Philippines: The Next Target for Irradiation

Introduction to Food Irradiation

Irradiation is the "treatment" of food with enormous doses of ionizing radiation, in the form of gamma rays from radioactive cobalt-60, cesium-137, electron beams and X-rays. It delays ripening of fruit, inhibits the sprouting of vegetables, and kills bacteria and insects that infest foods, but it destroys vitamins and creates potentially hazardous new chemical compounds in the process. Irradiation also allows food to withstand long distance shipments without spoilage.

Food irradiation is yet another avenue to globalization and harmonization. There is growing international pressure from the irradiation and agri-business industries to increase the use of irradiation on food, but irradiation has many potential dangers for consumers, workers, the environment, farmers and fishermen. As more consuming nations accept food irradiation, multinational food corporations will grow food in the Global South – where labor rights and environmental regulations are weak. And the Philippines is the irradiation industry's next target.

Recently, the Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) decided that irradiation could be used in place of chemical, heat or cold treatments to kill pests. For the first time in history, irradiated produce is now allowed and actually encouraged for exportation to the U.S. The rule will benefit large food producers, processors and exporters at the expense of small farmers.

Farmers in the Philippines will not be able to compete with cheap exports, so their land and labor will become susceptible to joint ventures that grow cash crops for consuming nations. Cash crops will be irradiated and shipped at low cost to the industrialized world. As a result, a blind eye will be turned to agricultural diversity, and hence ecological sustainability, as well as small-scale family farmers.

In advance of the APHIS ruling, SureBeam - an American irradiation company – developed relationships with Filipino politicians and businesses in order to have a stronghold on the Philippines once the APHIS ruling was complete. Currently, SureBeam is negotiating with two local agribusinesses to build an irradiation facility that will cost at least US$5 million, possibly near Manila. SureBeam is also negotiating with the Mayor of Cebu, Tomas Osmena. Meanwhile, the Visayas Chamber of Mango Industry Multi-purpose Cooperative is lobbying the Filipino government for a feasibility study on the installation of an irradiation facility in Cebu, which would cost US$6-7 million. Even the Filipino Bureau of Plant and Industry supports the construction of these facilities to irradiate mangoes, papayas, bananas and pineapples.[1] But, SureBeam is facing a financial crisis; therefore this is an opportune time to put a wrench in their plans by organizing public dissent of this questionable technology.

[1] Gallardo, Leilani M. "U.S. approval of irradiation expected to boost RP fruit, vegetable exports." BusinessWorld (Philippines), November 29, 2002.

As the World Trade Organization attempts to include all aspects of agriculture within its reach, countries will become more and more at the mercy of the powerful four quad nations – the United States, Japan, European Union and Canada. Developing countries will be pitted against each other in their attempts to be among the big four's favorites. This is already evident in the competition for mango exports by Mexico and the Philippines. The Philippines is second in mango production to Mexico, which accounts for 41 percent of the U.S. mango imports. The Philippines generates up to $35 million a year from the export of mangoes.[2] This export competition may grow until producing countries are divided and isolated from one another. Forcing threatening technologies, such as food irradiation, is only one aspect. By threatening to shut trade doors if food irradiation is not implemented, nations will also be forced to allow into their countries foreign companies, such as SureBeam.

Technologies, such as food irradiation, encourage the consolidation of agriculture. As exports increase, non-Filipino companies, such as Del Monte and Dole, will procure agricultural land. With that, farmers will struggle, be forced to sell their land and move to urban areas. This has already happened in numerous other countries with serious ramifications, such as increased urban poverty, unemployment and crime. Other farmers will become tenant farmers on their own land.

Irradiation forms new chemicals in food that are known or suspected to cause cancer and birth defects; destroys vitamins and other essential nutrients; and corrupts the flavor, odor and texture of food. A wide range of health problems have been observed in animals fed irradiated foods, including premature death, stillbirths, mutations, fatal internal bleeding, organ damage, immune system dysfunction, stunted growth and nutritional deficiencies. Recent research conducted in the European Union calls for further research into the wholesomeness of food before it is blindly accepted. The research found potential links between irradiated foods and the development of tumors.

Since the 1960s, dozens of accidents – as well as numerous acts of wrongdoing – have been reported at irradiation facilities throughout the world. Radioactive water has been flushed down the toilets into the public sewer system. Radioactive waste has been thrown into garbage. Radiation has leaked. Facilities have caught fire. Equipment has malfunctioned. Workers have lost fingers, hands, legs and their lives. Company executives have been charged with cover-ups and, in one case, sentenced to prison.

[2] Estabillo, Allen V. "WEEKENDER - AGRIBUSINESS RP mangoes have clients in US Pinoys." BusinessWorld (Philippines), December 13, 2002.

How the United States' Flawed Policy Impacts Other Nations

In 2002, the United States government legalized the importation of irradiated fruit and vegetables. To transnational food conglomerates, the new policy is a shot in the arm. To small scale family farmers, it is a slap in the face. Ostensibly intended to reduce the risk of infestation by fruit flies and other non-native pests, the ruling could have devastating side-effects. The U.S. agriculture industry - already reeling from the rising tide of low-cost imports from producing nations - will find itself at a further disadvantage. What's more, the ruling legalizes the importation of potentially infested, *non*-irradiated produce into 33 states, which could cause new exotic pest outbreaks and worsen infestations that already plague several southern states, particularly California, Florida and Texas.

The ruling came out of the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA). Originally established to block the importation of fruit and vegetables that could carry non-native pests, APHIS has increasingly - and admittedly - changed its focus to encourage imports, despite the well-known risks of infestation.

The APHIS ruling is significantly flawed. First, the new policy will further poison the marketplace for American growers, as imports from countries with low labor costs and lax environmental laws will increase further still. In recent testimony to Congress, the United Fresh Fruit & Vegetable Association stated: "Fruit and vegetable imports receive virtually open access to the U.S. market. Such unfettered access has resulted in increasing strains on many sectors of our industry. The impact of these disparities has resulted in not only lost markets and economic strains on the industry, but also our present trade deficit in horticultural products."[3]

Second, the new policy will likely hit California the hardest. With $28 billion in annual sales, California is by far the largest agricultural producer in the U.S. The state ranks first in the production of many crops, including citrus, grape, tomato, avocado, peach, lemon, cantaloupe, nectarine, plum, honeydew, apricot and kiwifruit. And it ranks second in orange, watermelon, pear, grapefruit and tangerine.[4] Each of these crops serves as a host to one or more of the pests listed in the APHIS ruling. Now that these crops can simply be irradiated and exported to the U.S., growers in California - and the rest of the country, for that matter - will face even more competition from transnational agribusinesses exporting to the U.S. from the Global South. For example, irradiation will stoke the

[3] Agriculture Trade Program Testimony. Statement by United Fresh Fruit & Vegetable Association, Farm Bill Oversight Hearing on International Trade, Committee on Agriculture, United States House of Representatives, June 28, 2001.
[4] Agriculture Statistical Review, California Dept. of Food & Agriculture.

importation of grapefruit and oranges from Mexico, grapes from Algeria, and kiwi fruit and tangerines from Greece.

Third, the rule contains no scientific or any other type of justification whatsoever for allowing the importation of non-irradiated fruit and vegetables into 33 Central and Northern states. The rule merely states that fruit flies "would not survive the winter" in these states. It defies explanation why the USDA would allow the importation of even more fruit and vegetables that can serve as hosts for invasive pests without fully studying the matter. This oversight becomes harder to believe when one considers that infestations cost the USDA and the U.S. agriculture industry at least $33 million per year.[5] Further, the USDA itself says that, in the absence of adequate management, fruit flies could cause $1.8 billion in damage per year.[6] The USDA also seems to be ignoring what one of the agency's own risk analysis officials recently told the U.S. General Accounting Office: there is a general lack of information about the success of measures to prevent the importation of invasive species.[7]

Also flawed is food industry hype that irradiation can replace the insecticide methyl bromide, an ozone-depleting chemical that must be phased out by 2005. A vast majority of methyl bromide is used as a soil fumigant; irradiation cannot be used as such. And, APHIS itself has acknowledged that irradiation would not be a cost-effective replacement for the post-harvest use of methyl bromide as a quarantine measure.[8]

Taken together, these shortcomings unmask the APHIS ruling as flawed public policy that not only further threatens the economic health of small scale farmers world wide, but also offers greater reach of transnational agri-businesses. California is looking towards various avenues that would stop the importation of irradiated produce to the largest state in the United States. That would put the brakes on plans in the Philippines to move forward with irradiation.

[5] Fruit Fly Program Information. Plant Protection and Quarantine, APHIS, USDA.
[6] Invasive Species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem.. U.S. General Accounting Office, Oct. 22, 2002.
[7] Note 5, op. cit.
[8] 67 Federal Register 65016, Oct. 23, 2002

The Story of SureBeam: From Zapping Missiles to Zapping Food

During the 1990s, when the "Star Wars" missile-defense program faded into the background, the defense industry began searching for new income sources to target. The industry found a new kind of missile – this time, aiming straight for the mouths of consumers. Titan Corporation, one of the most prominent defense contractors in the U.S., hoped that the linear accelerators the company designed to neutralize threats from the Soviet Union can neutralize threats from *E. coli, Salmonella, Listeria* and other food-borne pathogens.

