Report on Food Irradiation

By Brian Tomasik

I think this was written in early 2002

Note: I don't know if I agree with the conclusions in this paper anymore. My sources were clearly biased to one side. I haven't explored the issue since and so don't have firm opinions.

Food irradiation is the use of radiation to kill pathogens in foods. It has only recently been used to sterilize food, but was previously used more often to sterilize products, such as medical supplies. About 40 countries allow the irradiation of food, but few of them use it often (Hauter). China is currently the leader, performing 90 percent of the world's irradiation, while Russia is second (Hauter). Although the US Food and Drug Administration (FDA) has approved the irradiation of several types of food, almost no properly conducted studies regarding the safety of irradiated foods have been performed and there is considerable evidence that several perils to workers, consumers, and the environment result from the irradiation of food. Because irradiated food presents many dangers and unknown possibilities, we must fully test the technology and also eliminate our need for it by cleaning and making our farms and food processing plants healthier.

The irradiation of food is used to preserve the food, to kill pests in grains and spices, and to kill pathogens in the food (Bloomfield). Food is exposed to radiation, in the form of x-rays, gamma rays, or accelerated electrons ("An Idea"), and often colbalt-60 or cesium-137 are used for radioactive radiation (Bloomfield). The radiation possesses enough energy to hit electrons off of atoms or molecules, which creates a charged particle, or ion, which is why irradiation is occasionally called ionizing radiation ("The ABCs"). The radiation can disrupt the DNA of microorganisms in food, which either kills them or keeps them from reproducing ("Electrifying"). A kiloGray (kGy) is enough radiation to increase a food's temperature .43 degrees Fahrenheit and

approved radiation levels for food range from about one kGy for fruits and vegetables to 30 kGy for spices and herbs (Priesnitz). Electron beam radiation, which involves sending vivacious electrons at the food, does not penetrate the food as deeply as x-rays and are used more for thinner foods (The ABCs). The radiation leaves the food quickly, so very little radioactivity remains, and a day after food is irradiated, radioactivity is undetectable (Bloomfield). Irradiation does destroy many microorganisms, but not all of them are killed, some obstinately remain, and in order to destroy them all, radiation doses would be so high it would damage the food (Hunter, "Food"). It also doesn't eradicate any pathogens that might infect the food after it had already been irradiated (Papazian).

Using radiation to kill pathogens has existed for several decades. It first began to be promoted with President Eisenhower's Atoms for Peace Program (Hauter). Back then, its principal purpose was to sterilize medical products, including syringes and bandages (Papazian). After being approved in 1963, wheat and wheat powder became the first foods to be irradiated, and NASA experimented with the technology to sterilize meat for its astronauts (Gillette). However, the first commercial facility for the irradiation of food did not open until 1992; the facility in Florida irradiated foods such as strawberries (Gillette). Throughout the 1990's, the FDA approved the irradiation of several types of food, including fruits, vegetables, pork, poultry, spices, and grains (Priesnitz). The FDA requires the labeling of irradiation on whole packages of meat, but not on foods that might contain some irradiated ingredients, such as soups that might contain irradiated chicken (Gillette). Recently, the tractable FDA, after strong lobbying from cunning corporations, who are not willing to capitulate and accept labeling, attempted to terminate the labeling requirement, as consumers are less likely to buy food if they know it has been irradiated (Hauter).

While many consumers are apprehensive about purchasing irradiated foods, supporters of irradiation are trying to convince them that irradiation is needed. Proponents are claiming irradiation is needed to help prevent the 33 million food-related illnesses (Gillette) and 9,000 American deaths from foodborne illnesses each year (Scott). However, better alternatives exist, such as cleaning up our processing plants and farms, and this does not involve the many dangers of irradiated food ("Nuclear Lunch").

The many possible dangers of irradiated food have never been tested adequately to ensure the safety of consumers (Bloomfield). Before approving irradiation, the FDA reviewed 441 studies claiming the safety of the technology, yet only five of those studies were considered by the FDA to have been "properly conducted, fully adequate by 1980 toxicological standards, and able to stand alone in support of safety" ("Nuclear Lunch"). The Department of Preventive Medicine and Community Health of the New Jersey Medical School has said that two of the five studies were flawed ("Nuclear Lunch"). Two more of the studies were done with radiation doses below the normal levels, and the last of the studies actually showed negative effects ("Nuclear Lunch"). It was upon this type of evidence that the FDA justified its decision to allow the irradiation of food ("Nuclear Lunch"). John W. Goffman, M.D., a researcher of radiation, expounds about why the testing of irradiation has been exceedingly inadequate: "To really be able to say whether the technique [of food irradiation] has serious adverse effects on humans would require epidemiological studies of 20 to 30 years on 100,000 or more subjects. That study has not been done. It's not likely to be done. For someone to say that irradiated food is a safe product to eat is disingenuous. We don't know what the long-term safety is" (Hunter, "Hidden"). He clearly elucidates that the safety of irradiated foods cannot be assured until enormous studies are performed.

