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Food and Agriculture
Organization of
the United Nations

Nuclear accidents and radioactive contamination of foods
30 March 2011

This document is intended to provide basic background information and not to give a complete overview. It will be updated as appropriate.

1. Introduction

Radioactive isotopes of elements (radionuclides) are naturally present in the environment, and that includes our bodies and our food and water. We are exposed to radiation (also known as background radiation) from these radionuclides on a daily basis. Radiation comes from space (i.e., cosmic rays) as well as from naturally-occurring radioactive materials (radionuclides) found in the soil, water and air. Radioactivity can be detected in food and water and the concentration of naturally-occurring radionuclides varies depending on several factors such as local geology, climate and agricultural practices.

People can also be exposed to radiation from man-made activities, including medical diagnostic intervention. Radioactivity can contaminate food after it has been discharged into the environment from industries that concentrate natural radionuclides and from civil or military nuclear operations. Whether, man-made or natural in origin, radioactive material passes through the food chain in the same way as non-radioactive material. The degree of harm to human health depends on the type of radionuclides and the length of time people are exposed to it. The amount of radiation people are exposed to varies from place to place and among individuals.

In the event of releases of radioactivity following an emergency at a nuclear power plant, land, rivers, sea and structures in the vicinity of the power plant can become contaminated with a mixture of radionuclides generated inside the reactor, also known as “nuclear fission products”. Individuals can therefore become exposed to radiation from these fission products.

2. Radionuclides in food

Background levels of radionuclides in foods vary and are dependent on several factors, including the type of food and the geographic region where the food has been produced. The common radionuclides in food are potassium-40 (^{40}K), radium-226 (^{226}Ra) and uranium 238 (^{238}U) and their associated progeny. In general, ^{40}K is the most commonly occurring natural radioisotope. In milk, for example, levels of ^{40}K measure around 50 Bq/L, and for meat, bananas and other potassium rich products, levels may measure at several hundreds Bq/kg. Other natural radioisotopes exist in much lower concentrations, and originate from the decay of uranium and thorium.

When large amounts of radioisotopes are discharged into the environment, they can affect foods by either falling onto the surface of foods like fruits and vegetables or animal feed as deposits from the air or through contaminated rainwater/snow. Radioactivity in water can also accumulate in rivers and the sea, depositing on fish and seafood. Once in the environment, radioactive material can also become incorporated into food as it is taken up by plants, seafood or ingested by animals.

Although many different kinds of radionuclides can be discharged following a major nuclear emergency, some are very short-lived and others do not readily transfer into food. Radionuclides generated in nuclear installations and that could be significant for the food chain include; radioactive hydrogen (^{3}H), carbon (^{14}C), technetium (^{99}Tc), sulphur (^{35}S), cobalt (^{60}Co) strontium (^{89}Sr and ^{90}Sr), ruthenium (^{103}Ru and ^{106}Ru), iodine (^{131}I and ^{129}I), uranium (^{235}U) plutonium (^{238}Pu, ^{239}Pu and ^{240}Pu), caesium (^{134}Cs and ^{137}Cs), cerium (^{103}Ce), iridium (^{192}Ir), and americium (^{241}Am).

Radioactive iodine (I-131) in food is of immediate concern due to its rapid transfer to milk from contaminated feed and its accumulation in the thyroid gland. I-131has a relatively short half-life (8 days) and will therefore naturally decay over a short time frame. If radioactive iodine is breathed in or swallowed, it will concentrate in the thyroid gland and increase the risk of thyroid cancer. The uptake of radioactive iodine into the thyroid gland can be decreased or prevented by ingestion of non-radioactive iodine, by taking potassium iodide pills. Once the thyroid is saturated with iodine, no further iodine can be incorporated. Iodized table salt should not be used as an alternative to potassium iodide pills as it does not contain sufficient iodine to saturate the thyroid, and high salt intake may have adverse health effects.

Radioactive caesium (Cs-134 and Cs-137), in contrast to radioactive iodine, has a long half-life (Cs-134: 2 years, Cs-137: 30 years). Radioactive caesium can stay in the environment for many years and could continue to present a longer term problem for food, and food production, and a threat to human health. If caesium-137 enters the body, it is distributed fairly uniformly throughout the body's soft tissues, resulting in exposure of those tissues. Compared to some other radionuclides, caesium-137 remains in the body for a relatively short time. Like all radionuclides, exposure to radiation from caesium-137 results in an increased risk of cancer.

Other radionuclides could be of concern, depending on the nature of the nuclear accident and release of specific isotopes.

4. International standards and guidance

The Codex Guid d

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General Standard for Contaminants and Toxins in Food and Feed (CODEX STAN 193, page 33-37) is available in English at: http://www.codexalimentarius.net/download/standards/17/CXS_193e.pdf

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture

The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture provides advice on immediate actions to prevent and mitigate the radioactive contamination of agricultural foodstuffs when a nuclear emergency occurs in or affect your area. You will find the advice, counter measures, glossary and other relevant information at:

- Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency (Health Canada, 2000) : http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/emergency-urgence/index-eng.php

European Commission

- Maximum level of radioactive contamination in foodstuffs: http://europa.eu/legislation_summaries/food_safety/contamination_environmental_factors/l21109_en.htm

USA

- 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

References

- Radioactive fallout in soils, crops and food (FAO, 1989) http://www.fao.org/docrep/T0228E/T0228E00.htm

- Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear accident or a Radiation Emergency (ICPR Publication 111, 2008)

- Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency (IAEA Safety Standards Series No. GSG-2, 2011): http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf

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