The SureBeam Corporation, founded by Titan in May 2000, says electrons fired nearly to the speed of light can kill microorganisms. But SureBeam dismisses the well-documented side-effects of "treating" food with extremely high doses of ionizing radiation –such as forming toxic chemicals, destroying vitamins, breaking down protein and ruining flavor. SureBeam has also resorted to questionable marketing tactics, such as calling its process "electronic pasteurization."

After experiencing difficulties getting off the ground, SureBeam acknowledged that its troubles were not over. In a filing to the Securities and Exchange Commission, company executives acknowledged that their services "may not gain adequate commercial acceptance or success." They went on to say that food irradiation "is opposed by several organized and vocal consumer groups who claim that irradiated food products are unsafe for consumption... We risk not being able to overcome these fears through our educational efforts."[9]

Over the next year, however, SureBeam made strides forward. American Foodservice, Anchor Daniels Midland, Cargill, Del Monte, IBP, Kraft, Tyson and United Food Group were among the more than dozen companies that signed on as clients.[10] Problems, though, began to resurface by summer 2001. In June and July, participants of U.S. Food and Drug Administration focus groups said unanimously that companies should not be permitted to label irradiated foods "electronically pasteurized" or "cold pasteurized." These phrases were called "sneaky," "misleading," "deceitful," "dishonest" and "a fake."[11] This struck a blow to efforts by SureBeam and other irradiation companies to weaken federal labeling rules, which require irradiated foods sold in stores to be labeled "Treated by Irradiation" or "Treated with Radiation."

In September 2001, the U.S Department of Agriculture refuted SureBeam's claim that irradiation is the equivalent of pasteurization, which kills food-borne pathogens with heat.[12] The Federal Trade Commission began an inquiry into SureBeam's advertising practices. Also in November, Public Citizen – a Washington, DC-based consumer

[9] Form S-1, SureBeam Corporation, filed with the U.S. Securities and Exchange Commission, August 14, 2000.
[10] Titan Corp. and SureBeam Corp., press releases.
[11] Consumers' Understanding of Food Irradiation Labeling." Submitted to the Food and Drug Administration, Center for Food Safety and Applied Nutrition, by ORC Macro, April 2002.
[12] Ault, Alicia. "Firm's Claims on Food Irradiation Misleading: USDA." Reuters Health, October 8, 2001.

protection non-governmental organization - filed a complaint with the Securities and Exchange Commission against SureBeam and Titan, which called its technology "electronic pasteurization" in 48 of 49 press releases. SureBeam has since cut back on the use of this phrase. In April 2002, SureBeam announced losses of $74 million for 2001, due in part to "marketing initiatives,"[13] which have included television and radio ads, billboards, and newspaper coupons. These losses came as SureBeam executives and board members made millions of dollars by cashing in stock options.

In August 2002, SureBeam severed its financial ties with Titan, driving down SureBeam's stock price by two-thirds to an all-time low of $1.50. SureBeam calls itself a "leading" irradiation company. It certainly is the leading promoter of irradiated foods. But, plagued by huge financial losses, test market failures, public relations blunders, and allegations of false advertising and making misleading statements to investors, the company faces an uncertain future. For that matter, the future of the U.S. food irradiation movement may hang in the balance.

During the summer of 2003, the SureBeam Corporation was plagued by a number of embarassing incidents involving its financial records. In June 2003, the company fired its accounting firm, KMPG, because SureBeam claimed that the firm was charging too much to audit SureBeam's books. KMPG had replaced the Arthur-Andersen accounting firm in early 2002 after Arthur-Andersen went bankrupt for its involvement in the ENRON accounting scandal. SureBeam hired the accounting firm of Deloitte-Touche to replace KMPG. In August, SureBeam fired Deloitte-Touche after the new accounting firm refused to sign-off on the financial statements prepared by Arthur-Andersen and KMPG for the years 2000, 2001, and 2002 because Deloitte-Touche was uncomfortable with the manner in which SureBeam had been reporting revenue from its sale of equipment to Tech-Ion, a Brazilian irradiation company that went bankrupt. As a consequence of the firing of Deloitte-Touche, SureBeam missed its legal deadline to file its 2nd Quarter 2003 financial statement with the Securities and Exchange Commission. SureBeam now faces possible delistment from NASDAQ and twenty class action stockholder lawsuits. In addition, the chairman of SureBeam's audit committee resigned from his position on Ocotber 1, 2003 - after being on the job for less than three months. SureBeam has still not hired a new accounting firm to replace Deloitte-Touche.

With the financial crisis that SureBeam is experiencing, they may not be able to move forward in the Philippines, but there are other companies that are ready to replace them as the global leader in food irradiation if national laws and international trade agreements continue to push this questionable technology.

[13] Form 10-K405, SureBeam Corporation, filed with the U.S. Securities and Exchange Commission, April 1, 2002.

Irradiation and International Trade: Increasing Corporate Control Over the Global Food Supply

Around the globe, multinational corporations - such as Philip Morris/Kraft, Del Monte foods, and even Mitsubishi - are planning to use irradiation to increase their global reach. Multinational food corporations are interested in growing more fruits and vegetables in the Global South — where labor is cheap and agricultural chemicals are, in many cases, virtually unregulated. Irradiation not only allows food to be shipped over longer distances due to increased shelf life, it also kills insects and other invasive species that are considered "barriers to trade." It is evident that irradiation advances the industrialization of our food supply, and the companies that are promoting it in the United States are looking to export this technology to the countries, in order to broaden their grasp on the world's food supply.

The meat industry promotes irradiation as a way to kill the bacteria remaining on meat. Animals live in disgusting, crowded conditions and are butchered in dirty meat processing plants — sometimes while they're still alive — with fast-moving and inhumane slaughterlines. Instead of ensuring that meat is free of feces, urine, pus and vomit, large meat companies want to mask these unhygienic conditions by using irradiation to kill food-borne pathogens. To maximize their profits, multinational meat companies including Cargill/Excel, IBP and Tyson are using their influence in international trade negotiations to promote irradiation.

Industrialized corporate food operations treat the soil and water as commodities available to exploit for the purpose of making a profit. Industrialized agriculture uses massive amounts of herbicides and antibiotics to boost yields. Irradiation gives corporate agribusiness more power over the global food supply. Small farms that do not produce cheaply in bulk are shut out of the market. Trade agreements that promote global food trade increase the pressure on small food producers. As a result, independent farmers are losing their land and are forced to move to cities, where they live in poverty and are often coerced into working in sweatshops — if they are able to find work at all.

More than 140 nations are now allowed to irradiate food at any dose, trade it "freely" with any other country (whether they want to import it or not), and serve it to people who might not know that the food they're eating could make them sicker than the pathogens that irradiation is intended to kill. The Codex Alimentarius Commission, created in 1961, is an international body that creates global standards for globalized food trade. Under the innocuous-sounding policy of "harmonization," the Codex Commission — whose members are neither elected nor subject to removal by citizens — has been instrumental in breaking down trade "barriers" to promote "free" trade in agricultural products.

Moreover, countries may be forced to import foods that do not satisfy national standards. Under the Sanitary and Phytosanitary (SPS) Agreement of the World Trade Organization (WTO), a nation's domestic food safety laws and its use of the precautionary principle can be challenged as "barriers to trade" through the WTO's powerful and binding dispute resolution system. Irradiation eliminates "barriers to trade."

Specifically, the SPS Agreement recognizes the Codex Alimentarius Commission as the source for enforceable international standards on food safety. Codex has not only set poor standards for irradiated foods, but is currently in the process of weakening these standards. As a consequence, countries may be forced to import irradiated food and other food that does not meet their domestic standards for food safety.

Some countries, fearful that their consumers might be forced to eat irradiated, genetically modified and other harmful foods, have called for the implementation of the "precautionary principle" as a way to protect their sovereignty over food safety issues. Thus far, however, the United States has opposed this policy, arguing that it would impede free trade.

Small scale farmers are targeted by the promotion of irradiation, as well. Food irradiation facilitates international trade in food and leads to higher profits for large, industrialised food producers that move into producing nations. This could devastate family farmers as production is shifted overseas and cheap imports flood the European market under the WTO's free trade agreements.

The trade relationship between Brazil and Europe is an excellent example. The table at right details Brazil's relationship with irradiation and the European Union (EU)[14]. Brazil's government has approved the irradiation of every food category, from nuts to fish to bananas at any dose. Brazil is also a leading exporter of fruits to the EU. If cheap irradiated fruit imports are allowed into the EU, under neo-liberal multilateral trade policies, Europe's small growers will be threatened by driving down prices and encouraging overseas production.

Irradiation Facilities in Brazil	**11**
Irradiation Facilities Proposed for Construction in Brazil	**21**
Brazil's Irradiation Laws	*Any* food *Any* "suitable" dose
EU fruit and vegetable imports from Brazil, 2000	1.006 billion euros

Technologies, such as food irradiation, encourage the consolidation of agriculture. As exports increase, non-Filipino companies, such as Del Monte, will procure agricultural land. With that, farmers will struggle, be forced to sell their land and move to urban areas. This has already happened in a number of countries with serious ramifications, such as increased urban poverty, unemployment and crime. Other farmers will become tenant farmers on their own land. This neo-liberal policy will continue the drive of Filipino farmers off their land.

[14] "External and Intra-European Union Trade." European Commission, 2002. p 74.

More Foods to Dump Around the World

Industrialized factory-style farming in the developed world facilitates the cheap mass production of food. Surpluses that cannot be locally sold might then be government subsidized for export and flood the global market, driving down world prices and undermining domestic competition within importing countries. Such dumping spells disaster for farmers and small-scale producers who cannot compete with the unrealistically low prices created by government bailouts in the wealthy Global North.

