

Radiation Protection Authority



Zambia

SAFETY GUIDE

RPA SG 25

Guidelines for Monitoring of Radioactivity in Foodstuff

2025

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Abbreviations and Acronyms

ALARA:	As Low As Reasonably Achievable
CAC:	Codex Alimentarius Commission
EU:	European Union Commission
GSG:	General Safety Guide
IAEA:	International Atomic Energy Agency
ICP-MS:	Inductively Coupled Plasma Mass Spectrometry
ICRP:	International Commissioning on Radiological Protection
QA/QC:	Quality Assurance/Quality Control
RPA:	Radiation Protection Authority
RPAB:	Radiation Protection Authority Board
RPO:	Radiation Protection Officer
RPSP:	Radiation Protection and Safety Program
SI:	Statutory Instrument
WHO:	World Health Organisation

FOREWORD



The safety and quality of food consumed by the Zambian population is a cornerstone of public health and national development. As the country continues to grow and industrial activities expand—particularly in the mining, medical, and energy sectors—there is a growing need to ensure that foodstuffs remain free from harmful levels of radioactive contamination.

These Guidelines for Monitoring Radioactivity in Foodstuffs have been developed by the Radiation Protection Authority (RPA) in collaboration with key stakeholders, including regulatory agencies, scientific institutions, and international partners. The guidelines provide a comprehensive framework for the systematic monitoring, analysis, and interpretation of radionuclide levels in food. They align with national legislation and international standards, including those set by the International Atomic Energy Agency (IAEA) and the Codex Alimentarius Commission.

This document serves as an essential tool for regulatory bodies, laboratories, agricultural officers, health professionals, and food industry stakeholders. It is designed to promote consistency in monitoring practices and to facilitate timely decision-making aimed at protecting the health of consumers and preserving confidence in Zambia's food supply.

We commend all those who contributed to the development of these guidelines and urge continued cooperation and vigilance in their implementation.

A handwritten signature in black ink, which appears to read 'Christabel Jinja Ngongola-Reinke'. The signature is written in a cursive style and is positioned above a horizontal line.

Christabel Jinja Ngongola-Reinke
RPA Board Chairperson

ACKNOWLEDGEMENT



The Radiation Protection Authority (RPA) of Zambia extends its sincere gratitude to the dedicated professionals and stakeholders whose expertise and collaboration were instrumental in the development of these guidelines.

We acknowledge the foundational standards and advisory materials provided by the International Atomic Energy Agency (IAEA), World Health Organisation (WHO), Codex Alimentarius Commission (CAC), Food and Agriculture organization (FAO) and International Commissioning on Radiological Protection (ICRP), which form the technical backbone of this document. The contributions of water utilities, public health officials, environmental scientists, laboratory specialists, local and international stakeholders who have played a crucial role in customizing these standards to fit the specific operational context of Zambia.

Special thanks are extended to the Radiation Protection Authority Board, Management and technical staff, who are committed to ensure public and environmental safety through monitoring radioactivity in food. Their commitment ensures that the people and the environment are protected from the effects that may arise from ionizing radiation.

A handwritten signature in black ink, consisting of a stylized 'B' followed by a series of loops and a long horizontal stroke.

Dr. Boster Dearson Siwila, PhD
Executive Director

1.0. Introduction

Radioactive contamination in food can pose health risks to the population, particularly in areas impacted by radiological incidents, naturally occurring radionuclides, or environmental pollution. These guidelines aim to establish a structured approach for monitoring and controlling radioactivity in foodstuffs in Zambia, ensuring public safety and compliance with international standards.

2.0. Objectives

- 2.1. To protect public health by identifying and controlling radioactive contamination in food
- 2.2. To provide a standardized methodology for the sampling, analysis, and interpretation of radionuclide concentrations in food
- 2.3. To align national monitoring activities with international requirements, such as those from the IAEA, WHO, Codex Alimentarius Commission (CAC), and Food and Agriculture organization (FAO).

