ANSN Annual Meeting and Regional Advisory Safety Committee For Research Reactor in Asia Pacific (RASCAP), 31 August - 4 September, Serpong, Tangerang Selatan, Indonesia

SAFETY MANAGEMENT SYSTEM FOR DALAT REACTOR

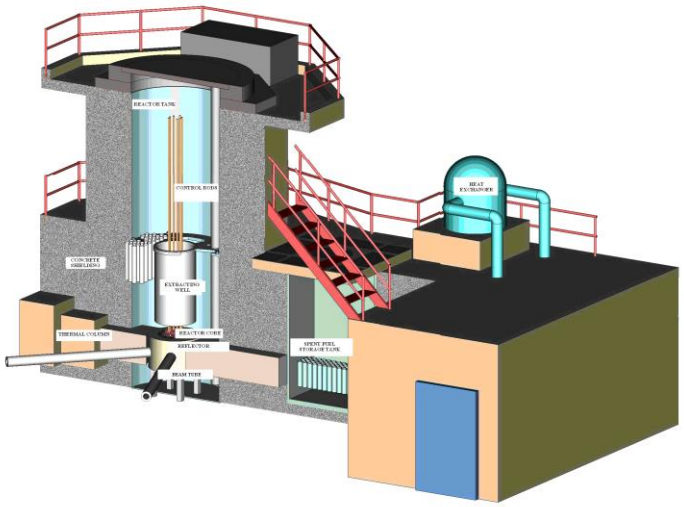
Nguyen Minh Tuan

Nuclear Research Institute, 2015

Contents

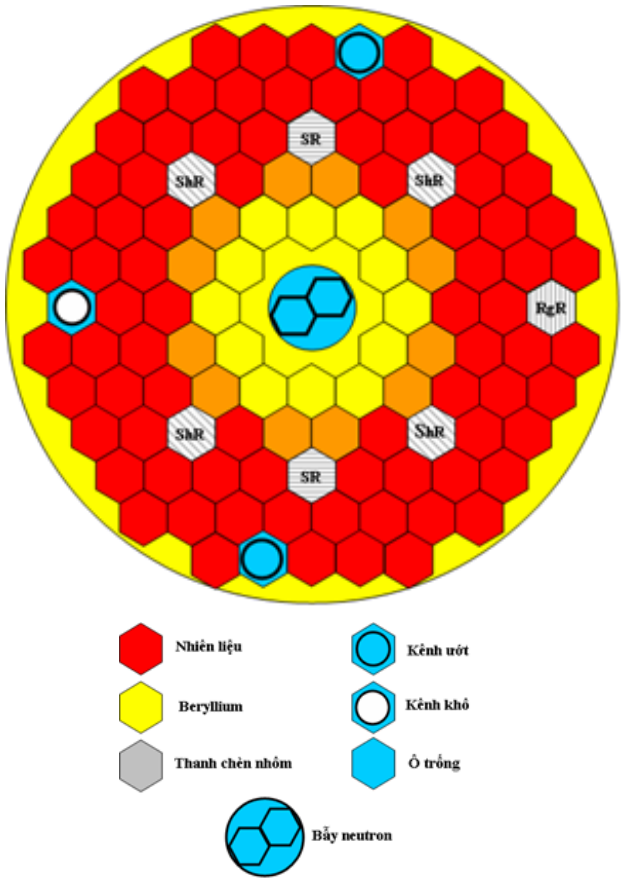
1. Introduction to Dalat Nuclear Research Reactor

History of the DNRR (1)



- Early 1960: Started to construction of former TRIGA Mark II Research Reactor;
- 02/1963: Achieved first criticality;
- 3/1963: Operated at full power of 250 kW
- 1968-1975: Shutdown;
- 1974-1975: Unloaded and shipped back fuel to USA;
- 03/1982: Started the reconstruction and upgrading work of the TRIGA Mark II reactor (DNRR now);
- 11/1983: Achieved first criticality with VVR-M2 HEU fuel of 36% enrichment;
- 03/1984: Operated at nominal power of 500 kW;
- 09/2007: Operated with mixed core (98 HEU FAs and 6 LEU FAs);
- 01/2012: Used only VVR-M2 LEU fuel of 19.75% enrichment (full core conversion).

