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Interview: Dr. Martin Welt

Food irradiation is finally at the commercialization stage

Nuclear scientist Martin Welt stands out among the pioneers who saw the promise of food irradiation in the 1960s for helping to supply food to a growing world population. He has dedicated his life to developing the technology and commercializing it, for the United States, and especially for developing nations. It was Welt's radiation-sterilized meals that the astronauts ate up in space. Welt has designed irradiators geared to operation in developing nations, and his company, Alpha Omega Technology, Inc., provides consulting services for food irradiation and other radiation technologies. He was interviewed in March by Marjorie Mazel Hecht.

EIR: What is your assessment of the current developments in food irradiation, now that the USDA has finally issued the go-ahead for the irradiation of red meats, and some major food producers have committed themselves to use the technology?

Welt: Where we stand today in the area of food irradiation is that the world is moving slowly, ever so slowly, in adoption of this technology. During the past three decades, a lot of science has gone into food irradiation. It has proven beyond a shadow of a doubt the safety of the technology. It has shown the efficacy of the technology.

But there has always been a hindrance, and in my view, the hindrance against moving ahead has been that the United States, which was the leader in the research efforts in food irradiation, is a wealthy country with regard to food, its storage and distribution, and so on. So, there was no impetus in this country to really adopt a new technology. It's unfortunate, because the developing nations were the real losers in this; they could have utilized this technology, to a very good extent over the past three decades. But many of these countries simply refused to serve as guinea pigs for the world; they felt that if the United States was not using the technology, there must be some reasons that they weren't doing so, and therefore, they didn't want to be the first.

What's happened recently, has been that the press in the United States has publicized the food safety issues, starting with the deaths that occurred a few years ago in the Jack-in-the-Box case, where hamburgers were contaminated with *E. coli;* also, coverage of listeria outbreaks, and other food poisoning outbreaks that have caused massive recalls of red meat and other types of smoked meat and related products. As a result, the public has become greatly aware of this, and the public has decided that they want a safe food supply.

If you really look at the alternatives, and you look at the safety record that food irradiation has accumulated over the past three or four decades, there is no alternative, other than food irradiation, if you want a safe food supply. So, therefore, we've reached a point today, where, legally speaking, if you will, the law of the land now basically says—and I'm paraphrasing—food is a potential source of hazard. If you have a technology that can eliminate that hazard from our food supply, and you don't use that technology, and your food causes illness, you are liable. I think that's one of the motivations that's driving the food industry today; there is this tremendous potential liability, the overreaction of the regulators.

Nobody in the food business sets out one morning to put listeria or salmonella in their food product. These are common organisms, and they happen to appear in food, even though we have very high standards in the United States and elsewhere in the world. You do get these outbreaks. And what has happened now is that the government has come down on this, and not only are there civil penalties, but there are criminal penalties. And the criminal penalties sometimes come up because when there is an outbreak of food poisoning, you have the inevitable cover-up—somebody is not certain of what's going on, they are frightened, they are fearful of losing their businesses, their jobs, or what have you, and there is that cover-up. The next thing you know, somebody's in jail and companies are out of business, jobs are lost, and so on.

EIR: Or 25 million pounds of beef get destroyed.

Welt: Yes, 25 million pounds of beef were recalled with Hudson Packing, causing a very major meat processor to go out of business, and essentially have its assets get picked up for a song by another major meat and poultry company.

So, that's basically what has happened.

We in the United States have two sources of approval that the food industry must go through. First, if you're using irradiated products, you have to go through the Food and Drug Administration, which has the government-given job of showing that the food is safe. So, therefore, if you want to use irradiation of red meat, first you go to the FDA; you submit a petition to them. The FDA then determines, okay, this technology is safe.

But then, in the United States, we still can't go ahead and commercialize the process at that point. We have further expense and further time, because now we must go to the U.S. Department of Agriculture, which has been given the regulatory authority, under the Federal Meat Inspection Act, or the Federal Poultry Inspection Act, where it is responsible for the labelling and marketing of these products. So, once the FDA approves, then you go to the USDA, which now will determine what type of labelling requirements there should be, and what type of marketing is required to get these products into the mainstream.

