
BAD TASTE



THE DISTURBING TRUTH ABOUT
THE WORLD HEALTH ORGANIZATION'S
ENDORSEMENT OF FOOD IRRADIATION

**Public
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*Protecting Health,
Safety & Democracy*

A special report by
Public Citizen
and GRACE
October 2002

GRACE
GLOBAL RESOURCE ACTION CENTER
FOR THE ENVIRONMENT

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October 2002

Prepared by Mark Worth

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GRACE works to form new links with the research, policy and grassroots communities to preserve the future of the planet and protect the quality of the environment.

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WHO, IAEA and FAO officials
falsely stated in 1980:

“All the
toxicological studies
have produced
no evidence of
adverse effects
as a result of
irradiation.”

Executive Summary

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 pursues a mission 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.”¹

Headquartered in Geneva, the WHO has grown from 61 member nations at its founding to 193 today, from Algeria to Zimbabwe. Its more than 100 initiatives encompass virtually every health problem imaginable, from anthrax and adolescent reproductive health, to vitamin A deficiency and violence against women.²

When the WHO speaks, the world listens.

In 1999, the WHO announced that any food could be “treated” with 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.”³

WITH IRRADIATION'S PROMISE of killing *E. coli*, *Salmonella*, *Listeria* and other food-borne pathogens; neutralizing fruit flies, mango seed weevils and other exotic pests; and delaying the spoilage of meat, fruit and vegetables, this proclamation holds the potential to dramatically alter the way food is produced, distributed and sold around the globe. As far as the world's food supply is concerned, the proclamation is one of the most significant in recent memory.

In the process of assessing the safety and wholesomeness of irradiated foods, did

the World Health Organization fulfill its mission to preserve the health of the Earth's population?

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?^{3a}

Has the WHO's assessment been made independent of efforts to further the legalization, commercialization and consumer acceptance of irradiated foods?

Has the WHO's analysis been uncorrupted by efforts to resuscitate the nuclear industry – an analysis that could have been tainted by an agreement giving the IAEA the ultimate control over nuclear research?

THESE QUESTIONS YIELD disturbing answers – answers that challenge the reliability of the WHO's stamp of approval. An in-depth review of the WHO's 40-plus-year involvement in assessing whether irradiated foods are safe for human consumption reveals the following:

- The WHO has played a role in abandoning the original research agenda that it co-drafted in 1961, which urged that a wide range of experiments be conducted into the safety and wholesomeness of irradiated foods. These experiments, the drafters wrote, should analyze whether irradiated foods are toxic or radioactive; whether they could cause cancer or nutritional deficiencies; or whether the scientific expertise even existed to answer these fundamental questions. Most of the items on this research agenda were not followed up in key WHO reports.

- The WHO has ceded an inordinate amount of authority to the International Atomic Energy Agency, going so far as to hand the IAEA the ultimate power to research the safety of irradiated foods. The IAEA – whose mission is preserving the nuclear industry, not the health of people – has exercised this power to a significant extent. The IAEA has published 19 of the 29 major international reports on food irradiation since 1962, and all but four of the reports issued during the formative period from 1973 to 1993. These later

reports led to the proclamation that any food could safely be irradiated at any dose.

- 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. Toward accomplishing this goal, the IAEA has published all eight of the major international reports related to these issues. 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’...will cause the product to be avoided...and should not be required on the label.”⁴

- 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 that the research actually revealed no health problems that could be attributed to irradiation. Moreover, some research that the WHO, IAEA and FAO initially claimed yielded adverse effects were later 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 in rats, caused the development of tumors and lesions in rats, and caused genetic damage in rats and in human cells. Cyclobutanones have never been found to occur naturally in any food. Furthermore, a prominent U.S. Army researcher falsely stated in a 1989 IAEA publication that no such unique chemicals have ever been detected in irradiated foods.

Despite efforts to downplay the potential hazards of cyclobutanones, the European Union and the Codex Alimentarius Commission (which sets food-safety standards for more than 160 nations) have delayed proposals to expand food irradiation. At this writing, the EU is conducting a formal inquiry into the potential hazards of cyclobutanones.

A full airing of these shortcomings and swift actions to remedy them are needed to help ensure that the increasing proliferation of irradiated foods throughout the world will not endanger the health of people who eat these products. By assuming, in the face of mounting evidence to the contrary, that irradiated foods are safe for human consumption, the World Health Organization 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 World Health Organization, the International Atomic Energy Agency, and the United Nations' Food and Agriculture Organization have endorsed food irradiation, Public Citizen makes the following 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 the conclusions and suspend the recommendations issued in the 1999 report, *High-Dose Irradiation: Wholesomeness of Food Irradiated with Doses Above 10 kGy*, which endorsed 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 raised at the FAO/IAEA/WHO meeting on the wholesomeness of irradiated food held in Brussels, 23-30 October 1961. Research should also be conducted into key safety and wholesomeness issues raised since the Brussels meeting, including 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. These chemicals include benzene, toluene and methyl ethyl ketone.

- A 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 review all WHO, IAEA and FAO publications, and identify and correct all inaccurate, misleading and incomplete statements regarding food irradiation.

This panel should also investigate the role played by the IAEA in the process of endorsing food irradiation, and whether the agency's role has corrupted the integrity of the analysis of the safety and wholesomeness of irradiated foods. Meetings of this panel should be open to the public, and all materials and findings should be distributed to member nations and be made available to the public.

“We have to know and understand the ordinary people.

We must confer with experts in the various fields of advertising and psychology to put the public at ease, and develop a more friendly feeling to irradiation.”

- A South African food industry executive, speaking in 1982 at an international conference on marketing and consumer acceptance of irradiated foods

Introduction

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 pursues a mission 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.”⁵

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CONTROLLING THE SCIENCE

A Solid Foundation

ON MAY 28, 1959, the Twelfth World Health Assembly agreed that the World Health Organization would cede to the International Atomic Energy Agency “the primary responsibility for encouraging, assisting and coordinating research on, and development and practical application of, atomic energy for peaceful purposes throughout the world.”

The agreement continues: “Whenever either organization proposes to initiate a program or activity in which the other

organization has or may have a substantial interest, the first party shall consult the other with a view to adjusting the matter.”

Further, the agreement states that the WHO and IAEA

“shall keep each other fully informed concerning all projected activities and all programs of work which may be of interest to both parties.”⁹

Few present that day in Geneva could have imagined the repercussions this five-page document would have over the future of food irradiation, a technology then in its infancy. As shall be seen, the IAEA’s prime directive – to “accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world” – would come at odds with the WHO’s mission.

The IAEA’s power to have the “primary responsibility” over nuclear research, however, was not apparent at the first

international meeting the WHO helped organize to discuss global food irradiation policy – just two years after the WHO/IAEA agreement was signed. For eight days in Brussels in 1961, 114 delegates from 28 countries raised virtually every question that would enter the mind of any competent health professional charged with examining the safety and wholesomeness of irradiated foods.

Though co-sponsored by the IAEA and the United Nations' Food and Agriculture Organization (FAO), the meeting's focus was clearly on the health considerations of irradiated foods – not on the role of nuclear interests, nor the role of agricultural interests.

The meeting's 205-page report explores in-depth a wide range of fundamental problems that the delegates believed must be resolved before recommending that irradiated foods are safe for human consumption (emphasis added):

- *The Wholesomeness Problem.* “By the very nature of radiation, certain changes in the molecular structure of the organic compounds present in food can be expected. Evidence of toxicity or severe nutritional damage would no doubt seriously curtail research into food irradiation.”

- *The Vitamin Problem.* “The fact that [vitamins] are quite [susceptible to radiation damage], and perhaps more so than other compounds, is ultimately reflected in certain biological responses observed in test animals. Vitamin loss may be overcome by supplementation.”

- *The Protein Problem.* “In addition to effects of irradiation on the internal chemistry of the amino acids which make up protein, irradiation also causes chemical changes in protein. More basic chemistry is required.”

