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(E S N S A)

IRT-1 Research Reactor Decommissioning: Preliminary Plan

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ABSTRACT

The Tajora Nuclear Research center (TNRC) has two reactors, one of them with a power of 10 MWth and the other Critical Facility Stand with a power of 100 within operation for 41 years, the status of the research reactor is extended shutdown since 2013, for these reasons, the decommissioning plan it became important. The preliminary decommissioning plan consists of actions and steps required as well as the strategies to be adopted for the shutdown of the facility under the technical and administrative, seeking the safety, of health workers and the general public, and minimizing environmental impacts. This work aims to develop a preliminary plan for decommissioning the research reactor, considering the technical documentation of the system (SAR-Safety Analysis Report), the existing rules of the Libyan Atomic Energy Establishment, as well as regulatory instructions and recommendations of the IAEA.

1- INTRODUCTION

The Tajoura nuclear research center (TNRC) is located about 30 Km to the east of Tripoli adjacent to the main highway, which separates the center from the Mediterranean seashore.

The TNRC was built to enable scientists to carry out fundamental and applied research in nuclear physics, activation analysis, and production of radioisotopes. The TNRC provides hot cells, a neutron generator, and an instrumental analysis laboratory designed for performing activation analysis

Tajora Research Reactor was built in 41 when the reactor was built, no plan was put to dismantle the reactor. Where it became necessary to develop a preliminary plan for the reactor according to the requirements of the International Atomic Energy Agency and its approval by the Nuclear Regulatory Authority.

The Tajora reactor has been operating with high-enrichment fuel since 1983. In 2006, the fuel was changed to low enrichment. In 2013, the reactor shut down due to the local situation is an effect on all activities (upgrading the CSS).

2. REACTOR DESCRIPTION

As shown in figure.1.a.b. The reactor core is located in a water-filled pool. The reactor pool is made of a metal tank composed of two steel layers: the layer of carbon steel is in contact with the concrete, while the layer of corrosion-resisting steel (stainless steel) forms the interior surface of the pool. The tank is embedded in two meters of thick protective concrete block which act as a biological shield. In the rounded portion of the tank, near the bottom, a special support grid mounts the assembly of the beryllium reflector with 36 cells in the center to accommodate fuel assemblies, beryllium blocks, and lead blocks.

The fuel storage pool is located next to the reactor pool. Spent fuel assemblies are transferred from the reactor pool to the storage pool underwater through

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a sealed door that separates the reactor pool from the storage pool. Under the pools, there is a tank (delay tank) connected with the reactor pool only which serves as a hold-up vessel to reduce the N-16 activity of the primary cooling water before it is delivered into the primary coolant. The reactor and storage pool are covered with protective plates of 200 mm thick stainless steel. The plates can be withdrawn by means of an electric motor drive in order to expose the reactor pool and the storage pool for maintenance and refueling.

3. PROTECTION OF PEOPLE AND ENVIRONMENT

Relevant dose limits for the exposure of workers and members of the public are applied during decommissioning. Radiation protection is optimized with regard to the relevant dose constraints. Provision is made during decommissioning for protection against, and for mitigation of, exposure due to an incident.

Radiation Monitoring System (Sistema) for stationary monitoring with a presentation of indications, recording of monitored parameters if necessary, and automatic warning signaling of exceeding the fixed rates for the various kinds of radiation taking into account the recommendations of ICRP (international commission on radiation protection) and IAEA.

a) The relevant types of equipment include gamma field level neutron fluxes in the reactor and the nearby rooms

b) Alpha and Beta active aerosols concentration in the rooms

c) Monitoring of the radioactivity after the gas cleaning system takes into account measurements of radioactive product concentration in the aerosol and vapor-gas phase.

d) Periodical radiation condition monitoring in the room by means of portable equipment.

4. RESPONSIBILITIES

As flowchart in figure.2. The operating organization (the Tajora nuclear researcher center) of the installation undergoing decommissioning is ultimately responsible for the safety of the installation during the decommissioning operations.