Fortunately, we've gone through that now, for red meat. After all of these many years, the USDA, last December, approved the irradiation of red meat. This is not the first time that the USDA has approved a major meat product. Back in January 1986, the USDA approved the irradiation of fresh pork products. This followed the approval of an FDA petition that my company happened to have submitted, way back when—in 1985. And then in 1986, upon further information that we supplied to the USDA, it issued the regulation in the Federal Register approving the irradiation of pork for commercialization.

But, what's happened with irradiated pork over the last 15 years? Very, very little.

EIR: Nothing, really.

Welt: There has been no commercial irradiation of pork in the United States. So, really, we have the old scenario: Was trichina the real problem in preventing people from eating pork, and if we did irradiate pork, so you could have fresh pork—or "pork tartar," if that's what you wanted—and be absolutely certain that you're not going to come down with trichinosis, you would have forced the industry to give you that product. But obviously, there was no public demand for such a product, and hence there was no industry that gave birth to irradiated pork.

EIR: Yet, U.S. pork cannot be exported to many countries, because there are higher trichina rates in this country than elsewhere.

Welt: That's correct. In many countries of the world, they use microscopic examination of the pork to see if there is any infection with trichina, but in this country we don't do that. So, U.S. pork is limited as an item for export. And it would help our farmers greatly, who are now suffering because of depressed hog prices, if this country had irradiated pork, because then they would be able to export pork to those countries that would accept it. Years ago, such a shipment was made overseas, and I remember that it was warmly received as a very fine product. But at that time, irradiated pork "did not fly" in the United States.

So, that's my view of where we stand in the United States today with food irradiation, and why we've reached this point in the regulations.

EIR: What's your view of the consumer response?

Welt: As far as what consumers will do, I believe that today, with the industry firmly behind the technology, you will begin to see products in the supermarkets that are labelled "*E. coli* safe," or "pathogen free," and it's my bet, that if consumers have the choice of buying that labelled product for their family, as against another product that does not have that claim on it, that there will be more of the former product sold. And once that happens, you're going to find that the other firms will want to follow suit.

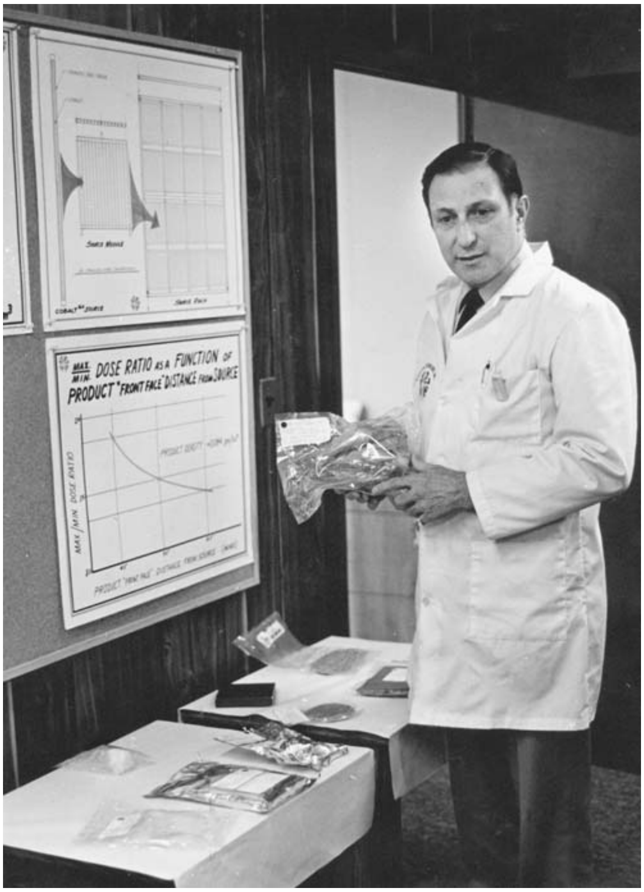
So, I think you're going to find that irradiation will be a growing business. I think it will be slow; it's not going to happen overnight. I know we have supermarket chains that have contacted us in our company, Alpha Omega Technology, that have asked us to introduce irradiated food products into their supermarkets, and to support the introduction with presentations to consumers in the store, and this is something that makes a lot of sense.

