Overview of the implementation of the Integrated Management System for Es-Salam research reactor, focusing on the development of the SSCs maintenance process

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Technical Meeting on Integrated Management Systems for the Sustainable Safe Operation and Effective Utilization of Research Reactors
MITO City Civic Centre, Mito, Japan 16 – 19 June 2025

CRNB
Centre de Recherche Nucléaire de Birine

COMENA
Commissariat à l'Energie Atomique

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Introduction

- Algeria has established a regulatory framework that governs nuclear activities and facilities based on national regulations and IAEA safety standards. It has two research reactors that are constitute a platforms for R&D and E&T in the field of nuclear engineering.

- Algeria contributes to the international effort to strengthen the safety and use of research reactors through its integration into IAEA regional cooperation projects, participation in the RASCA committee as observer, and participation in periodic IAEA events that enable the sharing and exchange of information and feedback experience.

- The management system for research reactors is one of the issues that strengthens safe operation. In this context and within the framework of IGORR 22nd IAEA TM, we present the CRNB's experience in developing quality management systems, focusing on maintenance process.

Legislative and Regulatory framework

- Promulgation of the National Law 19-05 of 17 July 2019 related to the nuclear activities : this Law Cover the Global nuclear activities including the nuclear energy ;

- Implementation of the National Nuclear Safety and Security Authority (ANSSN): an independent authority reporting to the Prime Minister of the Country

Organizational structures related to nuclear activities and facilities, COMENA

The **Algerian Atomic Energy Commission (COMENA)** is the governmental organization for implementing the national policy in matter of promotion and development of nuclear power and nuclear techniques.

It acts under the authority of the Minister of Energy and Mines in the field of :

- Pioneering the future of nuclear science and technology in Algeria
- Application of nuclear sciences and techniques for energy, health, industry, agriculture, environment,….
- Partner for sustainable development AFRA RDC

COMENA manages 4 nuclear research centers: CRNA, **CRNB**, CRND and CRNT.

Organizational & Infrastructure related to nuclear activities and facilities, CRNB

CRNB is nuclear research center of Birine is responsible for developing and implementing the scientific and technical research programs required for the development of reactor physics and technologies, nuclear facility instrumentation and control, radioisotope production techniques and processes, neutron applications, nuclear safety and the environment, radioactive waste management and processing. It is also responsible for ensuring the safe operation of existing nuclear facilities.

Es-Salam Research Reactor

- ✓ Es-Salam is the second Research Reactor in Algeria; went critical in 1992
- ✓ It is a 15MW, D_2O moderated and coolant, tank type reactor.
- ✓ Has several vertical irradiation channels (43), six horizontal channel and pneumatic rabbits for NAA analysis
- ✓ Max Thermal neutron flux of ≈ $2x10^{14}$ n/cm^2-sec
- ✓ Graphite reflector
- ✓ UO2-fuel, U-235 enrichment 3%
- ✓ The main utilizations and applications are :
  - **Nuclear materials Testing**
  - **Neutron transmutation doping (NTD)**
  - **Neutron diffraction - Neutron activation analysis - Neutron Radiography …**
  - **R&D in reactor physics, safety and technology**
  - **Reactor Operators training**

Overview of current management of operation and maintenance activities

The Center has an organization based on hierarchically structures and a support committees :

- A unit in charge of the operation and maintenance of the reactor in accordance with OLCs and approved procedures; this under the supervision of reactor director.
- The reactor director is accountable to the Director General for the center.
- A unit in charge of nuclear safety and protection against radiation;
- A Safety Committee that reports directly to the Director General and oversees all safety-related matters.
- Multidisciplinary technical support teams , assist the GD for technical aspects
- A “Reactor Utilization Committee" that reports directly to the Director of Reactor;
- Internal Safety Committee as advisor of General Director of CRNB

Management Responsibilities

- The director of reactor is responsible of operation, maintenance, training, utilization and modification of the reactor

- He is assisted by Responsible of Operation, maintenance and Technical Management

Weekly meetings

The Issues discussed in the weekly meetings are Generally :

- To assess the execution of the previous program and establish the new maintenance program
- To Coordinate all activities to monitor the operation status of the reactor
- To Discuss all technical issues of Reactor systems
- To Decide on necessary action for operation, maintenance and utilization of the reactor
- To validate Weekly program