The inclusion of agriculture trade policies within the framework of the WTO, NAFTA and other international treaties has further aggravated the wide-scale dumping of agricultural products. Under global trade agreements, countries may be forced to import goods that undersell domestic produce. This economic threat can also have devastating effects on the food security, environment, and social fabric of developing countries.

Wide-scale irradiation of food will lead to an increase in dumping. With a shelf life extended up to three times its normal length, surpluses of irradiated food will grow, and food conglomerates will need to dump these stores on whoever will take them, namely the economically disenfranchised peoples of the developing world. Due to high capital costs, staples will be irradiated in industrialized countries and subsequently dumped in the Global South.

As farmers in the Global South won't be able to compete with these cheap imports, their land and labor will become susceptible to joint ventures aimed at growing cash crops of tropical produce. Mono-culture crops will be irradiated and shipped at low cost back to the industrialized world. Agricultural diversity, and hence ecological sustainability, will turn a blind eye while shifting focus to the bottom line. Dumping, therefore, will occur in both directions: surplus staples to the developing world and luxury items to the industrialized world, while economic autonomy, food sovereignty and environmental sustainability are thrown out the window.

In addition to the dumping of irradiated foods through trade agreements, irradiated surpluses will likely be channeled through food aid programs. The U.S. is currently sending genetically modified foods, unlabeled as such, in disaster relief and food aid to developing countries all over the world.[15] As such, it is unlikely that the U.S. would suffer any moral qualms over passing out irradiated staples to the world's starving millions.

As is the case with "humanitarian military intervention," the U.S. administration prides itself on both the goodwill and the self-serving aspects of "humanitarian dumping." In fact, former U.S. Secretary of Agriculture Dan Glickman has advocated the use of humanitarian aid to further corporate agendas. Glickman has encouraged multinational corporations to contribute biotech foods to foreign aid programs: "If they took the longer view they might see the benefit of focusing on the developing world not just as a gesture

[15] "Food Aid in the New Millennium: Genetically Engineered Food and Foreign Assistance," Food First/Institute for Food and Development Policy Fact Sheet, Dec. 2000.

of corporate citizenship, but because such an investment will ultimately pay dividends as developing countries mature into reliable customers."[16] Such thinking prescribes a new axiom for corporate-led development: rather than teaching people to fish, pass out tins of irradiated sardines with coupons for future purchases.

Feeding the world with irradiated products is on the public relations agenda of international agencies and multinational corporations alike. In an effort to curry favor among relief groups and drape themselves in nobility, the International Atomic Energy Agency, the "Star Wars" defense contractor Titan Corporation, and other transnational entities have put forth dubious proposals to marshal irradiation as a silver bullet to end world hunger. They market food irradiation as a high-tech weapon in the war against starvation and malnutrition, overlooking the political roots of poverty and hunger.

Food irradiation combined with agricultural dumping will prove a nightmare to food sovereignty. An increased consolidation of the industrialized food supply will create a high level of dependence on import-export relationships, while undermining food security and sovereignty, basic rights to access food and to define domestic food and agriculture policies.[17] Industrialized farming adds stress to the environment as more forests are logged, waterways are polluted with more chemicals and waste, and land is deprived of the subtle nourishment and self-maintenance provided by diverse planting and traditional farming methods.[18]

The destruction of family farms leads to rural migration and urban sprawl, poverty, and the myriad of social ills that come of social stress and economic depression. Women, marginalized, underrepresented, and overworked in most societies, often bear the brunt of such economic, political, and social turmoil.[19]

The industrialized world has long exploited developing countries through a multitude of detrimental political and economic policies and practices. As if enough damage hadn't been incurred already, the spread of food irradiation promises to dump more inappropriate development strategies, dump more counterproductive trade policies, and dump more health risks on the developing world.

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[16] "U.S. Debate Over Biotech Food Ignores its Humanitarian Potential," Associated Press, July 17, 2000, cited in "Food Aid in the New Millennium: Genetically Engineered Food and Foreign Assistance," Food First/Institute for Food and Development Policy Fact Sheet, Dec. 2000.

[17] "Food Sovereignty and International Trade" Via Campesina, Oct. 2000.

[18] "Agriculture in Developing Countries: Which Way Forward? Small Farmers and the Need for Alternative, Development-Friendly Food Production Systems," by Aileen Kwa, The South Centre.

[19] See "Trade and Hunger: An Overview of Case Studies on the Impact of Trade Liberalisation on Food Security" by John Madeley, Forum Syd, 2000.

Codex Alimentarius Promotes Irradiation

Codex Alimentarius,[20] literally translated from Latin, means "food code." Codex sets standards for food that include the following: labeling; additives; contaminants; methods of analysis and sampling; hygiene; nutrition and foods for special dietary uses; import and export inspection; and certification systems, residues of veterinary drugs in foods and pesticide residues in foods. The Food and Agriculture Organization (FAO) of the United Nations (UN) and the World Health Organization (WHO) created the Codex Alimentarius in 1963, and still maintain joint oversight powers.

Although Codex claims to have broad community involvement to increase consumer protection with internationally recognized scientific food standards, its achievements fall flat under scrutiny. Codex does not rely on "broad community involvement" in its decision making process; decisions are made by governmental appointees behind closed doors. While Codex counts 168 member countries representing 97 percent of the world, the delegates to Codex who actually make the decisions are appointed by national governments, not elected by the people. Codex claims that delegations include senior governmental officials, academics and industry representatives. Delegations over represent industrial interests, not the interests of the people.

Within Codex, food irradiation is classified as an additive. Thus, food irradiation falls under the jurisdiction of the Codex Committee on Food Additives and Contaminants (CCFAC). CCFAC depends on several sources of information in evaluating food additives. In the case of irradiation, CCFAC draws from the Joint FAO/WHO Expert Committees on Food Additives (JECFA) as well as the International Atomic Energy Agency (IAEA) and the International Consultative Group on Food Irradiation (ICGFI). As shown in an October 2002 report by Public Citizen, *Bad Taste: The Disturbing Truth About the World Health Organisation's Endorsement of Food Irradiation,*[21] the WHO has relied on a very small number of faulty studies in declaring food irradiation safe; this unscientific and shoddy work is the foundation of acceptance of food irradiation across the world. The IAEA owes its loyalty to the nuclear industry and thus works with governments to apply nuclear technologies. It is impossible for the main advocate of nuclear technology to advise Codex in a disinterested, scientific manner because of its vested interests in the speedy and complete adoption of food irradiation.

Codex requires that irradiated foods be marked with a *radura*, which resembles a blooming flower. This moderate symbol looks very benign, and to an unaware consumer, could look like a stamp of approval. Consumers are not helped by efforts of the pro-irradiation lobby to call the process "electronic pasteurization" or "cold pasteurization," innocuous terms for a dangerous process.

Codex has not relied on disciplined, dispassionate or scientific advice in setting standards for food irradiation. Instead, the decisions and regulations recommended by Codex are

[20] Information concerning Codex from its website, at www.codexalimentarius.net
[21] Available at http://www.citizen.org/documents/BadTaste.pdf

used as a starting point for the facilitation of international trade. Both the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) of the World Trade Organization (WTO) and the Agreement on Technical Barriers to Trade (TBT) follow Codex's lead and encourage the international harmonization of food standards from a trade perspective.

A product of the Uruguay Round of multinational trade negotiations under the WTO, the SPS Agreement cites Codex standards, guidelines and recommendations as the preferred international measures for facilitating international trade in food. As such, Codex standards have become the benchmarks against which national food measures and regulations are evaluated within the legal parameters of the Uruguay Round Agreements. Codex has become an instrument of the liberalization of international trade, instead of a method to protect the food supplies of peoples across the world.

The Evolution of Weakening the Codex General Standard for Irradiated Foods
The original Codex General Standard for Irradiated Foods was developed in 1983. In 1999, the Codex Commission took the first step and decided to re-examine the Standard by assigning the work to the Codex Committee on Food Additives and Contaminants (CCFAC). Over the course of the following four years, seven more steps were taken before the new Codex General Standard for Irradiated Foods was finally accepted during the full Codex Commission meeting in Rome from June 30 - July 7, 2003. Most of the changes to the original 1983 Standard were pushed by the United States in order to liberalize the regulations regarding food irradiation.

Seven additional steps trace the Proposed Draft Standard for Irradiated Foods to its final adoption, as follows:

Step 2: In 1999, the Codex Secretariat called for the Proposed Draft Standard to be drawn.
Step 3: In 2000, the Draft Standard was sent to member nation agencies and international organizations for comments.
Step 4: In March 2001, CCFAC reviewed and modified the Draft Standard.
Step 5: In September 2001 the Codex Executive committee approved the Draft Standard.
Step 6: In September 2001, the Draft Standard was sent back to the designated government agencies and international organizations for comments.
Step 7: Delayed: In March 2002, CCFAC delayed the process for a year because of a new European study on the toxicity of 2-ACB's.[22]
Step 7: In March 2003, the Draft Standard returned once again to CCFAC for committee acceptance.[23]
Step 8: In the summer of 2003, the full Codex Commission ratified the new Codex General Standard for Irradiated Foods.

[22] 2- alkylcyclobutanones, which are chemical byproducts formed in irradiated foods.
[23] Although the American delegates to CCFAC did not attend the meeting in March in Tanzania, the Filipino delegation was there and pushed the US agenda to ensure that the Standard would be weakened in order for the irradiation industry to stretch its reach over the world.