EIR: Well, I know that wherever markets have tried irradiated products—and I know it's been done with tropical fruits and strawberries, and poultry, to some extent—they sell very well. The products sold out, even if they cost more. This is especially true with the tropical fruits, because the quality is so much better with the irradiated fruit.

Welt: This is absolutely correct. Every market study that I know of, everywhere in the world, from China, to Canada, to the United States, to Israel, and elsewhere, has shown that the majority of the public will choose the irradiated product. Some people have argued that during the tests that were carried out, the signs said, "This is an irradiated product," and on the other product, "This is an un-irradiated product," and the critics have said that people bought the irradiated product because they were curious. Whatever it might be, I do believe that when you do see the actual labelling of the product in the supermarkets, and you're offering the public the alternative—which is the only thing the food irradiation industry ever wanted: to give the public the chance to make the choice.

EIR: Sure. And I think that there will always be a small group of people who will not want irradiated food, but why should they determine what the rest of the market has to eat?

Welt: Absolutely. I recall at an international conference, almost 20 years ago, after my conference presentation, during the question period, one of the members of the audience, Dr. Sanford Miller, head of the FDA's Bureau of Foods (now a professor at the University of Texas at Austin), said: "Martin, remember, it took your grandmother 50 years before she accepted canned foods in her house. And it took your mother 20 years, before she accepted frozen foods. So, if it takes your



Dr. Martin Welt in his New Jersey irradiation plant in 1984. The chicken he is holding was irradiation-sterilized in a sealed plastic bag, and can be stored indefinitely at room temperature. Welt irradiated the sterilized meals that the astronauts ate in space.

wife a little longer than you would like to see irradiated food in your house, you'll understand why."

That was very cogent. And then he added to that, "Remember, 20% of the U.S. population today—and this was 20 years ago—will not eat canned foods."

EIR: I didn't realize that.

Welt: So, I think irradiated food will find its niche. After all, it's the first new, really new method of food preservation, since Nicholas Appert developed canning for Napoleon in 1809. So, it's been a long time.

EIR: One thing I think that people don't understand, is that there is more than one method of food irradiation. You're in a good position to describe these, because you're not wedded to any particular method.

Welt: Yes, Alpha Omega Technology will utilize or design for our customers, or provide consultation, for the form of ionizing radiation that is best suited for a particular task—the forms of ionizing radiation that have been approved under the international standards for food irradiation. By the way, I am very proud to say that I was involved in that, as a member of the United States delegation to the international Codex Alimentarius Committee on Food Additives.

EIR: When was that?

Welt: It was 1982, at The Hague. My function as a member of that delegation was basically to see if I could foster some interest in an international standard for food irradiation. I'll never forget the first day I attended this meeting, in a huge hall in Holland, where they were discussing an international standard for salt, not the Strategic Arms Limitation Treaty (SALT), but table salt. I'll never forget that the Greek delegate was arguing that the international standard for salt could not have a purity standard greater than whatever the purity was of the salt coming out of the Aegean Sea, because the Greek government owned the waters around Greece, from which they derived their salt. And I heard this argument, and I said to myself, "What a waste of time. If I'm expecting to get an international standard for food irradiation, and they can't even get one for salt . . ."

But, lo and behold, I drafted on yellow paper, in longhand, in the best legalese language I could conjure up, a motion to adopt a standard that would approve irradiated food. At these conferences, only the head of the country's delegation could speak, and the head of the U.S. delegation was a deputy director of the Bureau of Foods, Richard Ponk. I'll never forget, passing the motion along the line of our delegation, through the various people from different U.S. food companies who made up our delegation. And finally, the folded yellow piece of paper got to Richard Ponk, and in my mind, I could see what would happen. Because, in the United States the petitions that I submitted to the FDA for food irradiation would inevitably be turned down, or there would be a request for more information, and it was always a battle to get anything done. So, I thought, since now we were members of the same team, Ponk would read what I had to say, look at me, and wave to me, and say, "Okay, I'll speak to you later."

