Food irradiation—a weapon in the arsenal against hunger

An address by Dr. Martin A. Welt, president of Alpha Omega Technology, Inc., Parsippany, N.J., to the founding conference of 'Food for Peace,' Sept. 4, 1988, Chicago.

In 1955, almost 33 years from today, President Eisenhower proclaimed the Atoms for Peace Program. That program should have been the genesis of Food for Peace, since the research on the radiation preservation of food, first started in earnest by the U.S. Army Quartermaster Corps in 1943 under a contract to the Food Science Department at MIT, had shown remarkable potential.

Lack of governmental leadership, however, and bureaucratic snafus held the program back until 1964, when Food and Drug Administration (FDA) approval was given for the irradiation of potatoes to prevent sprouting, and for wheat and wheat flour to prevent insect infestation. Instead of rapid progress, the program floundered, and it was not until 1983, when the FDA approved my petition for the radiation sanitization of spices, that any positive action was taken by the United States. We had previously submitted a petition to the FDA in 1978, calling for the radiation disinfection of poultry for salmonellae. That approval has been awaiting final signature for at least two years, with no reason given for the delay other than that it is "political."

In 1985, we gained further FDA approvals for insect disinfestation and sanitization of herbs, vegetable seasoning, and dried powdery enzymes, followed by our most important accomplishment, the approval for irradiation of fresh pork cuts to control trichinae parasites. The importance of this last approval was that it represented for the first time FDA willingness to endorse the safety of the food irradiation process for a major food commodity. We felt that this would surely open the door for the commercialization of food irradiation, since United States FDA approval was critical for acceptance by developing nations.

This optimism was intensified when the FDA shortly thereafter issued a lengthy amendment to the Food and Drug Act that approved the low dose irradiation of fruits and vegetables for insect disinfestation and increased the maximum dosage allowed for the irradiation of spices, herbs, vegetable seasoning, and enzymes.

Regulatory inaction

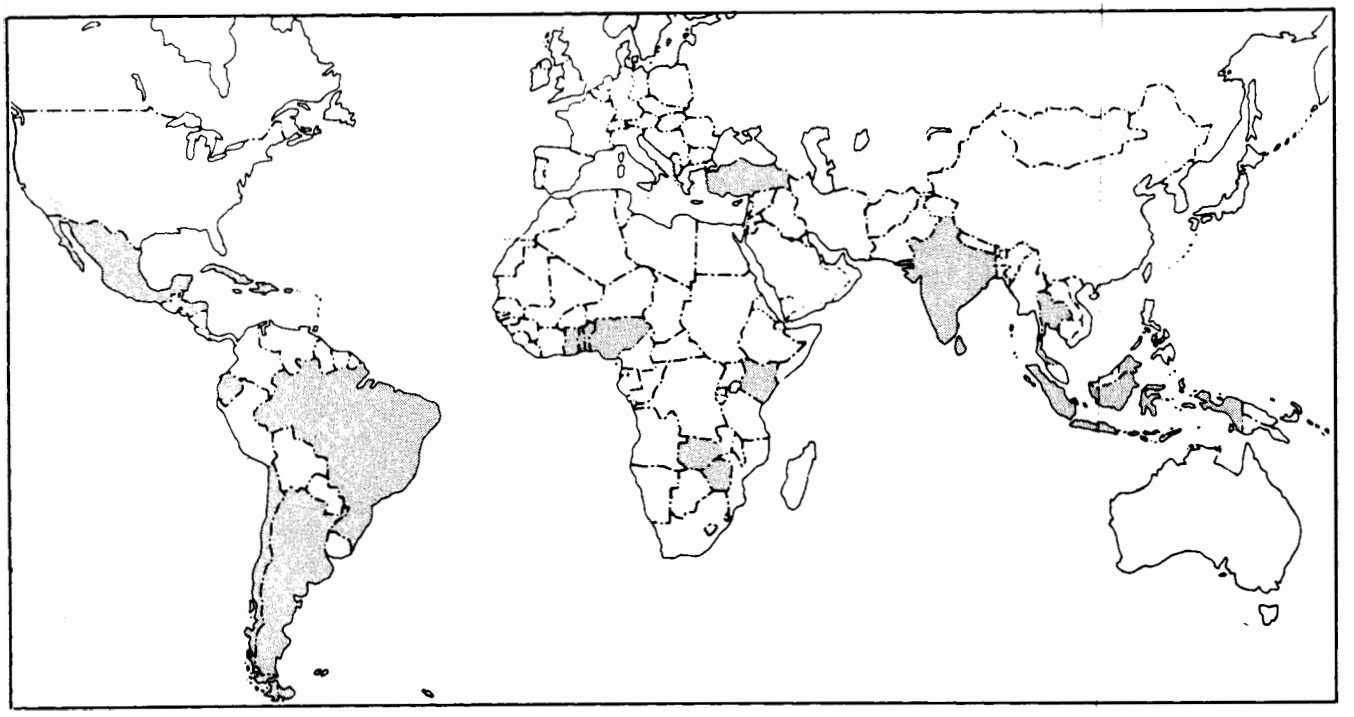
In spite of the eventual action of the FDA, commercialization was still hampered by regulatory inaction because the U.S. Department of Agriculture (USDA) now became responsible for regulation of the labeling and marketing of the irradiated product and for inspection of the irradiation facilities. In spite of the fact that the USDA had continually expressed interest in obtaining FDA food safety approval for food irradiation, particularly for poultry, pork, fruit, and vegetables, no machinery had been put in motion to gain any benefit from the FDA action. In fact, after a USDA Federal Register announcement Jan. 15, 1986 approving the irradiation of pork for trichinae control, administrative measures were taken that have successfully prevented any pork from being irradiated in the United States as of this date.