- *The Fat Problem.* “Many geneticists are of the opinion that the mutagenic effect of high-energy irradiation is mainly due to [free radical] action. The mechanism of the ultimate damage caused by irradiated fats is unknown. A large amount of fundamental work has still to be done before these questions can be answered satisfactorily.”

- *The Carbohydrate Problem.* “Carbohydrates when irradiated undergo chemical degradation. With regard to the possible toxicity of irradiated carbohydrates, it is necessary to ascertain whether there are any possible [indirect] effects involved. The problem should in no way be considered solved. Obviously it will be necessary to find out whether there

may not be some deleterious effects involving a mutation or carcinogenic hazard.”

- *The Safety Testing Problem.* “More sophisticated techniques for food toxicology investigations are needed and several newer approaches to the problem are needed.”

- *The Cancer Problem.* “Experiments are not sufficiently advanced to comment on carcinogenicity.”

- *The Induced Radioactivity Problem.* “It would be advisable to measure the radioactivity of irradiated products to ensure that no radioactive contamination has occurred during treatment. It is indeed very difficult

Irradiated carbohydrates could have “deleterious effects involving a mutation or carcinogenic hazard.”

– WHO/IAEA/FAO officials, 1961

to get the public to accept the fact that a product that is highly radioactive after irradiation becomes harmless a few hours later.”

- *The Indirect Radiation Problem.* “The [indirect] effects include mutagenic effects in plant tissues and a significant drop in the number of leukocytes in rats. These effects should not be overlooked, and only further research can clarify their relevance to the wholesomeness problem. [They] may be one link in the chain of events leading to cancer.”¹⁰

PARTICIPANTS IN Brussels concluded that a wide range of research avenues should be followed before putting their stamp of approval on irradiated foods, including:

- Further examination of how radiation affects nutrients and other food components;
- The chemical, physical and biological changes caused by irradiation;
- The wholesomeness of irradiated foods; and
- The nutritional adequacy and possible toxicity of irradiated foods by conducting long-term animal-feeding studies.¹¹

Overall, the meeting laid a solid foundation upon which food scientists throughout the world could build a credible research program into the wisdom of allowing people to eat food “treated” with high doses of ionizing radiation.

But, as will be seen, WHO, IAEA and FAO irradiation planners soon became less interested in health and safety, and more interested in politics and commerce.

The Foundation Begins to Crumble

THREE YEARS LATER, in April 1964, irradiation planners from the WHO, IAEA and FAO re-convened for another eight-day session, this time in Rome. Though many of the people who attended the Brussels session found themselves in the same room again, the agenda quickly turned away from safety and wholesomeness problems, and towards the problem of legalizing irradiation in countries throughout the world – including many developing countries.

Initiating a trend that continues to this day, the report that came out of the meeting makes little reference to the safety and wholesomeness problems initially raised in Brussels. Instead, the delegates bypassed these discussions and shifted the dialogue toward

In 1964, the dialogue shifted toward strategies designed to encourage governmental and consumer acceptance of irradiated foods.

strategies designed to encourage governmental and, ultimately, consumer acceptance of irradiated foods worldwide.

Accordingly, the meeting report begins not by calling for more research into the likelihood that irradiated foods could cause cancer, genetic damage, nutritional deficiencies and other health problems discussed in Brussels, but rather by calling for “a common approach to legislation [to] facilitate international acceptance of the process.”¹²

INITIATING ANOTHER TREND that continues to this day, the report states this common approach should be designed to “facilitate international trade in irradiated food.”¹³

Of the nine recommendations made by what would become known as the Joint FAO/IAEA/WHO Expert Committee, none specifically addressed any of the health and safety concerns so explicitly spelled out in Brussels three years earlier. Instead, the recommendations focused on efforts to foster the “acceptance,” “cooperation” and “exchange of information” among government officials wishing to establish a foothold for irradiated foods in their countries.¹⁴

In particular, the importance of influencing irradiation policy in the United States was underscored by the fact that two of the FAO’s four advisors were intimately involved with food irradiation research in the U.S.

One of the advisors was Edward Josephson, who directed the U.S. Army’s ill-fated food irradiation research program. Despite Josephson’s renown, the Army program was so poorly managed that in 1968 – even as overseas food supply problems mounted at the height of the Vietnam War – the U.S. Food and Drug Administration revoked the Army’s permit to feed irradiated bacon to military personnel.*

Meanwhile, only a few of the many concerns raised in Brussels were dealt with in Rome. Ironically, because the concerns

* The FDA took this action shortly after previously withheld Army research revealing premature death, cancer, stunted growth and other health problems in lab animals came to light, triggering congressional hearings into the affair.¹⁵ Despite this failure, Josephson, now deceased, remained very active in the field for the next 35 years. In 2000 he won the FDA’s approval to irradiate eggs, despite presenting no specific toxicological evidence indicating that irradiated eggs are safe to eat.¹⁶

that were raised received only token attention, even more worries were expressed in these areas.

In the one-page section on nutritional losses, for example, the report states:

In some countries, relatively few types of food may constitute a critical part of the diet. Consideration of the change in nutritional value may be needed in connection with any proposal to irradiate food which may be of particular importance in the diet of infants, children, and old or sick persons. Before permitting the use of radiation processing of a specific food

item, the appropriate government authorities should be aware of these possible effects, and it is desirable that they should conduct controlled surveys in order to ensure that there are no effects in the population in general and in vul-

nerable groups.¹⁷

THE TWO OTHER PROBLEMS originally raised in Brussels that were discussed in Rome – those dealing with induced radioactivity in food and the indirect effects of radiation – also received little attention in the Rome report and, for that matter, they were relegated to the appendix. And, like the problem of nutritional loss, the statements did not comprehensively address these concerns.

On the question of food becoming radioactive, the report states “there is a possibility that radioactivity will be induced

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in some atoms of the food.” The report, however, only suggests that further research “may be made” into this potential problem.¹⁸

On the question of the indirect effects of radiation – “radiomimetic” effects – the report acknowledges experiments that found mutations in fruit flies (a commonly used bellwether of mutagenicity); a decrease in white blood cell counts in rats; genetic damage in plants; and mutations in bacteria. Mutations of certain strains of *E. coli* and *Salmonella*, for example, caused the bacteria to become 14 and 10 times more resistant to radiation, respectively.¹⁹

Initiating another trend that continues to this day, the report calls for more research into these radiomimetic effects. But, in one of several leaps of faith, the report proceeds to equate the lack of information to a lack of concern.

Though acknowledging that “more data concerning a possible mutagenic effect are desirable,” irradiation planners from the WHO, IAEA and FAO “concluded that the evidence available at present is insufficient to establish whether substances present in irradiated food may be mutagenic in man and, at present, no significant hazard can be foreseen.”²⁰

And, in another of the report’s more noteworthy contradictions, delegates state in one section that animal toxicity and carcinogenicity studies can be extrapolated to humans “with a reasonable degree of certainty.” Later in the report, however,

delegates state that genetic damage observed in fruit flies “cannot be assumed to occur in man.”²¹

THE ISSUE OF EXTRAPOLATION is also addressed in a brief section on applying wholesomeness data on certain types of food to other types of food. Without citing any scientific research, the report states: “When an irradiated food has been established as safe for human consumption, it may be proposed that a closely related food be treated under similar conditions and with the same radiation dose.”²²

This statement – among the most significant ever made in the half-century of food irradiation research – continues to have repercussions today. In 2000, for example, the U.S. Food and Drug Administration legalized the irradiation of eggs based on no toxicity data whatsoever derived from irradiated eggs.²³

Taken together, the shift in dialogue from safety to acceptance, the leaps of faith, the discrepancies and the unsubstantiated claims that grew out of the Rome meeting represent a dividing line in the 40-year history of international deliberations on irradiated food policy.

Early experiments on the indirect – or “radiomimetic” – effects of irradiation found mutations in fruit flies, a decrease in white blood cell counts in rats, genetic damage in plants, and mutations in bacteria.

