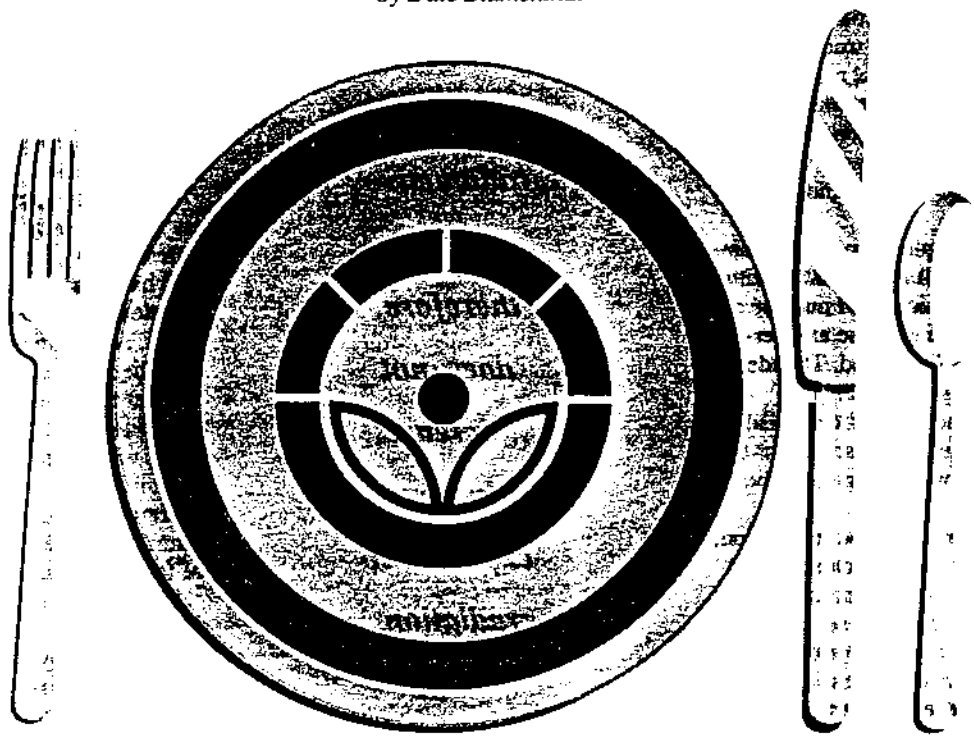
FOOD IRRADIATION

Toxic to Bacteria, Safe for Humans

by Dale Blumenthal



A measure FDA announced in the *Federal Register* this year may go unused because of consumer apprehension. On May 2, 1990, FDA issued a rule defining the use of irradiation as a safe and effective means to control a major source of food-borne illness—*Salmonella* and other food-borne bacteria in raw chicken, turkey, and other poultry. However, FDA has received written objections that it must evaluate before the rule can go into effect.

Experts believe that up to 60 percent of poultry sold in the United States is contaminated with *Salmonella*, according to Joseph Madden, Ph.D., acting director of FDA's division of microbiology. Madden adds that studies suggest that all chicken may be contaminated with the *Campylobacter* organism.

People often become ill after eating contaminated poultry. Symptoms may range from a simple stomachache to incapacitating stomach and intestinal disorders, occasionally resulting in death.

As equipment used to irradiate food is regulated as a food additive, the FDA rule is the first step in permitting irradiation of poultry. However, although the U.S. Department of Agriculture will soon propose a companion rule finalizing guidelines for commercial irradiation of poultry, industry groups cite consumer apprehension as a drawback to implementing the procedure. And reaction to FDA's new rule has elicited more questions than answers.

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A Scary Word

Irradiating food to prevent illness from food-borne bacteria is not a new concept. Research on the technology began in earnest shortly after World War II, when the U.S. Army began a series of experiments irradiating fresh foods for troops in the field. Since 1963, FDA has passed rules permitting irradiation to curb insects in foods and microorganisms in spices, control parasite contamination in pork, and retard spoilage in fruits and vegetables.

But, to many people, the word irradiation means danger. It is associated with atomic bomb explosions and nuclear reactor accidents such as those at Chernobyl and Three Mile Island. The idea of irradiating food signals a kind of "gamma alarm," according to one British broadcaster. (Gamma rays are forms of energy emitted from some radioactive materials.)

