

Regional Workshop for Central Governments and Regulatory Bodies on the  
Development of National Strategies and Regulatory Requirements for  
Decommissioning - 04-07 April, 2022



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# **DECOMMISSIONING PLAN OF DALAT NUCLEAR RESEARCH REACTOR**

**Presented by**

**Pham Quang Huy**

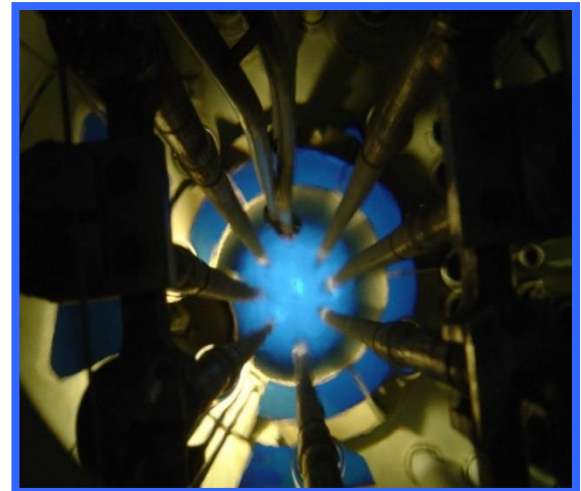
**Nuclear Research Institute-Vietnam Atomic Energy  
Institute (VINATOM)**

Regional Workshop for Central Governments and Regulatory Bodies on the  
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## CONTENTS

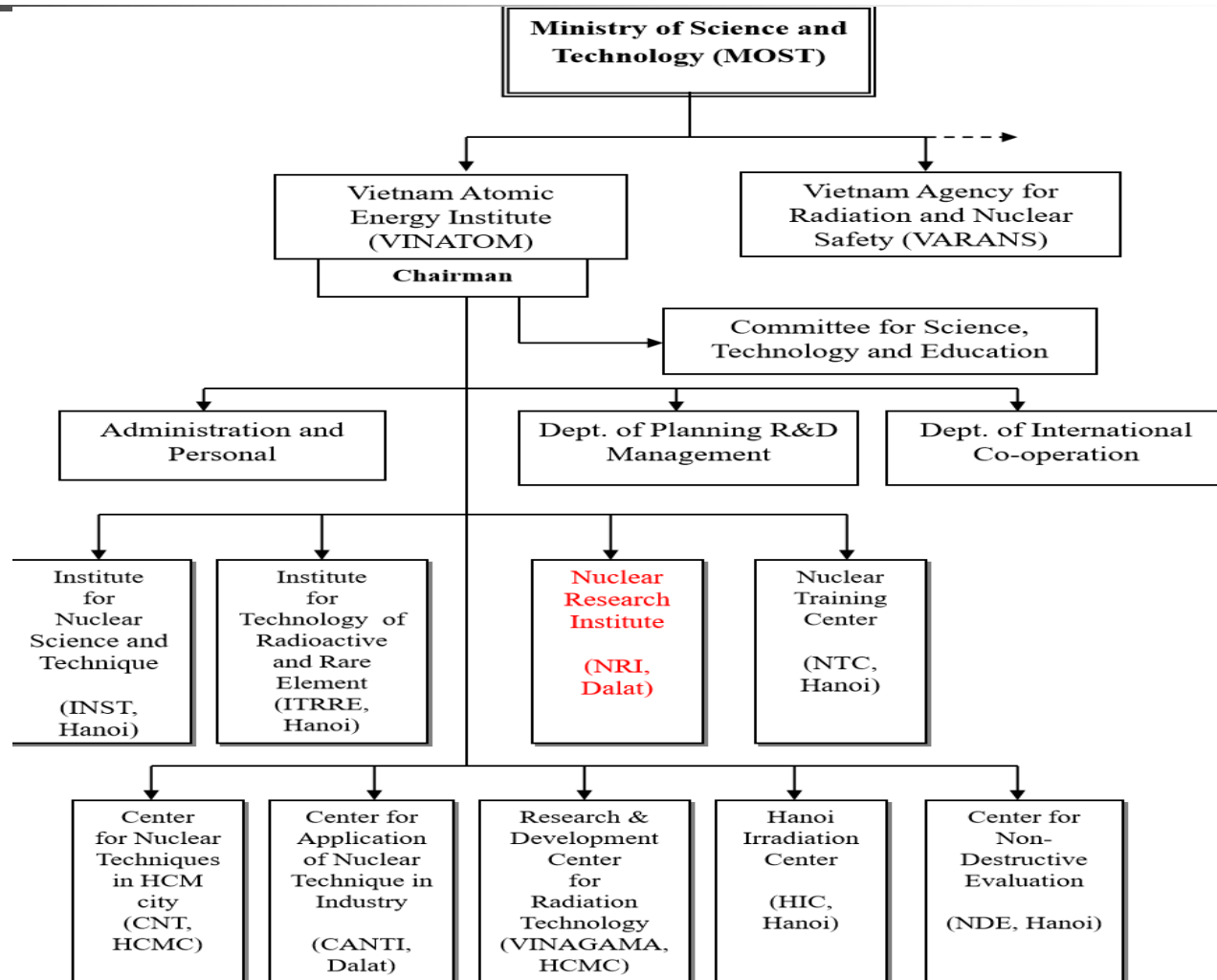
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1. ***VINATOM and VARANS***
2. ***National Policies and  
Regulatory Framework***
3. ***Brief intro. of the Dalat Nuclear  
Research Reactor (DNRR)***
4. ***Decommissioning plan of the  
DNRR***
5. ***Concluding remarks***



