



Everything You Should Know About Food Irradiation in Canada

Health Canada has proposed legalizing irradiation for ground beef, poultry, shrimp and mangoes. In order to prevent a serious error, Canadians need to understand what irradiation is and why it must be stopped.

Irradiation bombards food with ionizing radiation: gamma rays from nuclear material, X-rays, or speed-of-light electrons from linear accelerators. Irradiated is intended to kill harmful bacteria such as *E. coli* and *Salmonella*, extend shelf life, and kill invasive insects such as fruit flies and weevils.

In the process, however, electrons are knocked out of molecules and ricochet around in food. They shred the cellular structure of food, kill enzymes, create toxic chemicals and harmful free radicals, decrease the vitamin and protein levels, and ruin flavor, odor and texture of food.

In irradiation facilities, the food is moved on a conveyor belt past a radiation source, where it is zapped by cobalt-60, an accelerated electron beam, or X-rays. The irradiation industry advertises irradiation done with electron beams (e-beams) as “new and improved,” but e-beams cause the same problems in food as nuclear irradiation.

Contrary to what the industry insists, food irradiation is not the same as microwaving. Gamma rays, x-rays and electron beams carry more energy than microwaves. They also affect the food differently: microwaves heat the food, but irradiation does not and has nothing to do with cooking.

Timeline of Irradiation Approvals in Canada

- 1960: Potatoes, maximum dose of 0.15 kiloGray (kGy)
- 1965: Onions, maximum dose of 0.15 kGy
- 1969: Wheat and wheat flour, maximum dose of 0.75 kGy

- 1984: Spices and dehydrated seasonings, maximum dose of 10 kGy
- Nov. 23, 2002: Health Canada announced a proposal to expand the list of foods approved for irradiation to include fresh and frozen ground beef, poultry and shrimp and mangoes.

Timeline of Health Research

One year after Canada’s 1960 approval for potatoes, research presented at a World Health Organization (WHO) conference in Brussels revealed blood abnormalities and other health problems in rats fed irradiated foods, leading one scientist to warn: “These effects should not be overlooked. [They] may be one link in the chain of events leading to cancer.”¹

In 1968, the year before Canada’s wheat approval, the U.S. Food and Drug Administration (FDA) rescinded its approval of irradiation for bacon after previously withheld Army documents came to light. The research showed that lab animals fed irradiated foods died younger, gained less

weight, had more reproductive problems, had lower red blood cell counts, and developed more malignant tumors than animals fed non-irradiated food.

In 1969, the same year as Canada's approval for wheat, research presented at a WHO conference in Geneva revealed that mice fed irradiated wheat flour died younger, experienced a higher death rate for offspring, and had more tumors than mice fed non-irradiated flour. In addition, hens fed a diet that included irradiated wheat produced and hatched fewer eggs, and lost more embryos than hens fed non-irradiated food.²

Timeline of Irradiation Approvals in the U.S.

- 1963: Bacon (rescinded in 1968)
- 1963: Wheat and wheat flour
- 1964: White potatoes
- 1983: Certain spices and seasonings
- 1985: Pork
- 1986: Fruits and vegetables
- 1990: Poultry
- 1997: Red meat
- 2000: Eggs
- 2000: Sprouting seeds
- 2002: Imported fruits and vegetables

The 1986 approval, however, which laid the groundwork for later approvals and proposals, was based on a mere seven scientific studies. None of the studies meet the FDA's own testing protocols. None included short-term carcinogenicity and mutagenicity tests. One indicated higher mortality rates among rat offspring. And three were never translated into English. Further, subsequent FDA approvals were based on dozens of studies that the agency's own scientists reported were deficient.³

These shortcomings are of particular note, given that the *Canada Gazette* filing announcing the pending proposal specifically cites the FDA's legalization of irradiation for several types of food.

Irradiation in the European Union

Currently, the European Union only permits the irradiation of herbs, spices and vegetable seasonings. However, some Member States have approved the irradiation of more food categories, including Belgium, France, Italy, the Netherlands and the UK.

The *Canada Gazette* filing announcing the pending proposal cites a European Commission proposal to legalize irradiation for several types of

foods, including shrimp, which is also included in the Canadian proposal.

Since the *Gazette* filing, however, the European Parliament rejected the proposal, voting to maintain the list of foods approved for irradiation to only herbs, spices and vegetable seasonings.

The World Health Organization's Faulty Approval of Food Irradiation

In 1997, the WHO endorsed irradiation for all foods at any dose, no matter how high. On the road to this endorsement, however, the WHO resorted to some troublesome tactics.

In 1980, for example, the WHO endorsed irradiation for any food up to 10 kGy, even though the safety and wholesomeness of only eight individual types of irradiated food were specifically analyzed. The recommended maximum doses for 7 of these 8 individual food types – ranging from 0.15 kiloGray to 5 kiloGray – were far below the 10 kGy level that the WHO endorsed for *all* foods.