3.0. Scope

- 3.1. These guidelines apply to:
 - 3.1.1. Domestically produced and imported foodstuffs
 - 3.1.2. Foodstuffs potentially exposed to environmental radioactive contamination
 - 3.1.3. Agricultural products, animal products, and wild foods (e.g., mushrooms, game meat)

4.0. Legal and Regulatory Framework

- 4.1. The monitoring program shall be implemented in accordance with:
 - 4.1.1. The Ionising Radiation Protection Act, No. 16 of 2005

4.1.2. Relevant Statutory Instruments (SIs)

4.1.3. International standards such as the Codex Guideline Levels for Radionuclides in Foods Following Accidental Nuclear Contamination

5.0. Institutional Responsibilities

Table 1: Institutional responsibilities

Institution	Responsibility
Radiation Protection Authority (RPA)	Lead agency for coordination, regulation, and enforcement
Zambia Compulsory Standards Agency (ZCSA)	Facilitates import controls and market surveillance.
Ministry of Agriculture	conducts sampling and monitoring in farming areas.
Ministry of Health	Assesses public health risks and communicates with the public.
Zambia Bureau of Standards (ZABS)	Development of national food safety standards
Zambia Agricultural Research Institute (ZARI)	Research on uptake, transfer, and mitigation of radionuclides in crops and soils
National Institute for Scientific and Industrial Research (NISIR)	Scientific research, method development, and support for analytical measurements of radionuclides

6.0. Key Radionuclides of Concern

6.1. Naturally Occurring Radionuclides:

6.1.1. Uranium-238 and Uranium-234

6.1.2. Radium-226 and Radium-228

6.1.3. Thorium-232

- 6.1.4. Radon-222
- 6.2. Artificial Radionuclides (if applicable):
 - 6.2.1. Cesium-137
 - 6.2.2. Cesium-134
 - 6.2.3. Strontium-90
 - 6.2.4. Iodine-131
- 6.3. Radionuclides of Interest in an Emergency
 - 6.3.1. During emergencies, the most common radionuclides found in food that may require monitoring include:
 - 6.3.1.1. Iodine-131 (I-131)
 - 6.3.1.2. Cesium-134 (Cs-134)
 - 6.3.1.3. Cesium-137 (Cs-137)
 - 6.3.1.4. Strontium-90 (Sr-90)
 - 6.3.1.5. Plutonium isotopes (Pu-239, Pu-240)

7.0. Most Risky Food Types for Contamination

- 7.1. The following foodstuffs are the most susceptible to radioactivity contamination:
 - 7.1.1. **Meat, Milk, and Water:** These are highly susceptible to radionuclide uptake from contaminated soils or water sources.
 - 7.1.2. **Vegetables and Crops:** Especially root vegetables like carrots and leafy greens that assimilate radionuclides directly from soil.
 - 7.1.3. **Freshwater food and Wild Foods:** Fish and shellfish near contaminated water bodies can bioaccumulate radionuclides.

8.0. National Reference Levels

- 8.1. National Action Levels developed based on local dietary habits, contamination levels, and emergency scenarios will be used during an emergency.

9.0. International Reference Levels

- 9.1. The international levels are generally based on guidance from the Codex Alimentarius Commission (FAO/WHO) and the International Atomic Energy Agency (IAEA).

10.0. Monitoring Strategy

- 10.1. Targeted Monitoring
 - 10.1.1. Focuses on high-risk areas: mining zones, former uranium exploration sites, areas near hospitals or industries using radionuclides
 - 10.1.2. Prioritizes food types with a high likelihood of contamination
- 10.2. Routine Surveillance
 - 10.2.1. National baseline monitoring to track natural background and seasonal trends
- 10.3. Emergency Response Monitoring
 - 10.3.1. Triggered during nuclear or radiological emergencies

11.0. Sampling Protocols

- 11.1. Sampling Locations: Farms, markets, ports of entry, food processing plants
- 11.2. Sample Size: Determined based on statistical sampling principles (e.g., ISO 7002)
- 11.3. Sample Types: Milk, meat, vegetables, grains, water, wild food, seafood (if applicable)
- 11.4. Preservation & Transport: Use clean containers, refrigerate if necessary, and transport to the laboratory under chain-of-custody

