Workshop on safety standards on operational radiation protection and radioactive waste management for Research Reactors
Kinshasa, Democracy Congo Republic
09-13 Sep. 2019

Operational radiation protection for Tajoura nuclear research reactor

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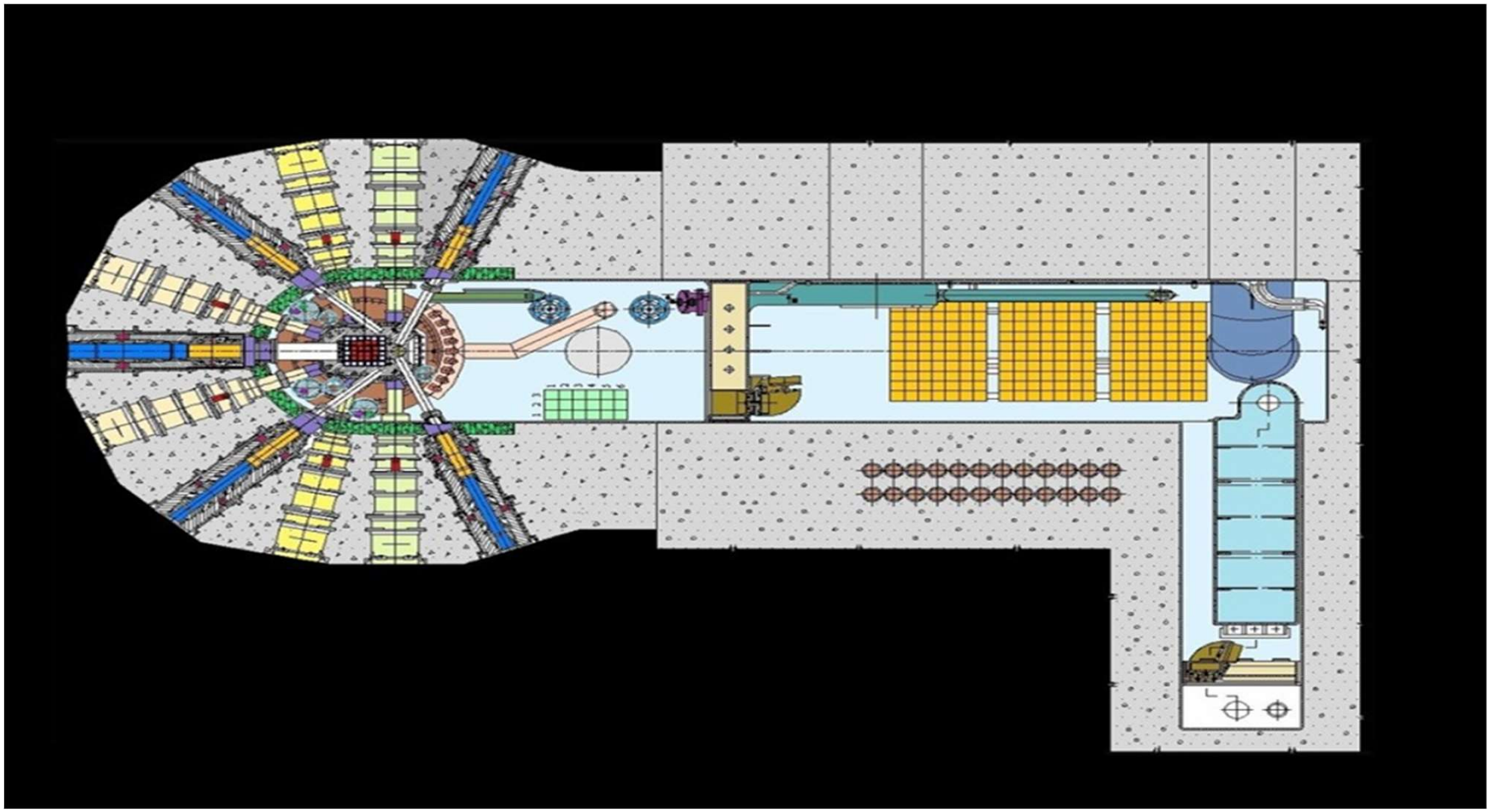
Tajoura Nuclear Research Reactor (TNRR);