Despite growing public dissent, Codex weakened the international food irradiation rule to allow any food to be irradiated at any dose, regardless of how high. The new Standard contains no maximum radiation dose to which foods can be "treated." The previous limit was 10 kiloGray, a dose of radiation equivalent to 330 million chest X-rays. At such doses, the chemical composition of foods can be altered; vitamins, proteins and other nutrients can be destroyed; and flavor, odor and texture can be corrupted. The decision was made over the objections of more than 10 countries, including Austria, Denmark, Germany, Italy, Mexico and Spain. Both the UN and the WHO are mandated to protect the health and welfare of the world's population, but they obviously shirked on this responsibility when the decision was made.

Since Codex standards are enforceable through the World Trade Organization, member nations that have food irradiation laws stricter than the new Codex Standard could have their laws challenged and overruled. Currently, only Brazil has a food irradiation law in keeping with the new Codex Standard. Brazil's food irradiation regulations were adopted in December 2001, immediately before the end of former President Fernando Henrique Cardoso's term. The regulations allow *any* food to be irradiated at *any* dose, without regard to health implications. Now, the food irradiation laws in every other nation – including all 15 European Union countries – are in jeopardy.

On a brighter note, Codex elected a new chairperson in July 2003: Dr. Stuart Slorach of Sweden's National Food Administration. Dr. Slorach is viewed as being more attentive to consumer needs than his predecessor, Thomas Billy of the U.S. Department of Agriculture. European consumer organizations have been pushing the European Parliament and the European Union delegation to Codex to ensure that the safety and well being of consumers are upheld in Codex and within Europe. The results of this effort were evident in the fact that the European nations were able to stand strong and garner enough support for Dr. Slorach, regardless that the United States backed a different candidate. This move also indicates that the United States can not get its way all the time in the Codex proceedings and that Europe has the possibility to be a leader at Codex. If Dr. Slorach continues to be interested in protecting consumers, then, perhaps, the debate over irradiated foods will be reopened and the health of the people will be the first priority.

Bad Taste: The Disturbing Truth About The World Health Organization's Endorsement Of Food Irradiation[24]

The World Health Organization is the most important and influential agency of its kind on the planet. Created in 1948 by the United Nations, the WHO's mission is nothing short of preserving the health of the Earth's population – "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." In 1999, the WHO announced that any food could be "treated" with any dose of ionizing radiation and still be safe for human consumption. Even though this radiation – in the form of gamma rays emanating from radioactive cobalt-60 or cesium-137, or near-speed-of-light electrons fired by linear accelerators – could be as high as the equivalent of several billion chest x-rays, a WHO report proclaimed that irradiating food "does not result in any toxicological hazard."

How could irradiated foods be declared safe and wholesome if animals fed irradiated foods in experiments dating back 50 years have suffered dozens of health problems – including premature death, mutations and other genetic abnormalities, fetal death and other reproductive problems, immune system disorders, fatal internal bleeding, organ damage, tumors, stunted growth and nutritional deficiencies?

An in-depth review of the WHO's 40-plus-year involvement in assessing the safety of irradiated foods reveals the following:

- The WHO has played a role in abandoning the original research agenda it co-drafted in 1961 – which urged experiments into whether irradiated foods are toxic or radioactive; whether they could cause cancer, mutations or nutritional deficiencies; and whether the scientific expertise even existed to answer these fundamental questions.
- The WHO has handed the ultimate power to research the safety of irradiated foods to the International Atomic Energy Agency, the world's leading proponent of nuclear technology. The IAEA has published 19 of the 29 major international reports on food irradiation since 1962.
- With the WHO assuming a backseat role, the IAEA is leading a campaign to further the legalization, commercialization and consumer acceptance of irradiated foods worldwide. One IAEA publication states: "We must confer with experts in the various fields of advertising and psychology to put the public at ease. Any word or statement containing the word 'radiation' or 'radiate' should not be required on the label."
- The WHO has played a role in dismissing and misrepresenting evidence suggesting that irradiated foods may not be safe for human consumption. The WHO, along with the IAEA and the United Nations' Food and Agriculture Organization (FAO), took research that revealed health problems in animals that ate irradiated foods, and stated

[24] The complete Bad Taste report can be viewed or downloaded at www.citizen.org/cmep

that the research actually revealed no health problems that could be attributed to irradiation. Additionally, such research was outright omitted from key reports.

- The WHO has played a role in dismissing recent evidence that unique chemical byproducts formed in irradiated foods – cyclobutanones – promoted the cancer-forming process, spawned tumors and lesions, and caused genetic damage in rats; and caused genetic damage in human cells.

By assuming, in the face of mounting evidence to the contrary, that irradiated foods are safe for human consumption, the WHO has taken a leap of faith that could threaten the health of millions of people living in more than 50 countries where these products can legally be sold.

Due to the irregularities in the process by which the WHO, the IAEA, and the UN FAO have endorsed food irradiation, Public Citizen makes these recommendations:

- The WHO, IAEA and FAO should promptly place a moratorium on any further recommendations to expand food irradiation in any fashion.
- The WHO, IAEA and FAO should promptly withdraw its endorsement of irradiation for all foods at any dose – no matter how high. The agencies should inform all member nations of this action and recommend that they not proceed with food irradiation of any kind.
- The WHO should promptly conduct, commission or otherwise foster published, peer-reviewed research into the core safety and wholesomeness issues at the first major FAO/IAEA/WHO food irradiation conference held in Brussels in 1961. Research should also be conducted into the toxicity of cyclobutanones, and the radiation-induced formation and increased concentration of chemicals known or suspected to cause cancer, birth defects and other health problems.
- The 1959 agreement giving the IAEA "the primary responsibility" to research and develop nuclear technologies, and to require the WHO to consult with the IAEA on overlapping projects, should be dissolved.
- The United Nations should promptly appoint an independent panel of experts from the fields of toxicology, food science, radiation chemistry, nutrition and other relevant fields to conduct a comprehensive review into the activities of the WHO, IAEA and FAO related to food irradiation. This panel should also investigate whether the IAEA's role in analyzing the safety of irradiated foods has corrupted this process. All of the proceedings should be open to the public.

Seafood Irradiation: The True Cost of Industrialization and Globalization

The demand for seafood is exploding and the seafood industry can hardly keep up. To continue making a profit, the seafood industry must find a way to mass produce fish and deliver them fresh to consumers' supermarkets. Supporters of irradiation say that it makes food safer by killing microbes and allows food to be shipped over greater distances. Yet this "silver bullet" to the seafood industry's dilemma will hurt consumers and communities across the world.

Irradiation will not make seafood safer. Seafood is more delicate than land-raised meats. Therefore, high levels of irradiation will cause deterioration of texture and juiciness. Yet, low levels cannot kill all bacteria present in the meat.[25] Irradiation does not obliterate food-borne viruses that cause more than 9 million people to become sick annually.[26] It also won't magically cleanse seafood of methylmercury, which causes neurological birth defects, or of the toxins that cause shellfish poisoning. More importantly, irradiation will not protect consumers from the most common sources of contamination—themselves. Irradiation addresses less than 7 percent of contamination found in seafood. In fact, if consumers believe their food to be safe, they are less likely to follow strict handling and cooking precautions and are more likely to get sick as a result.

Sources of seafood poisoning[27]	
Unsafe holding temperature	62%
Poor personal hygiene (i.e. dirty hands)	29%
Inadequate cooking	20%
Contaminated equipment	18%
Natural sources	7%

Factory-farmed seafood from Central America and Southeast Asia is shipped to the United States, the U.K. and Japan. Yet, industrialization and globalization of the food supply does not come without cost. Fish produced from farming activities currently accounts for over one-quarter of all fish directly consumed by humans and 40 percent of total fish trade. As demand increases and wild stocks are further depleted, fish farming will account for a greater and greater share of world fish production.

Shrimp are one example of mass-produced seafood.[28] They are farmed in mangroves - tropical coastal forests that protect shorelines from erosion and promote biodiversity. Mangroves serve as spawning and nursery grounds for thousands of marine organisms. Mangroves also discourage coastal flooding, trap sediments and filter inland water. To

[25] See the Seafood Science and Technology Society at http://sst.ifas.ufl.edu/proceed.html for studies on the effects of seafood irradiation.
[26] Mead, Paul S. et. al. "Food Related Illness and Death in the United States." Centers for Disease Control. http://www.cdc.gov
[27] Fleming, Lora E. et. al. "The Epidemiology of Seafood Poisoning." University of Miami School of Medicine.
[28] For more information, contact Isabel De La Torre at the International Shrimp Action Network (ISA Net) at http://www.shrimpaction.org

create a coastal shrimp farm, mangroves are destroyed and dikes are dug. Because intensive fish farms practice monoculture, they depend on staggering amounts of antibiotics, fungicides, algaecides and pesticides that pollute the water. Farms then pump in fresh water and pump out the dirty (up to 30 percent of the total water is discarded per day). The dirty water is dumped into the coastal sea, resulting in the degradation of the very water on which farms depend. Local communities are often dependent on the fresh water that is redirected for use at the fish farms. For the 10 types of fish most commonly farmed, an average of two kilograms of wild fish is required for every kilograms of fish produced.[29] This *net loss* in the amount of fish biomass is not promising, considering wild stocks are already depleted, and farms are marketed as alternatives.