12.0. Analytical Methods

- 12.1. Radionuclides of Interest: Cs-137, Sr-90, I-131, K-40, U-238 series, Th-232 series
- 12.2. Techniques:

- 12.2.1. Gamma spectrometry (HPGe detectors)
- 12.2.2. Alpha spectrometry
- 12.2.3. Liquid scintillation counting
- 12.3. Laboratories must be accredited and participate in inter-laboratory comparisons

13.0. Interpretation of Results

- 13.1. Compare with national limits (to be set) or refer to Codex Alimentarius, FAO, IAEA, ICRP and EU standards
- 13.2. Consider:
 - 13.2.1. Dietary intake pattern
 - 13.2.2. Vulnerable groups (e.g., children, pregnant women)
 - 13.2.3. Cumulative exposure from multiple sources

14.0. Reporting and Communication

- 14.1. Results shall be compiled in quarterly and annual reports
- 14.2. RPA shall publish risk assessments and guidance for public consumption when necessary
- 14.3. Immediate public notification required for exceedances.

15.0. Quality Assurance and Control

- 15.1. Use of validated methods and certified reference materials
- 15.2. Routine calibration of equipment
- 15.3. Periodic staff training.

16.0. Capacity Building

- 16.1. For continuous development, training programs, public awareness campaigns and stakeholder consultations will be conducted on regular basis
- 16.2. Investment in laboratory infrastructure and mobile monitoring units

17.0. Data Management and Reporting

A centralized data management system accessible to all relevant agencies for real-time monitoring and transparent reporting shall be established at the Radiation Protection Authority.

18.0. Review and Updates

18.1. These guidelines shall be reviewed every five (5) years or after a radiological emergency

18.2. Stakeholder consultations shall guide updates

APPENDICES

I: RADIATION PROTECTION AUTHORITY RADIOACTIVITY LIMITS IN IMPORTED FOODS

All imported food staff should comply with the requirement for artificial radioactivity as given in table 1 below.

Table 2: Imported food radioactivity requirements

Radionuclides	Guidance Level (Bq/kg)		Method of Testing
	Infant Foods	Other Foods	
²³⁸ Pu, ²³⁹ Pu, ²⁴⁰ Pu, ²⁴¹ Am	1	10	Gamma Spectrometry, Alpha Spectrometry, Liquid Scintillation
⁹⁰ Sr, ¹⁰⁶ Ru, ¹²⁹ I, ¹³¹ I, ²³⁵ U	100	100	Gamma Spectrometry, Alpha Spectrometry, Liquid Scintillation
³⁵ S, ⁶⁰ Co, ⁸⁹ Sr, ¹⁰³ Ru, ¹³⁴ Cs, ¹³⁷ Cs, ¹⁴⁴ Ce, ¹⁹² Ir,	1000	1000	Gamma Spectrometry, Alpha Spectrometry, Liquid Scintillation
³ H, ¹⁴ C, ⁹⁹ Tc	1000	10,000	Gamma Spectrometry, Alpha Spectrometry, Liquid Scintillation

*Accreditation and proficiency testing programs should align with Codex, FAO, ISO, IAEA, local and other international standards

II: INTERNATIONAL REFERENCE LEVELS

Table 3: International Reference levels of radioactivity in food during an emergency. The levels are expressed in becquerels per kilogram (Bq/kg):

Radionuclide Group	Infant Foods (Bq/kg)	General Foods (Bq/kg)	Milk and Dairy (Bq/kg)
Iodine-131	100	300	100
Cesium-134 and Cesium-137 (total)	400	1,000	1,000
Strontium-90	100	100	100

Plutonium and transuranic elements	1	10	1
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III: TESTING AND CONFORMITY TO THE STANDARD

The food testing shall ensure conformity to the WHO, IAEA, FAO and ISO standards for radioactivity in food and other local and international requirements prescribed.