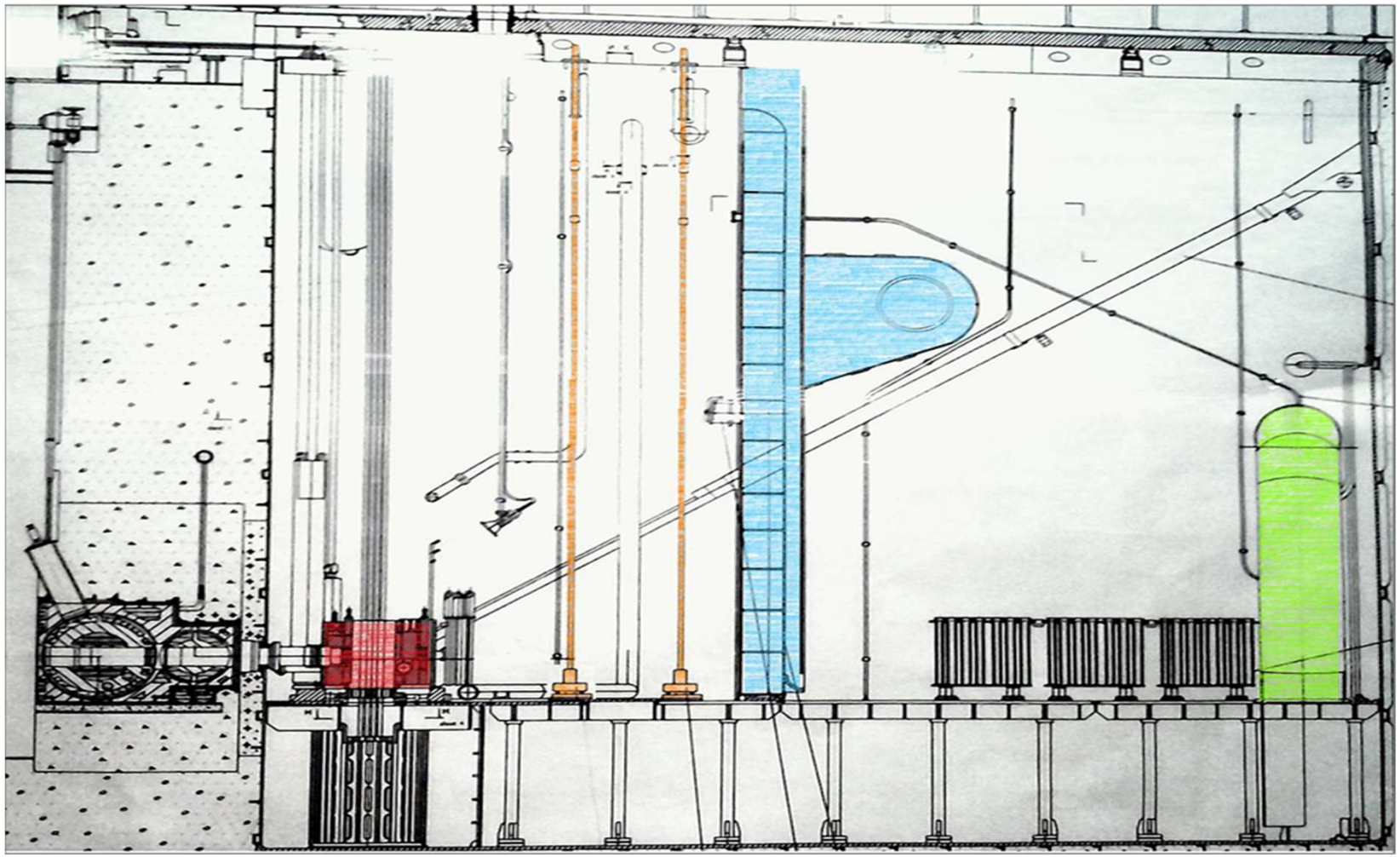
- Reactor10 MW, pool type reactor, Russian origin. with flux up to 10^{14} $n.cm^{-2}$ s^{-1}
- Type of the reactor:- IRT-1 (pool type)
- Fuel type 8TFA and 6TFA
- Each FA 300 gm-mass of U 235
- 11control rods
- Water Moderator and coolant I circuit, II circuit, III circuit
- Purification system

Tajoura Nuclear Research Reactor (TNRR);

- First criticality was in 1981
- The reactor started operation in Aug. 1981,with HEU (80%) U235 fuel and was converted to LEU **UO_2-Al 19.7%** fuel in Oct. 2006.