Instead, Ponk took the U.S.A. placard, which was sitting right in front of him, and he held it up. He was immediately recognized by the secretariat, and Richard read word for word from the yellow piece of paper which I had written in longhand. I remember the sweat pouring off my forehead, and my heart beating in my chest, and all the eyes of people from different countries around the world who were also involved with food irradiation, all looking at me. And the motion was accepted on a various step level—step six. The next year, in Holland, it was approved through our committee, and then in Rome, at the full Codex Alimentarius, it was finally adopted as an international standard in 1983.

EIR: So, that's a major achievement.

Welt: That was way back when. And now it's the year 2000, and many countries have now adopted regulations approving

Food irradiation is going to become so commonplace that we will wonder how we ever got along without it!

irradiated food—approximately 50 countries—and you are finding more and more products getting into the mainstream—spices, of course, and vegetable seasonings (these were approved back in 1983, in the United States). . . .

EIR: Was that your petition?
Welt: Yes, that was my petition, one of the first that I had approved in the United States. Spices and herbs, vegetable seasonings, powdered enzymes, fresh pork, and then the poultry petition, which was submitted in 1978, and finally approved by the FDA in May 1990.

EIR: Isn't that amazing, to take so long.
Welt: And I used to have people telling me that I had the FDA in my pocket! And I would say, that if it took 12 years to get something approved, the FDA was certainly not in my pocket. But it was a long, long battle. In retrospect, I look back now, and I realize the difficulty in dealing in a very product-rich, and resource-rich country such as the United States, and getting a new technology approved. And it's unfortunate that some of the developing nations could not be more aggressive in adopting this technology before some of the Western nations and more developed nations did.

EIR: I think it would have saved a lot of people from hunger.
Welt: Countless lives and hunger. That's absolutely true. I remember years ago, back in the 1970s, when there was a big salmonella recall on a world-famous chocolate product—millions of pounds of this chocolate. I naively wrote a letter to the United Nations at the time, suggesting that if the chocolates would be shipped to our plant, that we would irradiate the product, render it free of salmonella infection. At that time, there was widespread famine in Chad, in Africa, and I said that this is candy, perhaps not the finest nutritional supplement, but it's food, and possibly could have been put to some use. Of course, this fell on deaf ears; nothing ever came of that.

I feel that this world has wasted countless resources due to government regulations that say that if a product is contaminated with certain microorganisms, the product must be disposed of. If these microorganisms can be rendered harmless in the food, and the food maintains its nutritional value, then to me it's sinful to destroy that food, when there are people who are starving who could benefit from it. But, of course, there are other factors—distribution costs, getting the food to where the people need it—so it's not as easy as some people may want to pretend.

But, let's get back to your question about the different forms of food irradiation.

EIR: Yes, I wanted you to describe the different technologies and what they are each best suited for.
Welt: Actually, the reason I digressed, is that the international standard for food irradiation that was drafted at The Hague meeting, and subsequently approved, named four forms of ionizing radiation which have been approved and adopted, not only as the international standard, but by various other international groups and expert committees. These include gamma radiation from cobalt-60, gamma radiation from cesium-137, 10 million electron-volt electrons, or 5 million electron-volt X-rays.

These were the four forms of ionizing irradiation that were approved. The reason for that was that none of these forms of ionizing radiation can induce any radioactivity in any substance, regardless of how long you irradiate it. Therefore, if you did treat your food, there would be no way that anybody could claim that you were inducing radioactivity into the food product. Although, as you know, virtually all the food that is eaten by mankind, does contain naturally occurring traces of radioactivity—whether it be carbon-14 or potassium-40.

EIR: As do human bodies.
Welt: Yes. So, let's discuss then the various types of radiation.