Large farms move into prized coastal lands, and with the help of the government and loans from the World Bank, privatize public property. Traditionally, local communities depend on the mangrove forests for their survival. Women gather shellfish, mussels, crabs and other seafood to feed their families and to sell in local markets. Fishermen gain access to the sea through mangroves. Local people throughout Asia and Central America protest the construction and expansion of shrimp farms in order to defend their cultures, lives and livelihoods. Some of these local people have even been killed in the process. Eighty-five percent of all farmed fish imported to developed nations originate in developing nations.[30] Farmed fish in Southeast Asia and Central America are exported to the U.S. and Europe as delicacies, instead of feeding the local populations. The diversion of fish and fish products from local communities deprives people of traditional and inexpensive, but highly nutritious food. To make matters worse, local governmental officials benefit directly by owning shares in fish farms, and indirectly by foreign investment in their country. For the indigenous people threatened by intensive fish farming, there is nowhere to turn.

Irradiation is used by the seafood industry to boost consumer confidence, and thus profits, without regard to consumer safety. Nor does the corporate seafood industry consider the local communities and environment that are affected by the farms that supply the fish. An industrialized food supply sacrifices the needs of common people for corporate profit. This furthers corporate domination and takes away consumers' freedoms, as well of the freedom of small local economies. The modern international food supply continues to widen the gap between the rich and the poor. As food is shipped globally, transportation costs (both environmental and economic) increase as small-scale local fishermen watch their culture and livelihoods vanish. Multinational corporations produce cheap food overseas in places with little regulation concerning environmental protection or human rights. They make huge profits but ignore the trail of devastation they leave in their wake.

[29] Naylor, Rosamund L. et. al. "Effect of Shrimp Aquaculture on World Fish Supplies." Institute for International Studies, Stanford University.
[30] http://www.fao.org/focus/e/fisheries/trade.htm

Genetic Engineering and Food Irradiation: Evil Twins Threatening Global Food Security

Both genetically engineered and irradiated foods are proven to be nutritionally inferior to unadulterated foods. Genetically engineered (GE) foods have genes from other species added to their genomes, which can negatively alter the nutrient levels. For example, changes in the genetic structure of soybeans can change the way cells produce protein. Research indicates that irradiated foods have a lower nutritional value than their natural counterparts. For example, irradiation destroys up to 80 percent of vitamin A in eggs and 48 percent of beta carotene in orange juice.[31] Irradiation also produces new chemicals that continue to destroy nutrients during storage and in preparation.

The safety of GE foods has never been proven. Instead, scientists rely on a *trust us, we're the experts* attitude. As noted above, new genes in GE foods can alter chemical reactions within the cell, leading to the creation of new toxins or allergens. One example is Monsanto's GE soybeans, which have 26.7 percent more trypsin-inhibitor, a major allergen with anti-nutritional effects.[32] GE foods can also contribute to a further increase in antibiotic resistance. In one experiment, plants with antibiotic-resistant genes were grown together with a fungus. The fungus acquired the antibiotic-resistant genes.[33] Irradiated foods are hardly any safer, considering that it absorbs the equivalent of up to 1 *billion* chest X-rays. Exposure to this high level of energy causes the formation of "unique radiolytic products," many of which do not occur naturally in food.

One such type of radiolytic product, called cyclobutanones, is unique to irradiated food and has been shown to promote cancer development, tumor growth and genetic damage in rats, as well as genetic and cellular damage in human cells. Other radiolytic products include free radicals, which set off chain reactions in the body that can tear apart cell membranes and make the body more susceptible to cancer, diabetes, heart disease and liver damage. Additionally, chemicals known or suspected to cause cancer and birth defects can be formed in irradiated foods, such as benzene, toluene, and methyl ethyl ketone.

The biotech industry that supports genetic modification, and the nuclear industry that supports irradiation, seem determined to make GE and irradiated foods the norm in markets around the world. They consistently oppose the labeling of GE and irradiated foods, which makes it harder for consumers to know what they're eating. In May 1998, under pressure from the biotech industry, Codex decided that GE food labeling was discriminatory and therefore an illegal trade barrier. The U.S. government, likewise under industry pressure, will not require GE foods to be labeled. The message is clear: *don't ask, because we won't tell*.

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[31] FDA Memorandum, from Kim Morehouse, Ph.D. to William Trotter, Ph.D. April 11, 2000.
[32] Klotter, Jule. Organic Consumer's Association. "Health Concerns of Frankenfoods." October 1, 2001.
[33] Hoffmann T., Golz C. and Schieder O. "Foreign DNA sequences are received by A. niger..." Current Genetics, 27: 70-76, 1994.

The biotech and nuclear industries have moved south, armed with an alphabet soup of trade agreements, the facade of helping the poor, and the intent to make a profit. However, their nutritionally inferior harvests will not help a severely malnourished population. The dumping of food aid does nothing to address the underlying causes of hunger, creates further dependence on foreign aid, and forces indigenous populations into tenant farming. Proponents of GE foods often claim that fortified grains can help treat malnutrition. They tout GE "Golden Rice" as a way to alleviate vitamin A deficiency. What they don't publicize is that an adult would have to consume 9 kilograms — *nearly 20 pounds*— of rice every day to get the recommended daily intake. Besides, a malnourished body lacks the necessary fat to convert beta-carotene in Golden Rice to vitamin A.

Unquestionably, the irradiation of food causes nutrient loss. To feed nutrient-deficient foods to a population that is already nutrient deficient is illogical and harmful. The food industry is enthusiastic about irradiation because it extends shelf life so food can be shipped greater distances without spoiling — representing major savings for the food industry and allowing consumers in wealthy countries to eat exotic fruits. However, the percentage of lost vitamins actually *increases* during storage time. Thus, the very way that the industry intends to use irradiation to help nutrient deficient populations will results in nutritionally deficient food. Moreover, the chronically malnourished have lowered resistance to toxins, so irradiated food with its radiolytic products could prove harmful. GE and irradiated foods promote Third World dependence on large foreign businesses. GE "terminator seeds" produce harvests that will not germinate, meaning every year farmers must repurchase all their seed from a biotech corporation. "Traitor seeds" will not survive without applications of chemicals bought from the same biotech corporation. Genetic engineering is expensive, and farmers will find themselves as tenant farmers on their old land working for the benefit of a foreign company. In the world of stock prices and profit margins, ideas of quality, safety, sustainability and justice are meaningless. Instead of facing the real reasons for global hunger, biotech and nuclear corporations are forcing dangerous technologies onto the world. Global food security must be protected.

The Great Vitamin Robbery

Extensive research dating to the 1950s has found that irradiation destroys between 2 percent and 95 percent of the vitamin content in food. At the moment, very few irradiated products are on sale in grocery stores. However, with its approval of the irradiation of fruits, vegetables, poultry, pork, beef, eggs, juice and sprouting seeds, the Food and Drug Administration is allowing the irradiation of foods that comprise nearly half of the human diet. If the FDA goes forward with plans to approve the irradiation of ready-to-eat foods and shellfish, *most* of our food supply could be irradiated. The potential scale of The Great Vitamin Robbery would then be truly staggering: *up to 95 percent of certain vitamins in more than half of the food consumed in the U.S. could be lost.*

Today, it is legal to irradiate food with radiation doses between 1 and 30 kiloGray — the equivalent of 33 million to 1 billion chest x-rays. Among the chemicals formed by exposure to radiation are hundreds — or perhaps thousands — of unique radiolytic products and free radicals that have never been completely identified, much less adequately evaluated for safety.

What researchers do know is that free radicals are thug chemicals — just one can initiate tens of thousands of chain reactions that can have serious health effects. These range from destroying cell membranes and disrupting crucial processes in the body, to re-programming DNA and forming mutant cells. Research has also shown that these free radicals break down and destroy vitamins.[34]

The irradiation industry frequently argues that vitamin losses due to canning, freezing, drying, storing and cooking are unavoidable and happen to all food anyway. Irradiation, however, will not replace any of these decontamination and preservation techniques — it will be yet another nutrient-depleting process that food will undergo before it reaches your plate. Moreover, irradiation is qualitatively and quantitatively different from these other treatments: Vitamins continue being destroyed, long after the irradiation "treatment" has taken place.

Unlike heat sterilization, for example, irradiation results in the formation of new chemicals that remain in food and continue to react during storage and cooking. These chemicals have been shown to destroy vitamins at a higher rate during storage than other treatments. What's more, cooking accelerates this process even further. This is of particular concern, as one of the main reasons that the food industry is so enthusiastic about irradiation is because it helps extend shelf life. Food items could be kept on shelves for weeks or months and shipped even longer distances without spoilage, resulting in major savings for the food industry. So, the very way that the industry intends to make use of irradiation means an even higher rate of vitamin loss.

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[34] Diehl, J.F. "Combined effects of irradiation, storage and cooking on the Vitamin E and Vitamin B_1 levels of foods." Presented at the 33rd Annual Meeting of the American Institute of Nutrition, 1969.

Vitamins are essential to human health and life itself. They support bodily functions, protect cells and tissues, prevent deficiency diseases and can help prevent other diseases such as cancer and heart disease. Research has shown that *all* vitamins can and do suffer substantial losses due to irradiation. For example: 91 percent of vitamin B_6 in irradiated beef stored for 15 months and 33 percent of vitamin B_{12} in meat can be lost.[35, 36]

The five vitamins profiled below are the most sensitive to radiation "treatments."[37] They are also among the vitamins that many people are *already* not getting enough of. Up to one in five people, for instance, get inadequate supplies of vitamins A, C and E.[38] Where research has been conducted, information is provided on the synergetic effects of irradiation (irradiation plus storage plus cooking), as this indicates what the vitamin value of a food will be at the point that really matters — when it is actually consumed.