The Brussels Agenda Continues to Fade

FIVE YEARS LATER, in April 1969, irradiation planners from the WHO, IAEA and FAO reconvened for five days in Geneva – this time, officially speaking at least – to address wholesomeness problems.²⁴

Like in Rome, however, the Geneva report contains leaps of faith, discrepancies and unsubstantiated claims. Though the Brussels meeting was held just eight years earlier, most of the fundamental problems raised at that first meeting had fallen by the wayside.

Of the nine health and wholesomeness issues raised in Brussels in 1961, only three were discussed in the 1969 meeting report. Only one issue, dealing with toxicity testing, was discussed at any length. Meanwhile, problems concerning wholesomeness, nutrient depletion, carcinogenicity, and the direct and indirect effects of radiation were not discussed.

As shall be seen, the 1969 meeting was the first of three critical meetings held in Geneva at which WHO, IAEA and FAO officials asserted the safety and wholesomeness of irradiated foods, while failing to discuss a majority of the core issues raised in 1961 in Brussels. (*For a summary, see Table 1, next page. Further discussion follows.*)

In the case of the 1969 meeting, irradiation planners gave their “temporary acceptance” of irradiation for wheat and potatoes, pending further research.²⁵ At-

tendees did so despite a lack of discussion in the meeting report to six of the nine issues raised in Brussels – and without stating whether these six issues had been resolved.

Further, attendees gave their approval despite acknowledging recent evidence that cell-damaging and mutation-causing “substances may be formed in radiation-processed food,” and despite “a paucity of data” on cancer- and mutation-causing chemicals that may be present in irradiated foods.²⁶

MOREOVER, APPROVAL FOR wheat was granted despite a study conducted a year earlier in which mice that ate irradiated wheat flour died younger, experienced a higher death rate for offspring, and had more tumors than mice fed non-irradiated flour.²⁷

In another experiment, intestinal lesions developed in rats fed irradiated wheat flour. Attendees cited no rationale in dismissing the lesions as “probably unrelated to the consumption of irradiated flour.”²⁸

In yet another experiment, hens fed a diet that included irradiated wheat produced and hatched fewer eggs, and lost more embryos than hens fed non-irradiated food. Though calling these findings “disturbing,” and acknowledging “indirect evidence that vitamin D may be destroyed,” WHO, IAEA and FAO attendees endorsed irradiation for wheat.²⁹

Additionally, attendees of the Geneva meeting downplayed a contemporaneous report that explored many potential dangers

By 1969, most of the fundamental problems raised at the first major conference in Brussels had fallen by the wayside.

Table 1

A Dubious Record

How the Original Food Irradiation Research Agenda Has Largely Been Ignored

At the first major international conference on food irradiation, held in Brussels in 1961, WHO, IAEA and FAO officials documented nine key concerns they felt needed to be addressed before irradiated foods could be considered safe for human consumption. Only a few of these concerns, however, were addressed at the next three major conferences, held in Geneva in 1969, 1976 and 1980. Irradiation for all foods was endorsed in 1980, despite the fact that the original research agenda was largely ignored.

Concerns Raised in 1961	Discussion at later conferences		
	1969¹	1976²	1980³
Wholesomeness of Irradiated Foods	Limited	Limited	Limited
Irradiation's Effect on Vitamins	None	Limited	Limited
Irradiation's Effect on Protein	None	None	None
Irradiation's Effect on Fat	None	None	None
Irradiation's Effect on Carbohydrates	None	None	None
Testing for Toxicity	Yes	Limited	None
Likelihood of Causing Cancer	Limited	None	None
Induced Radioactivity in Food	None	None	Limited
Indirect Health Effects of Radiation	None	None	None

Key:

None: Issue not discussed at conference

Limited: Issue briefly discussed at conference

Yes: Issue discussed at some length at conference

¹ *Wholesomeness of Irradiated Food with Special Reference to Wheat Potatoes and Onions*. Report of a Joint FAO/IAEA/WHO Expert Committee, Geneva, 8-12 April 1969. World Health Organization Technical Report Series No. 451. Geneva: World Health Organization, 1970.

² *Wholesomeness of Irradiated Food*. Report of a Joint FAO/IAEA/WHO Expert Committee, Geneva, 31 August - 7 September 1976. World Health Organization Technical Report Series No. 604. Geneva: World Health Organization, 1977.

³ *Wholesomeness of Irradiated Food*. Report of a Joint FAO/IAEA/WHO Expert Committee, Geneva, 27 October - 3 November 1980. World Health Organization Technical Report Series No. 659. Geneva: World Health Organization, 1981.

of irradiated foods. Published in the World Health Organization's official journal two years before the 1969 meeting, the 32-page report describes in great detail the mutagenic and cytotoxic effects of irradiated foods.

The report was written by a University of Pittsburgh radiation chemistry professor working under a grant from the U.S. Atomic Energy Commission.³⁰ To date, the report stands as perhaps the most comprehensive analysis of the health problems associated with irradiated foods ever published in the English language.

In its report from the 1969 Geneva meeting, the WHO reduced the professor's findings to four sentences – disregarding his recommendations for further research, and ignoring his fears of another thalidomide-type disaster.³¹ (During the late 1950s and early 1960s, thousands of women in Europe and Canada who took the sleeping pill thalidomide lost their babies or gave birth to children with missing limbs, disfigurement, blindness and other major health problems.)

Drifting Further Afield

WITH THE PRECEDENT-SETTING approvals from the 1969 Geneva meeting in hand, irradiation planners redirected their attention away from making sure that irradiated food is safe to eat, to making sure that governments would legalize it, that corporations would sell it, and that people would eat it.

As a result of seven major conferences held in Europe between 1972 and 1980, WHO, IAEA and FAO officials concluded that people could safely eat food “treated” with a radiation dose of 1 million rads (or 10 kiloGray)³² – the equivalent of 330 million chest x-rays, a dose far beyond what the U.S. Food and Drug Administration had ever considered at that time.

Of those seven major conferences, however, only two dealt primarily with the safety and wholesomeness of irradiated foods. Moreover, the reports from those two conferences totaled 78 pages, only 16 of which dealt specifically with analyzing toxicity issues.^{33,34} The other five confer-

ences dealt primarily with issues related to efficacy, legalization, commercialization and acceptance.

The first of the two FAO/IAEA/WHO conferences that dealt primarily with safety and wholesomeness issues was held in Geneva in 1976.³⁵ The meeting

report fails to discuss six of the nine core issues raised in Brussels in 1961. (*See Table 1, page 19.*) And though numerous known and potential safety and wholesomeness problems were cited in the report, irradiation planners endorsed irradiation for eight common foods, including rice, wheat, potatoes, onions and chicken.

For starters, there was no discussion about the two most unsettling prospects of exposing food to high doses of ionizing radiation: the likelihood that food will become radioactive, and the potential indirect (“radiomimetic”) effects of irradiation.

The WHO ignored a report – published in its own journal – describing in great detail the mutagenic and cytotoxic effects of irradiated foods.

Like other FAO/IAEA/WHO documents, this report contains leaps of faith, discrepancies and unsubstantiated claims.