Gamma radiation from cobalt-60 is derived from a man-made radioisotope. Many people think that cobalt-60 is a fission product of the nuclear power industry, or the nuclear weapons industry from past years, but this is not true. Cobalt that is mined is inert; it is not radioactive. We refine that cobalt, which is cobalt-59. It is then put into a nuclear reactor in a stainless steel tube. The neutrons in the nuclear reactor cause the cobalt-59 to become cobalt-60. This radioisotope of cobalt is unstable; it gives off two gamma-rays, 1.33 million electron volts (MeV), and 1.17 MeV. Being a gamma photon, without any charge, the photon, like an X-ray, will pass through rather large distances in matter. The more dense the material, the more difficulty in passing through it; the less dense, the easier it is to pass through that material. On a relative basis, a gamma ray can pass through very good thicknesses of material, several feet, of typical materials that are irradiated.

On the other hand, the cesium-137 is a fission product. To get cesium-137, you must have a nuclear reactor using uranium or plutonium as fuel. The fission product of these

The electron beam research facility at Iowa State's Meat Laboratory, which conducted the irradiation testing on red meat.

materials is very radioactive, and potentially quite dangerous if not handled properly. You then separate the fission products, and after chemical separations, you end up with the form of cesium known as cesium-137, which also has other radioactive impurities of cesium with it, such as cesium-134. This is the material that we would use in irradiation.

The problem with cesium-137 today is that it is difficult to come by. There are very few governments or private organizations that are willing to set up the facilities that can separate the cesium-137 in commercial quantities. So, even though, in principle, you can say that irradiators can use cesium-137, there is very little prospect, in my view, for cesium-137 to become a major factor in the food irradiation industry.

There are firms that have spent a great deal of time and money in developing some extremely clever devices for the use of cesium-137. One of its advantages is, of course, that it has a very long half-life. So, once you load the cesium in, its half-life is of the order of 30 years, compared to around 5.3 years for cobalt-60. This means that in 15 years, you have half the processing throughput capability of the cesium left, whereas for cobalt-60, in 5.3 years, you have half the processing throughput capability left. So, obviously, there would be an advantage to using cesium.

However, you get two photons with the cobalt, where you only get 0.66 MeV photon with the cesium. So, all things considered, there is an advantage to using cobalt, especially since you can make the cobalt quite easily, whereas the cesium is difficult to come by. Both of them do have ease of penetration. They can irradiate whole pallet-loads of product. There is no problem with the penetration.

Now, with the 10 MeV electron, you can only pass through about 1⅜ inches of water, or that equivalent density. So, if you irradiate a glass of water from two sides, you can typically irradiate about 2¾ inches of water. If you have a lesser density, for example, half that of water, a density of 0.5 instead of 1, you can then double that, and irradiate something that is 5 inches thick. If the density of the material were 0.25, you could go through 10 or 11 inches of material. And if the density were half of that, 0.1, you'd be able to go through about 20 inches or so of it.

That means that you can easily use 10 MeV electrons for sterilization of low-density medical products, for example—low density, fluffy-type products—with good penetration. However, if you are doing food products, which have a reasonably high density, the penetration is limited to, say, packages of hamburger patties that are about 4½ to 5 inches thick. So, the patties are loaded into a carton, they go under a 10 MeV electron beam, and if you irradiate from both sides, you would be able to get through a package of about 5 inches depth.

EIR: With the gamma rays, do you also do it from both sides?

Welt: With the gamma rays, you don't have to, because you get penetration up to 30 inches.

EIR: So, that means you would need different types of plant designs.

Welt: Yes, and also different types of packaging considerations. You see, one of the constraints on food irradiation, is that not only must you get the FDA approval for the irradiation of a specific food product, but if you have a plastic material or some other packaging material that comes in contact with the food, under FDA regulations, that contact material must be treated in the same fashion as a food additive. You must go through the same testing procedures to show the safety and efficacy of the packaging materials, just as if they were an additive, or dye or something that you wanted to put directly into the food product. And that is costly and time consuming, as well.

Once you have solved these problems, and you have your packaging solved, and whatnot, then there is the sizing of the packaging. Obviously, if your plant is designed for 10 MeV electron-beam usage only, you can't design a hamburger box to be 12 inches thick. You can't process boxed beef, as beef is now typically packaged, using a 10 MeV electron beam. It cannot be done.

The plants that you've read about today in the United States are relatively low-power electron-beam plants. The new ones being set up in Sioux Falls, Iowa, and other places—

the SureBeam technology—this is a maximum 35 kilowatt plant.