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## ***VINATOM and VARANS***





## ***National Policies and Regulatory Framework***

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The following national laws, decrees, regulations and international guides related to decontamination and decommissioning activities are:

- Vietnam's Atomic energy Law (No. 13/2008/L-CTN, June, 12, 2008);
- Vietnam's Environmental protection Law (No. 52/2005/QH11, Dec., 12, 2005, No. 72/2020/QH14, No. 17/11/2020);
- Regulation on ionizing radiation protection (TCVN 4498:1988, TCVN 4397-87 17/01/2015);
- Management of radioactive waste - Classification of radioactive waste (TCVN 6868:2001 25/08/2014);
- Regulation on activities of nuclear control (No. 45 / 2010/QD-TTg, June, 14, 2010);
- Regulation on management of hazardous waste (No. 155/1999/QD-CP, July, 16, 1999);
- ALARA principle of IAEA.



## ***National Policies and Regulatory Framework***

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Article 40 of Vietnam's Atomic energy Law regarding Decommissioning and decontamination of nuclear facilities, handling nuclear fuel, nuclear equipment, radioactive waste:

- When a nuclear facility is planning to terminate its operation, the facility shall apply to **the Agency for Radiation and Nuclear Safety (VARANS)** for approval of the plan for decommissioning, decontamination, handling nuclear fuel, nuclear equipment, radioactive waste, and **shall organize to execute the approved plan.**
- **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.



## ***National Policies and Regulatory Framework***

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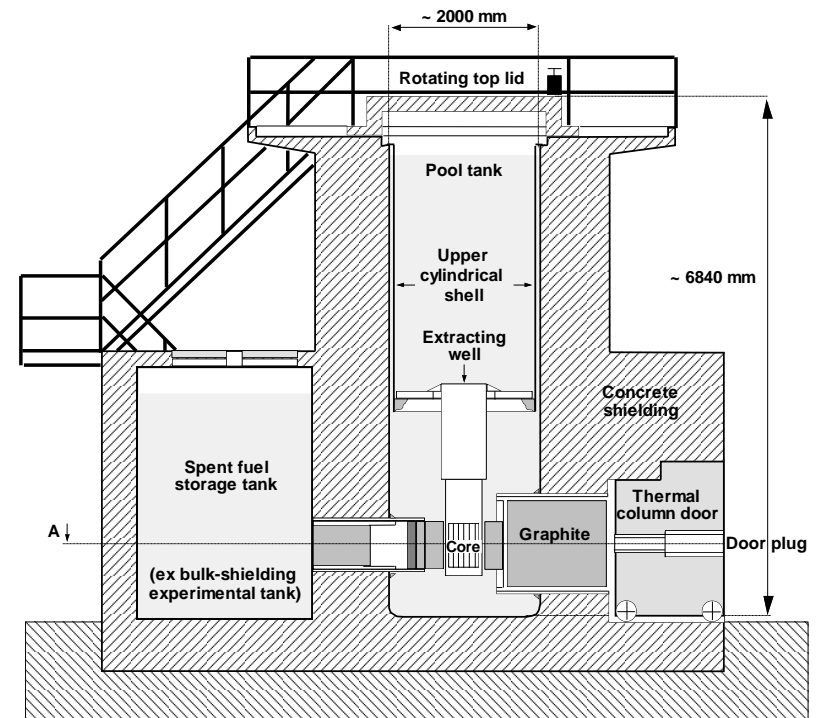
Article 40 of Vietnam's Atomic energy Law:

- **Nuclear facilities** shall bear **all the cost** associated with dismantlement, storage and handling of radioactive waste resulted from decommissioning process.
- Decommissioning, decontamination, handling of nuclear fuel, nuclear equipment and radioactive waste shall be complied with national technical standard.
- **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.