Attendees stated, for instance, that it “appears” the chemicals formed by irradiation (“radiolytic products”) “do not pose any toxicological hazards in the concentrations at which they have been detected.” Yet, they wrote that “it is not yet possible to give an assurance that all radiolytic products having possible toxicity have been identified.” They also said that “there remains the possibility that more subtle long-term effects (e.g. carcinogenesis, mutagenesis) may occur.”³⁶

In addition, attendees said – without citing any evidence – that irradiation would not cause “any significant deficiency in nutritional quality.” Yet, they acknowledged “it will be necessary to ensure that there is no cumulation [sic]” of nutrient loss.³⁷

PERHAPS MOST DISTURBINGLY, WHO, IAEA and FAO representatives gave their approval of irradiation for eight common types of food – wheat, potatoes, onions, chicken, rice, strawberries, cod and papayas – in the face of a still growing body of evidence suggesting that irradiated foods may not be safe to eat. Specifically, attendees cited studies showing that:

- A genetic aberration called polyploidy, which increases the number of chromosomes in a cell, developed in several animal species fed irradiated wheat.
- Genetic damage developed in mice fed irradiated potatoes;

- Ovary sizes changed in rodents fed irradiated potatoes; and
- Poison-producing fungi could form on irradiated potatoes that are improperly stored.³⁸

OVERALL, THE REPORT’S four-page discussion about the problems of toxicity and nutrient loss fails to mention a single experiment in the course of dismissing any need for worry. In both cases, irradiation planners blamed a lack of information, but stated nonetheless that they did not anticipate any serious problems.³⁹

The report did recommend further research into the chemicals formed by irradiation, toxicity and nutrient loss. But, as shall be seen, future conferences and reports consistently dismissed or, in some cases, misrepresented experimental findings that question the safety and wholesomeness of irradiated foods.

It is worth noting that this breakthrough decision by the FAO/IAEA/WHO committee to endorse irradiation for eight food types was based largely on research conducted by the International Project in the Field of Food Irradiation in Karlsruhe, Germany.⁴⁰ The program was established by the IAEA, and funded by the IAEA and U.S. Department of Energy, a federal government agency that oversees key aspects of the U.S. nuclear bomb program.⁴¹

It is also worth noting that although most of the eight foods types could not legally be irradiated in the United States at the time, the meeting was chaired by FDA

In 1976, the WHO, IAEA and FAO endorsed irradiation for eight types of food despite acknowledging the possibility of cancer and mutations.

Toxicology Director Hubert Blumenthal, for many years a key figure in setting U.S. food irradiation policy, and a member of the FAO/IAEA/WHO committee throughout the 1970s.⁴²

These two relationships are indicative of the central role that U.S. government officials and scientists have played in the course of endorsing higher irradiation levels for more types of food.

The Final Step

FOUR YEARS LATER, in 1980, WHO, IAEA and FAO representatives were back in Geneva for what would become perhaps the single most important meeting in the 40-year history of international deliberations over food irradiation policy.

Attendees of the week-long gathering reached an extraordinary decision that continues to shape – and likely will continue to shape for many years to come – not just the regulation and sale of irradiated foods in dozens of industrialized and developing countries, but, as economic structures become increasingly global, throughout the entire world.

Irradiation planners concluded that *any* food could be irradiated at doses up to 10 kiloGray⁴³ – the equivalent of 330 million chest x-rays – without posing a health hazards to people who eat it. As had been the case in prior meetings – and would be the case in future meetings – this decision was reached through leaps of faith, discrepancies and unsubstantiated claims.

And, as was the case with the 1969 and 1976 meetings, six of the nine core issues raised in Brussels in 1961 were not discussed in the meeting report. (*See Table 1, page 19.*) Most conspicuously, there is no discussion about methods to test the safety and wholesomeness of irradiated foods – perhaps the most fundamental problem that WHO, IAEA and FAO officials themselves said in 1961 needed resolution before further endorsements could be handed down.

OF THE THREE ISSUES THAT were discussed at the 1980 meeting, the question of wholesomeness was handled in particularly questionable fashion.

WHO, IAEA and FAO officials falsely stated in 1980: “All the toxicological studies have produced no evidence of adverse effects as a result of irradiation.”

First, attendees stated: “All the toxicological studies...have produced no evidence of adverse effects as a result of irradiation.”⁴⁴ This directly contradicts the report from the 1976 meeting, which references studies in which chromosomal aberrations

developed in several animal species fed irradiated wheat, and genetic damage developed in mice fed irradiated potato extracts.⁴⁵

Furthermore, numerous studies conducted over a more than 20-year period before the 1980 meeting revealed health problems in animals that ate irradiated foods. Some of these experiments were performed by the U.S. Army, which was searching for ways to preserve food destined for Vietnam and elsewhere. Among many health problems, rats died younger and suffered a reduction in live births; dogs

and mice gained less weight; dogs and rats had lower red blood cell counts; and rats developed more malignant tumors (including pituitary cancer) than animals fed non-irradiated food.⁴⁶

Second, seeking to dispense with a problem that remains unresolved to this day, attendees stated that radiolytic products formed in irradiated food “do not appear to pose any toxicological hazards in the concentrations at which they were detected.” This conclusion was reached primarily on the basis of “unpublished observations.” The meeting report does not state where, when or under what conditions these observations were made.⁴⁷

And, the meeting report does not discuss in detail and makes no reference to any published research concerning the potential toxicity of radiolytic products, despite three recommendations to do so made at the 1976 meeting.⁴⁸

Thirdly, and perhaps most significantly, representatives from the WHO, IAEA and FAO endorsed irradiation doses of up to 10 kiloGray for *any* food, even though the safety and wholesomeness of only eight individual types of irradiated food were specifically analyzed.

Further, the recommended maximum irradiation doses for 7 of these 8 individual food types, ranging from 0.15 kiloGray to 5 kiloGray, were far below the 10 kiloGray level that attendees endorsed for *all* foods. And, irradiation doses of at least

10 kiloGray were used in experiments for only 5 of these 8 types of food.⁴⁹

Despite these shortcomings, attendees stated in closing: “The irradiation of any food commodity up to an overall average dose of 10 kGy presents no toxicological hazard; hence, toxicological testing of foods so treated is no longer required.”⁵⁰

As shall be seen, WHO, IAEA and FAO officials did not waver from this declaration, despite an ever-expanding body of evidence that continues to throw into question the safety and wholesomeness of irradiated foods.

In U.S. Army experiments, rats died younger and suffered a reduction in live births; dogs and mice gained less weight; dogs and rats had lower red blood cell counts; and rats developed more malignant tumors.

CONTROLLING THE INFORMATION

‘Shaping Public Opinion’

THE SUPERFICIAL TREATMENT of toxicity issues in the 1976 and 1980 meeting reports brings into sharp focus the drift from the core safety and wholesomeness issues raised in Brussels 20 years earlier.

Instead of analyzing whether irradiated foods are safe, wholesome and nutritious, the WHO, IAEA and FAO by the end of the 1980s had shifted almost completely to studying how they could persuade more countries to legalize irradiated food, more corporations to sell it, and more people around the world to eat it.

As will be seen, the responsibility for the abbreviation of the process of assessing the safety and wholesomeness of irradiated foods lies with the International Atomic Energy Agency. And the responsibility for allowing this to happen lies with the World Health Organization.

Eight of the 12 major international conferences between 1972 and 1988 dealt primarily not with safety or wholesomeness, but legalization, commercialization, trade, information control and consumer acceptance. The official reports of all eight meetings were published by the IAEA.

ABOVE ALL, GETTING government officials and corporate executives on the same page regarding these key issues – particularly in developing nations where international trade potential was seen as the greatest – was, and remains today, the prime directive.

Accordingly, this transition cannot fully be understood without reviewing concurrent efforts by WHO, IAEA and FAO – led by the IAEA – to go one step further: To persuade people throughout the world that they should eat these products.

The first major meeting on acceptance issues was held in Bombay in November 1972. Irradiation planners came from far and wide: Bangladesh, Egypt, Indonesia, Iran, Iraq, Mexico, Nigeria, the Philippines, Thailand and Venezuela, as well as the host country of India. Standard-bearers Austria,

France, Germany, Japan and the United States were also represented.⁵¹

In summarizing the challenges facing the global food irradiation movement, attendees placed information control at the top of the list. This established a trend that would continue for the next three decades – a trend that directed the debate not only beyond safety and wholesomeness issues, but even beyond the questions of effectiveness and economic viability.

Accordingly, this trend served to marginalize the WHO and its role as the world's leading promoter of health, while elevating the role of the IAEA, the world's leading promoter of nuclear technology.