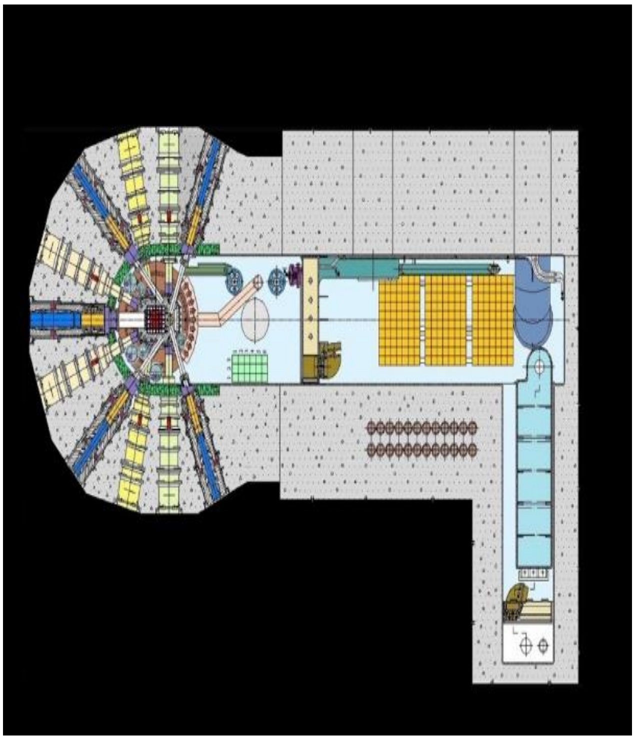

Fig. (1.a): horizontal cross section of the reactor pool

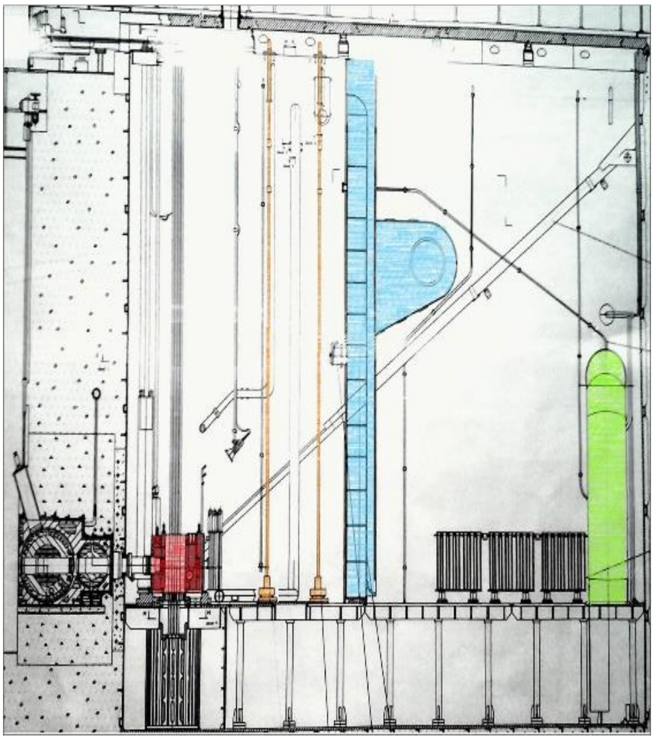

Fig. (1.b): Vertical cross section of the reactor pool

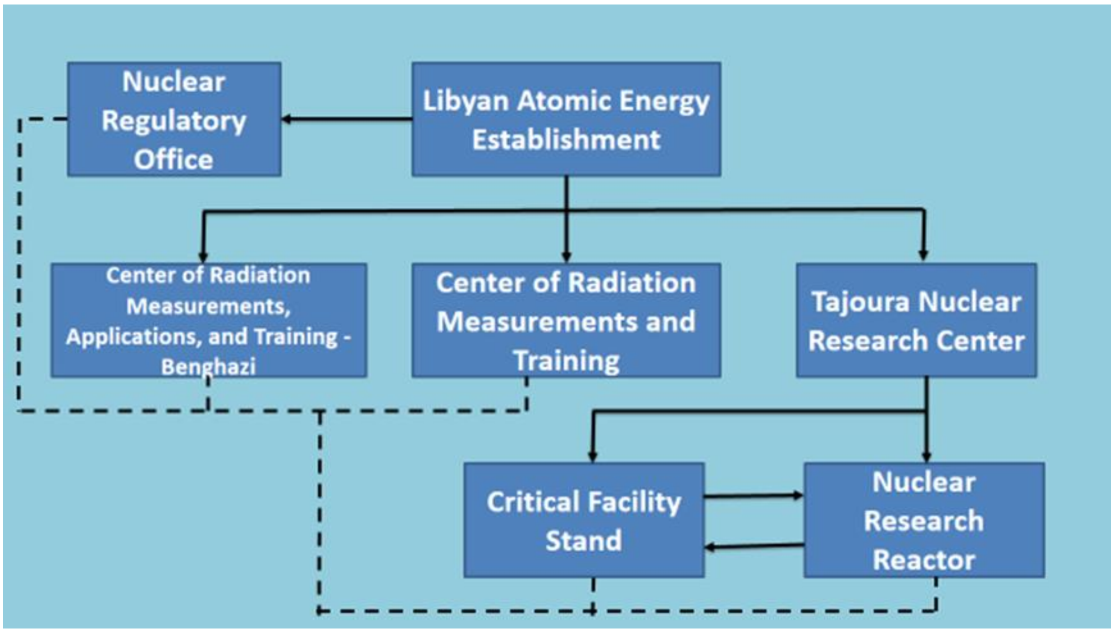

Fig. (2): Flowchart Structure of Libyan Atomic Energy Establishment

4.1. Responsibilities of the government

Establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning including management of the resulting radioactive waste.

4.2. Responsibilities of the regulatory body

The nuclear regulatory office (NRO) has established in 2009 and is responsible to give permission to operate the reactor and evaluating the safety status at the reactor building in the current status.