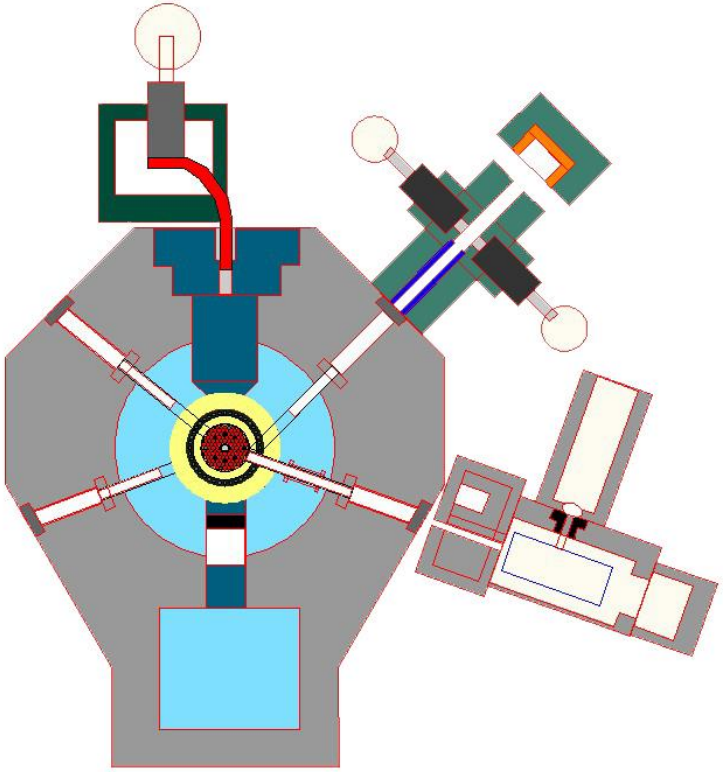
Main Characteristics (2)



Current core Configuration

- Reactor type: Pool type (TRIGA Mark II, modified to Russian type of IVV-9)
- Nominal power: 500 kW
- Maximum thermal neutron flux in the core: 2.1×10^{13} n.cm^{-2}.s^{-1}
- Coolant and moderator: Light water
- Reflector: Beryllium and graphite
- Core cooling mechanism: Natural convection
- Fuel type: Russian type, VVR-M2, UO2+Al, 19.75% enrichment
- Control rods:
  - 2 safety rods: B_4C
  - 4 shim rods: B_4C;
  - 1 fine rod (SS)

Irradiation and Experimental Facilities (3)



Horizontal section view of DNRR

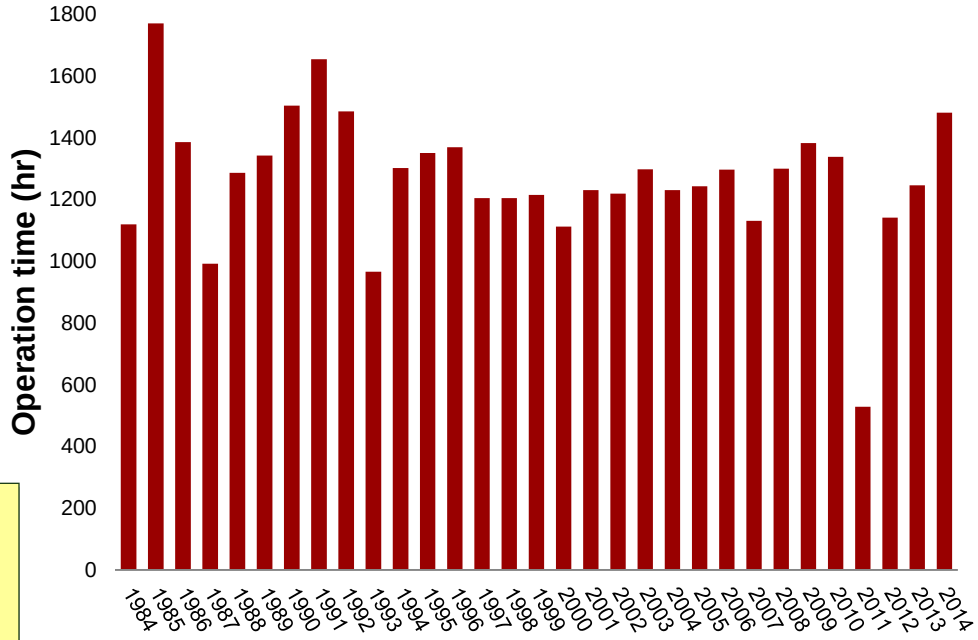
Irradiation facilities:

- 1 central neutron trap
- 2 pneumatic transfer channels
- 2 wet vertical channels
- 40 holes in rotary rack

Experimental facilities:

- 4 horizontal beam ports
- 1 thermal column

Reactor Operation (4)



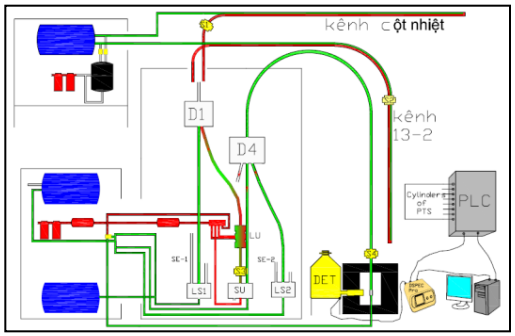
Every 3-4 weeks, continuous runs of 130 hrs for RI production, NAA, E&T, etc.

The remaining time between two consecutive runs for maintenance activities and reactor experiments.

Reactor Utilization (5)

RI products of NRI

- Production of radioisotopes (I-131, P-32, Tc-99m generator, Cr-51) for medical use and other uses in industry, agriculture, hydrology, scientific research, ...
- Irradiation of samples for neutron activation analysis (service for geology, oil field study, environmental research, etc.);
- Neutron beam researches (PGNAA, NR, nuclear data measurement, etc.);
- Education and training (practical works for students from universities, training courses on reactor engineering for professionals); and
- Public information.