Of the 11 problems and solutions listed by attendees of the Bombay meeting, six dealt exclusively or significantly with information control. Speaking with an unusual degree of frankness,

they said:

- “Some of the most primitive suspicions about irradiated foods still prevail even in certain otherwise educated circles who, e.g. believe that irradiated food contains radioactive material. In many countries, public opinion still associates treatment with ionizing radiation with the atom bomb.”

- “It is especially important to provide correct information to all those responsible for shaping public opinion, like journalists, science writers,...research councils, univer-

Eight of the 12 conferences held between 1972 and 1988 dealt primarily not with safety or wholesomeness, but with legalization, commercialization, trade, information control and consumer acceptance.

sities, etc.”

- “In view of the great deficiency in correct information about food irradiation, major efforts should be made to provide the public with factual information. Improving the education of the general public should start at school.”⁵²

‘Facilitate the International Movement of Irradiated Food’

FIVE YEARS LATER, in 1977, irradiation planners met in the Netherlands to brainstorm ways to encourage more countries to legalize irradiation for the widest variety of foods possible.⁵³ At this meeting, the Codex Alimentarius

Commission was discussed at length for the first time. Codex, a joint program of the FAO and WHO based in Rome, was created in 1963 to set food safety standards for most of the world’s countries.

Though not legally binding at the time, Codex standards became *de facto* regulations for many countries that lacked the resources and expertise to establish regulations of their own. As a natural extension of this, Western nations were largely responsible for proposing and approving Codex standards, which were then adopted by developing nations.

With this framework in place, leaders of the global food irradiation movement – mainly those from Canada, Germany, the

United States and other Western countries – sought to utilize the Codex system to create global irradiation standards in their image. This strategy – which has been adopted by many other international, quasi-governmental agencies – has become known as “harmonization.”

The pipeline was ready-made: The FAO and WHO oversee Codex, and the agencies hold two of the three seats aboard the Joint FAO/IAEA/WHO Expert Committee on food irradiation. (Today, Codex standards are enforceable by the World Trade Organization, thus intensifying efforts to harmonize irradiation and hundreds of other food safety standards.)

Leaders of the global food irradiation movement – mainly those from Canada, Germany, the United States and other Western countries – sought to utilize the Codex system to create global irradiation standards in their image.

IT IS PERHAPS BECAUSE OF these intimate relationships that discussions were brief and to the point. The report from the 1977 meeting states: “Harmonization of national legislation and regulatory

procedures will enhance confidence among trading nations... It is obviously important for the relevant national regulations governing food irradiation to be harmonized...as to facilitate the international movement of irradiated food.”⁵⁴

With discussions of trade and legal issues well underway, attention was turned to perhaps the biggest challenge of all: public relations.

‘Develop a More Friendly Feeling to Irradiation’

IN 1982 – JUST TWO YEARS after an FAO/IAEA/WHO panel concluded that irradiated foods are safe to eat – the IAEA turned away from health issues and toward the problem of public relations. To lend assistance, the IAEA hired consultants to craft a strategy to enhance the image of irradiated foods in the minds of consumers worldwide.

The meeting at which the consultants’ findings were presented – “Marketing and Consumer Acceptance of Irradiated Foods” – was attended by a select group of 15 leaders of the global food irradiation movement.

Unlike most previous meetings, this gathering was not a joint effort of the WHO, IAEA and FAO. It was organized by an IAEA division specifically created to find “applications of atomic energy for food and agricultural development.”⁵⁵

Held in the IAEA’s home city of Vienna, the five-day meeting featured some of the most frank and revealing discussions ever published about marketing strategies designed to enhance the image and expand sales of irradiated foods.

Quoting from the report:

“Any word or statement containing the word ‘radiation’ or ‘radiate’ would inspire fear of a nonexistent danger...and therefore will cause the product to be avoided. The consultant group does not recommend

that the label carry a statement of the process.” (Emphasis in original.)

Efforts to find substitute words for “irradiated” resulted in some comical suggestions, including “processed with electrons” and “gammatized.”

In any event, the consultants recommended that “identification of the process should not be required on the label.” (Emphasis in original.)⁵⁶

WITH UNUSUAL CANDIDNESS, one of the presenters, an executive with a large South African retailer, talked extensively about the difficult task of resuscitating the image of nuclear technology:

“Any word or statement containing the word ‘radiation’ or ‘radiate’ would inspire fear of a nonexistent danger and therefore will cause the product to be avoided.”

– IAEA consultants, 1982

We have to know and understand the ordinary people... We must confer with experts in the various fields of advertising and psychology to put the public at ease, and develop a more friendly feeling to

irradiation. Symbols, if they must be used, must be developed not to look like radiation symbols. Names of the process must be simple and not necessarily related to the words irradiation or radiation... We start from a totally negative situation because nothing has threatened mankind so completely as total destruction through nuclear holocaust... Therefore, it is difficult for the ordinary person to accept that anything that is associated with radiation, even indirectly, is not going to cause terrible

death or disaster.^{57 *}

Another presenter at the IAEA meeting suggested that marketing campaigns for irradiated foods resemble those for low-calorie soft drinks and decaffeinated coffee.⁶³

The IAEA's consultants drafted an elaborate marketing plan listing a wide variety of "target groups": health authorities; government agriculture, commerce and consumer affairs officials; food industry executives; food retailers; caterers; educational broadcast channels; the mass media; and consumers. In most cases, the "appropriate body to deliver the message effectively" was listed as government officials or government-appointed organizations.⁶⁴

Many of the "messages" listed by IAEA's consultants were unsubstantiated or overstated, including statements that irradiation:

- "improves quality;"
 - "retains original taste, aroma, colour and texture [of food] for longer periods;"
 - "reduces dependency on chemicals;"
- and
- results in "savings in cost."⁶⁵

* Ironically, five years earlier, the U.S. Nuclear Regulatory Commission suspended a New Jersey irradiation company's license after a worker received a near-fatal radiation dose when a safety device failed. The company's president was convicted of conspiracy and making false statements to the NRC, and sentenced to federal prison.^{58,59,60,61,62)}

THE PARTICIPANTS INCLUDED several of the most influential members of the international food irradiation movement. Among them:

- Edward Josephson (chair) – former director of the U.S. Army's food irradiation program in Natick, Massachusetts.

- Jan Leemhorst – a high-ranking officer with the Association of International Industrial Irradiators. Leemhorst, of the Netherlands, later became a delegate to the International Consultative Group on Food Irradiation, which has consistently

dismissed evidence questioning the safety and wholesomeness of irradiated foods.

- Jacek Sivinski – engineering consultant with CH₂M Hill,⁶⁶ a prominent energy, nuclear technology, telecommunications, water, transportation and manufacturing company located in Colorado. The firm, often the recipient of government contracts, was hired by the U.S. government in the

1980s to find creative uses for huge stockpiles of highly radioactive cesium-137 generated by the production of nuclear weapons. Along with food, the firm also suggested irradiating sewage sludge and using it as fertilizer, and as feed for cattle and sheep.^{67 *}

* Speaking to Congress in 1984 about the possibility of selling Americans on the cesium program, Sivinski said: "Those people on Madison Avenue have us buying most of the things that we can afford, and many things that we can't."⁶⁸

“We have to know and understand the ordinary people. We must confer with experts in the various fields of advertising and psychology to put the public at ease, and develop a more friendly feeling to irradiation.”

– presenter, 1982 IAEA conference

'All Available Methods Should Be Exploited'

THREE YEARS LATER, in 1985, a robustly attended FAO/IAEA meeting in Washington, DC, entitled "Food Irradiation Processing" was dominated not by discussions of food safety or consumer benefits, but by strategizing ways to speed the "commercial introduction of the food irradiation process."

