IRT-1 Research Reactor Decommissioning: Preliminary Plan

Eng, Usamah Amara Ben Nail _1, Eng. Fathi Mohamed Haj _2

Tajura Nuclear Research Centre

Osa_om_74@yahoo.com_1, Fathi_abduo@yahoo.com_2

208

1. Background and Goal of the present work

The Tajura Nuclear Research Centre (TNRC) has two reactors, one of them with a power of 10MWth and the other Critical Facility Stand with a power of 100W within operation for 41 years, The status of the research reactor has been 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.

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 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 The plates can be withdrawn by means of an electric motor drive in order to expose the reactor pool and the storage pool for maintenance and refuelling.

:

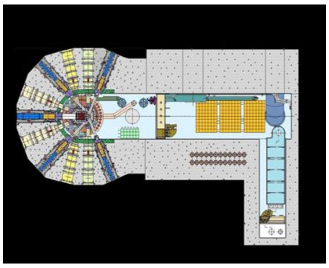

Fig.1.a. horizontal cross section

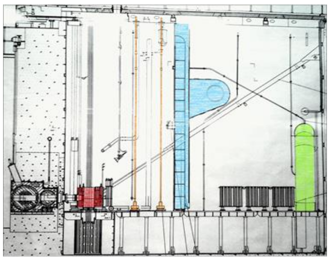

Fig.1.b. Vertical cross section

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 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 signalling 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.

4. 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. There are three options for dismantling, which are as follows:

4.1 immediate dismantling

Decommissioning actions begin shortly after the permanent shutdown. Equipment, structures, systems, and components of a facility containing radioactive material are removed and/or decontaminated. Removal of all radioactive materials from the site, allowing unrestricted release.

4.2 deferred dismantling (safe enclosure option)

Deferred dismantling - all or part of a facility containing radioactive material is either processed or placed in such a condition that it can be put in safe storage and the facility maintained until it is subsequently decontaminated and/or dismantled.

4.3. Situ disposal

Encapsulation of the reactor and subsequent restriction of access, All or part of the facility is encased in a structurally long-lived material, or situ disposal involving the encapsulation of the reactor and subsequent restriction of access, under exceptional circumstances, (e.g. following a severe accident), entombment could be considered as a solution. Entombment is not considered a decommissioning strategy.

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

After the removal of the fuel, only part of the reactor staff will be needed to run the facility.

- Anticipated technical, organizational, and managerial changes that will be necessary during the transitional period.
- The reactor fuel should be placed in the storage pool for cooling for a few years to reduce heat release to the level accepted for dry storage
- A water purification system has to be operated to keep water quality

5 Facilitating decommissioning (IRT-1 RESEARCH REACTOR)

5.1 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.

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

5.2 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 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.

5.3 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, segregating different categories of wastes, and avoiding and prompt clean-up of spillages and leaks.

5. Conclusions and Acknowledgements

- 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. The capabilities of the Nuclear Research Center, such as the construction department, the services department, and the possibilities available in the material-turning workshop can be used in the process of dismantling and cutting materials.
- The predisposal facility can also be used to lay contaminated materials.
- The KP-2 hot cell is designed to cut radioactive products for long periods and check 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.