But when it comes to food irradiation, the only danger is to the bacteria that contaminate the food. The process damages their genetic material, so the organisms can no longer survive or multiply.

Irradiation does not make food radioactive and, therefore, does not increase human exposure to radiation. The specified exposure times and energy levels of radiation sources approved for foods are inadequate to induce radioactivity in the products, according to FDA's Laura Tarantino, Ph.D., an expert on food irradiation. The process involves exposing food to a source of radiation, such as to the gamma rays from radioactive cobalt or cesium or to x-rays. However, no radioactive material is ever added to the product. Manufacturers use the same technique to sterilize many disposable medical devices.

Tarantino notes that in testing the safety of the process, scientists used much higher levels of radiation than those approved for use in poultry. But even at these elevated levels, researchers found no toxic or cancer-causing effects in animals consuming irradiated poultry.

Beyond the Gamma Alarm

Market tests show that once consumers learn about irradiation, they will buy irradiated food. For example, Christine Bruhn, Ph.D., of the University of California's Center for Consumer Research in Davis, Calif., reports that irradiated papayas outsold the nonirradiated product by more than 10 to 1 when in-store information was available. And, Danny Terry, Ph.D., a consumer researcher at Central Missouri State University in Warrensburg, Mo., says that a recent market test he conducted with irradiated strawberries showed that consumers who received written information about irradiation along with the fruit were slightly more interested in buying irradiated products in the future.

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Nevertheless, concern about the process remains strong. Since 1989, three states (Maine, New York, and New Jersey) have either banned or issued a moratorium on the sale of irradiated foods. According to a U.S. General Accounting Office report prepared in May 1990 at the request of Rep. Douglas Bosco (D-Calif.), "officials of these states told us that their states took the actions in response to public concern by citizen groups rather than as a result of scientific evidence questioning the safety of food irradiation."

"Something quite aside from food safety appears to lie at the root of the entire controversy, which may explain why it continues to flourish in the face of all safety assurances," says Carolyn Lochhead in the August 1989 issue of *Food Technology* magazine. "Many opponents charge that the Food and Drug Administration, the World Health Organization, and the nuclear power industry are conspiring to promote the technique as a way to dispose of nuclear waste."

Lochhead discusses concerns that one source of radioactive material for food irradiation, cesium 137, is recovered from spent fuel rods in nuclear power plants. The conspiracy charge promotes unwarranted fear among consumers, says Lochhead.

"For economic, as well as other, reasons," says Department of Energy official Barbara Thomas, "the U.S. commercial nuclear power industry does not attempt to recover material, such as cesium 137, from spent fuel."

According to DOE, commercial irradiators in the United States choose their irradiation source (whether the gamma-emitting radioactive materials cesium 137 or cobalt 60, or accelerators that can produce electrons, x-rays or both) based on practical requirements, such as cost. The product to be irradiated also influences the choice. Many foods require low energy levels to kill harmful organ-

...ms, while medical supplies may need higher doses for sterilization.

However, the fallout from a falsely characterized cesium recovery plan has charged the legislative atmosphere. George Giddings, Ph.D., a consultant food scientist and expert in food irradiation matters, sees it as the "single most inciting issue in the food irradiation area." Giddings suggests that legislators are wary of supporting food irradiation measures some critics say are linked to increased nuclear activity, including the production of nuclear weapons.

A 1982 congressional amendment bars using spent commercial fuel for military purposes. The Department of Energy has no interest in changing this law.

Michael Colby, director of Food and Water, Inc., one of the more vocal groups lobbying against food irradiation, says the new poultry regulation will lead to nuclear hazards, including "the continued generation of radioactive wastes for which a secure isolation technology has yet to be developed." Colby submitted the comment during a 30-day objection period following publication of the final rule. In the case of food additives, FDA evaluates objections in order to determine whether any changes in the final rule are appropriate. Based on FDA's findings, those raising the objection may be entitled to a hearing before the commissioner.

"As soon as consumers are ready to accept irradiated poultry, we'll use the process," say poultry associations.

FDA inspections of all irradiation plants conducted from 1986 to 1989 showed no violations of the food irradiation regulations.

Giddings contends that groups such as Food and Water play on the public's fear of nuclear energy and misrepresent the safety questions surrounding food irradiation. They frame it as a "populist" issue to legislators and pressure them to introduce legislation banning food irradiation.