The final panel of the meeting – "Implementation of the Food Irradiation Process" – was not chaired by a government official, a food industry representative or a food safety expert, but by Sivinski of CH₂M Hill.⁶⁹

Among the panel's conclusions: "Acceptance of the concept of food irradiation by the consumer [is] recognized as being an essential prerequisite to the introduction of the process. All available methods of achieving this objective should be exploited; the production of both written and audio-visual material by international agencies, governments, and representatives of industry should be encouraged."⁷⁰

Retaining their focus on consumer acceptance, WHO, IAEA and FAO officials convened in France in 1988 to discuss – again – not safety and wholesomeness, but "public information on food irradiation."⁷¹ The meeting was co-chaired by Johannes Diehl, former director of the IAEA-funded International Project in the Field of Food Irradiation in Karlsruhe, Germany, which had conducted food

irradiation experiments that the FDA later rejected as scientifically inadequate.⁷²

By this point, the problem of consumer acceptance loomed so large that questions about safety and wholesomeness – even questions about whether the process worked or made economic sense – all but disappeared from the agendas of irradiation planners. The big problem was not what, where, why and how foods were being irradiated, but what consumers thought about eating these products.

"Why are foods with such scientifically proven health benefits not available to consumers?" attendees asked in their

report. "Because much of the information made available is neither accurate nor complete." To distribute this information, attendees suggested producing a television documentary for broadcast throughout the world, and publishing an international

newsletter "with the broadest possible circulation."⁷³

ON CLOSER INSPECTION, Diehl and the other meeting planners did not live up to their own standards for distributing "accurate and complete" information. The meeting report dismisses concerns about induced radioactivity, chemical changes, toxicity, nutritional deficiency, mutant microorganisms and radioactive hazards without citing any scientific research to support these conclusions.⁷⁴

Further, as will be discussed later (*see page 35-36*), the report falsely states that in "more than 25 years" of research, "no

Key participants of a 1982 conference included a consultant who wanted to irradiate sewage sludge and use it as fertilizer and feed for cattle and sheep.

compound has ever been identified in an irradiated food which is unique to the radiation process.”⁷⁵ In reality, chemicals called cyclobutanones, which have never been found to occur naturally in any food, were discovered 17 years earlier.

Later that year, in December in Geneva, the WHO, IAEA and FAO organized a meeting – once again – that dealt not with safety and wholesomeness, but “acceptance, control and trade of irradiated food.”⁷⁶

A provision of the “International Document on Food Irradiation,” a list of guiding principles that attendees adopted by consensus at the end of the meeting, summarized 16 years worth of brainstorming for ways to distribute irradiated foods throughout the world: “Acceptance of irradiated food by the consumer is a vital factor in the successful commercialization of the irradiation process, and information dissemination can contribute to this acceptance.”⁷⁷

The importance of an orchestrated public relations campaign was crystallized by one of the keynote speakers, a consumer affairs official with the Australian government, who attributed the lack of public acceptance of irradiated food to “hysteria and emotionalism.” The official suggested that the consumer movement had been “hijacked” by the “lunatic fringe.”⁷⁸

The Australian government official continued: “For the first time that I can remember, I see consumer organizations losing control over their direction and being led by individuals who have embarked on an anti-food irradiation campaign that has no room for logic or rationality.”⁷⁹

Dismissing Consumer Concerns

IT WAS AT THIS SAME CONFERENCE in Geneva in December 1988 where the WHO attempted to quiet what little organized opposition there was at the time

to food irradiation. The WHO went so far as to publish a 12-page response to a wide range of concerns raised by the International Organization of Consumers Union (IOCU).⁸⁰ Like several previous reports published or co-published

by the WHO, this document has numerous shortcomings.

First, of the nine points of contention that IOCU raised, the WHO failed to completely address two of the most significant issues: experiments that found health problems in animals that ate irradiated foods, and the related problems of residual contamination in irradiated foods and the overdependence on irradiation as a solution to food-borne illness.

On the issue of animal experiments, the WHO did not respond to findings of

An Australian government official attributed the lack of public acceptance to “hysteria and emotionalism,” and said the consumer movement had been “hijacked” by the “lunatic fringe.”

genetic damage, reproductive problems, tumors, weakened immune systems, stunted growth and kidney damage.⁸¹

On the issue of contamination, the WHO did not respond to questions dealing with quality standards for foods prior to irradiation; storage and handling of foods after irradiation; and training for public health, food safety and enforcement officials charged with assuring the wholesomeness of irradiated foods.⁸²

IN ADDITION, THE WHO's response:

- Dismisses concerns over the chemical byproducts formed in irradiated foods without addressing concerns raised 12 years earlier at the FAO/IAEA/WHO meeting in Geneva, at which attendees stated that "it is not yet possible to give an assurance that all radiolytic products having possible toxicity have been identified."⁸³

- Dismisses concerns over the irradiation of residual pesticides, food additives and contaminants without citing any evidence; and

- States incorrectly that nutrient destruction caused by irradiation is "insignificant."⁸⁴

Going Global

ARRIVING AT A COHESIVE strategy designed to enhance the legalization, commercialization and consumer acceptance of irradiated foods took 16 years – from the first major meeting in Bombay in

1972 to the 1988 meeting in Geneva. Meanwhile, the most important decision to endorse the safety and wholesomeness of irradiated foods took only three years longer – from the 1961 Brussels meeting to the 1980 Geneva meeting.

The disproportionate emphasis on expanding the proliferation of irradiated food, versus assessing its safety and wholesomeness, widened in the years to come. From 1985 to 1998, legalization and commercialization dominated the discussions at a series of eight meetings. Meanwhile, only four meetings dealing with safety and wholesomeness were held during that 13-year period.

Initiating a trend that continues to this day, most of these meetings on legalization and commercialization focused on promoting irradiated foods in developing nations, particularly those in Asia:

- At perhaps the most significant meeting of the eight, irradiation planners from the WHO, IAEA and FAO gathered in Marseille, France in 1995 to discuss how recent changes to the General Agreement on Tariffs and Trade (GATT) could be exploited to expand trade in irradiated foods. Specifically, new GATT provisions on Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT) were featured on the agenda. Because SPS and TBT are designed to liberalize trade by harmonizing food-safety standards worldwide, and by banning

The WHO did not address consumer concerns that animals fed irradiated food suffered genetic damage, reproductive problems, tumors, hampered immune response, stunted growth rates and kidney damage.

import restrictions not supported by “scientific evidence,” attendees agreed that national regulations should be harmonized “urgently.” Also at the meeting, an “Industry Working Group” was formed to expand the proliferation of irradiated foods worldwide. Members include executives from two of the world’s largest irradiation companies, GAMMASTER of the Netherlands and MDS Nordion of Canada.⁸⁵

- In 1992, five meetings in Asian countries were sponsored by the IAEA and the United Nations Development Programme – with no official participation by the FAO or WHO. Among the meetings:

- In the Philippines, it was recommended that irradiation be reclassified from an “additive” to a “process,” and that this be accomplished administratively instead of legislatively to avoid a “protracted and unpredictable” procedure. It was also recommended that the “global trend” to broaden the production of irradiated foods necessitates a “harmonizing and implementing” of laws and regulations worldwide.⁸⁶

- In South Korea, it was recommended that the country “permit the irradiation of all dry spices/seasonings.”⁸⁷

- In Sri Lanka, it was recommended that the country “expedite” the opening of an irradiation facility using radioactive cobalt-60. Draft food irradiation legislation was also presented.⁸⁸

- At a 1985 meeting in Bangkok co-sponsored by the Association of Southeast

Asian Nations (ASEAN), the opening address was given by the deputy prime minister of Thailand, who remarked that his country “has taken an important step to explore the possibility of commercialization” of irradiated foods.⁸⁹

THE FACT THAT DISCUSSING the sale of irradiated foods has consumed nearly as much time and energy as analyzing the safety and wholesomeness of these products, if not more, is indicative of deliberations that have been dominated by strategizing ways to commercialize irradiated foods at the expense of analyzing whether they are safe to eat.

The prime mover of this shift has been the International Atomic Energy Agency.

For the past 40 years, the IAEA has been the main organizer of international and regional confer-

ences on all aspects of food irradiation, including legalization, commercialization, trade, information control and consumer acceptance; published or co-published nearly all of the key reports on food irradiation; and, perhaps most importantly, the IAEA has become the overseer of scientific research on irradiated foods via its 1959 agreement with the WHO.