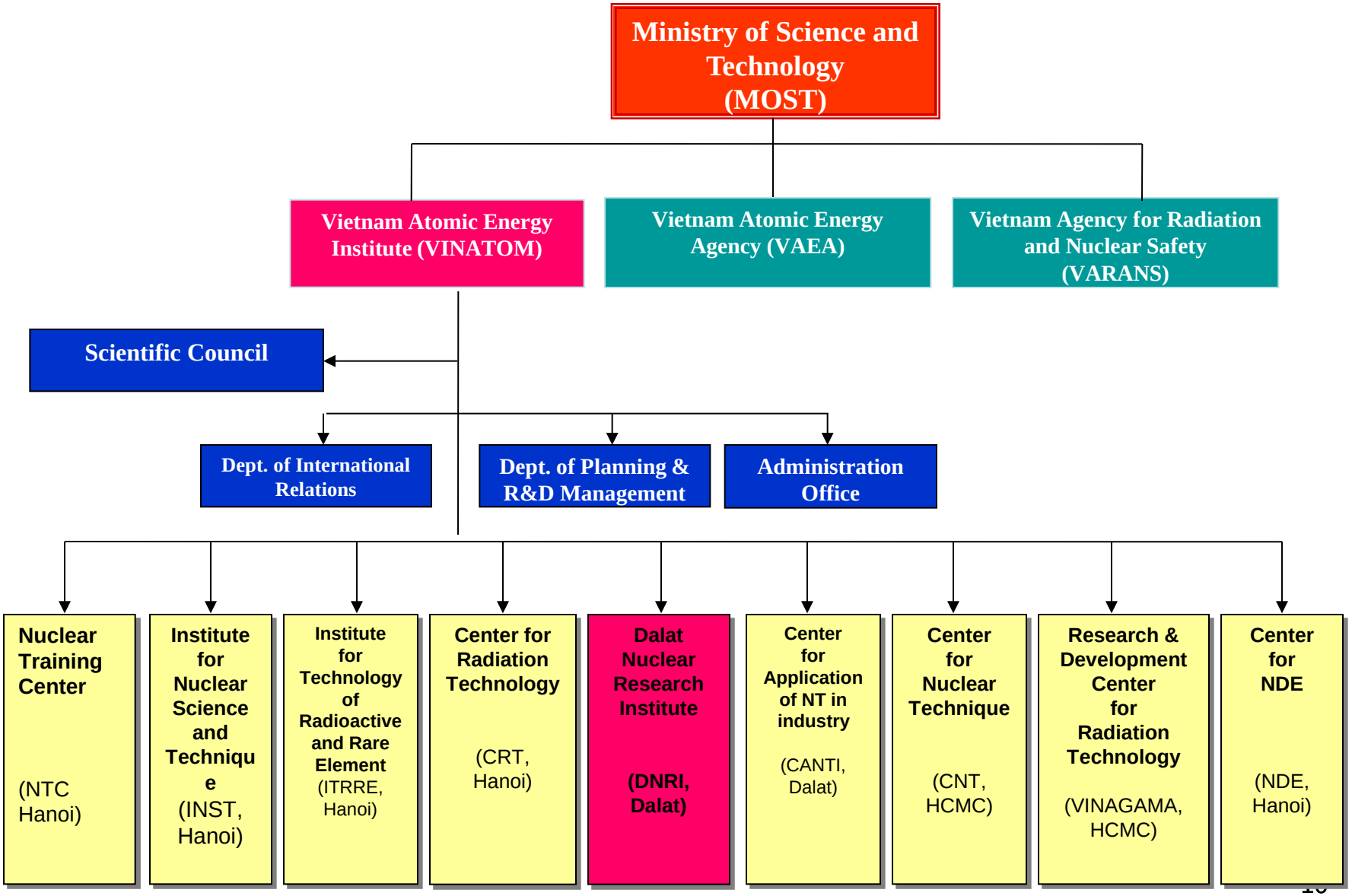
Pneumatic transfer system

Beam ports No.4