Horizontal cross section of the reactor pool

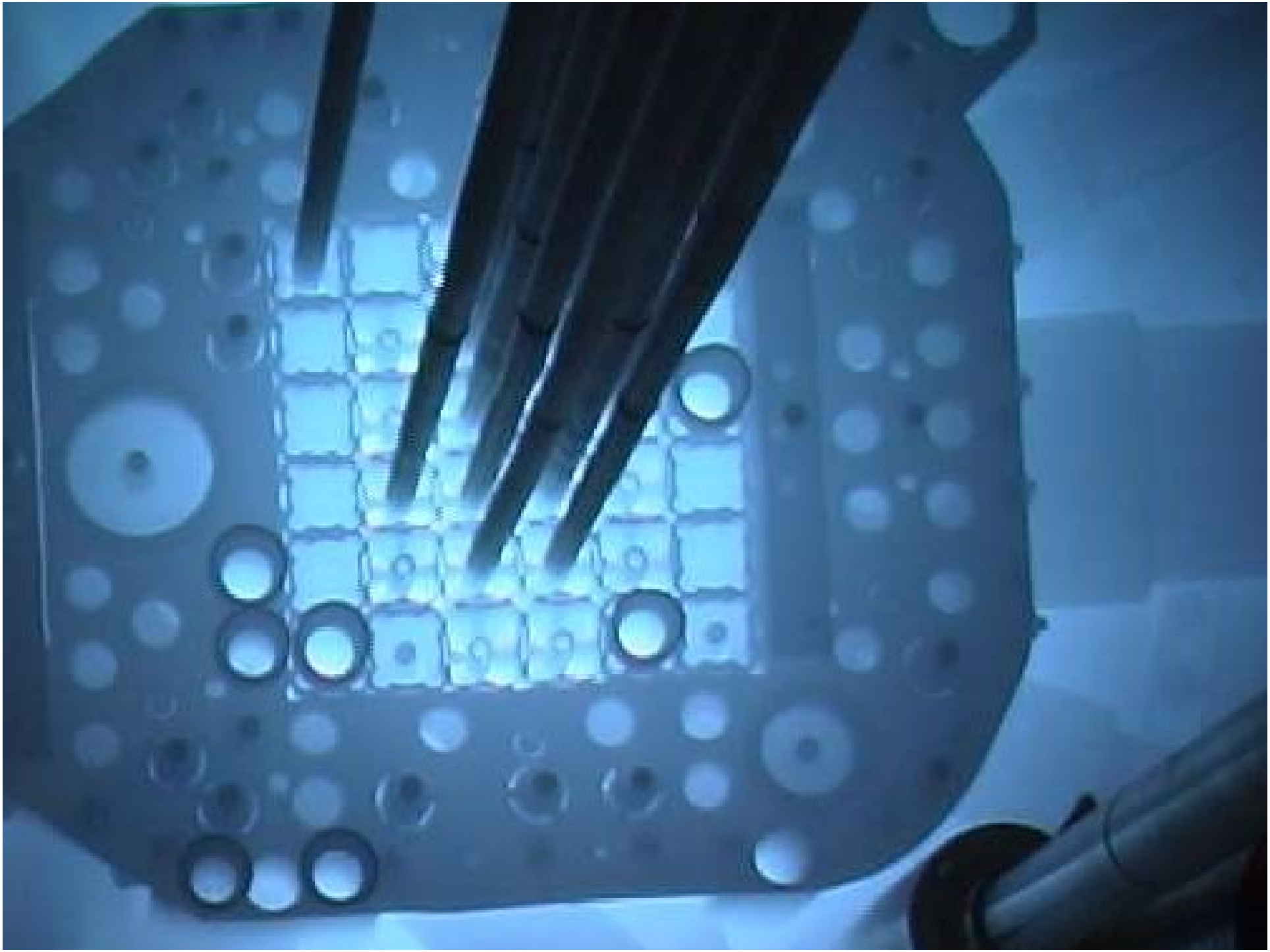


Horizontal cross section of the reactor pool

Mediterranean See
Location of the TNRC 32 Km East Tripoli
First Gate
Main Gate
Checkpoint for TNRC
Checkpoint for RR

The main purpose of TNRR are

- A source of neutrons.
- The production of radioisotopes for use in laboratories or medical and industrial applications;
- Measurements and analysis with neutron based techniques such as neutron activation analysis.
- Irradiation of materials for study.
- Education and training of staff from other organizations
- in reactor physics, operation, radiation shielding and protection.