In several subsequent reports, the WHO systematically overlooked and dismissed substantial evidence published in peer-reviewed journals questioning the safety and wholesomeness of irradiated foods – to the point of outright mischaracterizing studies revealing health problems in lab animals as actually supporting the safety of irradiated foods.⁴

The *Canada Gazette* filing announcing the pending proposal specifically cites the WHO's endorsement of food irradiation.

Canadian House of Commons' Recommendations on Food Irradiation

In 1987, three years after irradiation for spices and seasonings was legalized, the House of Commons' Standing Committee on Consumer and Corporate Affairs on the Question of Food Irradiation and the Labeling of Irradiated Foods made 33 recommendations on these issues. Among them (emphasis in original):

- "Irradiation by any form of ionizing energy [should] continue to be regulated as a food additive, and be restricted to those foods and doses presently approved by the existing regulations until an in-depth scientific assessment of health implications and further toxicological studies indicate that no significant adverse health effects would be expected

to be found by the ingestion of irradiated foods.”

- “[T]he irradiation of wheat [should] no longer be permitted until the specific safety questions addressed in other recommendations in this report are resolved... [F]urther feeding studies (not on humans) [should] be conducted to determine if the effects from eating irradiated wheat as indicated by earlier studies do in fact occur.”

- “[M]ethods more cost-effective than irradiation [should] be pursued to contend with the *Salmonella* problem in Canada.”

- “[I]nvestigations [should] be conducted on the effect of irradiation on the nutritional degradation of the foods for which irradiation is presently permitted. Investigations into the nutritional degradation of other foods should also be conducted before they are approved for irradiation.”

- “[I]n addition to other toxicological tests that need be conducted, emphasis should be placed on tests to examine the long-term chronic effects (if any) of ingesting irradiated foods.”

Health and Welfare Canada failed to implement any of these recommendations. In direct contradiction, the Food and Drug Regulations were amended in 1989 to overturn a 40-year-old policy by reclassifying irradiation from an “additive” to a “process,” thus lowering the toxicity testing standards for irradiated foods. This decision came one year after the Canadian government began privatizing Atomic Energy of Canada Limited (AECL).

Atomic Energy of Canada Limited

Founded in 1952, AECL⁵ is the world’s leading supplier of cobalt-60, a radioactive isotope used to treat cancer, sterilize medical equipment, and kill microorganisms in food. In 1991, AECL’s radioactive isotope division, then called Nordion International, was sold to MDS Inc, a \$1.8 billion-a-year health care and venture capital company based in Toronto. MDS has since installed cobalt-60 irradiators in more than 40 countries.⁶

MDS maintains a relationship with AECL and the Canadian government. To settle a lawsuit filed by MDS against AECL, the government agreed to issue a \$100 million, interest-free loan to MDS to build two nuclear reactors, which AECL will operate.⁷ AECL is one of the most active sellers and operators of nuclear equipment and materials throughout the world, becoming somewhat notorious for dealing with questionable regimes.

Health Canada Today

Health Canada’s proposal to legalize irradiation for ground beef, poultry, shrimp and mangoes employs the same type of tactics used by the FDA and WHO. Among all of the information the agency has made available to the public, there is only one reference to the safety and wholesomeness of irradiated foods:

“Irradiation causes minor chemical modifications, similar to cooking, and some irradiated foods may taste slightly different. Irradiation does not lead to changes in food that, from a toxicological point of view, would have an adverse effect on human health. Food irradiation, at permitted levels, does not diminish the nutritional value of the food.”⁸

This statement minimizes, misrepresents and outright omits a vast scientific record established over the past 50 years that calls into question the safety of irradiated foods.

Food Irradiation Process

- Though not known to be used commercially, cesium-137 – a highly radioactive waste from the production of nuclear weapons – may be used in the near future. This material is among the “hottest” of all nuclear waste and is water soluble, meaning that a leak could have deadly results if it enters the water supply.

It is legal in Canada to irradiate with cesium-137. Under the present proposal, cesium-137 could be used to irradiate ground beef, poultry and shrimp, though not mangoes.

- Under the present proposal, all four types of food could be irradiated with more than 1 kGy of radiation – the level above which the Standing Committee on Consumer and Corporate Affairs in 1987 recommended toxicological testing for each food. Fresh and frozen ground beef could be irradiated at 4.5 kGy and 7 kGy, respectively; fresh and frozen poultry and shrimp at 3 kGy and 5 kGy, respectively; and mangoes at 1.5 kGy. Health Canada has not proposed any toxicological testing.

Research

- Research dating to the 1950s has revealed dozens of health problems in animals that ate irradiated foods, including premature death, mutations and other genetic abnormalities, fetal death and other reproductive problems, fatal

internal bleeding, immune system disorders, fatal internal bleeding, organ damage, tumors, stunted growth and nutritional deficiencies.⁹

- Irradiation disrupts the chemical composition of everything in its path – not just harmful bacteria. Numerous chemicals known or suspected to cause cancer and birth defects can be formed in irradiated food, including benzene, ethanol, hexane and methyl ethyl ketone.¹⁰

- A class of chemicals formed in irradiated foods, called 2-ACBs – which have never been found to occur naturally in any food – were recently found to promote the development of cancer in rats, cause genetic damage in rats, and cause genetic and cellular damage in human and rat cells.^{11,12,13,14} Based largely on the toxic properties of 2-ACBs, the European Parliament has rejected a proposal to expand food irradiation.