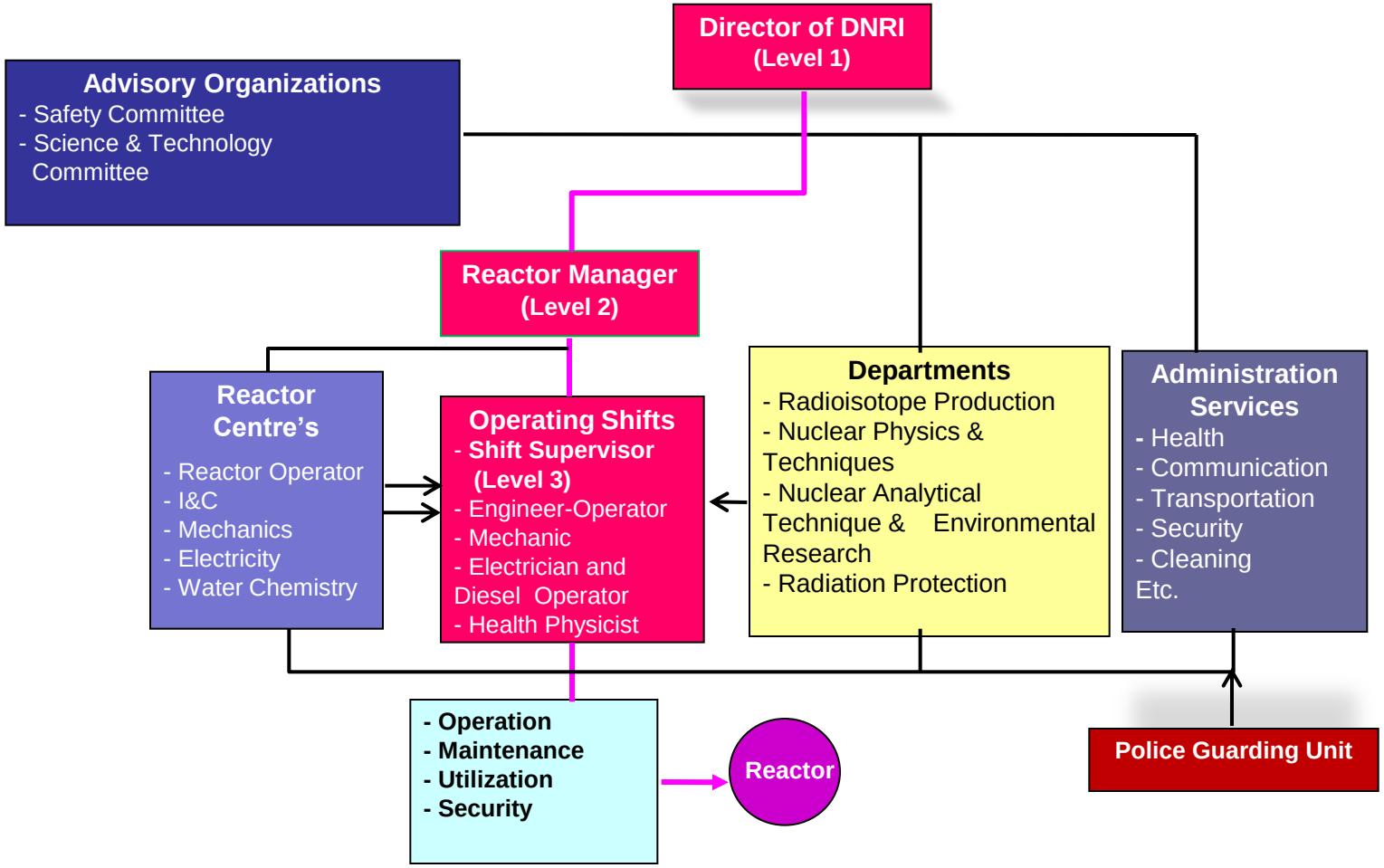
Officials of local authorities of Ninh Thuan Province

