*TECHNICAL MEETING ON "THE RESEARCH REACTOR DECOMMISSIONING DEMONSTRATION PROJECT: TRANSITION PHASE " AUSTRALIA, 12 – 16 NOVEMBER 2007*

# OPERATION STATUS OF DALAT NUCLEAR RESEARCH REACTOR AND DECOMMISSIONING PLANNING

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- Nuclear Organizational Structure in VN
- Brief Introduction to the DNRR:
  - History of the reactor
  - Operation and Utilization of the reactor
- The modification projects at the DNRR:
  - Reactor I&C System Replacement
  - Core Fuel Conversion
- Decommissioning Planning

# THE ORGANIZATION CHART OF VAEC AND VARANSAC


**Ministry of Science and Technology (MOST)**

**Vietnam Atomic Energy Commission** (VAEC)

**Vietnam Agency for Radiation and Nuclear Safety and Control (VARANSAC)**

Chairman

**Scientific Council**

**Dept. of International Relations**

**Dept. of Planning & R&D Management**

**Administration Office**

**Institute for Nuclear Science and Technique** (INST, Hanoi)

**Institute for Technology of Radioactive and Rare Element** (ITRRE, Hanoi)

**Nuclear Research Institute** (NRI, Dalat)

**Center for Nuclear Technique** (CNT, HCMC)

**Research & Development Center for Radiation Technology** (VINAGAMA, HCMC)

**NEAD Technology Application & Development Company** (NEAD Co., Hanoi)

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# NUCLEAR ORGANIZATIONAL... (1)

## Vietnam Agency for Radiation and Nuclear Safety & Control (VARANSAC)

- Before 1994, VARANSAC belonged to the VAEC with the name of Radiation Protection and Nuclear Safety Department.
- Since July 31, 1994 VARANSAC has been established and directed by Ministry of Science and Technology.
- The VARANSAC's main activities are concentrated in the inspection and licensing for nuclear facilities; in radiation protection and management of radioisotope sources distributed in the country.

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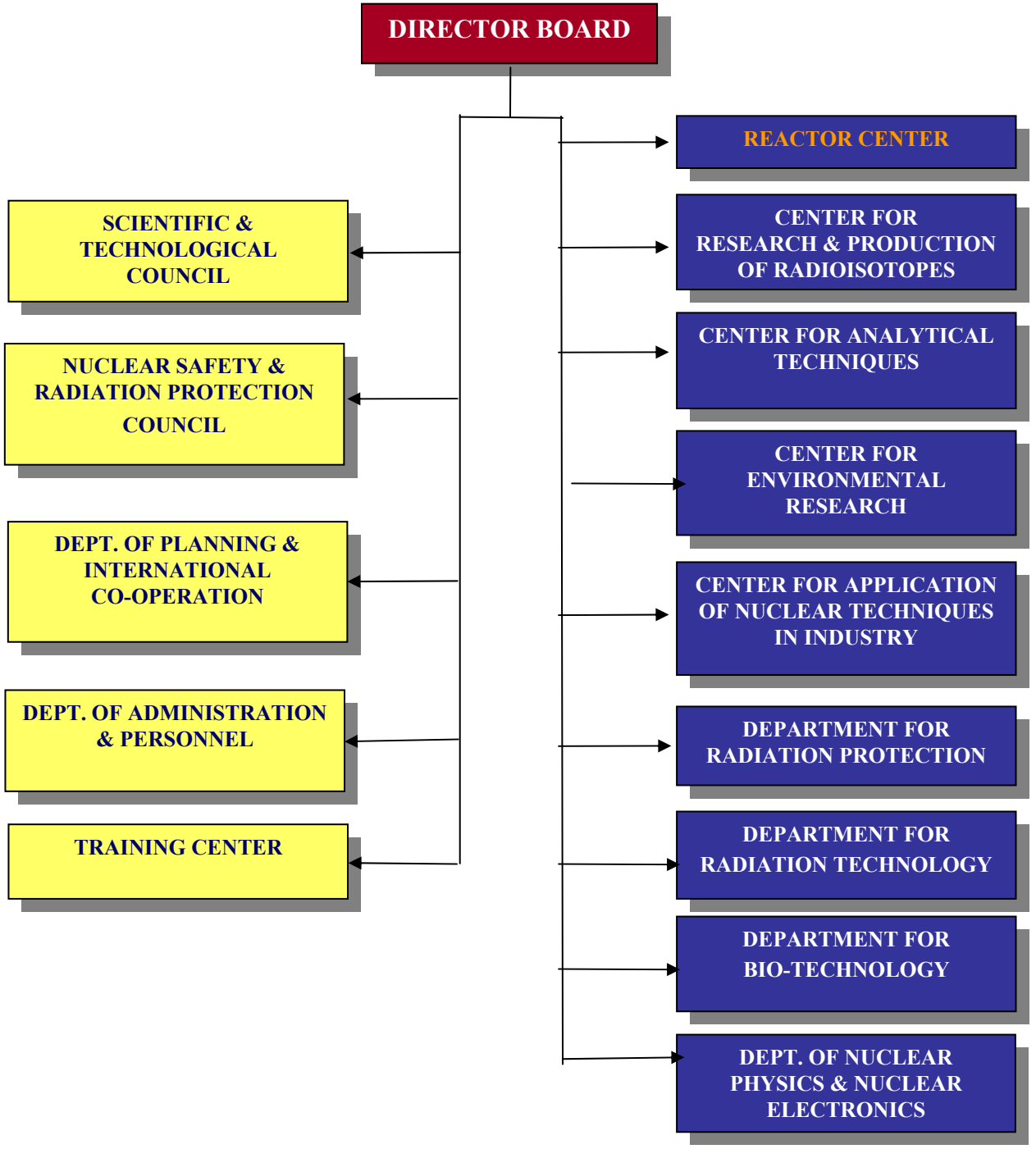
# NUCLEAR ORGANIZATIONAL... (2)

