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### Kenya's Steps Towards Safe Operation and Utilization of the First Nuclear Research Reactor

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#### ABSTRACT

Kenya through Nuclear Power and Energy Agency (NuPEA) has developed a feasibility study that provides the justification of having the first Nuclear in the country. The study determined Kenya's status and readiness to introduce a research reactor. Through the study, the potential stakeholders and their needs were identified. The study shows that there is a need to have a research reactor in Kenya, which will support education and training, industrial, medical, and research applications. The priorities of utilization of the 5Mwth multipurpose research reactor will include Education and Training, Radioisotope Production, Instrument testing and calibration, Neutron Activation Analysis, Material Structure Studies, and Neutron Transmutation Doping. For safe operation and utilization of the Kenya nuclear research reactor, there is need to have comprehensive regulations in the country. To that effect, Kenya Nuclear Regulatory Authority (KNRA) established under the Nuclear Regulatory Act No. 29 of 2019 has the mandate to provide protection of persons, property and the environment against the harmful effects of ionizing and non-ionizing radiation. The Authority is currently developing nuclear regulations. The role on Nuclear Power and Energy Agency is Monitor the progress on development of the regulations, inclusive of licensing a research reactor, assist the Regulator on regulation required for RR project towards its operation and Ensuring Kenya ratifies relevant conventions & treaties such as Joint Conventions and Convention on Nuclear Safety.

#### INTRODUCTION

Nuclear safety is key during the operation and utilization of research reactors (RR). Regulations therefore should be in place before the commencement of the project. Kenya being a newcomer country and in phase 2 of her first nuclear research reactor project is developing infrastructure for its utilization. Kenya has developed a strategic implementation framework approach towards its first research reactor that has the following objectives: development of Feasibility Study for RR project; Human resource development plan for the RR; development of the RR utilization plan; development of stakeholder management plan; and formulation of RR Safety and Sustainability Strategy.

Towards the safe operation and maintenance of the Kenya Nuclear Research Reactor (KNRR), nuclear

regulations are under development by the newly formed Kenya Nuclear Regulatory Authority (KNRA). The Authority is responsible for the protection of persons, property and the environment in relation to nuclear and radioactive material, activities and facilities and other apparatus generating ionizing radiation. KNRR being one of the nuclear facilities will need the regulations for its licensing and inspection.

Nuclear Power and Energy Agency (NuPEA) is one of the stakeholders working together with the regulator to come up with effective nuclear regulations since the Agency is the Assessment Marketing and Project Team (AMPT). The role of the AMPT according to IAEA is to be the Lead coordinator on the research reactor project in assessment of the project as well as marketing of the research reactor. As part of assessment of the project

therefore, its role is to ensure regulations are in place before the implementation of the project by working in harmony with the regulator.

### **Safety and Safeguard Requirements of the Kenya Nuclear Research Reactor**

The proposed KRR facility shall meet the safety requirements given in the IAEA specific safety requirements SSR-3. Where appropriate and justifiable, less strict safety requirements could be apply according to the IAEA guide to the graded approach for research reactors.

The KRR shall provide fundamental safety functions such as the capability to safely shutdown the reactor, the capability to remove residual heat after shutdown, and the capability to reduce the potential for the release of radioactive material.

In order to reduce the potential hazard to the public and environment due to radioactive materials, the reactor building will be a confinement. Furthermore, it is also required that any releases are within prescribed limits during and after operational states, and within acceptable limits during and after design basis accidents.

Safeguards obligations are important in operation of research reactors. To meet nuclear non-proliferation requirements, the fuel material will be Low Enriched Uranium (LEU) with  $^{235}\text{U}$  enrichment of less than 20 weight percent.

### **Radiation Protection Requirements**

Radiation protection (RP) is a key infrastructure issue in the safe operation of research reactors. Radiation protection shall be guided by three fundamental principles; justification, optimization and use of dose limits. The design and/or utilization/operation of systems, structures and components of the Kenya nuclear research reactor shall incorporate the concept of As Low As Reasonably Achievable (ALARA) in order to reduce potential radiological hazards.