Integrated management system for Es-Salam RR

- The ongoing Project to implementing the SMI around Es-Salam RR is based on IAEA requirements, in particular **GSR part 2** and **SSR-3**.
- The reactor has a **QAP** quality assurance program based on **50-C/SG-Q** and **50 CQ** for all phases of the reactor's lifetime (site, design, construction, manufacturing, commissioning, operation and maintenance, etc.)
- In 2012, The Commissioner of COMENA decided with General Directors of nuclear research centers to implement IMS in all activities and facilities in compliance with updated standards **ISO 9001**, **ISO 14001**, and **ISO 45001**
- Quality assurance program following the IAEA Management System for facilities and activities general safety requirements **GSR part 2** and **SSR-3**, safety of Research reactor and **ISO** quality management requirements was used as references for the modernization of I&C systems of Es-Salam RR. (period 2014-2019).

Current status of implementation of IMS

1. Commissioner's Decision: Implementation of IMS/RR-Es-Salam.
2. Appointment of project leader.
3. Appointment of project team members.
4. Decision: GSR Part 2 selected as the standard for IMS/Es-Salam-RR.
5. Committee working meetings
6. Development of the roadmap (action plan):

    - Staff training on MS/QA (Two sessions: QA/ISO 9001/GSR part 2)
    - Establishment of the checklist (GSR part 2)
    - Self-assessment according to the established checklist
    - Identification of gaps
    - Action Plan to address Gaps
    - Assignment of tasks to IMS committee members

Maintenance management of Es-Salam RR under IMS

SSCs maintenance process of Es-Salam RR

Maintenance around nuclear facilities is a regulated activity (Licence for Engineer of Maintenance). It ensures that all structures, systems, and components (SSCs), particularly those related to safety, fulfill the assigned safety functions. This is done based on the facility's documents (FSAR, OLCs, maintenance manuals, design, manufacturer manuals, feedback, etc.), through appropriate management and rigorous, ongoing monitoring.

A qualified staff is responsible for maintaining the SSCs. This staff has undergone regulatory training, depending on the grade, by the Algerian National Institute for training on Nuclear Engineering (IAGN). The head maintenance team must hold a license issued by the national authority for nuclear safety and security (ANSSN) . Continuing and recycling training is organized periodically to maintain skill levels and improve safety culture.

SSCs maintenance process of Es-Salam RR

Systems of Es-Salam research reactor was upgraded and modernized, these digital systems are : electrical systems, I&C systems and radiation protection systems. As a result, the maintenance routines associated with the renovated systems were completely changed.

Following this, since 2019 the Op. division has initiated actions leading to the establishment of a maintenance management system, including the updating of maintenance sub-programs, the processing and monitoring of maintenance activities, organization, training as well as the introduction of QA aspects following the IAEA Management System for facilities and activities, general safety requirements GSR part 2 and SSR-3, safety of Research reactor and ISO quality management requirements.

SSCs maintenance process of Es-Salam RR

Integrating maintenance into an integrated management system (IMS) requires a structured approach. Here are some key steps to achieve this :

Needs Assessment	Identify existing maintenance processes and evaluate their effectiveness. This includes analyzing equipment, procedures, and current performance
Objective Definition	Establish clear maintenance objectives that align with the overall objectives of the IMS. This should include reducing downtime, improving safety, and optimizing costs
Process Documentation	Create documented procedures for maintenance activities. This should include clear instructions on planning, executing, and monitoring maintenance interventions
Training and Awareness	Develop key performance indicators to measure maintenance effectiveness. These indicators should be monitored regularly and included in IMS performance reviews
Communication and collaboration	Foster open communication between maintenance teams and other departments. This ensures everyone is aligned on objectives and priorities