With this much power and influence at its disposal, the IAEA has, to a large extent, shaped the international debate on food irradiation – a debate that over the past 20 years has been driven as much, if not more, by economic interests than health considerations.

The disproportionate emphasis on expanding the proliferation of irradiated foods, versus assessing its safety and wholesomeness, widened in the years to come.

CONTROLLING THE FUTURE

Another Disturbing Trend

AT A TIME WHEN THE IAEA's efforts to further the acceptance of irradiated foods was reaching its peak, the World Health Organization's final analysis of the safety and wholesomeness of irradiated foods was also reaching a climax.

This analysis was spelled out in WHO reports published in 1994, 1995 and 1999. These three lengthy reports lay the foundation for an ongoing effort to allow any food grown virtually anywhere in the world to be irradiated at any dose – no matter how high. Each of these reports catalogues more than 100 experiments dating to the 1950s that assessed the safety of irradiated foods.

As unsettling as it may seem, a close review of these three reports reveals an effort to dismiss and misrepresent evidence suggesting that irradiated foods are not safe for human consumption.

Instead of presenting experimental findings in a consistent fashion from one report to the next, research that the agencies initially claimed yielded adverse effects in lab animals were later said to be “negative.”

In other words, the agencies took research that revealed health problems in

lab animals that ate irradiated foods, and stated that the research actually revealed no health problems that could be attributed to irradiation.

Moreover, some studies that the agencies initially claimed yielded adverse effects were not mentioned later.

In 1994, the WHO published a report entitled *Safety and Nutritional Adequacy of Irradiated Food*. The report stemmed from an FAO/IAEA/WHO meeting held in Geneva two years earlier. The document lists about 150 studies conducted on the

safety of irradiated foods, including those involving monkeys, dogs, rabbits, pigs, hamsters, mice, rats and fruit flies. Among these studies, the report lists a wide range of adverse health effects.⁹⁰

In the 1994 report, 11 studies classified as yielding adverse effects⁹¹ were re-classified as negative in an FAO/IAEA/WHO report

published in 1999, *High-Dose Irradiation of Food*.⁹² Among these studies, the 1994 report lists a wide range of adverse health effects in animals that ate irradiated foods, including birth defects and genetic damage; fatal internal bleeding and other blood disorders; fewer offspring; stunted growth and weight gain; and liver malfunction.⁹³

Additionally, 19 studies that the 1994 report classifies as yielding adverse effects⁹⁴ were not listed at all in an FAO/IAEA/WHO report published in 1995, *Review of High-Dose Irradiation of Food*.⁹⁵ Among these studies, the 1994 report lists a wide range

The WHO, IAEA and FAO took research that revealed health problems in animals that ate irradiated foods, and stated that the research actually revealed no health problems that could be attributed to irradiation.

Table 2

Scientific Shell Game

How Research Questioning the Safety of Irradiated Foods Fell by the Wayside

In 1994, 1995 and 1999, the WHO published the three most important documents since international deliberations over food irradiation policy began in 1961.^{1,2,3} These documents culminated in a significant endorsement: that any food could be irradiated at any dose, no matter how high. The agencies arrived at this decision after taking research that revealed health problems in animals that ate irradiated foods, and stating that the research actually revealed no health problems that could be attributed to irradiation. In addition to reclassifying studies that found “adverse effects” as “negative,” many studies that found negative effects were not mentioned later. These discrepancies occurred 52 times. (See discussion, p. 32, 34-35.)

Studies Finding Adverse Effects in 1994 Reclassified as Negative in 1999	11
Studies Finding Adverse Effects 1994 Not Listed in 1995	19
Studies Finding Adverse Effects 1994 Reclassified as Negative in 1995	1
Studies Finding Adverse Effects in 1995 Reclassified as Negative in 1999	21
<u>Total Discrepancies</u>	<u>52</u>

¹ *Safety and Nutritional Adequacy of Irradiated Food*. Geneva: World Health Organization, 1994.

² *Review of Data on High Dose (10-70 kGy) Irradiation of Food*. Report of a Consultation, Karlsruhe, Germany, 29 August - 2 September 1994. Geneva: World Health Organization, 1995.

³ *High-Dose Irradiation: Wholesomeness of Food Irradiated with Doses Above 10 kGy*. Report of a Joint FAO/IAEA/WHO Study Group, Geneva, 15-20 September 1997. Geneva: World Health Organization, 1999.

of adverse health effects in animals that ate irradiated foods, including tumors, mutations and chromosome damage, stunted growth, liver and thyroid malfunction, a blood disorder, prolonged estrous cycles, and atrophied testicles.⁹⁶

And, one study that the 1994 report classifies as yielding an adverse effect – stunted growth in rats fed irradiated oranges for five months⁹⁷ – was re-classified in the 1995 report as having no adverse effects.⁹⁸

NONE OF THE DISCREPANCIES between the 1994 report and 1995 report are specifically explained in the latter. The only reference in the 1995 report to the issue of interpretation of studies states that adverse effects attributable to irradiated foods “were sometimes not shared by other observers or were not confirmed by later work.”⁹⁹ There is no explanation in the 1995 report of the omission of 19 studies and the re-classification of another.

The discrepancies between the 1995 report and the 1999 report are just as troubling, if not more. In the 1995 report, 21 studies that yielded adverse effects¹⁰⁰ were re-classified as negative in the 1999 report.¹⁰¹ Again, these studies revealed a wide range of health problems in animals that ate irradiated foods, including increased mortality; fatal internal bleeding and other blood problems; decreased fertility and other reproductive problems; lower white blood cell counts; mutations and other genetic damage; liver malfunc-

tion; and stunted growth.¹⁰²

All told, there are 52 discrepancies in these three WHO reports in which studies that yielded adverse effects were later re-classified as negative, or in which such studies simply were not mentioned later. (*See Table 2, previous page.*)

THE DISCREPANCIES BETWEEN the 1995 report and 1999 report become more troubling considering that in 27 of the 102 studies listed in 1995, researchers “concluded [that] adverse effects” were observed in animals that ate irradiated foods. An endorsement of food irradiation when fully one-fourth of experiments revealed health problems in lab animals that ate irradiated foods would be difficult to defend.

With little explanation, authors of the 1999 report attributed nearly all of the health problems to nutritional deficiencies in the animal feed and other dietary factors.¹⁰³

This argument is of questionable merit, in light of a 1989 WHO statement: “If the animals [that ate irradiated food] are sick from vitamin deficiency, researchers will be hard pressed to determine whether observed adverse effects have been caused by irradiation or stem from the symptoms of vitamin deficiency.”¹⁰⁴

These re-classifications were, and continue to be, no small matter. The 1995 report, which focused on foods irradiated at doses higher than 10 kiloGray, led directly to the 1999 report. In this later report, the WHO, IAEA and FAO endorsed irradiation for any food at any dose – as high as the

In a 1995 FAO/IAEA/WHO report, 21 studies classified as yielding adverse effects were re-classified as negative in a report published four years later.

equivalent of several billion chest x-rays.

Further, the 1999 report is being used to support a proposal by the Codex Alimentarius Commission, which sets food-safety standards for more than 160 countries, to completely remove its 10 kiloGray dose cap for all foods.

Hidden Harm?

ANOTHER DISTURBING TREND relates to the WHO's handling of research conducted on unique chemical byproducts formed in certain irradiated foods called cyclobutanones. These chemicals – which have never been found to occur naturally in any food – have emerged from three decades of obscurity to centerstage of a deepening international debate that could have major repercussions for the global food irradiation movement.