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Decommissioning - 04-07 April, 2022

## ***Brief intro. Of Dalat Nuclear Research Reactor (DNRR)***

- Reconstructed from the former TRIGA Mark II reactor (built in 1963).
- Operation since 1984.
- Thermal Power 500kW, light water moderated, natural convection.
- Maximum thermal neutron flux:  $2.2 \times 10^{13} \text{ n/cm}^2.\text{sec}$
- Number of FA: 94 LEU (04/2021); Al-UO<sub>2</sub> Alloy, Enrichment 19,75% of U-235.





## ***Decommissioning plan of the DNRR***

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- The Dalat Nuclear Research Reactor (DNRR) will be in operation **until 2030** or later.
- The **first version** of Decommissioning plan for the DNRR was completed **in 2011** by NRI staff.
- The Decommissioning plan for the DNRR based on the guidance of IAEA (Safety Report Series No. 45).
- Decommissioning plan for the DNRR has just been **updated in 2021**.





## ***Decommissioning plan of the DNRR***

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The major chapters of the decommissioning plan for DNRR:

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



## ***Decommissioning plan of the DNRR***

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The major chapters of the decommissioning plan for DNRR:

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



## ***Decommissioning plan of the DNRR***

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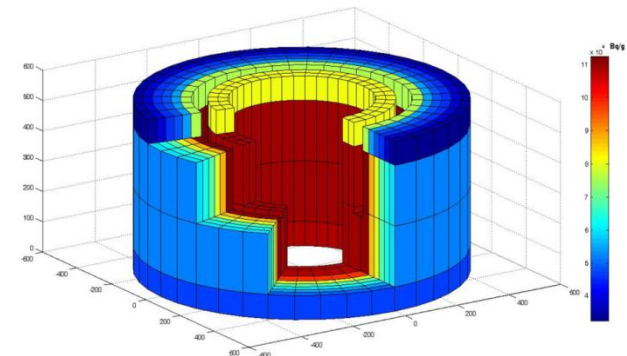
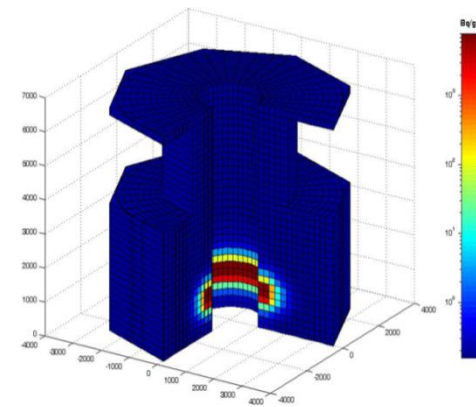
8. Cost estimate and funding mechanisms.
9. Safety assessment.
10. Environmental assessment (background data, environmental protection programme, effluent monitoring programme, effluent control programme).
11. Radiation protection plan, nuclear criticality safety, dose estimation and optimization for major task, clearance criteria, etc...).
12. Quality assurance.
13. Emergency planning.
14. Physical security and safeguards.
15. Proposed Final Status Survey Plan.

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## ***Decommissioning plan of the DNRR***

Radionuclide inventory assessment and characterization in the main structures of DNRR (reactor pool, reflectors, concrete structure, etc...):

- Collecting of related documents.
- Calculating the neutron distribution within structures, systems and equipment of the reactor (such as beryllium and graphite reflectors, aluminum 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 to verify calculated results.



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## *Decommissioning plan of the DNRR*

- Establishment of the cost estimation methodology and list items (reference to the guidance documents of IAEA and reports published by expert groups).
- Preliminary cost estimate for decommissioning of the DNRR is still in the process of analysis from the reference to a decommissioning costs of TRIGA and similar nuclear research reactors.