Consumer Uncertainty

Other consumer groups have taken more moderate positions. The Center for Science in the Public Interest, for instance, says that "at a minimum, irradiated foods should be labeled" so that consumers know what they're buying.

Since 1966, FDA has required that irradiated foods be labeled as such. In 1986, a mandatory logo was added to this labeling requirement. The international logo, first used in the Netherlands, consists of a solid circle, representing an energy source, above two petals, which represent the food. Five breaks in the outer circle depict rays from the energy source.

Consumer surveys show mixed reactions. According to an article in the October 1989 issue of *Food Technology* magazine, which reviewed surveys conducted by various academic and con-

Poultry Producers Respond

With one hand, poultry producers are giving a thumbs up sign to FDA's rule permitting irradiation of poultry. With the other, they are putting its use on hold.

Stuart Proctor, executive vice president of the National Turkey Federation—which represents 95 percent of turkey growers and producers—says "we are encouraged by FDA's decision. The industry should be allowed to use any science available that makes food safe from food-borne illness and also is safe." He continues, "as soon as consumers are ready to accept the product, we'll use it."

As George Watts, president of the National Broiler Council, says, "the U.S. poultry industry has always been a consumer-driven business, demonstrated by the variety of new products developed over the years to meet the American public's demand." He says that should consumers desire irradiated food products, "the industry will respond."

Perdue Farms, Inc., a large, East Coast chicken producer, says it has no plans to use the irradiation process. Steve McCauley, a company spokesman, said that the firm sees no need for decontaminating its poultry with irradiation because Perdue tests its products stringently. He claims this keeps them safe from contamination.

The need is for consumer education. Although poultry groups say they do not have the resources for the costly campaign needed, they believe that once consumers understand more about food irradiation, they will demand it.

Proctor compares reaction to food irradiation to earlier apprehension about microwave ovens. Once consumers recognized microwave cooking as safe, desire for fast and convenient food led to a microwave revolution. He said he could foresee the same demand for irradiated food, prompted by a desire to cut down on food-borne illness, once consumers are no longer afraid of the process. ■

—D.B.

U.S. Food Irradiation Rules

Product	Purpose of Irradiation	Dose Permitted (kGy)	Date of Rule
Wheat and wheat powder	Disinfest insects	0.2-0.5	8/21/63
White potatoes	Extend shelf life	0.05-0.15	11/1/65
Spices and dry vegetable seasoning (38 commodities)	Decontamination/ disinfest insects	30(max.)	7/5/83
Dry or dehydrated enzyme preparations	Control insects and microorganisms	10(max.)	6/10/85
Pork carcasses or fresh non-cut processed cuts	Control *Trichinella spiralis*	0.3(min.)-1.0(max.)	7/22/85
Fresh fruits	Delay maturation	1	4/18/86
Dry or dehydrated enzyme preparations	Decontamination	10	4/18/86
Dry or dehydrated aromatic vegetable substances	Decontamination	30	4/18/86
Poultry	Control illness-causing microorganisms	3	5/2/90

Measuring Irradiation

Absorbed radiation is measured in units called "Grays." The amount of Grays refers to the level of energy absorbed by a food from ionizing radiation that passes through the food in processing.

1,000 Grays = 1 kiloGray (1 kGy)

In the past, the term "rad" was commonly used. It stands for "radiation absorbed dose."

100 rad = 1 Gy

sumer research groups, consumers are more concerned about chemical sprays and pesticide residues, preservatives, and food-borne illnesses than about food irradiation. A Louis Harris poll, conducted from 1984 through 1986, however, found that 76 percent of Americans consider irradiated food a hazard.

"Consumer acceptance of irradiation as a treatment for foods is showing only minimal positive change, at best," said Fred Shank, Ph.D., director of FDA's Center for Food Safety and Applied Nutrition, in a symposium on food irradiation at the 1990 annual meeting of the Institute of Food Technology. Shank said that the greatest concern about the process is its perceived association with radioactivity and nuclear power.

Another concern, raised often in comments to FDA when it proposed the use of radiation to kill microorganisms in spices and insects in fresh foods, is that irradiation may produce substances not known to be present in nonirradiated foods.