2. Safety Management System

The Organization Chart of VINATOM (1)



Organizational Structure of Reactor Management (2)



Operating Organization (3)

- **Director (Level 1) with the assistance of his deputy has the direct responsibility for the reactor management and for radiological safety of the facility.**

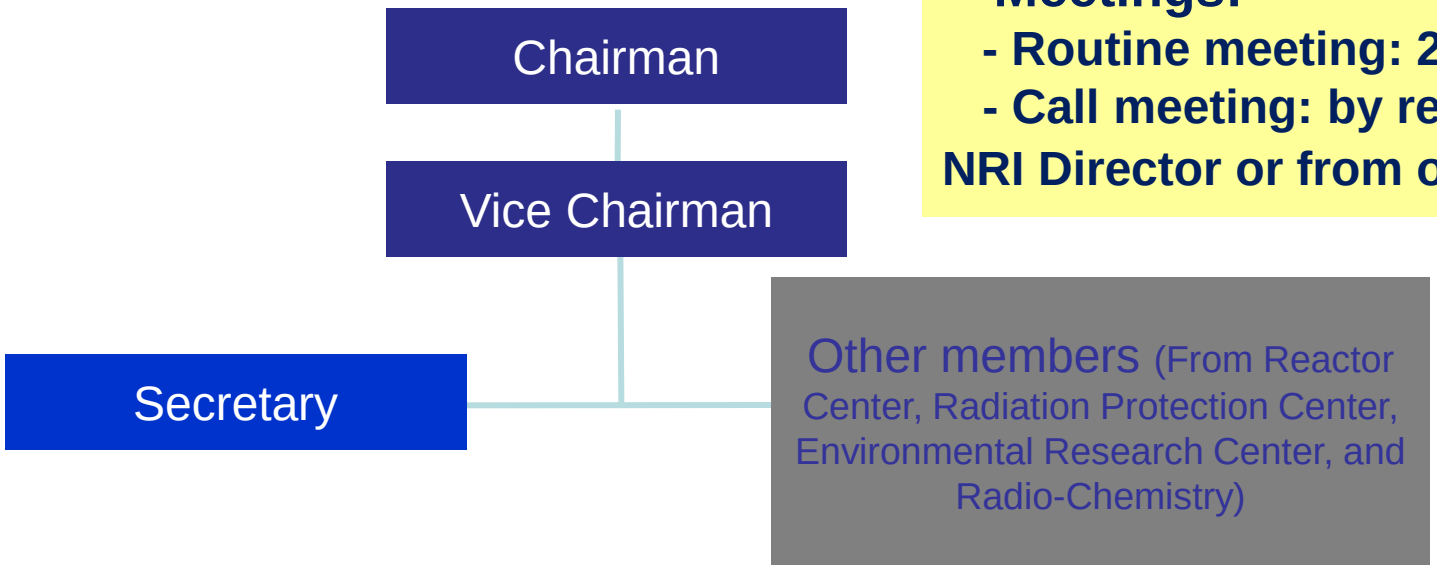
- **The Reactor Manager (Level 2) is a single member of the reactor management. He is responsible for the day-to-day operation of the reactor and for ensuring that all operations are conducted in a safe manner and within the prescribed operational limits and conditions (OLC).**

