following duties and authorities:

1) To develop draft legal documents on radiation and nuclear safety;

2) To organize for the notification of radioactive substances, radiation equipments, nuclear material, nuclear equipments, and to license for conducting radiation practices in accordance with its competency;

3) To conduct and organize verification on radiation and nuclear safety;

4) To carry out checking, inspection; to handle violations against regulations on radiation and nuclear safety; and to suspend radiation practices in accordance with its competency; to recommend to the relevant State competent authority to suspend operation research reactor and nuclear power plant if suspecting there is unsafe factor;

5) To organize nuclear control activities in accordance with provisions by laws;

6) To take part in emergency response to radiation and nuclear incidents within its competency;

7) To establish and maintain the national information system on radiation and nuclear safety;

8) To organize and cooperate for professional trainings on radiation and nuclear safety;

9) To carry out international cooperation activities in radiation and nuclear safety.

LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (4)

Besides Regulatory Authority, according to the National Atomic Energy Law, the **National Nuclear Safety Council**, established by Prime Minister, shall have the following functions and duties:

- To provide advice to the Prime Minister on policies and measures to ensure nuclear safety for atomic energy utilisation;
- To review and assess verification reports of Regulatory Authority on the safety of a nuclear power plant to provide advice for issuance of operation licenses; to ensure safe operation of nuclear power plants; to request to stop or shut down operation if safety requirements are not complied;
- To review and evaluate nuclear safety level of other nuclear facilities to advise Prime Minister in decision making when needed.

LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (5)

A National Atomic Energy Law, which covers provisions for decommissioning, was ratified by Vietnam National Assembly on 3 June 2008 (cont'd)

Article 39. Safety analysis report and safety assessment report for nuclear facilities

1. Nuclear facilities shall submit safety analysis reports when applying for permit for construction, modifications of operation scope and scale, termination of operation, operating research reactors and operating nuclear power plants.

2. Nuclear facilities shall submit safety assessment reports when applying for license or renewal of license for conducting radiation practices specified in Article 18 of this Law, except for operating research reactors and nuclear power plants.

3. The Ministry of Science and Technology shall specify contents of safety analysis report and safety assessment report.

LEGAL AND REGYLATORY FRAMEWORK IN VIETNAM RELATED TO THE DECOMMISSIONING OF NUCLEAR FACILITIES (6)

A National Atomic Energy Law, which covers provisions for decommissioning, was ratified by Vietnam National Assembly on 3 June 2008.

Article 40. Decommissioning and decontamination of nuclear facilities, handling nuclear fuel, nuclear equipment, radioactive waste

1. When a nuclear facility is planning to terminate its operation, the facility shall apply to the agency for radiation and nuclear safety for approval of the plan for decommissioning, decontamination, handling nuclear fuel, nuclear equipment, radioactive waste, and shall organize to execute the approved plan.

2. The agency for radiation and nuclear safety shall organize to inspect the decommissioning, decontamination, handling of nuclear fuel, nuclear equipment and radioactive waste and shall certify that the nuclear facility is released from its responsibilities for ensuring safety.

3. Nuclear facilities shall bear all the cost associated with dismantlement, storage and handling of radioactive waste resulted from decommissioning process.

4. Decommissioning, decontamination, handling of nuclear fuel, nuclear equipment and radioactive waste shall be complied with national technical standards.

5. The Ministry of Science and Technology shall specify procedures, formalities of verification and approval of plan for decommissioning, decontamination, handling of nuclear fuel, nuclear equipment and radioactive waste.

PREPARATION FOR THE DECOMMISSIONING PLAN OF DNRR (1)

- Recently, after 25 years of operation, a decommissioning plan for the DNRR and other relevant facilities is not yet carried out and the decommissioning plan proposed for DNRR is still under study. However, from the early phases of facility design and construction and during operation, the aspects that facilitate decommissioning process have been considered. The radioactive wastes have been cemented and immobilized in the metal drums of 200 litters - this can provide easy adaptation to the national plan of radioactive waste management and disposal in the future.

- A decommissioning plan for the DNRR in operation stage will be prepared by NRI staff under the 2 year ministerial project, starting from January 2009 to December 2010.

PREPARATION FOR THE DECOMMISSIONING PLAN OF DNRR (2)

The contents of the ministerial project for preparing the decommissioning plan of the DNRR:

1. Radionuclide inventory assessment and characterization:

- calculating the neutron distribution within structures, systems and equipment of the reactor (such as beryllium and graphite reflectors, alluminium tank, concrete structure…) using MCNP computer code

- determining the activation activity of radionuclides (maximum and average levels) present in the structures, systems and equipment of the reactor based on the reactor operating history and using ORIGEN2 computer code

- carrying out the sampling when necessary

2. Development of the decommissioning plan for the DNRR based on the IAEA guidance (Safety Reports Series No.45)

PREPARATION FOR THE DECOMMISSIONING PLAN OF DNRR (3)

The major topics of the decommissioning plan

1. Introduction to the name and address of the reactor and licensee's name and address.
2. Facility description, including:
   - site location and description,
   - building and system description,
   - current radiological status, and
   - facility operating history
3. Decommissioning strategy:
   - alternatives considered (immediate decommissioning or deferred dismantling or entombment)
   - rationale for chosen strategy

PREPARATION FOR THE DECOMMISSIONING PLAN OF DNRR (4)

The major topics of the decommissioning plan (con't)

4. Project management:
   - legal and regulatory requirements
   - project management organization and responsibilities
   - Task management organization and responsibilities
   - Safety culture
   - Training
   - Schedules
5. Proposed decommissioning activities (contaminated structures, contaminated systems and equipment, soil, surface and groundwater)
6. Waste management (solid radioactive waste, liquid radioactive waste, and waste containing both radionuclides and other hazardous material)

PREPARATION FOR THE DECOMMISSIONING PLAN OF DNRR (5)

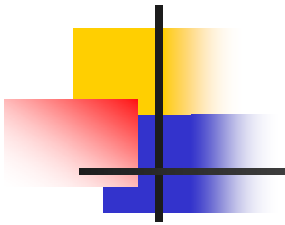
The major topics of the decommissioning plan (cont'd)

7. Cost estimate and funding mechanisms
8. Safety assessment
9. Environmental assessment (background data, environmental protection program, effluent monitoring program, effluent control program)
10. Health and safety (Radiation protection program, nuclear criticality safety, dose estimation and optimization for major task, clearance criteria, etc…)
11. Quality assurance
12. Emergency planning
13. Physical security and safeguards

SUMMARY

1. Law on Atomic energy approved by The National Assembly 12th Session, 3rd Meeting of the Socialist Republic of Vietnam on the 3rd day of June 2008. This Law has enter into force on the 1st day of January 2009. The provisions for decommissioning was covered by the Law.

2. The ongoing decommissioning plan of the DNRR are being prepared by the operator within the national project.



Thank you for your attention