These substances, described by scientists as "radiolytic products" sound more threatening than they actually are, says George Pauli, Ph.D., an FDA food irradiation expert and policy maker. For instance, Pauli says, when we heat food it often creates new substances that produce new tastes and smells. These substances could be called thermolytic products—an intimidating word for a harmless change.

In 1979, FDA established the Bureau of Foods Irradiated Food Committee (BFIFC) to review safety assessments of irradiated food. Experiments have shown that very few of these radiolytic products are unique to irradiated foods. In fact, the BFIFC estimated that approximately 90 percent of the substances identified as radiolytic products are found in foods that have not been irradiated—including raw, heated and stored foods. Moreover, many of these substances are not well known because the foods usually hav not been studied at the minute (parts per million) levels scrutinized by chemists who analyzed the irradiated foods.

Proving the Absence of a Ghost

For 30 years, FDA has reviewed experiments attempting to show possible harmful effects of consuming irradiated food. But, "just as we can't prove the absence of a ghost, scientists cannot point to some 'thing' that proves the absence of risk," Pauli adds. "One can only search diligently."

The only relevant safety issue in food irradiation, BFIFC determined, would be the production of harmful substances. BFIFC examined all available data on such products obtained by the U.S. Army's high-protein food sterilization program. Only six substances (found in beef irradiated at 50 kiloGrays) of the 65 identified by Army researchers could not be verified in the literature as present in nonirradiated foods. These six substances were similar to natural food constituents.

The committee determined that even a diet consisting mainly of food irradiated at the 1 kiloGray level (see accompanying article) would not be likely to contain a significant amount of any of these products.

BFIFC concluded in 1980 that food irradiated at a dose not exceeding 1 kiloGray is safe for human consumption, and that animal tests are recommended only for foods irradiated above 1 kiloGray.

A second team of scientists then reviewed all animal feeding and other irradiated food toxicity studies—several hundred—from agency files and the scientific literature and reaffirmed the BFIFC recommendation.

Since then, FDA has set the use of food irradiation at levels higher than 1 kiloGray. The 1990 rule, for instance, would allow irradiation of poultry at levels up to 3 kiloGrays after animal data again revealed no hazardous effects.

In a separate review, the international community reached a similar conclusion. Representatives from the United Nations, the International Atomic Energy Agency, and the World Health Organization, making up the joint "Committee on the Wholesomeness of Irradiated Food," declared in 1980 that the irradiation of any food up to an overall average dose of 10 kiloGrays causes no toxicological hazard and introduces no special nutritional or microbiological problems. The Codex Alimentarius Commission, a United Nations organization that recommends international food standards, adopted the recommendation in 1983.

According to a U.S. General Accounting Office report, state officials say that measures banning food irradiation have resulted from activist pressure, not scientific evidence.

The Future of Food Irradiation

The World Health Organization believes irradiation can substantially reduce food poisoning. According to a 35-year WHO study, there has been a constant increase in the incidence of food-borne diseases, as well as emergence of "new" disease-causing organisms, such as *Campylobacter* and *Listeria*.

Food irradiation would be another weapon in the arsenal against food-borne illness. FDA and WHO, however, emphasize that irradiation is not a substitute for careful handling, storage and cooking of food. Irradiated poultry can become recontaminated, for instance, if placed next to contaminated, nonirradiated poultry, or left unrefrigerated so that remaining organisms can grow.

To date, 35 countries have issued unconditional or provisional clearances allowing irradiation of commercial foods. Of the more than 140 industrial gamma irradiators in over 40 countries, 29 are used part-time to irradiate food items and conduct food-related research. (They are used mostly for sterilizing disposable medical supplies.) A 1989 Library of Congress report prepared for Congress estimates that by the early 1990s, 55 facilities worldwide will be used for food irradiation and related food irradiation research.

However, as Tanya Roberts of USDA's Economic Research Service stresses, the future of irradiation depends upon consumer acceptance—based largely on proof that the process can produce safer foods at lower cost. Roberts estimates that the cost of medical treatment and lost productivity for five food-borne diseases—trichinosis, toxoplasmosis, salmonellosis, campylobacteriosis, and beef tapeworm—totals more than $1 billion annually.

The last chapter in the story of food irradiation still remains to be written. Will the fear of nuclear energy prevent this technology from being used to its fullest potential? Or will education win acceptance for a procedure that can lower the incidence of food-borne illness? Only consumers can supply the answers. ■

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