The fourth form of approved ionizing radiation, is X-rays. You start with the electron beam, and you convert electrons into bremstrahllung, or a continuous X-ray, and the maximum X-ray energy would be the maximum energy of the electron beam. But remember, I said that the approved energy level for X-rays was only 5 MeV, whereas the approved electron-beam level was 10 MeV, so, if you want to convert a 10 MeV electron into X-rays, you couldn't legally process the product, because you would have 10 MeV photons.

EIR: What are these new plants going to do if they are designed to convert the electron beams to X-rays?

Welt: They have to de-tune the beam. They have to tune down the energy, the acceleration, or the potential of the electron beam, before it hits the X-ray conversion target, so that the maximum energy is only 5 MeV. Then your maximum photon energy would be only 5 MeV. So, that is the technological problem that the radiation engineers face.

EIR: Is it possible that they would also ask for a change in standards?

Welt: When I was actively involved with international standards, on the day that I submitted the motion for food irradiation standards at The Hague meeting, the French delegation threatened to filibuster, because they then were hard at work on a 10 MeV linear accelerator. They thought, understanding the physics involved, that if you limited the X-ray energy to 5 MeV, and you had a 10 MeV machine, and the conversion efficiency to X-rays was directly related to the electron energy—in other words, the higher the electron energy, the higher the conversion efficiency—that as the energy goes down, that conversion efficiency drops sharply, so it wouldn't pay to even try to convert it, because you wouldn't have enough photons coming out to process anything of any commercial value.

So, at that time, I argued with the head of the French delegation, a woman scientist, and I convinced her that the data we had collected at that time, showed that 5 MeV photons would not cause photoactivation, but there was some concern about higher photon energies causing photoactivation. Even though, we knew, technically, that we could go up to energies well above 12 MeV, even as high as 24 MeV. This was from work done at the Army's Natick [Massachusetts] Laboratories, where the induced radioactivity, which was real, was so minute, that it was typically less than the radioactivity that was normally present in the food. So, you weren't adding anything substantially greater than what you were normally eating in the food supply. But, you could not make the claim that you were not inducing radioactivity into the food, and that, we felt, would be a big stumbling block for consumers.

We told the French delegation then, let's start at this level—5 MeV—and we would then amend the international standard to go to 10 MeV. I do believe, that there is a movement now to increase the standard to 7.5 MeV, and then gradually, to try to bring it up to 10 MeV. But you still have the problem, that if you have a 10 MeV electron beam, you would still have to operate your machine at a somewhat lower efficiency to operate only at a maximum of 7.5 MeV, so that the conversion to photons would have a maximum of only 7.5 MeV, or now, 5 MeV, which is the legal limit.

So, those are the constraints there. Once you have your 5 MeV photon field, you've got better penetration than you will have with the cobalt-60 gamma irradiation: You have a 5 MeV versus a 1.33 MeV.

EIR: More than three times.

Welt: Now, the penetration with the gamma ray does have another facet here. Some people think that because the gamma ray will penetrate through a pallet-load of boxed beef, that they will irradiate 1,800 pounds or 2,000 pounds in that pallet, and just run it through the gamma plant, as quickly as they can. The problem is, that as you penetrate through that pallet-load of box beef—or whatever else on the pallet-load—you get quite an exponential falloff in the intensity, from the introductory point on the pallet, to the far side of the pallet. And when that pallet goes around the conveyor belt to the other side of the cobalt source, you get the mirror image of that penetration pattern.

The net result is that when the pallet leaves the plant, you have a parabolic distribution throughout the material. The minimum dose appears at the center of the pallet, and the maximum dose appears at the outside. If that maximum-to-minimum dose exceeds certain values, where the maximum dose is too high, you can get off-flavors in the meat products, which are noticeable. Tests have been done, that show that when you irradiate a large quantity of boxed beef, to eliminate any possibility of pathogenic contamination from listeria, or *E. coli,* or salmonella, you do need to maintain a certain maximum-to-minimum dose distribution, and the only way you can do that is to limit the thickness of the target. So, instead of having the ability of doing a complete pallet-load, you have to limit yourself to doing a portion of that pallet.