Operating Organization (4)

- **The member of an operating shift includes:**
  - **Shift Supervisor (Level 3);**
  - **Reactor Operator concurrently Instrumentation and Control Operator;**
  - **Mechanic;**
  - **Electrician; and**
  - **Health Physicist.**
- **The Shift Supervisor on duty is responsible for control of the work performed by his shift; for assurance of nuclear, radiological and technological safety in operation and utilization of the reactor.**

Safety Committee (5)

- **Safety Committee in DNRI is an advisory organization, internal to the DNRI but independent from the reactor management.**
- **The Safety Committee is established in order to advise the DNRI Director on nuclear safety, radiation safety and industrial safety in the activities of facility operation and R&D at the Institute.**

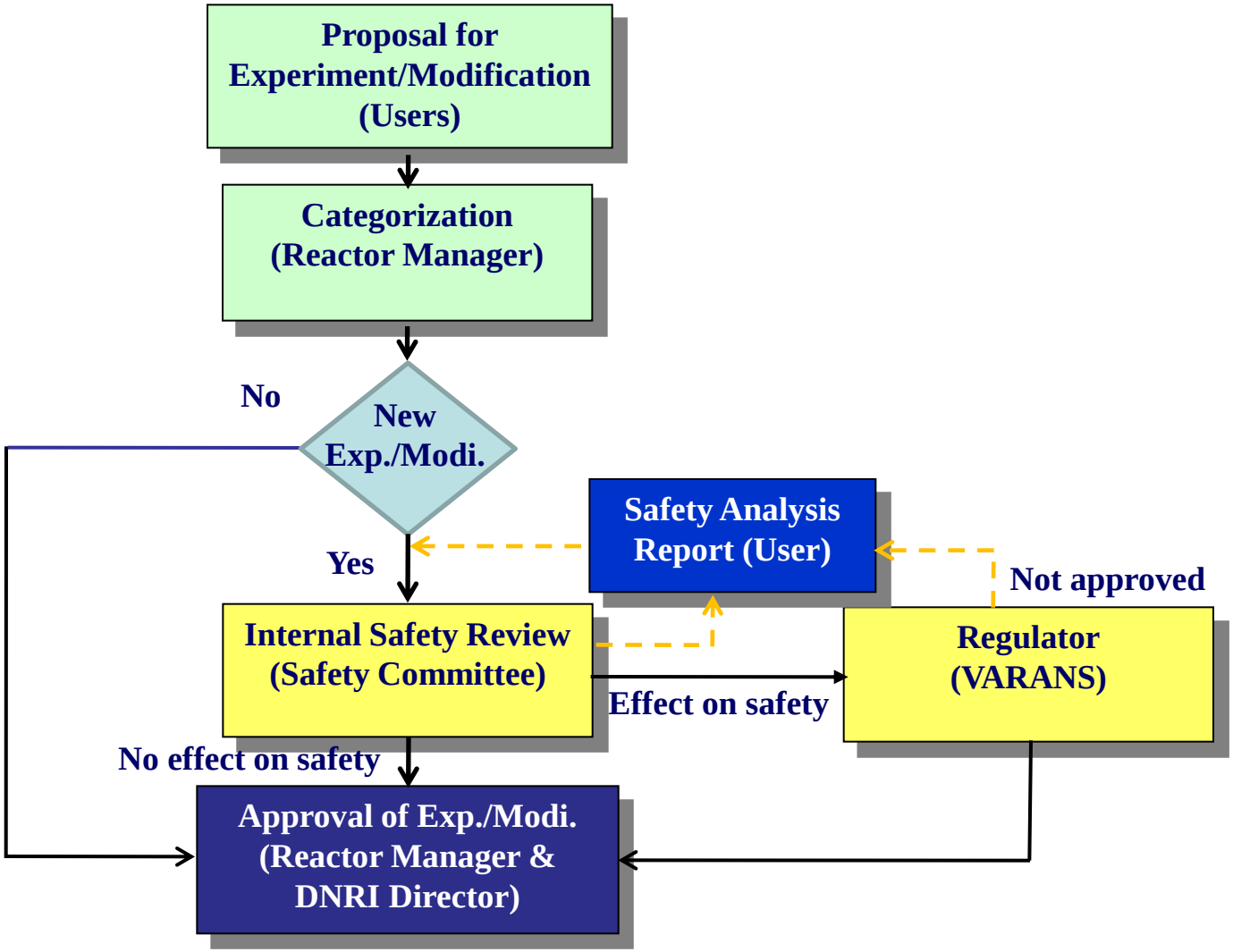


- **Meetings:**
  - **Routine meeting: 2 per year**
  - **Call meeting: by request from NRI Director or from operator.**

Safety Documentation (6)

- Safety Analysis Report for the Dalat Nuclear Research Reactor (5 versions, latest version in 2013).
- Operational Regulations for the Dalat Nuclear Research Reactor (Updated in 2015).
- Regulations for the Safety in Utilization of the Dalat Nuclear Research Reactor (Updated in 2012).
- Maintenance, periodic testing and inspection programmes for Dalat Nuclear Research Reactor (Updated in 2011).
- Radiation Protection Programme at the Dalat Nuclear Research Reactor (Updated in 2010).
- Quality assurance programme for the Dalat Nuclear Research Reactor (2010).
- Ageing management programme for the Dalat Nuclear Research Reactor (2013).
- Nuclear and radiological emergency plan at the Dalat Nuclear Research Institute (Updated in 2014).
- Etc.

Review and Approval Process (7)



Maintenance & Ageing Management (8)

- **The ageing management programme at DNRR is actually implemented by coordinating the maintenance, periodic testing and inspection programmes.**

- **As a low power research reactor (500 kW), ageing management activities for DNRR are performed by maintenance personnel in Reactor Center.**

- **Examples of ageing management:**
  - **Pool Liner Ageing Management**
  - **Replacement of I&C system**
  - **Visual inspection of beam tubes**

Maintenance & Ageing Management (9)

Pool Liner Ageing Management:

- **Some SSCs remained from former TRIGA Reactor (about 50 years old):**
  - **Reactor building,**
  - **Reactor aluminum tank,**
  - **4 horizontal beam-ports,**
  - **Thermal column,**
  - **Graphite reflector, etc.**
- **Methods of ageing management of Pool Liner:**
  - **An underwater high-resolution Video-camera system was designed and used.**
  - **Visual inspection has been carried out regularly (3 times/year)**
  - **Inside pool cleaning by an home-made system (3 times/year)**
  - **Reactor water quality monitored regularly (daily, weekly) → Pool water is always maintained in good condition.**

Maintenance & Ageing Management (10)

The underwater high-resolution Video-camera system

Remote controller

Monitor

Camera head of SANYO
37008 /3912P, Zoom x 108 – 80mm
TAMRON

Maintenance & Ageing Management (11)

The cleaning system

Suction pump of 5 m^3/h and outside-cover of mechnical filter system

3 layers of stainless steel filters

Stainless steel suction head with soft bloom

Maintenance & Ageing Management (12)

Replacement of I&C system:

- **The I&C system of DNRR was put into operation in 1983.**
- **The first renovation of the I&C system was implemented in 1992-1993.**
- **The replacement of the I&C system was implemented during 2005-2007 (digital system).**

Previous Control Console

Existing Control Console

Maintenance & Ageing Management (13)

Visual inspection of beam tubes:

- **The inspection was done in October 2011 when all HEU fuel assemblies was removed out of the reactor core for core conversion.**