Indeed, such studies are badly needed, as several dangers to human health are already associated with irradiated foods. One of these is the creation of new substances in the foods, some of which we can't even identify (Gillette). Irradiation disrupts bonds between molecules and can free unstable parts, creating "free radicals" (Papazian). Most of the time, these free radicals recombine with their original molecule, but occasionally, they form new substances called radiolytic products (RPs) (Papazian). Many RPs are created from cooking or conventional preservation methods, but some unique radiolytic products (URPs) are formed only from irradiation (Hunter, "Hidden"). Very little is known about the safety of these chemicals, but the FDA has stated that there may be enough created in certain foods "to warrant toxicological evaluation" (Hunter, "Hidden"). Irradiation can result in the creation of formaldehyde, a carcinogen, formic acid, which can cause mutations (Papazian), and quinines, which are also damaging to human health ("Nuclear Lunch"). Benzene, a known carcinogen, was found to be at seven times the levels in cooked, irradiated beef than it was in cooked, non-irradiated beef. Also, chemicals from the plastic that foods are wrapped in during irradiation could potentially travel into the food itself (Hunter, "Hidden")

Apart from the formation of new chemicals, irradiation also lowers the nutritional content of foods (Bloomfield). Irradiation can destroy vitamins A, C, E, B1, B6, B12 (Hunter, "Hidden"), D, K (Bloomfield), carotene, amino acids such as cysteine, tryptophan, and methionine, and other essential nutrients (Hunter, "Hidden"). A loss of 20 to 80 percent of vitamins, amino acids, or essential fatty acids is common ("Nuclear Lunch"). At radiation levels of under 10 kGy, 22 percent of the thiamine can be lost from oats; 20 to 63 percent of it from wheat; 40 percent of it from bacon; 60 percent of it from trout; 25 to 85 percent from milk (Pattern 2) (Bloomfield). An issue of Nutrition Action, which is published by the Center for Science in the Public Interest, reported on a study which found that with normal doses of radiation, 50 percent of the vitamin C

in potatoes was lost, at radiation levels three times less than those allowed by the FDA, 17 percent of the thiamin in pork was lost, and chicken lost vitamin E and 9 percent of its thiamin when it was irradiated at normal levels (Burros). Potatoes lose 28 to 56 percent of their ascorbic acid after irradiation (Bloomfield). Animal tests have shown problems that resulted from decreased nutritional content: due to a lack of vitamin E, rats fed irradiated foods had reproductive trouble and muscular atrophy, and rats fed irradiated beef got haemorrhagic diathesis as a result of reduced levels of vitamin K (Pattern 3) (Bloomfield). Nutrient losses are also caused by the normal processes of cooking and storage, but irradiation would only contribute to the total nutrient losses (Burros). Also, many irradiated foods, such as fruits, would be eaten raw, and wouldn't lose nutrients from cooking (Bloomfield). Irradiation might also exacerbate normal losses; for example, when normal wheat and oats were stored for eight months, they lost 25 to 26 percent of their vitamin E and thiamin, but when irradiated wheat and oats were stored for eight months, 67 to 85 percent of the thiamin and vitamin E was lost (Bloomfield). Because irradiated foods last longer, they may be stored for longer periods of time, which would only further decrease the nutritional value of the food (Bloomfield).

Besides the creation of new chemicals and the depletion of nutrients, several other possible health problems are associated with irradiated foods. Irradiation kills harmless bacteria that naturally produce smells that indicate that the food is spoiled, making it harder for the consumer to detect if a food has gone bad ("Nuclear Lunch"). Irradiation doesn't kill all bacteria, and if some of the harmful ones survive, they could multiply (Hunter, "Food"). For example, irradiation doesn't kill Clostridium botulinium, which produces the botulism toxin, so when other innocuous bacteria, such as yeasts and molds, are killed, this bacteria would flourish without competition from other bacteria (Hunter, "Food"). If a bacteria produces a toxin that is harmful to humans in the food before irradiation, that toxin will remain in the food after the bacteria that produced it is

killed (Hunter, "Food"). When food is constantly exposed to radiation, most of the pathogens will be killed, but those with a mutation to resist radiation will survive and reproduce, and this could potentially create bacteria that are resistant to radiation (Gillette). Researchers at Louisiana State University have already identified a bacterium, D. radiodurans, that is resistant to up to five times the radiation levels allowed for beef (Priesnitz). Irradiation may also increase the levels of aflotoxins, which cause liver cancer in mammals (Hunter, "Food"). Aflotoxin levels in highly irradiated rice were found to be 50 times those in non-irradiated rice, and similar results were obtained when grains and vegetables were irradiated (Hunter, "Food"). There is evidence that irradiated foods may lead to increased infant mortality, chromosomal damage, testicular damage, and cancer (Hunter, "Food"). Twelve tests performed by Raltech Scientific Services, Inc., found that animals fed irradiated chicken had increased levels of damage to chromosomes, kidney disease, fibroplasias, cardiac thrombus, and immunotoxicity ("Nuclear Lunch"). Rats fed irradiated food experienced an increase in testicular and kidney damage and an increase in testiculat tumors ("Nuclear Lunch"). A controversial study in India in the 1970's found that some rats, mice, monkeys, and children fed freshly irradiated wheat developed polyploid cells (Hauter), a chromosomal abnormality often associated with cancer ("Nuclear Lunch").

