



ATOMIC ENERGY COUNCIL



N.O.R.M
NATURALLY OCCURRING
RADIOACTIVE MATERIAL



1.0 INTRODUCTION

- Naturally Occurring Radioactive Material (NORM) refers to radioactive material containing low levels of radioactivity found naturally in certain mineral deposits, rocks, soils, water, and vegetation.
- Examples of NORM include elements like radium, uranium, thorium, and potassium.
- NORM is present everywhere at low concentrations and background levels of radiation.
- However, human activities that exploit these resources lead to enhanced concentrations of radionuclides and hence increased potential for exposure compared with the unaltered situation".

2.0 SOURCES OF EXPOSURE TO NORM

2.1 Natural Background sources

a. Terrestrial NORM

- The Earth itself is a source of terrestrial radiation.
- Radioactive materials (including uranium, thorium, potassium and radium) exist naturally in soil, rock, water, plant and animal.
- All air contains radon gas which is biggest contributor of background radiation.
- Radon is a naturally occurring radioactive gas that forms from the natural radioactive decay of uranium and radium in rock, soil, and water.

b. Cosmogenic NORM

- This is formed because of interactions between certain gases in the Earth's atmosphere and cosmic rays from the sun and stars.
- The most exposed group are those who use air transport and those moving to space. This is because at high altitudes, there is less atmosphere to shield the incoming radiation.

2.2 INDUSTRIAL AND TECHNOLOGICAL SOURCES

These include activities and processes that enhance concentrations of radionuclides and increase the potential for exposure such as.

- Mining operations extracting commodities like coal, gold and phosphate. uranium mining and milling through the disposal of used (spent) fuel etc. as shown in figure 1.
- Oil and gas production equipment as scale buildup.
- Industrial water treatment plants
- Traditional building materials like stone and clay
- Fertilizer production from processing of phosphate rock



Figure 1: One of the small-scale gold mining sites in Uganda

3.0 MAJOR RADIATION EXPOSURE PATHWAYS OF NORM

i) External radiation exposure pathway

External exposure of workers and members of the public to radiation occurs due to exposure to Gamma and other high-energy rays emitted from radioactive material as shown in figures 2 and 3 below.

ii) Internal radiation exposure pathway

Internal exposure to NORM can happen through a few pathways as shown in figures 2 and 3 below:

- Ingestion
- Inhalation
- Absorption

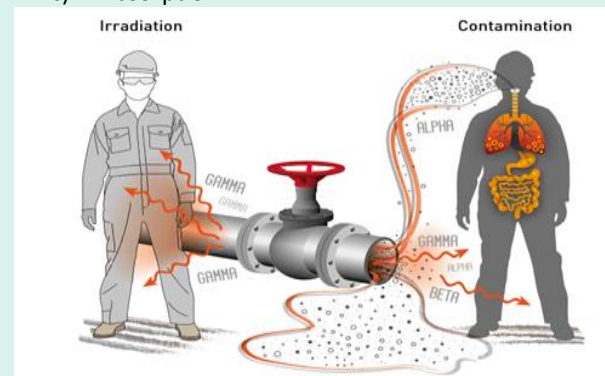


Figure 2: NORM exposure pathways

Human exposure pathways associated with radioactive isotopes in the environment

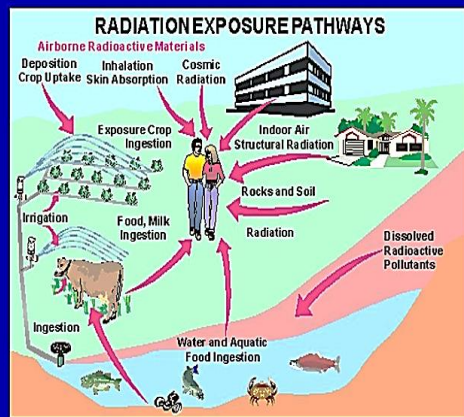


Figure 3: Human exposure pathways

Figure 3 above shows that the human being is at the center and risk of exposure from all types and sources of ionizing radiation through both the external and internal pathways due to the ecosystem.

4.0 HEALTH EFFECTS DUE TO NORM EXPOSURE

The key health effects that can occur due to exposure to Naturally Occurring Radioactive Material (NORM) are long-Term Stochastic Effects such as:

- Cancer
- Leukemia
- Increased risk for lung, stomach, liver cancer after many years due to bioaccumulation and prolonged internal exposure

However, the probability and severity depend on exposure pathways, concentration of radionuclides, dose amounts, and individual risk factors.

Note: There is overwhelming evidence that radon gas is a major cause of lung cancer in the general population at concentrations found in ordinary homes.

5.0 WHAT AEC IS DOING ABOUT NORM

- Stakeholder mapping and identification of industries and facilities with potential NORM occurrences.
- Identify a list of all mining sites in Uganda (Both active and legacy sites) as well as tourist centres and map radon gas prone areas to determine the extent of exposure in the country.
- Collection of environmental samples (soil, water, sediments, and other relevant media) for radiological and laboratory analysis.
- Continued environmental radiological surveys in mines, caves, and other suspected areas such as homes and commercial buildings.
- Equipping and strengthening the environmental radiation laboratory to support NORM characterization, monitoring, and analysis.
- Test construction materials for radioactivity.
- Test consumable products such as water, milk as well as other food stuffs for radioactivity. Figure 4 shows AEC staff analyzing water samples using the High Purity Germanium detector



Figure 4: AEC staff analyzing water samples using the High Purity Germanium Detector

- Conducting stakeholder awareness campaigns, sensitization meetings, and workshops to promote understanding of NORM. The figure 5 shows AEC staff and stakeholders during a NORM sensitization workshop.



Figure 5: AEC staff and stakeholders during a NORM sensitization workshop in Mubende district

6.0 CONCLUSION

Monitoring radiation levels, limiting exposure times, maintaining distance from radiation sources, proper ventilation, protective shields, and personal protective equipment help minimize occupational and environmental NORM exposure.

CONTACT ADDRESS

Atomic Energy Council,
Plot 40, Bukoto Street
P.O Box 7044, Kampala.

Tel: +256 417 101700

Email: admin@atomiccouncil.go.ug

Website: www.atomiccouncil.go.ug