© CERREX-D2_Cost Estimation for Research Reactors in Excel; IAEA project DACCORD-4; © XB					No. of work.		25	USD	Con	Period dependent activities and collateral cost					La	
Case:	Vietnam IVV9 research reactor			21	Duration [y]	0.11		2,020	tin	Investment cost		Expences		1,800		
Reactor:	TRIGA Mark II type; 100 kW-1 MW			10	Total calculated data				gen	Fixed	Period	Fixed	Period	Dura-	La	
Operation:	Standard Operation			SO	Workforce	Costs	Contingency		cy					tion		
Version: AM	© International Atomic Energy Agency			2014-01	[man.h]	[USD]	[USD]		[%]	[USD]	[USD/y]	(Assets)	[USD]	[USD/y]	[y]	
C7-F.o.th.	Row 7: Sums of calculated data, sums of inventories and waste				406,641	2,906,065	386,940			R12-V548: User settings for period dependent activities and for collateral costs for any ISDC item, independent on selection of the ISDC item for D&D and WM activities in columns H and J.					W	
1	Categories	BA8-FZ8: User defined workforce unit factors [man.h/unit]			K7-P7: Sums of calculated data for activated ISDC items										8.0	
	BA2-FZ2	BA9-FZ9: user defined investment cost unit factors [currency/unit]							MC						5.0	
	ISDC No.	BA10-FZ10: user defined expenses cost unit factors [currency/unit]													0.022	
A	ISDC calculation items; rows 12 to 448				I	C	W	Workforce	Costs	CNT	CNT	FX-INV	PS-INV	FX-EXP	PS-EXP	DUR
	04.0303	Decontamination of remaining systems			1			0	0	0	20					
	04.0304	Decontamination of areas in buildings			1			0	0	0	20					
1	04.0400	Removal of materials requiring specific procedures			1			1,620	11,905	1,984	20					0.3
	04.0401	Removal of thermal insulation			1			0	0	0	20					
	04.0402	Removal of asbestos			1			0	0	0	20					
	04.0403	Removal of other hazardous materials			1			0	0	0	20					
	04.0500	Dismantling of main process systems, structures and comp.			1			0	0	0	50					
1	04.0501	Dismantling of reactor internals			1			3,245	20,326	4,065	25					0.50



## ***Decommissioning plan of the DNRR***

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### **Fund resource**

The strategy of **immediate dismantling** requires a large fund in such a short period, it is easily affected negatively by the inadequate fund. The DNRR, however, belongs to government, **the funds** for operation, maintenance and for reactor decommissioning also are **provided annually by Ministry of Science and Technology**.

The lack of fund for DNRR decommissioning only occurs in the case there is no requirement in Regulatory Framework. However, in accordance with the Article 7 and Article 30 of section 3 in the Vietnam Atomic Energy Law, **government will be responsible** for supplying fund for DNRR decommissioning.



## ***Decommissioning plan of the DNRR***

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### **Decommissioning technologies**

- The technologies for decommissioning of DNRR are still in the process of discussion.
- The co-operation with other countries, hiring contractors and renting equipment for decommissioning of the DNRR are still not considered. It will be expected in the final decommissioning plan.



## ***Decommissioning plan of the DNRR***

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### **Radioactive waste and spent fuel management system.**

- Ideally, spent fuel and waste management system, including final repositories for all types of waste, will be available at the time of decommissioning.
- In the case of no on-site management system for waste generated during decommissioning, the immediate dismantling could not be completed without the availability of waste repositories.





## ***Decommissioning plan of the DNRR***

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### **Radioactive waste and spent fuel management system.**

- In order to safely manage radioactive waste generated in DNRI, a combining technical management system for low and mediate – level waste was designed and installed by former USSR in the stage of reactor innovation (1982 – 1984).
- This system includes Liquid Waste Treatment Station and its control room, temporary waste storage and chemical – physical laboratories.
- After DNRR's shutdown, this waste management system will be still in operation to support reactor decommissioning.



## ***Decommissioning plan of the DNRR***

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### **Radioactive waste and spent fuel management system.**

- To store spent fuel assemblies, there is a spent fuel pool which locates in the reactor building to contain up to 300 assemblies. After reactor shutdown, assemblies in core will be cooled adequately, and consequently they will be moved to spent fuel pool for temporary storage.
- Before dismantling reactor structures, these fuel assemblies will be shipped back to Russia or to another site (in DNRI area or national radioactive waste repositories) for long term storage.



## ***Decommissioning plan of the DNRR***

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Radioactive waste and spent fuel management system.

However

- The national radioactive waste repositories for long term are not available in Vietnam.
- Specific criteria for release materials, structures and site to reuse for nuclear or non-nuclear purposes need to be developed.



## ***Decommissioning plan of the DNRR***

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- No overlapping with other governmental authorities in case of conducting decommissioning for the DNRR. But we need support and co-operation with other governmental authorities such as Environmental, Health and Safety, Transportation, Security Ministry...
- Requirements for conducting radiological surveys for determining levels of contamination at the facility prior the decommissioning actions has already mentioned in law and regulations.



## Concluding remarks

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- The Decommissioning of Nuclear Facilities is already included in the national legal and regulatory Framework.
- Decommissioning plan for Dalat Nuclear Research Reactor has prepared by NRI staff and just been updated in 2021.
- National radioactive waste repositories for long term storage are not available.

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Thank you for your attention !