Irradiated foods may have several adverse effects on human health, but the facilities where food is irradiated also pose many dangers, such as to workers who may be exposed to radiation (Gillette). In June 1988 in Decatur, Georgia, the radioactive waste cesium-137 leaked, 70,000 products that had touched the radioactivity were sent out and only 900 were recalled, and the accident cost taxpayers $30 million to clean up ("The Dangers"). At a facility in Parsippany, New Jersey, in June 1974, a worker, William McKimm, who was sterilizing medical supplies, was exposed to a large dose of radiation that almost killed him and sent him to the hospital for a month ("The Dangers"). At the same facility in 1976, radioactive water was flushed down the toilet into

public sewers ("The Dangers"). In Rockaway, New Jersey, in 1977, Michael Pierson, a worker at an irradiation facility, was almost killed from a dose of radiation, and that same facility also ignominiously violated over 30 rules of the Nuclear Regulatory Commission (NRC), such as when radioactive garbage was thrown away in a normal trash bin ("The Dangers"). In 1989, three worker in El Salvador experience burns after exposure to colbalt-60; one worker died and the other two had legs amputated ("The Dangers"). The NRC reports that, since 1974, there have been 54 accidents at irradiation facilities all over the world, but the actual figure is probably higher ("Nuclear Lunch").

With possible adverse health effects and dangers from irradiation facilities, it is easy to understand why the most of the public tries to avoid irradiated foods (Hunter, "Food"). An August 1997 CBS news poll found that 77 percent of Americans wouldn't eat irradiated food, and that 73 percent of Americans were opposed to irradiated food ("Nuclear Lunch"). An April 1999 poll by the American Association of Retired Persons and the Center for Science in the Public Interest found 88.6 percent of consumers wanted irradiated foods labeled (Hauter). Food irradiation is an easy fix for diseases caused by poor factory farm conditions and unsanitary meat processing plants, at which diseases are rampant and spread quickly ("Nuclear Lunch"). Factory farms involve crowded, stressful feedlots, which are often unprotected from the weather, and slaughterhouse operations are very fast and dangerous ("Nuclear Lunch"). They can process over 300 cows per hour, and this rapid pace is the reason workers at these plants have the fifth most dangerous job in the United States ("Nuclear Lunch"). The poor quality of the meat produced is, in part, due to the fact that only three meat corporations, Iowa Beef Processors (IBP), Cargill, and ConAgra (Hauter), control 77 percent of the market, instead of many more small businesses, which almost always provide a better quality meat product ("Nuclear Lunch"). The main economist for the US House of Representatives Committee on Small Business from 1979 to 1987,

Dr. John W. Helmuth, explained why large meat corporations produce a lower quality product: "When a few large firms buy, slaughter, and sell the meat products from most of the livestock produced by farmers, those few firms are in a position to control the price they pay for livestock, control the quality of the meat product, and control the price of the meat products they sell. Such firms are motivated to pay the lowest possible price for farmers' livestock, [and] produce the minimum quality meat product consumers will accept…." (Hauter). Improving our farms and processing plants could prevent many of the diseases irradiation is supposed to eradicate. This would not only be more beneficial to the livestock, farmers, consumers, workers, and the environment, but it would prevent all of the negative impacts of irradiating food. Michael Jacobson, Executive Director of the Center for Science in the Public Interest, eloquently articulated this beneficial solution as compared with irradiation: "Irradiation is no silver bullet for improving the safety of meat products. It is a high-tech end-of-the-line solution to contamination problems that can and should be addressed earlier. Consumers prefer to have no filth on meat than to have filth sterilized by irradiation" (Priesnitz). Theresa Carbrey, who works for the New Pioneer Coop in Iowa City as its education director, expressed a similar view: "We should not put a bad food technology on top of bad food handling" (Scott). Better alternatives to irradiation exist, which entail additional benefits without the many risks and dangers of irradiated food.

Because of inadequate safety testing by the FDA and possible dangers, including the creation of URPs, decreased nutritional content, the creation of radiation-resistant bacteria, higher aflotoxin levels, possible chromosomal and organ damage, and many other adverse human health effects, food irradiation must be banned in the United States until complete and meticulous research is performed by independent scientists over a long period of time to ensure the safety and quality of the food. Overall, we need to reduce our use of irradiation because of facility dangers, possible harm to workers and the environment, and other reasons. Instead, we must focus on

cleaning up squalid meat processing plants and sordid factory farm conditions, so the process will be safer for livestock, farmers, workers, consumers, and our environment.

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