Now, with electron beams, you penetrate with a different type of dose-distribution profile. Basically, there is a buildup of electrons after you penetrate, so you have a peaking of the ionization, and then it falls off. So, you have a mound shape to the halfway point in the product; after you turn it over, to do the other side, you end up with two little mounds, two bumps. Your max-to-min dose distribution can be quite favorable under that type of treatment.

Those are the various constraints that you have. It's not only the radiation engineer who becomes important, but the food scientist, who will do the evaluation on the taste, color, and other aspects after irradiation. You also want to know that when you do irradiate the product, it's just like a frozen hamburger patty in the supermarket today. That hamburger

Pathogen-free chicken parts, produced by Nation's Pride, on sale at the Carrot Top market in the Chicago area.

patty is processed, frozen, and put into the supermarket with a certain shelf-life. After a period of time, the food may not spoil, but its quality diminishes. When you irradiate the same product, you have to test the shelf-stability of the irradiated product, to make sure that you can duplicate the type of performance of the non-irradiated product.

EIR: I think for the past seven years, they have had a research e-beam irradiator at the University of Iowa, where they have been doing just that, with meat and poultry.
Welt: Dennis Olson runs that operation there, and the plant that they put in there, was, in fact, the French design, and it was that 10 MeV linear accelerator that was the object of the issue I mentioned back in 1982, in setting the energy standards.

EIR: I'd like to get back to X-rays, and have you explain how they create the X-rays from the electron beam.
Welt: It's no different from the dental X-ray, or the medical X-ray. You basically have a hot filament, which boils off electrons. Then you have a magnetic drift tube, an evacuated tube, and a potential difference from the creation of the electrons to the other end of the drift tube. These electrons are accelerated through some means, such as radio-frequency pulses, and the beam is contained with magnetic fields, into a rather thin pencil, and that pencil will be accelerated as it moves through the drift tube, as energy is pumped into it.

When it gets to the end of the drift tube, there are typically scanning magnets, just as those in a color TV set, where the electrons are scanned, and are then allowed to bombard a phosphor, which causes the picture to be viewed. It is the same thing with the conversion of the electrons into X-rays for processing. Instead of using a phosphor, you use a high-Z [heavy element] convertor plate, so that the electrons will hit into a tungsten target, or some material like that. The tungsten has to be thin enough, and designed in such a way that the electrons will hit the target, give up their energy, and that energy will then be converted into an X-ray, which moves essentially in a forward direction. If the target is too thick, it not only will absorb the electron, but it will absorb a good portion of the photons, which are formed. So you have to have a rather thin target, and by having that thin target, you then risk the possibility of having this extremely high energy, a very powerful electron beam, burning holes right in the target, so you have to water-cool that target.

It's a good engineering feat to design an electron-beam facility that is capable of conversion to X-rays, that will operate efficiently, where the target will not burn out so readily that the cost of target replacement becomes a barrier for commercialization.

EIR: I think that part of this technology came out of the Strategic Defense Initiative.
Welt: Certainly, there have been designs that came out of Livermore, for types of high-powered electron-beam units.

Now, I want to point out another thing: When you utilize electron accelerators, you can produce dose rates that are very, very high. In other words, you are producing a lot of radiation in a very short period of time, compared to gamma dose rates, which take a much longer time to get the same dose in the target. So, your processing time with cobalt is comparatively slow—you might move a pallet every couple of minutes, which is no great deal for a conveyor designer.

However, if you are using an electron-beam facility, and you want to limit the dose that you are putting into a product, then you are going to be travelling at enormous speeds to get the product through fast enough not to build up too high a dose. Therefore, you have to be careful.

In other words, if you simply take the theoretical throughput that you can have in an electron-beam facility, you would be producing billions of pounds a year of processed product—but this is not feasible.

EIR: The hamburgers would be flying.
Welt: They would be going at the speed of light!

It turns out that when you run an analysis between an efficient gamma facility that is capable of processing the loads so that you have good max-to-min distributions, versus the higher-speed electron beam unit, surprisingly, the numbers don't come out greatly different for the amount of product per year that you end up with for what you can actually put into the machine, and get out of the machine, and package up.