## Vietnam Atomic Energy Commission (VAEC)

- The VAEC was established in April 26, 1976 and directed by Prime Minister.
- In April 1994, VAEC has been re-organized and directed by Ministry of Science and Technology (MOST).
- VAEC's activities are focused on:
  - *Formulating the policy for nuclear power development;*
  - *Promoting the applications of nuclear techniques in medicine, industry, agriculture, geology, environmental protection, etc.;*
  - *Improving the research and development infrastructure;*
  - *Coordinating the International and Regional Co-operation.*

# THE ORGANIZATION CHART OF NRI



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# NUCLEAR ORGANIZATIONAL... (3)

**Missions and roles of NRI are concentrated in:**

- Managing and exploiting the research reactor and other scientific instruments at NRI
- Carrying out research and development in nuclear and related fields
- Preparing material & technical bases and manpower for the institute and for nuclear energy program in Vietnam
- Ensuring nuclear and radiation safety for the Institute and helping other organizations on radiation protection
- Carrying out activities on international collaboration in research and training


# BRIEF INTRODUCTION…
# HISTORY OF THE REACTOR (1)

- Early 1960: Construction of the TRIGA Mark II reactor started
- 12/1962: Completion of the reactor construction
- 26/2/1963: First criticality of the TRIGA Mark II
- 4/3/1963: Official inauguration of TRIGA reactor with the nominal power of 250 kW
- 1968-1975: Reactor was in extended shutdown
- 1974-1975: Fuels were unloaded and shipped back to USA

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# BRIEF INTRODUCTION...

## HISTORY OF THE REACTOR (2)

- 9/10/1979: Contract No. 85/096-54100 for reconstruction and upgrading of the DNRR was signed.
- 15/3/1982: The reconstruction and upgrading work of the reactor was started.
- 01/11/1983: The reactor reached first criticality.
- 20/3/1984: The DNRR with the nominal power of 500 kW was officially inaugurated.
- 3/1984 to present: The reactor has been operated for the purposes of Radioisotope production, neutron activation analysis, fundamental and applied research, and manpower training.

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# REACTOR CHARACTERISTICS (1)

**Reactor type:** Pool type
**Nominal thermal power:** 500 kW
**Coolant and moderator:** Light water
**Core cooling mechanism:** Natural convection
**Reflector:** Beryllium and Graphite
**Fuel type:** VVR-M2, U-Al alloy, 36% enrichment and $UO_2$+Al, 19.75% enrichment
**Number of control rods:** 7 (2 safety rods, 4 shim rods, 1 regulating rod)
**Control rod material:** $B_4C$ for safety and shim rods, Stainless steel for automatic regulating rod