Vitamin A / Beta-Carotene

- *Recommended Daily Intake:* Men, 1000 micrograms; Women, 800 micrograms.[39]
- *Sensitivity to irradiation:* High/Medium: 4-50 percent loss
- *Why do you need it?* For good vision, healthy skin and healthy cells and tissues; to fight infection; to aid bone growth. It may also help fight cancer and heart disease.
- *What happens if you don't get enough of it?* Deficiency may lead to higher susceptibility to infection and poorer eyesight. Ultimately, deficiency can result in death.
- *Where can you get it?* Eggs, meat and fish. Also present in the form of a precursor called beta-carotene in plants, which your body converts to vitamin A. Sources are carrots, pumpkin, potatoes, winter squashes, cantaloupe, pink grapefruit, apricots and most dark green, leafy vegetables.
- *What the research says:* Irradiated liver lost 4 percent more vitamin A than unirradiated liver after one week; after two weeks, the irradiated meat had lost 18 percent more than the non-irradiated meat.[40] Irradiated potatoes lost 50 percent of

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[35] Urbain, W.M. *Advanced Food Research*, 24:155-227, 1978. Cited in Murray, D.R., *Biology of Food Irradiation*, Somerset, England: Research Studies Press, 1990.

[36] Webb, T. and Lang, T. *Food Irradiation - The Facts*. Rochester, Vermont: Thorsons Publishing Group, 1987.

[37] Kilcast, D. "Effect of radiation on vitamins." *Food Chemistry*, 49:157-164, 1994. Ranking of vitamin sensitivity to radiation: High: C, B_1, E, A; Medium: beta-carotene and K; Low: D, B_2, B_6, B_{12}, B_5, Folic acid, Pantothentic Acid, B_{10}, Choline.

[38] United States National Health and Nutritional Examination Survey (NHANES III, 1988-94), cited in Song W.O. and Kerver J.M. "Nutritional contribution of eggs to American diets." *Journal of American Nutrition*, 19 (5 Suppl):556S-562S, 2000.

[39] Data for Recommended Daily Intake, vitamin functions and food sources cross-referenced from MEDLINEplus Encyclopedia, www.nlm.nih.gov; and the Vitamin and Mineral Guide, www.thriveonline.com.

[40] Diehl, J.F. "Vitamin A in irradiated foodstuffs." *Zeitschrift fuer Lebensmittel-Untersuchung und Forschung*, 168:29-31, 1979. Cited in Stevenson, M.H., "Nutritional and other implications of irradiating meat." *Proceedings of the Nutrition Society* , 53:317-325, 1994.

their beta-carotene content after six months in storage.[41] Up to 80 percent of the vitamin A in irradiated eggs is lost after one month of storage.[42] Research is not available on possible additional accelerated loss during cooking.

Vitamin B_1 (Thiamine)

- *Recommended Daily Intake:* Men, 1.5 micrograms; Women, 1.1 micrograms
- *Sensitivity to irradiation:* High: 11-95 percent loss.
- *Why do you need it?* Helps cells convert carbohydrates into energy; essential for the functioning of the heart, muscles and nervous system.
- *What happens if you don't get enough of it?* A deficiency can cause weakness, fatigue, psychosis, and nerve damage.
- *Where can you get it?* Fortified breads, cereals, pasta, whole grains, lean meats, fish, dried beans, peas, and soybeans.
- *What the research says:* Vitamin B_1 loss in unirradiated rolled oats is 0 percent during storage (3 months) and 8 percent during cooking — a total loss of 8 percent. For irradiated rolled oats, 37 percent is lost during treatment; another 18 percent is lost during storage; and a further 19 percent is lost during cooking — a total loss of 74 percent. These kind of synergetic losses where found to be typical for a range of foods.[43] Even with using low temperatures during irradiation to try to minimize nutrient loss, chicken still lost between 11 and 45 percent of its B_1 content.[44] Results for haddock, beef, turkey, ham, bacon, peaches and beets showed losses of 70-95 percent.[45]

Vitamin C

- *Recommended Daily Intake:* Men, 45-60 micrograms; Women, 45-60 micrograms
- *Sensitivity to irradiation:* High: 20-90 percent loss.
- *Why do you need it?* For healthy gums, teeth, bones and muscles; to help heal wounds and fight infection; to act as an antioxidant to protect cells. It may also reduce the risk of heart disease, cancer and cataracts.
- *What happens if you don't get enough of it?* Can lead to fatigue, anorexia, muscular pain and greater susceptibility to infection and stress. Deficiency can lead to scurvy.
- *Where can you get it?* Green peppers, citrus fruits, strawberries, tomatoes, broccoli, greens, potatoes, and cantaloupe. Most other fruits and vegetables contain some vitamin C; fish and milk contain small amounts.

[41] Janave, M. T. and Thomas, P. "Influence of post-harvest storage of potato carotenoids." *Potato Research*, 22:365-9, 1979. Cited in Kilcast, 1994.

[42] FDA Memorandum from Kim M. Morehouse (Division of Product Manufacture and Use) to William Trotter (Division of Product Policy), April 11, 2000.

[43] Diehl, 1969.

[44] Hanis, T. et al. "Poultry meat irradiation: effect of temperature on chemical changes and inactivation of microorganisms." *Journal of Food Protection*, 1989. Cited in Kilcast, 1994.

[45] Ziporin, Z. Z. et al. U.S. Army Medical Nutrion Laboratory. April 1957.

- *What the research says:* Irradiation has been shown to destroy 13 percent of the vitamin C in orange juice. One-third of vitamin C in potatoes is destroyed.[46] After 40 days of storage, lemons lost 90 percent of vitamin C.[47]

Vitamin E

- *Recommended Daily Intake:* Men, 10 micrograms; Women, 8 micrograms
- *Sensitivity to irradiation:* High: 17-91 percent loss
- *Why do you need it?* It is a powerful antioxidant that helps protect body tissues and cells. It may also help fight heart disease, cancer, Alzheimer's, cataracts and improve the immune system.
- *What happens if you don't get enough of it?* Vitamin E deficiency can cause a progressive neural degeneration syndrome involving reduced reflexes, decreased sensation and ataxia. If not treated soon enough, then the debilitation is irreversible. It may also be linked with depression and infertility.
- *Where can you get it?* Wheat germ, corn, nuts, seeds, olives, spinach, asparagus, and other green leafy vegetables and vegetable oils.
- *What the research says:* Vitamin E loss in unirradiated hazelnuts is 4 percent after 3 months of storage, and a further 29 percent during cooking — a total loss of 33 percent. For irradiated hazelnuts, 17 percent is lost during treatment, 25 percent is lost during storage, and a further 49 percent is lost during cooking — a total loss of 91 percent. This kind of synergetic loss was found to be typical for a range of foods.[48]

Vitamin K

- *Recommended Daily Intake:* Men, 65-80 micrograms; Women, 55-65 micrograms
- *Sensitivity to irradiation:* Medium
- *Why do you need it?* Known as the "clotting" vitamin — without it, blood will not clot. It may also help maintain strong bones.
- *What happens if you don't get enough of it?* May lead to improper coagulation of the blood and hemorrhaging.
- *Where can you get it?* Cabbage, cauliflower, green leafy vegetables, cereals, soybean, and other vegetables. Also made by the bacteria that line the gastrointestinal tract.
- *What the research says:* A study to assess the effects of vitamin K deficiency in rats caused by feeding irradiated beef resulted in the death of 70 percent of the male rats.[49]

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[46] Gibbs, Gary. *The Food That Would Last Forever*. Garden City Park, New York: Avery Publishing Group, 1993.

[47] Maxie, E.C. et al. *Radiation Botany*, 405-411, 1964. Cited in Murray, 1990.

[48] Diehl, 1969.

[49] Metta, V.C. et al. "Vitamin K deficiency in rats induced by feeding of irradiated beef." *Journal of Nutrition*, 69:18-21, 1959. (Co-sponsored by the Surgeon General of the U.S. Army)

The Health Problems of Irradiated Foods

During the process of irradiation, food is exposed to gamma rays of radioactive material (cobalt-60 or cesium-137) or electron beams. Ionization of food causes complex chemical modification. The result is a *radiolytic product*, never found in nature and linked to cancer and genetic modification. More than 40 years of scientific research has shown many health problems in animals that ate irradiated food, including premature death, mutations, reproductive problems, fatal internal bleeding, destruction of immune systems and others.[50,51]

Recent research conducted in Europe concentrated on a specific by-product of irradiation, called 2-alkylcyclobutanones, or 2-ACBs. The team of scientists found links to colon tumors and the stimulation of the cancer-forming process in rats fed 2-ACBs. Never before had these studies been conducted, nor these results reached. This study indicates that further research is essential before irradiated food is implemented, or else human beings will be used as guinea pigs to determine long-term health impacts.[52,53,54]

Below are several examples of research conducted over the course of nearly fifty years, the first dating back to 1957. This demonstrates that there is more than adequate information demonstrating that there are clearly numerous health implications associated with irradiating foods. Unfortunately, the research is turned a blind eye by the United Nations Food and Agriculture Organization, as well as some national health agencies, such as the United States food and Drug Administration.