### **Regulatory Infrastructure**

For any country to safely operate and utilize nuclear technology for peaceful purpose through nuclear research reactors there must be well-established regulatory infrastructure i.e. a regulatory body that is functional for licensing and supervision as well as

nuclear regulations. Kenya has made significant steps towards safe operation of nuclear facilities through the Nuclear Regulatory Act 2019. The Act established the Kenya nuclear Regulatory Authority (KNRA). The act also mandates the Authority to protect persons, property and the environment in relation to nuclear and radioactive material, activities and facilities and other apparatus generating ionizing radiation.

For the Kenyan case, there have been tremendous steps towards the development of nuclear regulation that have brought together all the relevant stakeholders in the development of nuclear regulations. The regulations are in the final stages of development and shall be in place before the commencement of phase 3 of the project. This regulations will be key in the licensing of the first nuclear research reactor in Kenya that is expected to be commissioned by the 2030.

### **Capacity Building**

The regulator and the operator are both involved in training of their staff to ensure that there is availability of skilled and competent human capital for safe operation and maintenance of the project. IAEA organizes trainings both physical and virtual that are very instrumental at enhancing the capacity of the staff from the Agencies.

Kenya is one of the guest countries in the IAEA – Internet Reactor Laboratory (IRL) project. The host reactor is at the Centre for Nuclear Energy Research (CNESTEN) in Rabat, Morocco. Kenyatta University is coordinating this project in Kenya. The lab is now operational and ready for the live transmissions from the host in Morocco. Eight local Universities will benefit from this project. The IRL project will help in Human resource development for both the regulator and Owner Operator of the research reactor.

### **Stakeholder's Engagement**

Stakeholder engagement is a key component of establishing a strong national commitment for the Research Reactor Program. To ensure that the research reactors are well utilized it is critical to involve the stakeholders that will directly and indirectly utilize the facility. Stakeholder engagement also ensures that there is sustainable public acceptance, which is essential to the introduction of the project.

Through various public information/communication channels, NuPEA seeks to ensure that the public is well informed in an open, transparent and objective manner about the rationale. The agency also did a countrywide

engagement of the utilizers of the facility that include; Education and Training institutions, Medical, Energy, Industrial and Research applications institutions. The specific needs in each category are:

Stakeholder	Applications	Identified Needs
Learning Institutions and General Public	Education and Training	Teaching and training for science, medical and engineering students  A platform for public information on peaceful application of nuclear technology  Enhance the nuclear research and development capabilities
Health and Industry	Medical and Industrial (Radioisotope Production)	Self-sufficiency in production of radioisotopes for medical and other applications both for the country and the region  Availability of cost-effective medical radioisotopes
Energy Sector	Nuclear Power Programme	Carry-out nuclear research,  Opportunities for experiencing localization of nuclear power technology.  Training staff for operating organization, regulatory body; R&D personnel for the planned NPP, technical service organization, waste management organization
Research institutes and Industries	Research and Industrial Application (Irradiation Services)	Improve R&D programs and studies in nuclear science, technology and innovation  Enhance capability of the Nuclear Research Center  Enhance collaborative research and training within the region (research tourism).  Improve calibration and testing services for industrial and medical instruments.  Explore and enhance industrial services (Non-Destructive Testing, neutron scattering, Neutron Transmutation Doping) to support industries.  Manufacturing process development and process flow monitoring  Trace element determination

Technical requirements have been derived from the engaged stakeholders' demands that which will be used to develop the bid invitation specification and avoid redundancy of the facility.

Other stakeholders engaged were the security agencies and emergency responders for physical security of the research reactor as well as the nuclear power plant. This has enabled early planning in case of an emergency that will require their response. Early planning is essential for safe operation and utilization of research reactors through early planning on the planning zones as well as evacuation routes and facilities.

### **CONCLUSION**

Safety of nuclear research reactors through their lifetime is a priority and proper planning is essential

in all phases following the IAEA guidelines. To avoid underutilization all the stakeholders that are to be involved in utilization should be engaged to come up with the required demand of the products and services from the facility. Therefore, it is important to involve all the relevant stakeholders through the entire project.

### **REFERENCES**

- [1] NuPEA strategic plan, 2020-2025
- [2] Kenya Nuclear Research Reactor draft Feasibility study report, 2022
- [3] Kenya Energy Act, of 2019
- [4] Kenya Nuclear regulatory Act, 2019