In spite of USDA pronouncements that government policy was to find ways to increase exports of U.S. pork, and knowing that foreign buyers were sometimes reluctant to purchase our fresh pork because of presumed trichinae infection, there was still no leadership in overcoming the questions raised concerning the necessary quality assurance documentation, despite two years of intense and costly effort.

Some basics of food irradiation

To better understand food irradiation technology, let us answer several obvious questions. Food irradiation is a process that utilizes ionizing radiation (energy) to assist in preservation of food or to bring about other beneficial results.

FIGURE 1
Developing sector nations considering food irradiation



The greatest need for food irradiation is in the developing sector, where now 60 to 75% of food products are lost to insects, rodents, or spoilage.

What is ionizing radiation? Ionizing radiation is a form of electromagnetic energy that is capable of stripping an electron from an atom. In order to be ionizing, the energy form must be above the electron binding energy holding it to the atom. The electromagnetic spectrum contains both high and low energy forms. For example, microwaves and infrared rays have long wavelengths and relatively low frequencies and energies, whereas x-rays, gamma rays, and cosmic rays have just the opposite. Visible light, ranging from red to violet and ultraviolet have energies between the types described. Very high temperatures can also strip an electron from an atom and cause it to be ionized.

Can the form of ionizing energy used for food irradiation make the food radioactive or somehow leave the radiation in the food? Both the Codex Alimentarius Commission, an agency of the Food and Agriculture Organization of the United Nations, and the U.S. FDA have endorsed only those forms of ionizing energy that cannot cause *any* substance to become radioactive.

How is food irradiated? Alpha Omega Technology, Inc. has developed a computer-controlled pallet irradiation facility that can transport bulk or packaged products into a specially designed radiation chamber where the product receives a controlled dosage of ionizing radiation. The radiation chamber is designed in accordance with international standards to prevent environmental impact or worker exposure.

Why use food irradiation? Food irradiation is actually more than one process, depending on the dose delivered, and can be compared to cooking food for varying times and at different temperatures. Here is a list of the processes and the typical food products treated:

Sprout inhibition: Potatoes, yams, onions, garlic.
Insect disinfestation: Fruits, spices, grain, cocoa.
Shelf life extension: Fresh poultry, fish, mangoes.
Pathogen elimination: Poultry (salmonellae), pork.
Shelf-stable meals: Prepared packaged meals (all).
Virus inactivation: Meats and vaccines.

