



# Algerian Experience with Refurbishment of Es Salam RR.

For the Technical Meeting on Research Reactor  
Ageing Management, Refurbishment and  
Modernisation.

Government of the Russian Federation, Research  
Institute of Atomic Reactors, 31 Mai - 4 June 2021

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Virtual mode





# I. Introduction

- Es Salam is a 15 MW Research reactor, owned by the Algerian National Atomic Energy Authority (COMENA) and operated by CRNB. Its first criticality was in 1992. Since then, some of its systems and components have become aged or obsolete. In addition, as the Algerian Government projected to produce radio pharmaceuticals isotopes for national needs, COMENA undertook the necessary actions. So, in 2007-2008, a National ad-hoc committee has carried out a safety self assessment of Es Salam RR using the IAEA standards. Recommendations issued, the early list of equipments to be changed, the feedback experience of the master-builder, and the new recommendations of IAEA (Fukushima-Daichi accident) were considered to define the Technical Specifications of the refurbishment & modernisation project. The project was initiated in 2011, starting in yard in 2015 and successfully achieved in 2019.



## II. The development of the project team (before starting the project on the site):

- As soon as the project is initiated:
- ✓ Incorporate the reactor teams in the early formulation of the list of systems and components to be changed;
- ✓ Train the reactor team in the field of “the management of the project” to be familiar with Gant, range-pole, projects costs....etc
- ✓ Since Es Salam was built by the same master-builder, and with the feedback experience from the reactor-twin, the master-builder can advise on the systems to be changed or not;



### III. The first implementation step's of the project (before starting on the site):

1. Set up a team constituted from technicians of the reactor and lawyers to elaborate a contract between client (contractor) (CRNB) and the master-builder. This official document fixes the juridical aspects, the term of the project, costs of the project and other clauses of the contract .... etc and the list of systems and components to be changed;
2. Elaborate a technical specifications document which gives more details about the systems and components to be changed (for technicians);



4. Prepare all the documents of the systems and components to be changed; Organize a guided visits to the team of the master-builder to know more about the systems and components which will be dismantled;
5. Launch the detailed studies jointly between the teams of the master-builder and the ones of the reactor ; the team of master-builder have to make the calculations, the new design, the layout ... etc, and the team of the reactor have to follow the studies and make technical reservations according to technical documents and the contract;



## IV. The management of personnel on the yard

When starting the works on the site:

- First, under take a radiological background measurement on the site;
- Set up the plates of highway code to regulate the itineraries circulation of vehicles (one way, stop, turn ...)
- Set up the list of the personnel access-right to the controlled zones of the reactor. Badge is obligatory;
- Security-shoes, helmets, suits and special gloves for electricians are obligatory;
- No smoking area in the reactor building;
- Set up a procedure to regulate the works on the yard thanks to “work permit”



# The “work permit”

- The work permit is an important work management procedure applied on the yard. It is about a sheet issued jointly between the two responsables of operations (the one of the client and the one of master-builder)
- It is an obligatory authorization before starting any work.
- The work permit allows :
- To team on the yard to take knowledge of all performed works. Particularly the electric works;
- Organization of teams on the yard: Planned the operations in such manner to avoid the overcrowded workers in areas;
- Enough time for the preparation of procedures before starting the work;
- To under take the radiological and safety counter-measures;
- Thanks to this procedure we have avoided the electrocution of the workers, the contamination and the nuclear incident on the site.



## V. Systems which have been modernized or added:

1. **Mechanical systems inside the reactor building:** added a closed demineralised cooling system for the primary pumps, air sampling vacuum pumps to analyse the air activity in different technological rooms;
2. **Electrical system inside the reactor building:** a new fireproof cables, UPSs instead the old Motor-generators, remote control of equipment, operator station linked to mean control room;
3. **Control system:** Replacement the old analog system by a new digital system (Reactor Protection System, Nuclear Measurement System, Control Road System, RTMS and DCS...). The principal control room of the reactor is remade entirely Digital;





4. **Thermal instruments system:** all thermal measurement devices are changed from analog to digital. A new chromatograph and oxygen analysers are installed in helium system for online measurement of the reactor gases,
5. **Radiation protection system:** Replacement the old analog system by a new digital system.



# VI. The New IAEA Post Accident Fukushima Recommendations

Fukushima recommendations were taken into account when refurbishing Es Salam, , so:

1. The Es Salam was dotted with a new auxiliary control room used in accidental case to monitor the important safety parameters, dotted with PAMS, remote control of the primary pumps, scram buttons
2. Independent access path to the auxiliary control room;
3. UPS class 1E instead the old Motor-Generator sets;
4. Earthquake monitoring system is added;
5. Online gas monitoring in helium system is added to monitor the explosive gas in the reactor core;



# IX. Commissioning tests

- Before starting the commissioning tests, reactor operators and maintenance staff must be trained on the new systems;
- The authorization is issued by the regulatory body;
- Commissioning tests are performed according to known method from the IAEA standards;



# X. Technical reservations

- The formulation of the list of the technical reservations starts since the detailed studies;
- When the dismantle and assembly process is finished, set up a specialist team to check the conformity between the as-built systems and the contract;
- When the commissioning tests are successfully accomplished, and the technical reservations are solved, set up a specialist team to check the conformity between the as-built status of the reactor and the new documents;



# XI. Review and Update the Final Safety Analysis Report:

- The Final Safety Analysis Report (FSAR) has been remake to take into account the modifications of the systems and components.
- FSAR demonstrates that the reactor remains within its Operating limits and Conditions.
- FSAR was approved by the regulatory body;



THANK YOU FOR YOUR ATTENTION

