



NUCLEAR REGULATORY AUTHORITY, GHANA

RADIOACTIVE MATERIAL IN GHANA- THE REGULATORY ASPECT

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Introduction

- **What is the meaning of radioactive material?**
- **Material** that emits radiation energy in the form of alpha, beta, or gamma particles or rays - all of which can damage living tissue.
- **Ionizing radiation**—it weakens and breaks up DNA, either damaging cells enough to **kill** them or causing them to mutate in ways that may eventually lead to cancer. (α, β, γ)
- **Non-ionizing radiation**, e.g. radio waves, infra red, visible light, micro waves, etc.

Introduction

- Naturally Occurring **Radioactive Materials** (NORM)
 - (Primodal and Cosmogenic) e.g. radium, thorium, and uranium.
 - ❑ NORM are low in concentration in Earth's crust
 - ❑ Concentration increases when brought to the surface through human activities-oil and gas exploration or mining
- **What is the main cause of radioactive material decay?**

Excess protons or excess neutrons leads to instability of the atom.
Atom attempts to become stable by releasing energy and matter in the form of radiation (α, β, γ).

Radioactive Material Exposure Pathways

- ❑ External irradiation from radionuclides outside the body:
 - e.g. gamma radiation from radionuclides in the soil, rocks, suspended dust particles in the air or atmosphere, wastes materials discharged into the environment, radon and decay products and other gaseous airborne radionuclides, cosmic rays, etc.
- ❑ **Internal exposure through** Inhalation of airborne radionuclides:
 - Internal exposure from inhalation of airborne radionuclides in dusts and other gases, radon and decay products.

Radioactive Material Exposure Pathways

- ❖ **Internal exposure through** Ingestion of contaminated items :
 - Food from plants grown on contaminated soil and irrigated with contaminated water from both surface and underground sources
 - Meat and Milk from livestock fed with contaminated fodder (e.g. grass) and water
 - Fish from contaminated water (river, pond, reservoir, sea, lagoon, etc)
- More than 80 % of radiation we are exposed to comes from background radiation-natural source, soil, rock, sunlight
- Remaining exposure come from manmade sources: x-ray, household devices-smoke detectors, color TV, etc

Benefits vs Hazards of Radioactive Material Usage

☐ Benefits includes:

- Diagnosis and Treatment of diseases: radioisotopes; I-131, Co-60, Tc-99
- Process quality control: Oil and gas exploration, nuclear gauges for density and moisture measurements, etc.
- Scanners at various Destination Ports

❖ Poor applications-Hazards

- Unnecessary exposure to radiation(scatter and primary beam)
- **Deterministic and Stochastic effects**

Controls are required as a result of hazards associated with use of radiation (radioactive materials).

Objective of Protection and Safety in the use of radioactive material

- ❖ The major Safety Objective for the Protection and safety measures in the design, operation and use of ionizing radiation facility and activity (radioactive materials) is to protect people and the environment from harmful effects of ionizing radiation.
- That means the design shall ensure:
- Control of radiation exposure of workers and public
- Minimize the likelihood of accidental and over exposure
- Mitigate the consequences of such events if they do occur

History and Legal Basis for Controlling Ionizing Radiation in Ghana

- **Before 1993** there was no clear regulation of radiation (radioactive material) applications in Ghana
- In **April, 1993** the **LI1559** was promulgated to establish **Radiation Protection Board (RPB)** to regulate radiation usage in Ghana.
- But the LI1559 was promulgated under the Atomic Energy Commission Act, Act 204 of 1963 amended by Act 588 of 2000.
- In **August, 2015** the Nuclear Regulatory Authority NRA ACT, ACT 895 of 2015 established the current **independent** regulatory authority.
- **That is the NRA is completely different in mandate to GAEC**

Regulatory Processes for Radioactive Material Applications

- Legal person must go through Regulatory requirement as mandated by the NRA Act, Act 895 of 2015
- Notification
- Design approval/Construction permit
- Import/Export Permit application
- Application for Authorization
- Inspection
- Authorization granted or refused
- Enforcement of non compliances

(guidelines available at www.gnra.org.gh/downloads)

Requirements for Protection and Safety (Management)

❑ Provide Shielding requirements

- Site selection-Bunkers, etc
- Radiation facility plans and Drawings
- Descriptions, Occupancy and Classification of Adjacent Areas
- Equipment Design Workload
- Dose Rates and Annual Dose Calculations for Adjacent Areas

Requirements for Protection and Safety (Management)

❑ Safety System Requirements

- ❖ Doors or Entrance interlocks for radioactive material/radiation device storages
- ❖ Warning Lights, and signs
- ❖ Radiation warning system
- ❖ Emergency off buttons and Beam Stop to control the source
- ❖ Viewing Systems
- ❖ Tools and Equipment for stuck source emergencies

Requirements for Protection and Safety (Management)