What are the benefits of food irradiation? No other method of food preservation can reduce spoilage for an expanded market, reduce energy costs below those of canning and freezing, and eliminate the need for post-harvest chemical fumigation.

Where has food irradiation been approved? As of March 1988, food irradiation has been approved in Canada, Chile, Brazil, Holland, Belgium, France, Norway, U.S.S.R., U.S.A., Japan, India, Thailand, Philippines, Australia, South Africa, Israel, Bangladesh, Hungary, Italy, East Germany, China, Czechoslovakia, Denmark, Poland, New Zealand, Spain, U.K., Yugoslavia, Argentina, Finland, Bulgaria, Indonesia, Korea, and Uruguay.

Philip Ulanowsky

Dr. Welt discusses his work with participants at the Food for Peace conference, following the science panel.

Greatest need in developing sector

The greatest need for food irradiation technology in the world today is in developing nations, where alternative methods of food preservation are either nonexistent or too expensive. The ability to extend shelf life is critical where food distribution systems are lacking, and the ability to preserve prepackaged balanced nutritious meals without freezing or refrigeration can mean the difference between life and death for whole populations in time of natural or man-made disasters. The current situation in Bangladesh and southern Sudan are two immediate cases in point.

However, the preparation and stockpiling of the shelf-stable (no refrigeration required) radiation-sterilized food must take place prior to the disaster. This requires vision and nonpolitical determination to adopt the well-proven technology that has been used by the U.S. Appolo and Space Shuttle programs since the 1960s, and by cancer and other seriously ill hospital patients in the United States, Holland, and Great Britain for more than 30 years.

Developing nations cannot and should not rely on surplus handouts from developed nations. Charity food lessens the will to seek domestic self-sufficiency. The old proverb, "Give a hungry man a fish and he is satisfied for a day, but give him a fishing pole and he will be satisfied for a lifetime," is certainly relevant. Alpha Omega Technology, Inc. (AOT) believes in this concept and has developed a joint venture program aimed at establishing our proprietary irradiation technology in developing nations, with relatively low start-up costs and continuing technology transfer by AOT to help create economically viable situations. To be successful, the program requires the support of the host government.

A commercial irradiation facility, such as the patent pending AOT Model T6-V™ pallet irradiator can help a developing nation increase its hard currency export revenues, while extending and preserving domestic food supplies that are free of food-poisoning pathogens. For example, why ship spices from the developing nation to Holland or the United States for irradiation? The value added can be had where it is most needed, and the resultant product can be shipped to the end user for a lower unit cost. Further, methyl bromide fumigation can be eliminated, thereby excluding highly toxic bromide residues from the spice, while adding to the quality.

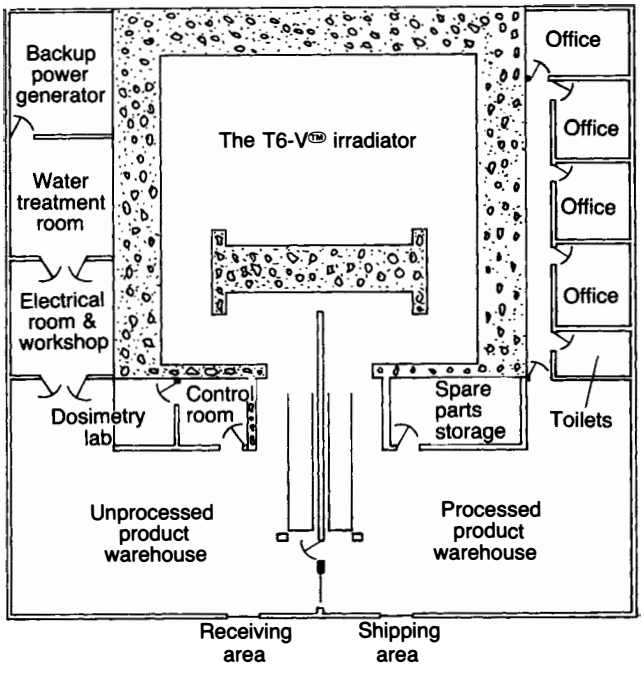
Mangoes and other tropical fruit are in great demand in the United States, Japan, and Western Europe. Imports of these products would not impact domestic farmers since the products are not grown or are in very short supply in those economies. Yet, these products are cheap and plentiful in many developing nations of the world and, with irradiation technology, substantial export revenues can be generated.

