NUCLEAR RESEARCH REACTOR SAFETY

Safety is at the heart of Kenya's Nuclear Research Reactor programme.

From site selection and design to operation and decommissioning, safety requirements guide every stage of the reactor's lifecycle.



THE GOAL

Protect people and the environment

Every safety requirement serves one objective: protecting people and the environment from the harmful effects of radiation. A research reactor does this by performing three safety jobs at all times.

Control the reaction

The nuclear reaction can be adjusted and safely shut down whenever needed, including automatically.

Remove the heat

Heat is continuously carried away from the reactor and from the place where fuel is stored.

Contain the radioactivity

Barriers and shielding keep radioactive material confined and limit any release to the surroundings.

THE LIFECYCLE

Safety at every stage

Safety is not added at the end. It is examined and authorised stage by stage, from the first site studies until the facility is finally released from regulatory control.

01
Site selection and assessment

Earthquakes, floods, extreme weather, nearby activities and local population are studied. A site that cannot be made safe is ruled out.

02
Design

Safety is built in from the start: several layers of protection, at least one automatic shutdown system, and checks by experts independent of the designers.

03
Construction

Building starts only once the main safety issues in the design are resolved and the regulator has granted authorisation.

04
Commissioning

Before routine use, the finished facility is compared with its approved design and its systems are tested to confirm they perform as intended.

05
Operation

Qualified staff run the reactor within approved limits, backed by routine maintenance, testing, inspection and radiation monitoring.

06
Decommissioning

A plan for safely retiring the reactor is prepared at the design stage, kept up to date, and approved by the regulator before work begins.

DEFENCE IN DEPTH

Five layers of protection, not one

Nuclear safety never relies on a single safeguard. Each layer works independently, so if one is not enough, the next is already in place.



Layers build outward from the reactor. Each one backs up the layer before it.

1. **Prevent problems** — A carefully chosen site, cautious design, quality construction and disciplined operation keep the reactor running normally.
2. **Detect and correct** — Dedicated systems and procedures catch any departure from normal early, before it can grow into something serious.
3. **Control** — Built-in safety features and fail-safe design bring the reactor to a stable, safe state if a problem does develop.
4. **Contain** — Confinement keeps radioactive material inside, so that any release is kept as low as reasonably achievable.
5. **Respond** — Equipped emergency facilities and practised emergency plans protect people on site and, if necessary, beyond it.

OVERSIGHT AND READINESS

Who and what keeps the reactor safe

Strong engineering is only part of the picture. Rules, people, monitoring and preparedness work together throughout the reactor's life.

Independent regulation

An independent regulatory body authorises each stage, carries out scheduled and unannounced inspections, and can stop activities if safety declines.

Proof before progress

The operator must demonstrate safety in a detailed safety analysis report. The regulator reviews it before the project may move to the next stage.

Competent people

Safety roles are filled by qualified, trained and fit-for-duty personnel. Training is refreshed, and certain positions may require a licence.

Continuous monitoring

Radiation doses are kept below authorised limits and as low as reasonably achievable. Site conditions are monitored throughout the reactor's life.

Emergency preparedness

Emergency arrangements must be complete before fuel is loaded, coordinated with off-site responders, and tested through exercises.

Continuous oversight

Periodic safety reviews, an independent safety committee and lessons learned from other research reactors keep safety under constant review.

Does this mean there is no risk at all?

No technology is free of risk, and international safety standards say so openly. That is why nuclear safety is achieved through many independent layers of protection, strict regulation, trained people, constant monitoring and readiness to respond.

KENYA'S PROGRAMME IS GUIDED BY

- IAEA safety standards and safety guides
- The IAEA Milestones Approach
- Kenya's national legal and regulatory framework

Source: adapted from IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors (International Atomic Energy Agency, Vienna, 2016).