



Radionuclides in Foods

EMSL Radiochemistry Laboratory

Introduction

Radionuclides, whether man-made or natural in origin, are present in the environment. These radioactive materials can contaminate food and can affect your health. Long-term consumption of radiological contaminated foods can damage DNA, resulting in the mutation of genes contained in the DNA and lead to cancer. When exposed, the degree of harm to human health depends on the type and the dose of radionuclides. It is also critical to know the radioactivity of the contaminated food.

Radionuclides in Foods

The common radionuclides found in food are the naturally occurring radionuclides such as Potassium-40, Uranium-238, Radium-226 and their associated progeny. The man-made radionuclides can also be discharged into the environment following a major nuclear incident. Iodine-131 is an immediate concern since it's distributed over a large area and rapidly transferred from contaminated feed into milk. Other radioisotopes that could be of long-term concern if released are Cesium-134 (Cs-134), Cesium-137 (Cs-137), Strontium-90 (Sr-90), Strontium-89 (Sr-89) and Plutonium. They can remain in the environment for a long time.

FDA Guidance Levels for Radionuclides in Domestic and Imported Foods

In 1998, the U.S. Food and Drug Administration (FDA) released a document (63 FR 43402, FDA 1998) titled "*Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations to State and Local Agencies*". This document provides guidance to State and local agencies in planning and execution of protective actions associated with human food and animal feeds accidentally contaminated with radionuclides.



Table 1: Derived Intervention Levels (DIL, Bq/kg)

Radionuclide Group	DIL (Bq/kg)
Strontium-90 (Sr-90)	160
Iodine-131 (I-131)	170
Cesium-134 + Cesium-137 (Cs-134, Cs-137)	1200
Plutonium-238 + Plutonium-239 + Americium-241 (Pu-238, Pu-239, Am-241)	2
Ruthenium-103 + Ruthenium-106 ^(a) (Ru-103, Ru-106)	$C3/6800 + C6/450 < 1$

^(a) Due to large differences in daily intervention limits (DILs) for Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106 are divided by their respective DILs and summed. The DIL for the Ruthenium group is set at less than one.

Radionuclides listed above are usually contained in nuclear installations or used as a radiation source in large enough quantities. They are those important for uptake into the food chain and could be significant potential contributors to levels in foods.

Analysis of Radionuclides in Foods

EMSL Analytical, Inc.'s Radiochemistry Laboratory provides the analytical services for radionuclides in foods:

- A. Gamma Emitters Analysis by Gamma Spectroscopy includes Cs-134/137, Ru-103/106 and I-131.
- B. Determination of Pu-238/239 and Am-241 by Alpha Spectroscopy.
- C. Analysis of Strontium-90 by Beta Counting.



Compliance Analysis of Radionuclides in Foods

Radionuclide Group	Radiation Type	DIL (Bq/kg)	Detection Limit (Bq/Kg)	Method
Iodine-131	Beta, Gamma	170	20	EPA 901.1
Cesium-134 Cesium-137	Beta, Gamma	1200	10	EPA 901.1
Ruthenium-103 Ruthenium-106	Beta, Gamma	6800 450	50	EPA 901.1
Strontium-90	Beta	160	10	EPA 905
Plutonium-238/239, Americium-241	Alpha	2	0.5	EPA 907

Listed Radionuclide Package (Alpha, Beta, Gamma)

Sampling Instructions

- Liquid samples are collected in a one-liter plastic or glass bottle.
- At least 500g of solid samples are collected in a one-quart or larger straight-sided plastic or glass container with a plastic or Teflon lined cap.
- An ice-cooler for the shipment of wet food samples such as meat, fish, milk and fresh vegetables is preferred.

Additional & Cited Information

- Radiation and Your Health: <https://www.cdc.gov/nceh/radiation/sources.html>
- Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies" (FDA, 1998):
<http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM094513.pdf>
- Supporting Document for Guidance Levels for Radionuclides in Domestic and Imported Foods (FDA, 2004):
<http://www.fda.gov/Food/FoodSafety/FoodContaminantsAdulteration/ChemicalContaminants/Radionuclides/UCM078341>
- Foodstuff And Cancer: Analysis of Radionuclides And Its Radiation Levels in Common Ghanaian Maize:
<http://gssrr.org/index.php?journal=JournalOfBasicAndApplied&page=article&op=view&path%5B%5D=1110>