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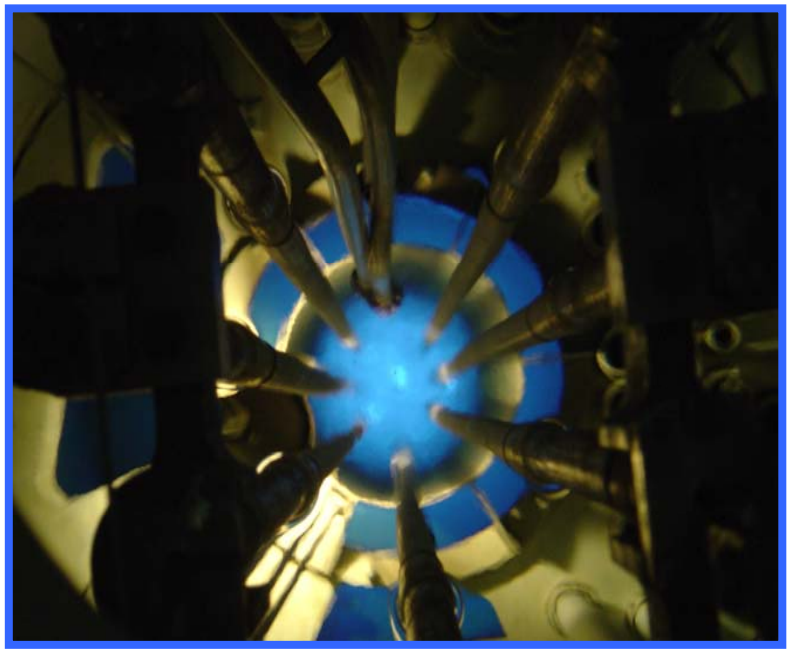
# REACTOR CHARACTERISTICS (2)



**Neutron measuring channels:** 6 (3 CFC, 3 CIC)

**Vertical irradiation channels:** 4 (neutron trap, 1 wet channel, 2 dry channels) and 40 holes at the rotary specimen rack

**Horizontal beam-ports:** 4 (1 tangential, 3 radial)

**Thermal column:** 1

**Spent fuel storage (temporary):** inside reactor building, next to the reactor tank

**Maximum thermal neutron flux in the core:** $2.1 \times 10^{13}$ $n.cm^{-2}.s^{-1}$

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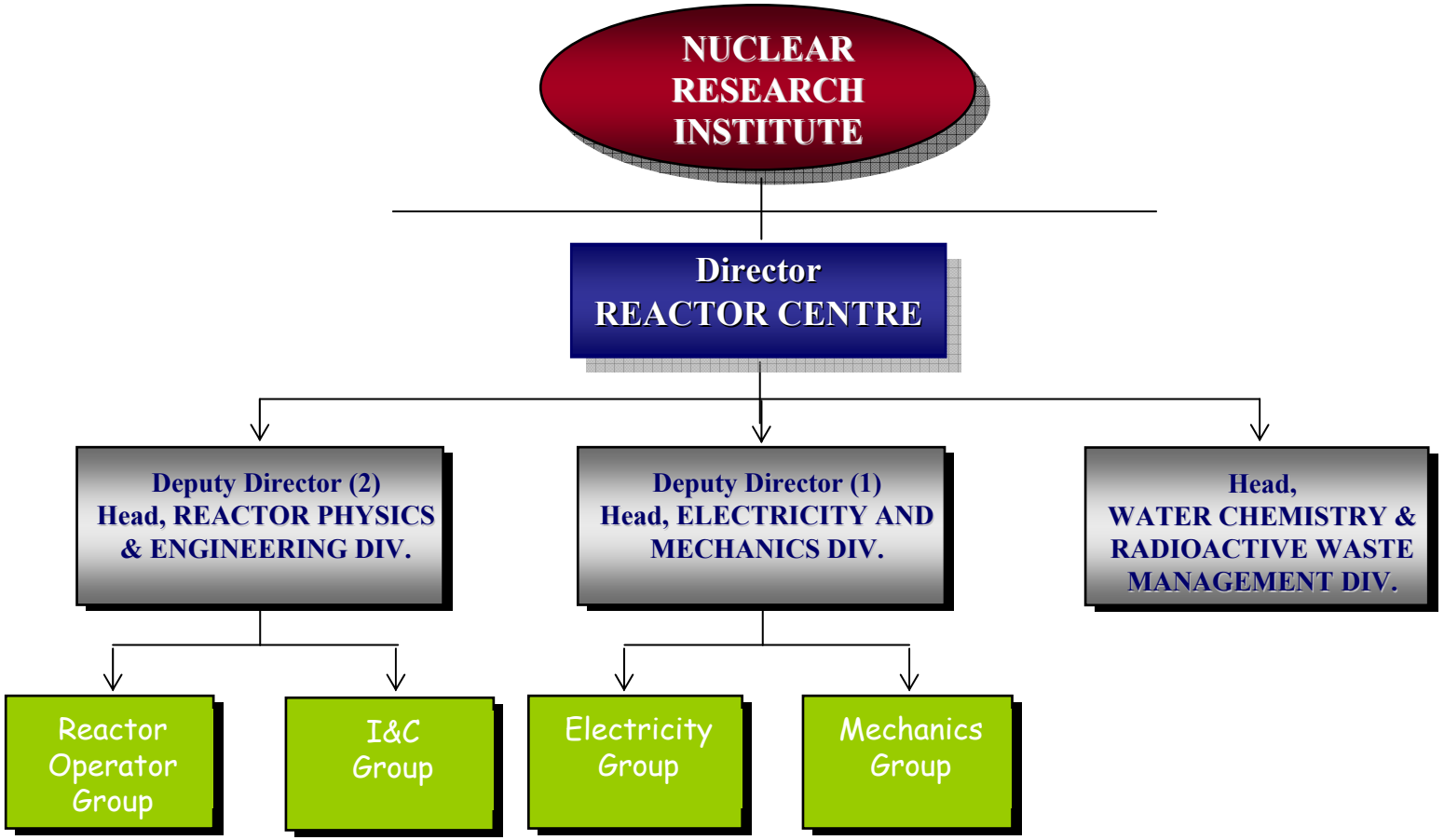
# ADMINISTRATIVE ORGANIZATION OF REACTOR CENTER