The new legislation (at the parliament to ratification) where will regulate the nuclear rules in the country for all institutions. With this legislation, the regulatory office will become an independent institution.

Regulates (NRO) all aspects of decommissioning from the siting and design of the facility to the completion of decommissioning actions and the termination of authorization after the new legislation ratification.

4.3. Responsibilities of the TNRC

Tajora nuclear research centre Implements planning for decommissioning, carries out the decommissioning actions, and in compliance with the authorization and with requirements derived from the national legal and regulatory framework

Tajoura nuclear research center is responsible for all aspects of safety, radiation and environmental protection during decommissioning.

5. AVAILABILITY OF EXISTING EXPERTISE

The availability and utilization of facility-specific expertise are highly important for efficient and safe operations during decommissioning to Decrease the potential for events such as industrial accidents or overexposures and May help to reduce problems associated with loss of corporate memory, and retraining or recruiting of new personnel.

To preserve knowledge some of the reactor staff has to continue to work at the reactor facility up to the end of the decommissioning stage.

6. CONSIDERATIONS RELATING TO THE PUBLIC

The issue of public concerns surrounding decommissioning is largely center on the concern of waste disposal, Local employment considerations after cessation of facility operation and during decommissioning, use of land after decommissioning;

7. DECOMMISSIONING STRATEGY

Present the options identified the method chosen for decommissioning and the differences between the different options in terms of optimization of protection and safety, the protection of the environment, and minimizing the generation of waste.

Decommissioning strategy is consistent with national policy on decommissioning and radioactive waste management (selected by TNRC).

8. FACILITATING DECOMMISSIONING (IRT-1 RESEARCH REACTOR)

8.1. Design features that need to be considered for decommissioning:

Careful selection of materials and optimization of the facility's design, layout, and access routes**.** Design solutions that minimize the amount of waste generated and that facilitate decommissioning.

a) The reactor core is placed away from the walls of the reactor pool. The gap between the core and the walls of the reactor pool is long enough and filled with light water to reduce the neutron flux at the walls to a minimum. This will reduce the activation of walls to very low levels.

b) The core is made of the stationary and removable reflector the stationary is made of parts that can be easily dismantled, while available clamps can remove the removable reflector.

c) The reactor core grid is made of aluminum to reduce radioactive waste and corrosion which can contaminate surfaces.

d) Tank walls are made of two layers, the inner layer made of stainless steel (to lower corrosion to a minimum) and an outer layer made of carbon steel which facilitates decommissioning and reduces waste volume

e) The reactor has eleven neutron beams that can extract neutrons out of the reactor to reach the reactor hall. To prevent neutrons from entering the hall when neutrons are not needed two wheels are used small wheel facing the neutron beam near the begging of the concrete shield and a large wheel near the end of the concrete shield. Both wheels are placed in a moving large shield which can be moved away when needed for maintenance or during decommissioning. This strategy minimizes time for dismantling and reduces the size of generated waste.

8.2. Considerations during facility operation

Records are configured so that those relevant to decommissioning may be readily identified. All operation journals should be kept for the life of the facility. All changes to the system should be reported and documented with enough detail. All maintenance journals should be kept for the life of the facility. All know how documents should be kept in good condition in the reactor building and in the document control department. In addition to drawings and diagrams, photographic records of the construction and operational phases of the reactor's lifetime are kept

8.3. Considerations of the types, volumes, and activities of radioactive waste generated during operation and decommissioning

During operations, consideration is given to minimizing the extent of contamination of structures and surfaces, segregation of different categories of wastes, and avoidance and prompt clean-up of spillages and leaks**.**

1- Air filters that need to be changed during the reactor lifetime

2- Raisin which needs to be changed during the reactor lifetime several times

3- Inside reactor flux measuring detectors for power control when they are out of order (in the hall, there are some storage places to take care of such items like reactor power detectors when they are out of order)

4- Reactor fuel at the end of their life (storage pool is devised to take care of all spent fuel)

5- The center has a predisposal facility to take care of all radioactive waste that can be generated during reactor operation and all waste that can be generated during decommissioning.

9. CONCLUSION

The IRT-1 Research Reactor is a nuclear facility in a multi-utility site that can be used after the dismantling process in other fields.

The phased release of the Nuclear Research Center is considered the best method that can be implemented in terms of the safety of workers and people, decontamination over long periods, and conducting radiological surveys until the end of the dismantling process.

After the spent fuel is removed, deferred disassembly of the reactor structures (concrete, metallic materials, etc.) begins. Such as the construction department, the services department, and the possibilities available in the material-turning workshop in the process of dismantling and cutting materials. The radioactive waste cemetery can also be used to lay contaminated materials. The KP-2 hot cell is designed for cutting radioactive products for long periods and checking fuel assemblies after they are suspended. It is equipped with a grinding machine, a crane, and a mechanical screwdriver. There is a fuel building with containers for dry storage of spent fuel. Reducing the number of workers during the dismantling process and identifying the experts, technicians, and radiation protection members needed during the dismantling process.

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