Health Problems in Humans [I]

Fifteen children suffering from severe protein-calorie malnutrition…receiving freshly irradiated wheat developed polyploid cells and certain abnormal cells in increasing number as the duration of feeding increased…Though the biological significance of polyploidy is not clear, its association with malignancy makes it imperative that the wholesomeness of irradiated wheat for human consumption be very carefully assessed. - Bhaskaram, C., and G. Sadasivan. "Effects of feeding irradiated wheat to malnourished children." Amer Journ Clin Nutr, 28:130-135, 1975.

Health Problems in Humans [II]

[After eating] gamma-irradiated potatoes, … the haemoglobin values were significantly higher *during* (14 weeks of feeding on irradiated potatoes) the period than *before*. The

[50] Diehl, J.F. "Combined effects of irradiation, storage and cooking on the Vitamin E and Vitamin B_1 levels of foods." Presented at the 33rd Annual Meeting of the American Institute of Nutrition, 1969.
[51] Urbain, W.M. *Advanced Food Research*, 24:155-227, 1978. Cited in Murray, D.R., *Biology of Food Irradiation*, Somerset, England: Research Studies Press, 1990.
[52] Burnouf, D. et al. (Eds.) "Etude toxicologique transfrontalière destinée à évaleur le risque encouru lors de la consommation d'aliments gras ionisés – Toxikologische Untersuchung zur Risikobewertung beim Verzehr von bestrahlten fetthaltigen Lebensmitteln – Eine französisch-deutsch Studies im Grenzraum Oberrhein. Rapport Final d'étude Interreg II, Projet N° 3.171, 2002.
[53] Delincée, H. et al. "Genotoxicity of 2-alkylcyclobutanones, markers for an irradiation treatment in fat-containing food – Part I: cyto- and genotoxic potential of 2-tetradecylcyclobutanone." *Radiation Physics and Chemistry*, 63:431-435, 2002.
[54] Delincée, H. "Rapid detection of irradiated frozen hamburgers." *Radiation Physics and Chemistry*, 63:443-446, 2002.

values were also significantly higher *during* than *after*… An additional comparison of the values *before* with the values *after* shows than a small effect still remains.
- Cited in Kesavan, P.C. "Cytotoxic and mutagenic effects of irradiated substrates and food material." Radiation Botany, 11:253-281, 1971.

Health Problems in Humans [III]
Ten young men served as test subjects for this study, [and were fed] pork loin which had been ground … and subjected to gamma radiation… It is apparent … that there may very well be differences in the digestibility of the foodstuffs from irradiated or non-irradiated meat, and in the ability of protein in irradiated or non-irradiated meat to maintain nitrogen balance.
- Plough, I.C. et al. "An evaluation in human begins of the acceptability, digestibility and toxicity of pork sterilized by gamma radiation and stored at room temperature." U.S. Army Medical Nutrition Laboratory, Fitzsimons Army Hospital, Denver. Report No. 204, May 1957.

Health Problems in Humans [IV]
Thirteen young men served as test subjects, [and were fed] an irradiated food diet … of 8 different food items… The excretion of indophenol-reducing substances was significantly higher ($p<.005$) during the irradiated food periods… Irradiation decreased the thiamine and ascorbic acid content and increased the "browning reaction" derivatives, fat soluble carbonyl compounds, and thiobarbituric acid reactants.
- Bierman, E.D. et al. "Short-term human feeding studies of foods sterilized by gamma radiation and stored at room temperature." U.S. Army Medical Nutrition Laboratory, Fitzsimons Army Hospital, Denver. Report No. 224, July 1958.

Chromosomal Aberrations in Human Blood Cells [I]
Irradiated sucrose solutions…were extremely toxic to human lymphocytes. Mitoses were inhibited... Degenerated mitoses were observed and the chromosomes were grossly damaged. The chromatin [DNA] material was clumped or the chromosomes appeared shattered or pulverized... In contrast, treatment with unirradiated sucrose at the same concentration had no apparent effect on the mitotic rate and the chromosomes were not visibly damaged.
- Shaw, M.W. and Hayes, E. "Effects of irradiated sucrose on the chromosomes of human lymphocytes in vitro." Nature, 211:1254-1255, 1966.

Chromosomal Aberrations in Human Blood Cells [II]
Leukocyte cultures from four different healthy human males [underwent] a considerable inhibition of mitosis and chromosome fragmentation. [Additional] research would be extremely prudent.
- Kesavan, P.C. and Swaminathan, M.S. "Cytotoxic and radiomimetic activity of irradiated culture medium on human leukocytes." Current Science, 16:403-404, 1966.

Unique, Toxic Chemicals Formed in Irradiated Food Containing Fat [I]
When food containing fat is treated by ionizing radiation, a group of 2-alkylcyclobutanones is formed... To date, there is no evidence that the cyclobutanones

occur in unirradiated food... *In vitro* experiments using rat and human colon cells indicate that 2-dodecylcyclobutanone (2-DCB) ... is clearly cytotoxic and genotoxic… [M]ore experiments than these preliminary ones are required.
- 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. (Co-sponsored by the International Consultative Group on Food Irradiation.)

Unique, Toxic Chemicals Formed in Irradiated Food Containing Fat [II]
In this study, *in vivo* experiments were conducted on rats, which received two different doses of 2-DCB by way of pharyngeal probe… Slight but significant DNA damage was observed in the experimental group that received the higher concentration of 2-DCB (14.9 mg/kg body weight). Further studies are needed to clarify the relevance of these results to an evaluation of risk from the consumption of irradiated foods.
- Delincée, H. et al. "Genotoxicity of 2-dodecylcyclobutanone." Food Irradiation: Fifth German Conference, Report BFE-R-99-01, Federal Nutrition Research Institute, Karlsruhe, Germany, 1998.

Unique, Toxic Chemicals Formed in Irradiated Food Containing Fat [III]
To date, there is no evidence that 2-alkylcyclobutanones [2-ACB's] occur in unirradiated food, and therefore, it is advisable to determine the toxicological potential… [Human colon tumor cells were incubated with 2-tetradecylcyclobutanone, one particular ACB.] After prolonged incubation times, (1-2 days) at higher concentrations (>50ìM), cytotoxicity did appear.
- Delincée, H. et al. "Genotoxicity of 2-alkylcyclobutanones, markers for an irradiation treatment in fat-containing food – Part I: Cyto- and genotoxic potential of 2-tetradecylcyclobutanone." Radiation Physics and Chemistry, 63:431-435, 2002.

Unique, Toxic Chemicals Formed in Irradiated Food Containing Fat [IV]
[U]sing an experimental colon carcinogenesis model in rats, 2-ACB's [2-alkylcyclobutanones], when tested at a high concentration, potentiate the effect of an inducing carcinogen on the long term. This was revealed by the increase of colonic neoplastic lesions and the development of a higher number of colon tumours with larger size… This suggests that, in this experiment, 2-ACB's, although they do not induce carcinogenesis, *per se*, rather promote the colonic carcinogenesis process. Finally, it was shown that small fractions of 2-ACB's had been stored in rat adipose tissues and excreted in faeces of the trated rats. This indicates that most of the 2-ACB's is metabolically transformed or stored in other organs…[I]n our opinion further investigations…will help to elucidate a possible risk associated with the consumption of irradiated fat-containing foods.
- Marchioni, E. et al. "Toxicological study to assess the risk associated with consumption of irradiated fat-containing food." (Summary) International Consultative Group on Food Irradiation, Dec. 2001.

Cancer Warning

An increase in concentration of a mutagen in food by irradiation will increase the incidence of cancer... It will take four to six decades to demonstrate a statistically significant increase in cancer due to mutagens introduced into food by irradiation... When food irradiation is finally prohibited, several decades worth of people with increased cancer incidence will be in the pipeline.
- Tritsch, G.L. "Food Irradiation." Nutrition, 16:698-701, 2000.

Thalidomide Warning [I]
The thalidomide disaster might have been prevented if an easily performed investigation of possible cytotoxic effects in plant cells had been made. It must be acknowledged that any compound causing [cellular] damage must be considered a potential hazard to any living cell or cell system – including man.
- Lofroth, G. "Toxic effects of irradiated foods." Nature, 211:302, 1966.

Thalidomide Warning [II]
Irradiating can bring about chemical transformations in food and food components resulting in the formation of potential mutagens, particularly hydrogen peroxide and various organic peroxides... It is now realized, especially since the thalidomide episode, that [older testing] protocols do not detect the more subtle population hazards such as mutagens and teratogens... In view of the serious consequences to the human population which could arise from a high level of induced mutations, it is desirable that protocols for irradiated food should include in *vivo tests* on mammals for possible mutagenicity.
- Schubert, J. "Mutagenicity and cytotoxicity of irradiated foods and food components." Bulletin of the World Health Organization, 41:873-904, 1969. (Co-sponsored by the U.S. Atomic Energy Commission and Food and Drug Administration)

Reproductive Dysfunction, Cancer, Stunted Growth in Mammals
A careful analysis by FDA of all [Army] data present (including 31 looseleaf notebooks of animal feeding test results) showed significant adverse effects produced in animals fed irradiated food... What were these adverse effects?... A decrease of 20.7 percent in surviving weaned rats... A 32.3 percent decrease in surviving progeny of dogs... Dogs weighing 11.3 percent less than animals on the control diets... Carcinomas of the pituitary gland, a particularly disturbing finding since this is an extremely rare type of malignant tumor.
- Spiher, A.T. "Food irradiation: An FDA report." FDA Papers, Oct. 1968.