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# OPERATING CYCLE AND RESULTS


The control room of the DNRR

**Operating cycle:** Continuous operation for 108 hrs at full power and then shut down for 3 weeks to carry out maintenance work (sometimes short-run).

**Total operating time:** (as the end of 2006): 29790 hrs

**Accumulative thermal energy:** 595 MWd

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# UTILIZATION OF THE DNRR

I-131 Production Line

Radioisotopes and Pharmaceuticals Produced at DNRI

## DNRR is currently utilized for the following purposes:

- *Radioisotope Production*
- *Neutron Activation Analysis*
- *Basic and applied research in nuclear physics*
- *Research on reactor physics and thermo-hydraulics*
- *Personnel training and education*

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# REACTOR I&C REPLACEMENT

## Status of the new I&C system project:

- In July 2005, A Contract No. 405 of the installation of a new I&C system has been signed between Joint Stock Company SNIIP-SYSTEMATOM (Russian Federation) and NEAD Company (Vietnam) authorized by VAEC.
- Design and construction works of the new I&C system have been finished from beginning of August 2006.
- Test procedure at designer site will be started from mid of August 2006.
- The equipment of the new I&C system was delivered to Dalat at the beginning of December 2006.
- The installation and performance of tests for the new I&C system have been completed at the end of March 2007.
- The I&C system was put into operation in April 2007.

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# CORE FUEL CONVERSION (1)

## DNRI's interests and requests for core conversion:

- No interruption of reactor operation because of user requirements (RI, NAA, etc.)
- No change in core construction (core size, irradiation facilities in the core, core configuration, etc.)
- No much change in reactor characteristics (neutron flux, reactor statics and dynamics, reactor thermo-transient, etc.)
- The number of LEU FA supplied under RERTR program would be enough for reactor operation at least to 2015 (equivalent of existing number of unirradiated FAs)
- Technical supports (experts, training, …)
- Financial supports

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# CORE FUEL CONVERSION (2)

## Chief events of core fuel conversion project:

- The US DOE mission paid a first visit to Dalat Nuclear Research Institute on 14 February 2004.
- US technical experts presented results of neutron calculations for LEU and HEU mixed core of the DNRR (Oct. 2004).
- US DOE sent letter to VN MOST informing that US will sponsor for core fuel conversion project at the DNRR (Feb. 2005).
- VN experts were dispatched to Argonne National Laboratory (ANL) in order to join study on core fuel conversion of the DNRR (Apr. 2005).
- A report containing the results of design and safety analyses (performed by the joint study between RERTR program at ANL and VAEC) for using LEU and HEU mixed core at the DNRR was submitted to Vietnam Agency for Radiation and Nuclear Safety & Control for review (Mar. 2006).