Cyclobutanones were discovered in 1971 by University of Massachusetts food scientists Wassef Nawar and Paul Letellier, when they exposed fats commonly found in foods to ionizing radiation.¹⁰⁵

Because irradiation is responsible for forming these chemicals, which are completely distinct from any known food component, they are referred to as “unique radiolytic products.” Subsequent research found cyclobutanones in many common foods after irradiation, including chicken, pork, lamb, salmon, cheese, eggs, peanuts, certain fish and certain fruits.¹⁰⁶

Six years later, in 1977, Nawar made reference to cyclobutanones in a paper he presented at an FAO/IAEA/WHO meeting held in the Netherlands.¹⁰⁷ He also stated during open discussion that “we still do not know all the compounds produced in [irradiated food] and, in some cases, we cannot even measure them.”¹⁰⁸

At that same meeting, Nawar co-presented a paper with Charles Merritt of the U.S. Army's food irradiation program in Natick, Massachusetts.¹⁰⁹ (which was soon to be shut down due to a scandal and shoddy research). Merritt frequently col-

laborated with Nawar, who has conducted perhaps more research on radiolytic products than any scientist in the world. From 1978 to 1983, Merritt and Nawar coauthored six published articles on radiolytic products.¹¹⁰

DESPITE MERRITT'S FIRST-HAND, in-depth knowledge of Nawar's work on radiolytic

products, and despite being well-versed on the subject himself, Merritt went on to make one of the more notable errors in the 40-year history of international food irradiation deliberations. In 1988, at an FAO/IAEA/WHO conference on “public information on food irradiation” held in Cadarache, France, Merritt wrote:

Radiation chemistry studies [have shown] that the radiolytic products of major food components are identical, regardless of the food from which they are derived... In all stud-

Unique chemical byproducts formed in irradiated food called cyclobutanones have emerged from three decades of obscurity to centerstage of a deepening international debate.

ies on radiolytic products, no product has ever been identified in an irradiated food which is unique.¹¹¹

Merritt's error would go uncorrected for 11 years, during which four major WHO/IAEA/FAO reports were published – none of which addressed the issue.

Even when the agencies publicly acknowledged in 1999 that cyclobutanones are unique radiolytic products, the scientific evidence related to these chemicals and their toxic properties was misrepresented.

The toxic properties of cyclobutanones are downplayed in the same 1999 WHO report that questionably re-classified 21 studies. The report states that a recent experiment on human colon cells found one particular cyclobutanone – 2-DCB – caused “some cytotoxicity and an associated but weak effect in DNA.”¹¹² The study, however, found that “a cytotoxic effect with increasing dosage [was] clearly demonstrated,” and that “the results clearly demonstrate a genotoxic effect of 2-DCB.”¹¹³

The 1999 WHO report also states that an experiment on rats found a “small but positive effect” of 2-DCB.¹¹⁴ The study, however, found “slight but significant DNA damage.”¹¹⁵

And, the WHO report states that researchers used an “extremely high level” of 2-DCB.¹¹⁶ In reality, the researchers used a level of 2-DCB commensurate with an

irradiation dose that would be permitted under a proposal being considered by the Codex Alimentarius Commission and endorsed by the WHO, IAEA and FAO. Additionally, when researchers applied the FDA's standard toxicological safety factor of 100, 2-DCB was shown to have a genotoxic effect, thus failing the safety test required by the U.S. Code of Federal Regulations.¹¹⁷

TWO YEARS LATER, at a meeting in The Hague in March 2001, the WHO's representative to the Codex Committee on Food Additives and Contaminants

(CCFAC) stated that “the available evidence did not indicate that 2-DCB posed a public health risk.”¹¹⁸ This statement was made despite the fact that toxicity experiments on 2-DCB were still underway, and despite several warnings from scientists conducting the experiments that additional research is necessary.

In 1998, for example, these scientists wrote: “[F]urther clarification is needed to determine whether these results are relevant to the safety of irradiated foods... The results urge caution, and should provide impetus for further studies.”¹¹⁹

Also at the 2001 CCFAC meeting in The Hague, a representative from the International Consultative Group on Food Irradiation (an FAO/IAEA/WHO project that recommends food irradiation policies to Codex) said in regard to ongoing cyclobutanone experiments that “prelimi-

U.S. Army researcher Charles Merritt falsely stated in 1988: “In all studies on radiolytic products, no product has ever been identified in an irradiated food which is unique.”

nary results were negative with regard to genotoxicity and cytotoxicity.”¹²⁰ In reality, these experiments attributed genetic damage, tumors and cellular damage to cyclobutanones, and found that these chemicals “promote the colonic carcinogenesis process” in rats.¹²¹

THE EUROPEAN COMMISSION cited this discrepancy in formal comments submitted to the CCFAC last December. The EC said it “considers it as prudent not to proceed” with the Codex proposal to remove the 10 kiloGray dose cap.¹²²

Two months later, in February 2002, a key EC food safety panel voted to delay a proposal to legalize irradiation for several types of food – including frozen herbs, dried fruit, cereal flakes, egg whites, frog legs, peeled shrimp and certain chicken meats – in all 15 European Union nations until the ongoing experiments on cyclobutanones are completed.

A preliminary report on these experiments, conducted by a team of German and French scientists, states:

[Cyclobutanones] potentiate the effect of an inducing carcinogen on the long term. This was revealed by the increase of colonic preneoplastic lesions and the development of a higher number of colon tumours with larger size... This suggests that, in the model experiment [cyclobutanones], although they do not induce carcino-

genesis per se, rather promote the carcinogenic process. Finally, it was shown that small fractions of [cyclobutanones] had been stored in rat adipose tissues and excreted in faeces of the treated rats. This indicates that most of the [cyclobutanones are] metabolically transformed or stored in other organs... In our opinion further investigations, including confirmations of our results by other laboratories, will help to elucidate a possible risk associated with the consumption of irradiated fat-containing foods.¹²³

A recent study found that cyclobutanones “promote the carcinogenic process” in rats and caused “a higher number of colon tumours with larger size.”

At the CCFAC’s latest meeting, held this past March in Rotterdam, the EC’s concerns over cyclobutanones led the CCFAC to delay by at least a year the Codex proposal to remove the 10 kiloGray dose cap.¹²⁴ Formal concerns over cyclobutanones have been expressed to the CCFAC since

2000, when Germany went on record as opposing the Codex proposal.¹²⁵ Since then, Poland¹²⁶ and Sweden¹²⁷ have also come out in opposition to the proposal.

Despite the fact that toxic properties of cyclobutanones have been demonstrated in four consecutive experiments since 1998; despite the fact that research is still ongoing; and despite warnings from researchers that their findings “urge caution,”¹²⁸ IAEA officials stated at the Rotterdam meeting: “No scientific grounds have been established for [cyclobutanones] to be considered a public health risk.”¹²⁹

RECOMMENDATIONS

DUE TO THE IRREGULARITIES in the process by which the World Health Organization, the International Atomic Energy Agency, and the United Nations' Food and Agriculture Organization have endorsed food irradiation, Public Citizen makes the following 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 the conclusions and suspend the recommendations issued in the 1999 report, *High-Dose Irradiation: Wholesomeness of Food Irradiated with Doses Above 10 kGy*, which endorsed 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 raised at the FAO/IAEA/WHO meeting on the wholesomeness of irradiated food held in Brussels, 23-30 October 1961. Research should also be conducted into key safety and wholesomeness issues raised since the Brussels meeting, including 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. These chemicals include benzene, toluene and methyl ethyl ketone.

- A 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 independent should review all WHO, IAEA and FAO publications, and

identify and correct all inaccurate, misleading and incomplete statements regarding food irradiation.

This independent panel should also investigate the role played by the IAEA in the process of endorsing food irradiation, and whether the agency's role has corrupted the integrity of the analysis of the safety and wholesomeness of irradiated foods. Meetings of this panel should be open to the public, and all materials and findings should be distributed to member nations and be made available to the public.

The WHO, IAEA and FAO should place a moratorium on recommendations to expand food irradiation. The agencies should withdraw their endorsement for irradiation for all foods at any dose – no matter how high.

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BAD TASTE

THE DISTURBING TRUTH ABOUT
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