Neutron transmutation doping (NTD)

NTD changes the properties of silicon, making it highly conductive of electricity.

The irradiated silicon is sliced into chips and used for a wide variety of advanced computer

Radioisotope Production

The most widely used isotope in nuclear medicine is technetium-99m, a decay product of molybdenum-99

This is usually produced by irradiating a target of uranium foil with neutrons (for a week or so) and then separating the molybdenum-99 from the other fission products of U-235 in a hot cell .

Figure 5: Open Pool Lightwater reactor (Interior View)

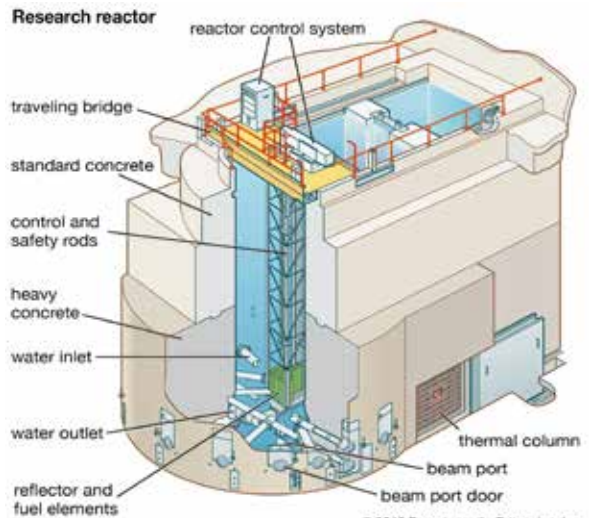

Figure 5: Open Pool Lightwater reactor (Interior View)

Well Logging

Use of radiotracer to evaluate formation both hydraulically fractured andnon-fracked wells

Isotope Hydrology

Assessment of the quantity, quality and sustainability of the ground water.

Artificial Insemination (AI)

Radioimmune assay (RIA) techniques for monitoring progester-one (P4) concentration in castles

Insect and Pest Control

Sterilization of insects so that, they cannot produce offspring

Nondestrictive Testing

Examination of the internal structure of manufactured components identifying any flaws or defects

Radiation safety concerns

The use of nuclear technology must ensure to maximize the opportunities/benefits while mini-mizing risks The role of Rwanda Utilities Regulatory Authority (RURA) is to ensure the best practices in nuclear technology are followed on the safe possession and use of nuclear technology as well as management of radioactive waste

RWANDA UTILITIES REGULATORY AUTHORITY

Inspiring development

COMMON APPLICATION OF NUCLEAR TECHNOLOGY

1.Agriculture: *Mutation breading*

Radiation-induced mutation is one the most widely used method to improve direct mutant varieties.

This mutation process generates random genetic variations, resulting in mutant plants with new and useful traits and therefore, it *(Figure 1)*

Ionizing radiations such as X-rays and gamma rays are used for improvement of several crops such as wheat, rice, barley, cotton, tobacco, beans,

2.Sterilization of foods and Medical Equipment

Radiation *not only kills cells*, it can also kill germs or bacteria Nowadays, medical instruments (e.g. syringes) are prepacked and then ir-radiated using an intense *gamma ray sources* This kills any germs or bacteria but does not damage (contaminate) the material under irradiation, nor make it radioactive. *(Figure 2)*

3.Food preservation

Irradiation is a technique in which food is subjected to ionizing radiations (Eg: Gamma, X rays) to keep them safe for longer period of time. *(Figure 3)*

Advantages

Other beneficial nuclear applications

- Control of ripening
- Reduction of pathogens
- Shelf life extension

  Improvement of quality of final product

Figure 1: *Checking banana plants after irradiation with-rays*

Figure 2: *Sterilization of foods and Medical Equipment*

Figure 3: *Food preservation*

INDICATIVE RADIATION DOSE RANGE VARY BETWEEN 01-10KGY FOR FOOD PRESERVATION

Dose (KGY)	Effects	Examples
0.1-1	Sprouting inhibited	Potatoes, onions, garlic and yams
	Ripening delayed	Banana and papaya
	Insects killed	Dried fish, dried fruit and legumes
1-10	Shelf life extended	Refrigerated meats and fish, ready to eat meals
	Non-sporulating micro- organisms inactivated	Refrigerated or frozen meats, fish and seafood

4.Calibration of Radiation Measuring

Nuclear Technology play an important role in calibrations for dosimetry equipment such as Personal dosimeters, radiation survey meters, etc. Dosimeters are used to determine dose levels for patients, staff or the public Survey meters are used to check such as personnel, equipment and the environment for radioactive contamination and ambient radiation. Measurement results shall be consistent with International System of Units (SI). Figure: (See figure 4)

Figure 4: Gamma Beam Irradiator Used for SSDL

Most commonly used radioactive sources for calibration of monitoring instruments:

Cobolt-60	Energy (MeV)	Half life (Years)
Cesium-137(Cs-137)	0.6617	30.17
Cobolt-60(Co-60)	1.1732	5.26
	1.3325	

5. Research Reactor

Research reactors are sophisticated devices for basic and applied research in the fields of;

- Particle and nuclear physics
- Radiochemistry
- Activation analysis
- Materials sciences
- Nuclear power
- Nuclear medicine

Research reactors are nuclear reactors that serve primarily as a neutron source.

5.1.Application of Research Reactor

Neutron activation

Is the only common way that a stable material can be made radioactive

Using neutron activation analysis, it is possible to measure minute quantities of an element. Atoms in a sample are made radioactive by exposure to neutrons in a reactor

The characteristic radiation each element emits can then be detected.