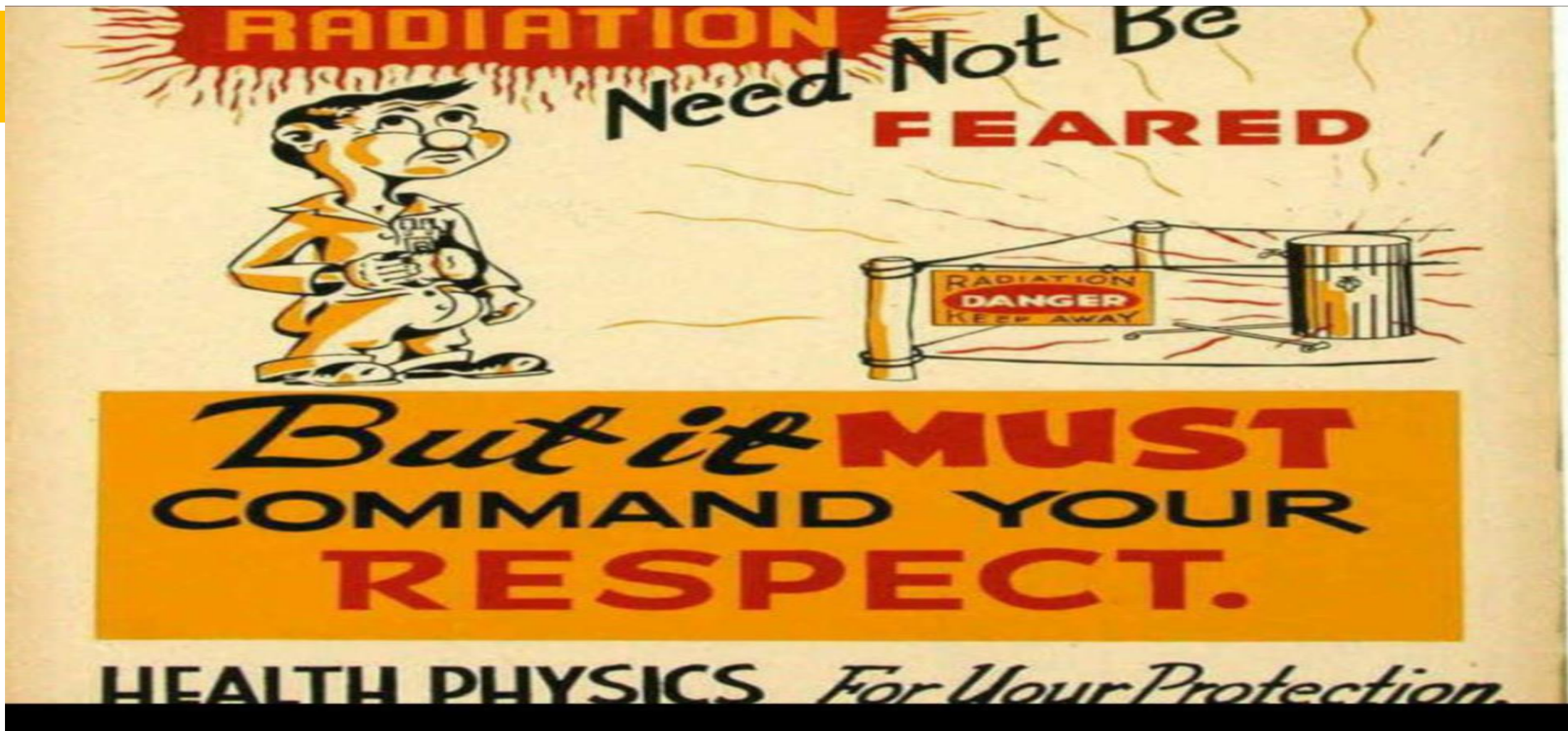
- Only qualified staff (education, trained, and professional experience) shall be engaged to work with radiation sources and devices (e.g. Health Professionals, Operators, RPOs, etc.)
- Provide **radiation monitoring** equipment (for area and personnel monitoring).
- Provide **protective equipment** i.e. lead aprons, respirators, goggles and gloves.

Measures to ensure Protection and Safety Workers

- The use of the principle of:
 - ❖ Time
 - ❖ Distance
 - ❖ Shielding
- ❑ Ensure that all staff in controlled areas are monitored and wear their monitoring badges at work.
- Promptly ensure that Personnel monitoring badges are assessed at regular intervals.
- Keep records of personal doses and analysis of these records to ensure that doses are ALARA.

Measures to ensure Protection and Safety Workers

- RPO
 - Conduct an **investigation into incident/accidents** leading to doses exceeding investigation levels (**1mSv/month**) and or overexposures.
 - **Control cubicle** should be able to attenuate radiation to less than or equal to **7.5 μ Sv/h**.
 - **Stop unsafe operations** and call management attention for the appropriate corrective actions to be taken.
 - **Liaise** with the Nuclear Regulatory Authority on all matters relating to radiation safety.



THANK YOU