What about the U.S. farmer?

What about the U.S. farmer, poultry, and livestock producer? We sometimes wonder why these individuals are the only ones in our society who are penalized for being productive. If yields go up, prices go down, and economic disaster is close at hand. Two years ago, I proposed to Secretary of Agriculture Richard Lyng a methodology using radiation preservation techniques that might offer a solution. Unfortunately, there has been no reply or discussion concerning the proposal.

We know that radiation sterilization methods can provide shelf-stable meat, poultry, fish, and shellfish products, since

FIGURE 2
Typical irradiation facility layout



Source: Alpha Omega Technology, Inc.

In this schematic of a typical food irradiation facility, the unprocessed food enters at left, travels around the irradiator on a conveyor belt, and exits at right. Alpha Omega's irradiator shown here is designed to be economically viable in developing sector nations, with relatively low start-up costs.

TABLE 1
How the experts rank the risks

The Seattle Post Intelligencer *recently asked five experts to rate potential health hazards. Here is what they came up with—from the riskiest (smoking) to the almost risk-free (eating irradiated food).*

1. Smoking one pack of filtered cigarettes per day
2. Driving in congested traffic every day
3. Removing asbestos containing plaster from a home ceiling without protection
4. Indoor air pollution
5. Drinking two glasses of wine per day
6. Using a woodstove regularly for heat in a home, or living in a valley where woodstoves are used by others
7. Getting sunburned during a two-week vacation every year to Mexico
8 and 9. A tie between (a) getting a full-mouth dental X-ray every two years and (b) using ordinary garden pesticides in a home vegetable garden
10. Eating a charcoal-broiled steak once a week
11. Eating a half-pound per week of bottom fish caught in Elliot Bay, Wash.
12. Flying an average of three hours per month on a regular commercial airline
13 and 14. A tie between (a) eating two peanut butter sandwiches per week and (b) living within one mile of a Superfund site
15. Drinking diet sodas sweetened with saccharine twice a day
16 and 17. A tie between (a) living within one mile of a garbage incineration plant and (b) living downwind within 25 miles of a nuclear power plant
18. Eating food that has been treated using irradiation

these materials lend themselves to enzyme inactivation through blanching (heating or light cooking), so that they can be vacuum pouched and radiation sterilized after packaging. The irradiation itself will not inactivate the enzymes, which are very resistant, and without blanching, the sterilized product would deteriorate while stored. Frozen food is also blanched for this reason. We found that strawberries, stone fruit, and other fruit and vegetable varieties could be prepared in a similar fashion to the meat products and stored for extended periods.

We proposed that a program be enacted that would permit a farmer to maintain fresh market prices with a portion of the crop while turning the surplus over to a regional radiation processing facility where the product would be preserved for future sale and use. The farmer would maintain a financial interest in the product, which could be used as collateral for bank loans. When the product is sold by the cooperative or other agency, the farmer would get his share of the profits.

Naturally, we cannot preserve a plump strawberry that will respire in a sealed pouch, but we can preserve the puree or enzyme-inactivated product for future use by confectioners, bakers, yogurt manufacturers, etc.

We believe this approach is far better than to have the farmer plough under a crop to preserve market prices because yields were too high. We can never know when a blight of some kind will hit our farms and eliminate crops we have always taken for granted. Further, it is an economic fact of life that it is cheaper to preserve what we now have than to produce new product. Radiation technology can bring this option home to food producers.

Food irradiation, a well-proven method of food preservation, is available to take its place along with other preservation methods to help mankind eliminate hunger and starvation. No one method provides a panacea for all food preservation problems and needs, but certainly we owe it to ourselves to use every weapon in the scientific arsenal in our fight to preserve and distribute the food we are capable of raising. We should no longer allow a well-fed and possibly well-meaning bureaucrat to deny this technology to the needy of the world.