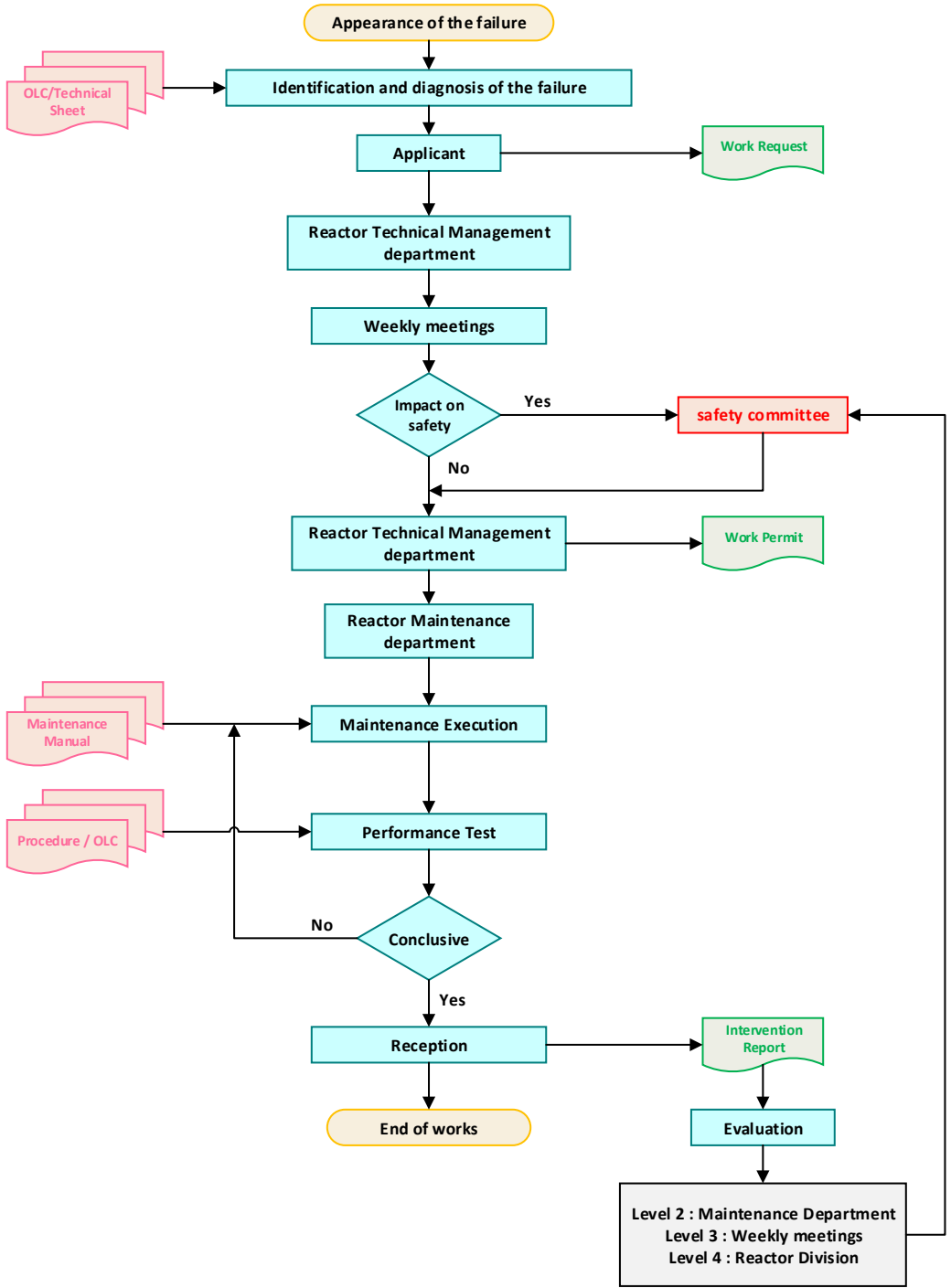
SSCs maintenance process development, corrective maintenance (as example)

- Integrating corrective maintenance on the IMS lead to optimize resources, improve awareness to avoid failures, and strengthen collaboration between different intervenes. Corrective maintenance data analyzed at different levels can lead to identify trends, anticipate recurring problems, and implement preventive actions to reduce failures frequency.

- The flowchart below describe steps of corrective maintenance process from problem onset to accepted final report including : - Identification of the failure (SSCs classification, previous data, operation and maintenance evaluation…), Intervention mode (urgent or routine), safety committee notice, discussion and preparation of the intervention (weekly maintenance meeting), work permit, execution, performance test, preliminary report (evaluation at different levels and safety committee notice) and Final report.

- Execution of maintenance operations; Performance testing of the repaired system or equipment while adhering to operating procedures, quality, and operating limits and conditions (OLC)

Corrective maintenance Flowchart



Conclusion

Integrated Management System **IMS** for the Es-Salam Research Reactor according to the requirements of **GSR part 2** and **SSR-3** is under consideration, many actions related to maintenance process of **SSCs**, directed linked to the safety of Es Salam RR, are in progress :

- Considering graded approach,
- Identification of key process (core of IMS)
- Revision of the classification of SSCs
- Increase levels of evaluation
- Updating of the documentation
- Taking on consideration the ageing factors
- Enhancing activities programs related to : maintenance, ageing, in service inspection
- Working on interfaces (radiation protection, technical support, security, procurement, auxiliary systems…

Thank you for your attention