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# CORE FUEL CONVERSION (3)

## Chief events of core fuel conversion project (con't):

- The VAEC sent a proposal for core fuel conversion of the DNRR to MOST.
- The contract (among JSC TVEL (Russia), VAEC and US DOE) for LEU FA manufacture and supply for the DNRR; The contracts (between IAEA, SOSNY and VAEC, and between VAEC and SOSNY) for return of Russian-origin HEU fuel from Vietnam to Russian Federation were signed on 14 Mar. 2007.
- According to the intended plan, from 11-14 Sept. 2007, 36 LEU VVR-M2 FAs arrived NRI and 34 HEU VVR-M2 FAs plus 1 IFA were shipped to Russia.
- a mixed core for the DNRR (98 HEU FAs + 6 LEU FAs) was commenced from 12 Sep. 2007.
- The full core conversion of the DNRR is also being paid much attention by our government at these days. A project on feasibility study for the full core conversion of the DNRR has been proposed by NRI.

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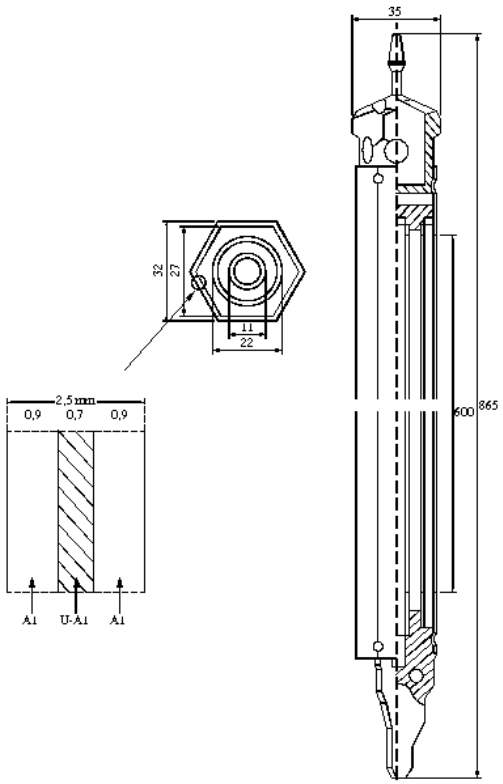
# FAs currently on-hand at DNRR




| Parameter | VVR-M2 HEU | VVR-M2 LEU |
|---|---|---|
| Enrichment, % | 36 | 19.75 |
| Average Mass of $^{235}U$ in FA, g | 40.20 | 49.70 |
| Fuel Meat Composition | U-Al Alloy | $UO_2$+Al |
| Uranium Density of Fuel Meat, g/cm$^3$ | 1.40 | 2.50 |
| Cladding Material | Al alloy (SAV1) | Al alloy (SAV1) |
| Fuel Element Thickness (Fuel Meat and Cladding), mm | 2.50 | 2.50 |
| Fuel Meat Thickness, mm | 0.70 | 0.94 |
| Cladding Thickness, mm | 0.90 | 0.78 |

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# DECOMMISSIONING PLANNING

- A national nuclear law which includes provisions for decommissioning has been prepared and it will be reviewed by our National Assembly in this month.
- There has not been a Decommissioning Plan for the DNRR before. The decommissioning plan for the DNRR in operation stage is under preparation.
- Some problems are faced with decommissioning planning:

  ** Lack of experience*

  ** Lack of personnel training*
- Training in the field of the decommmissioning of research reactors for staffs of NRI (VAEC) and international cooperation are needed.

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# CONCLUDING REMARKS

- The DNRR is an unique nuclear reactor in Vietnam at present time. The reactor has been safely operated and effectively utilized so far.
- The project for modification of the reactor I&C system was carried out and the new reactor I&C system was put into operation in April 2007.
- Under the framework of the Core Fuel Conversion Project, the DNRR now is being operated with a mixed core using 98 HEU VVR-M2 FAs plus 6 LEU VVR-M2 FAs.
- Decommissioning plan for the DNRR in operation stage are being prepared.
- A new multipurpose research reactor is now under consideration in Vietnam. If the proposal for new RR is approved by our government, the initial decommissioning plan will be considered in design stage.

# THANK YOU
# FOR YOUR ATTENTION!