- Irradiation destroys or disrupts vitamins, protein, essential fatty acids and other nutrients in food – sometimes significantly. The process, for instance, destroys 80 percent of vitamin A in eggs and 48 percent of beta-carotene in orange juice.^{15,16}

- Irradiation can change flavor, odor and texture. Pork can turn red; beef can smell like a wet dog; fruit and vegetables can become mushy; and eggs can become runny and lose their color.^{17,18}

What Should Happen Next?

Given the totality of documented problems and hazards associated with irradiated foods, the Canadian government must rescind its proposal to legalize irradiation for ground beef, poultry, shrimp and mangoes until the lingering safety and wholesomeness questions are amply addressed.

Notes

¹ *Report of the Meeting on the Wholesomeness of Irradiated Foods.* Organized by the Food and Agriculture Organization, the World Health Organization and the International Atomic Energy Agency, Brussels, 23-30 October 1961. Rome: Food and Agriculture Organization of the United Nations, 1962.

² *Wholesomeness of Irradiated Food with Special Reference to Wheat Potatoes and Onions.* Report of a Joint FAO/IAEA/WHO Expert Committee, Geneva, 8-12 April 1969. World Health Organization Technical Report Series No. 451. Geneva: World Health Organization, 1970.

³ *A Broken Record: How the FDA Has Legalized – and Continues to Legalize – Food Irradiation Without Testing it for Safety.* Public Citizen, Cancer Prevention Coalition, and Global Resource Action Center for the Environment. Washington, DC, October 2000.

⁴ *Bad Taste: The Disturbing Truth About the World Health Organization's Endorsement of Food Irradiation.* Public Citizen and the Global Resource Action Center for the Environment. Washington, DC, October 2002.

⁵ AECL has sold nuclear reactors to China, which has had a long history of handing over nuclear secrets to Iran, Iraq and Pakistan; plutonium to India, which reportedly used it to detonate the country's first nuclear bomb; and a nuclear reactor to Argentine dictators, who later offered to help Iran build its first reactor. (*Food Irradiation Alert!* Public Citizen, Washington, DC, July 2000.) In 1994 a South Korean agent attempting to sell AECL products to the Korean Electric Power Corp. was convicted of bribing officials with \$250,000, delivered in paper bags. ("Canada's shady nuclear deals." *Multinational Monitor*, Sept. 1995.)

⁶ Industry Canada. <www.ic.gc.ca>

⁷ MDS Inc. 1997 Annual Information Form.

⁸ "Frequently Asked Questions Regarding Food Irradiation." Food Program, Health Canada. <www.hcsc.gc.ca/food-aliment/fpi-ipa/e_faq_food_irradiation03.html>

⁹ *Bad Taste: The Disturbing Truth About the World Health Organization's Endorsement of Food Irradiation.* Public Citizen and the Global Resource Action Center for the Environment. Washington, DC, October 2002.

¹⁰ *A Broken Record: How the FDA Legalized – and Continues to Legalize – Food Irradiation Without Testing it for Safety.* Washington, D.C.: Public Citizen, Cancer Prevention Coalition, Global Resource Action Center for the Environment, Oct. 2000.

¹¹ Delincee, H. and Pool-Zobel, B. Genotoxic properties of 2-dodecylcyclobutanone, a compound formed on irradiation of food containing fat. *Radiation Physics and Chemistry*, 52: 39-42, 1998.

¹² Delincee, H. et al. Genotoxicity of 2-dodecylcyclobutanone. Food Irradiation: Fifth German Conference, Karlsruhe, November 11-13, 1998.

¹³ Delincée, H. et al. "Genotoxicity of 2-alkylcyclobutanones, markers for an irradiation treatment in fat-containing food." (Abstract) Presented at the 12th International Meeting on Radiation Processing, March 25-30, 2001, Avignon, France.

¹⁴ Burnouf, D. et al. "Toxicological study to assess the risk associated with the consumption of irradiated fat-containing food." Federal Research Center for Nutrition, Karlsruhe, Germany. BFE-r-02-02, 2002.

¹⁵ FDA Memorandum, from Kim Morehouse, Ph.D. to William Trotter, Ph.D. April 11, 2000.

¹⁶ FDA Memorandum, from Antonio Mattia, Ph.D. to William Trotter, Ph.D. Nov. 2, 1999.

¹⁷ Huang, S. et al. "Effect of electron beam irradiation on physical, physicochemical and functional properties of liquid egg during frozen storage." *Poultry Science*, 76:1607-15, 1997.

¹⁸ Wong, Y.C. et al. "Comparison between irradiated and thermally pasteurized liquid egg white on functional, physical and microbiological properties." *Poultry Science*, 75:803-808, 1996.



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