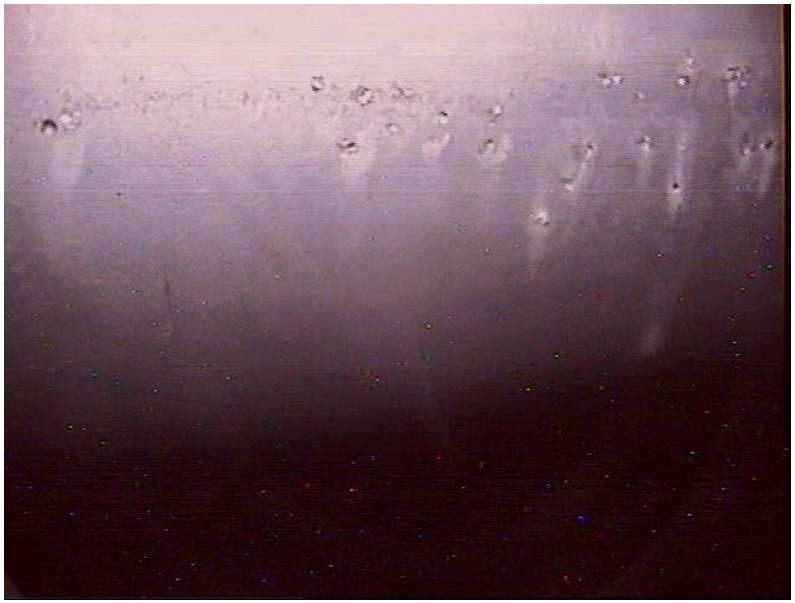
Equipment used for removing the shielding plug

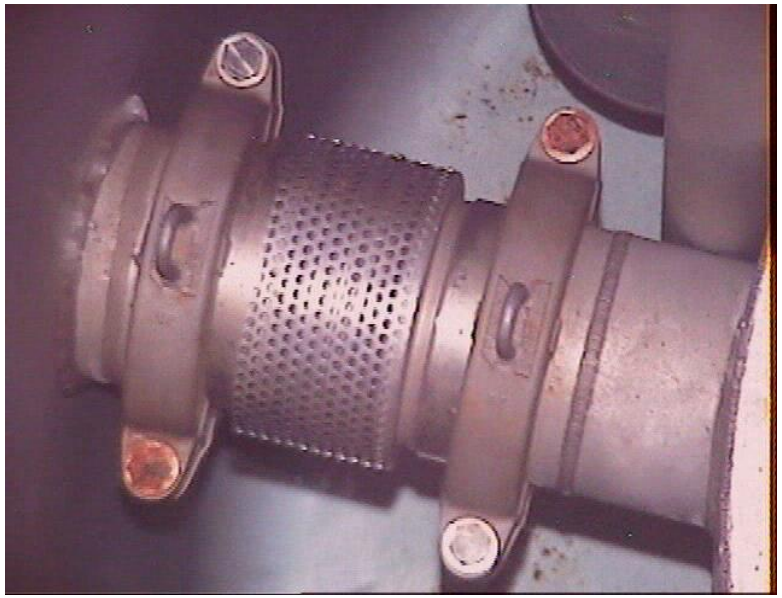
Image inside the beam tube # 1

3. Recently Safety issues

3. Recently safety issues (1)

- **Beam-port corrosion:**





3. Recently safety issues (2)

- **Equipment failures (low-voltage power supply)**

3. Recently safety issues (3)

- **Cable rupture of the control rod driven motor:**

4. Conclusion Remarks

Concluding Remarks (1)

- During 31 years of operation, the DNRR has played an important role in the use of atomic energy for peaceful purpose in Vietnam.

- The reactor has been effectively utilized to:

  - Produce radioisotopes for medicine and industry applications,
  - Carry out NAA of geological, crude oil and environment samples,
  - Carry out fundamental and applied researches on nuclear and reactor physics,
  - Create a large amount of human resource with high skills and experiences on application of nuclear techniques in the country.

Concluding Remarks (2)

- **Management system for the Dalat reactor has been established, implemented, assessed and improved.**

- **The recommendations and comments from in this workshop are very important for the DNRI to improve safety management system and also good for new research reactor project.**

THANK YOU FOR YOUR ATTENTION