Operational Radiation Protection program: - General

- The operational radiation protection programme of TNRR include:
  - *The policy statement of operating organization which includes the radiation protection objectives and commitment to the radiological protection principles, in particular the optimization principle;*
  - *The organization of radiation protection, including the functions, responsibilities, qualifications, and line of communication of the radiation protection personnel. Provisions for adequate training in practices for radiation protection;*

- The operational radiation protection program of TNRC include:
  - *Measures for Controlling compliance with applicable regulations.*
  - Ensuring cooperation between radiation protection staff and the operating staff;
  - Providing for decontamination of personnel, Structures, Systems, and Components;
  - Recording inventory of radioactive material;
  - Providing for the review and update of the program.

Dose Limitation

We set it as the IAEA Safety Standard (for workers) GSR Part 3:

- 50 mSv/y (effective dose) maximum;
- 20 mSv/y (effective dose) averaged over 5 consecutive years;
- 20 mSv/y (equivalent dose) to eye lens averaged over 5 consecutive years;
- 500 mSv/y (equivalent dose) for hands and feet.

- We optimize radiation protection measures for each source or operation in a practice to comply with dose constraints.

- We prospectively use dose constraints for task planning, execution, and design purposes, not as limits but as a ceiling on acceptable individual dose values during the optimization process.

Dose Control

- **Three types of control:**
  - *Source control:*
  - *Physical control:*
  - *Administrative Control:*

Dose Control: Source Control

- *Material selection:*

All reactor components are non-activated and exhibit high corrosion resistance, with impurities monitored twice weekly.

- *Quality of reactor coolant:*

The coolant is maintained as free from impurities as possible via operating the purification system twice a week.

- *Beam tubes:*

We have 11 well-designed, shielded, and monitored beam tube ports

Dose Control: Source Control

- *Irradiated fuel:*

We are handled and stored in a way that criticality, and cladding corrosion, melting, and damage are avoided.

- *Minimization of gaseous material:*

There are ventilation system reduction of ingress of air near the core, purging the spaces with inert gases such as nitrogen or helium to prevent build up of radioactive materials in ducts.

- *Minimization of waste:*

It is segregation of waste and placement of designated locations prior to its storage, treatment, and disposal.

Dose Control: Physical Control

- Shielding:

It has adequate shielding provided for all sources or radiation in and around the reactor facility.

- Ventilation:

Control the concentration of Ar41 and fission product gases during fuel failure by managing differential pressure between contaminated areas. A filtration system is in place for both normal and emergency conditions. The effectiveness of the ventilation system (integrity, air exchange rates, flow rates, etc.) and filters is routinely assessed.

Dose Control: Physical Control

- Distance:

Using specialized tools to reduce the dose.

- Time:

This may be the only viable method of dose control in some cases, and we use it when the dose rate is high despite shielding and distance protection.

Dose Control: Physical Control

- *Decay:*

Allow irradiated materials, equipment, and samples to decay as long as possible before handling them with careful planning and scheduling.

- *Decontamination:*

Contamination monitors, decontamination procedures, and facilities are in place for personnel, areas, and equipment, with contamination checks conducted on items before transferring them outside controlled areas.

Dose Control: Physical Control

- *Personnel protective equipment:*

providing simple laboratory coats, gloves, overshoes, full protective suite with air supply, masks, etc. They are chosen in accordance with the anticipated hazards.

Dose Control: Administrative Control

- *Working Area Classification and access control:*

It has divided the areas into two regions based on the potential for radiation and contamination hazards: the first is the controlled area (reactor), and the second is the supervision area. Area classifications are indicated with appropriate signage to warn of hazards.

- *Workplace monitoring program:*

includes external radiation, surface contamination, and airborne contamination.

Dose Control: Administrative Control

- *Approval:*

Formal approval is done for undertaking work involving the control of radiation hazards. This includes:

  - Maintenance work permits,
  - Experiment approval;
  - Routine irradiation approvals;
  - Approval of modification to the facility based on assessment of its radiological implication.

THANK YOU FOR YOUR
ATTENTION