A Summary of Problems
Numerous studies have been carried out to ascertain whether cytotoxic effects occur when unirradiated biological test systems are cultured or fed with irradiated media or food. In such studies, adverse physiological (growth retardation and inhibition), cytological (mitotic inhibition and chromosome aberrations) and genetical (forward and reverse mutations) effects have been observed in a wide range of test systems, ranging from bacteriophages to human cells... The available data suggest that [a variety of free radicals] may act as the toxic and mutagenic agents.
- Kesavan, P.C. and Swaminathan, M.S. "Cytotoxic and mutagenic effects of irradiated substrates and food material." Radiation Botany, 11:253-281, 1971.

The Dangers of Irradiation Facilities

Food irradiation supporters often say that irradiation facilities and irradiation equipment are safe, that accidents rarely happen, and that injuries and deaths are infrequent. The historical record says otherwise. Since the 1960s, dozens of accidents have been reported throughout the world. Radioactive water has been flushed into the public sewer system. Radioactive waste has been thrown into the garbage. Radiation has leaked. Facilities have caught fire. Equipment has malfunctioned. Workers have lost fingers, hands, legs and, in several cases, their lives. Company executives have been charged with cover-ups and, in one case, sentenced to federal prison. The debate over food irradiation would not be complete without an understanding of the risks associated with the technology itself.

The United States Environmental Protection Agency recognizes that all ionizing radiation, including cobalt-60 and cesium-137, is known to cause cancer. Exposures to gamma radiation from cobalt-60 and cesium-137 can result in an increased risk of cancer. External exposure is usually considered a greater threat, because stronger gamma rays are emitted. The magnitude of the health risk depends on the quantity of the radioactive isotope involved, length of exposure, distance from the source and whether the cobalt-60 was ingested or inhaled.

Below are some examples of what can go wrong.[55,56]

Brazil

In the south-central Brazilian city of Goiânia in 1987, scavengers dismantled a cesium-137 irradiation canister while rummaging through a junkyard and took it home. Over the next week, several hundred people were unwittingly exposed. Some children and adults, thinking the cesium powder was pretty, rubbed it over their bodies. Others inadvertently ate food that had been contaminated with the radioactive powder. More than 100,000 people were monitored for radiation exposure, 300 of whom were contaminated with cesium-137. Four people eventually died. Homes and businesses were also contaminated, requiring a major clean-up operation that lasted six months.

Israel

At a cobalt-60 irradiator in Soreq in 1990, a worker entered the irradiation chamber after an alarm sounded. Acting against operating and safety instructions, he did not notify his supervisor and instead handled the situation on his own. He turned off the alarm, bypassed the safety system, unlocked the door and entered the radiation room. He did not notice that the cobalt-60 was exposed until he moved a pile of boxes. After a minute of

[55] Proposal for a Council Directive on the Control of High Activity Sealed Radioactive Sources. Commission of the European Communities, Brussels, 18 March 2002, COM (2002) 130 final. <http://europa.eu.int/eur-lex/en/com/pdf/2002/en_502PC0130.pdf>

[56] González, Abel J. Strengthening the Safety of Radiation Sources & the Security of Radioactive Materials: Timely Action. *IAEA Bulletin*, 41(3):2-16, 1999. <http://www.iaea.or.at/worldatom/Periodicals/Bulletin/Bull413/article1.pdf>

direct exposure, he began to feel a burning sensation in his eyes and left the room. He died 36 days later.

El Salvador[57]

In February 1989, three workers were poisoned when they entered the irradiation chamber at a cobalt-60 irradiation facility near San Salvador. Responding to a malfunction, a worker bypassed the safety system and entered the radiation room with two others neither of whom had formal training to operate the equipment. All three men were exposed when they stood directly in front of the cobalt source. One man was sick for more than six months. Another had his legs amputated. The most-exposed worker (who first entered the chamber) was hospitalized for radiation poisoning throughout his body and for extensive radiation burns to his legs and feet. His right leg was amputated and, 197 days after the accident, he died. The company was unaware of the accident for several days because the workers were incorrectly diagnosed as having food poisoning.

Belarus

In 1991, a worker was fatally poisoned at a cobalt-60 irradiation facility in Nesvizh, about 120 km from Minsk. When a piece of equipment jammed, the worker entered the irradiation chamber after bypassing a number of safety features. The radioactive material became exposed and irradiated the man for about one minute. After undergoing specialized treatment in Moscow, the man died 113 days after the accident.

United States

In 1986, two company executives were indicted on federal charges following a 1982 spill of 600 gallons of contaminated water at a cobalt-60 facility in New Jersey. Workers were instructed to pour the radioactive water down a shower drain that emptied into the public sewer system. Workers were also ordered to wear their radiation-detection badges in such a way to falsify radiation levels. A $2 million cleanup included the cost to dispose of radioactive material at a nuclear waste dump. A company vice president who once served on the U.S. Atomic Energy Commission was convicted of conspiracy and fraud.
A worker at a cobalt-60 facility in New Jersey was exposed to a near-fatal dose of 150-300 rems in1977 when a system designed to protect workers from radioactivity failed. In 1988 after more than 30 Nuclear Regulatory Commission violations, including throwing out radioactive garbage with the trash the company's president was indicted on federal criminal charges and sentenced to two years in prison.

The radiation director at a cobalt-60 facility in New Jersey was exposed to a near-fatal dose of 400 rems in 1974. The man was critically injured and hospitalized for a month. Two years later, a fire near the cobalt storage pool released chemicals into the pool that caused the cobalt rods to corrode and leak.

[57] Guide for the Preparation of Applications for Licenses for Non-Self-Contained Irradiators. Nebraska Department of Health and Human Services, Regulation and Licensure, Regulatory Guide 19.0.<http://www.hhs.state.ne.us/puh/enh/rad/rg/rggd19.pdf>

Radioactive water was then flushed down the toilet into the public sewer system. Eventually, concrete around the cobalt-60 pool, as well as the toilet and bathroom plumbing, was found to be radioactive and taken to a nuclear waste dump. The amount of radiation released into the public sewer system was never determined.

China
In China in 1992, a cobalt-60 source was lost and picked up by an unsuspecting individual. Three persons in the family died of resulting overexposure.

Italy
In 1975, a worker at a cobalt-60 irradiation facility in Brescia was exposed when he bypassed all safety controls, climbed onto a conveyor belt and entered the irradiation chamber. He died 12 days later.

Norway
A Norwegian worker received a huge cobalt-60 dose in 1982 while trying to fix a jammed conveyor belt. He died 13 days later.

Turkey
In 1998 in Istanbul, two cobalt-60 sources in their shipping containers were sold as scrap metal. Ten people were inadvertently exposed to radiation, though none were reported to have died. One of the cobalt-60 sources was still missing several months following the incident.

Viet Nam
In 1992, a mishap at a 15 million electron-volt linear accelerator in Hanoi cost the facility's research director a hand and several fingers.

Since plans are underway to construct irradiation facilities in the Philippines, there is potential for an unnecessary deadly accident to take place. There are lessons to be learned from history, and the best way to prevent an irradiation facility accident is to prevent the facility from being built at all.

Conclusions

Irradiation is yet another tool for multinational corporations to gain more control over the world's food supply; thus, decreasing people's right to food sovereignty, increasing health problems, and causing more threats to the environment.

Because it increases the shelf life of food and utilizes centralized facilities, irradiation encourages globalization and consolidation of the food production, distribution and retailing industries. Due to these trends, agriculture operations have moved into the Global South, while multitudes of family farmers and ranchers have been forced out of business, product diversity has been reduced, and local economies have been disrupted. Irradiation exacerbates the problems faced by family farms because it opens the floodgates to low-cost, imported food. Irradiation facilities have been constructed in many countries that export large amounts of fruit, vegetables and meat, including Argentina, Australia, Brazil, Chile, Mexico and New Zealand.

Irradiation destroys vitamins, protein, essential fatty acids and other nutrients in food – sometimes significantly. Research dating to the 1950s has revealed a wide range of health problems in animals that ate irradiated foods, including premature death, a rare form of cancer, stillbirths and other reproductive problems, mutations and other genetic damage, organ malfunctions, stunted growth and vitamin deficiencies. Irradiation uses ionizing types of radiation – electron beams, gamma rays and X-rays – that disrupt the chemical composition of everything in its path. Scores of new chemicals called "radiolytic products" are formed by irradiation – chemicals that do not naturally occur in food. In legalizing and endorsing food irradiation, the World Health Organization ignored a vast amount of research suggesting that irradiated foods are not safe for human consumption.

The Philippines does not need this questionable new technology which poses a threat to farmers, consumers, the environment and workers. The money has not yet been granted to build an irradiation facility in the Philippines. Citizens need to contact their Members of Congress and tell them about the dangers associated with food irradiation and that the whole world does not accept this technology. In the United States, more and more parents are standing up to oppose serving irradiated foods in school lunches. They do not want their children to be guinea pigs and neither should any other citizen of the world. Codex also needs to reopen the case of food irradiation. Organizations throughout the world need to contact their Codex delegates[58] and inform them of the dangers associated with consuming irradiated foods. Codex is intended to protect consumers, and as such, the Codex Standard for Irradiated Foods needs to be revised. Japan and Europe proceed with caution when taking into consideration the well fare of consumers and the environment. The rest of the world needs to do the same. With solid information and citizen input, the policies can be changed.

[58] Delegates can be found on the website, http://www.codexalimentarius.net/, under "About Codex."