There's a rule of thumb that says that if you can do something with electrons, it's typically going to be cheaper. X-rays would be next, and gamma rays last. However, you turn that around when you talk about the simplicity of operation and

The driving force, finally, after all these decades, to bring the food irradiation technology into the developing nations, will not be because of the needs of their citizens, but for exports.

ease of operation. Gamma facilities are obviously the simplest and easiest to utilize, whereas the electron beams and the X-ray conversion devices, are much more complicated. So, it's a trade-off.

In developing nations, we've talked to certain countries around the world where ionizing radiation and food processing is going to become more and more important in future years, they definitely shy away from the electron-beam technology today, because they realize that they are going to need sophisticated staffs of people and sophisticated scientists, for maintenance and operation. Therefore, the tendency seems to be to opt for the gamma facility in these developing nations.

EIR: The statistics are that, worldwide, we lose 25% of harvested food products—to bugs, rodents, spoilage, and so on. And in a tropical country, it's even worse.

Welt: This is certainly a lot worse in tropical countries than in developed nations. If we consider the fact, that under the Montreal Protocol [regulating so-called "greenhouse gasses"], methyl bromide, the major agricultural fumigant in use today, is due to be banned by the year 2005—

EIR: Which I hope will not happen, because I don't think it's scientifically necessary—

Welt: Right now, it is a fact, however, that methyl bromide will be banned by 2005, with the exception that it can be used at ports of entry, when a product comes in to the United States, and if the product is contaminated with insects, you would still be able to use methyl bromide. But the problem is, of course, that if you ban methyl bromide from its major uses, the availability will become scarce, and the cost will become much higher. So, there is a need for irradiation as an alternative for quarantine use. But for developing nations, the Third World nations, which export a lot of raw materials, such as coffee, cocoa, herbs, teas, and other agricultural products, with the ban on methyl bromide, the only viable alternative is irradiation. It appears that the driving force, finally, after all these decades, to bring the food irradiation technology into the developing nations, will not be because of the needs of their citizens, but for exports.

The needs are there. In certain West African nations, you can get plenty of fish in the coastal areas, but in the interior of the country, it is scarce, because of the poor roads and lack of infrastructure to ship fish. There was no push to get irradiation there to ease the burden for the population as a whole. Today, however, food irradiation will come to those countries because of their need to *export:* to get their products out. But once those facilities are in place, then, I think, you'll find that more and more of the local products will be irradiated.

For example, yams are one of the major food sources for millions and millions of people in Africa, Latin America, the Caribbean, and elsewhere. Yet yams, like potatoes, will sprout in a rather short time. If you irradiate the yam, you can keep them from sprouting for periods up to six to nine months, which is incredible, because once that potato starts sprouting, it converts its starch to sugar, and you've lost the nutritional benefit. Whereas, if you simply irradiate the product, and maintain reasonably good storage—you can't leave it in a moist place—you can basically keep your major food staple as a wholesome product for that population for nine months of the year, and allow them to export that product as well. In some areas of the Caribbean, they don't have the soil to grow yams, although yams are a major component of the diet, and they must import them. So, if you were able to irradiate the yams, you'd have markets for them in the Caribbean.

This is where it's going to happen. It will enable these countries to export coffee, cocoa—major products. Unfortunately, there are some chemical products on these crops, and when you irradiate them, they can cause off-taste and oxidation and things like that. So, it's not just irradiation technology. It's a food science technology, really, because you have to incorporate a few scientific disciplines to maximize the benefits to the population.

EIR: I think it can't happen soon enough.

Welt: Well, it is going to be a boon to mankind. In a speech given by Dr. David Kessler some months ago—he's now dean of the medical school at Yale University, and he was formerly commissioner of the Food and Drug Administration—he stated that irradiated food will become as commonplace as pasteurized milk. I believe that that is what will happen. It is just going to become so commonplace that we will wonder how we ever got along without it! Because, we will begin to get more and more irradiated food into our food supply. We won't have to worry about listeria outbreaks, or salmonella outbreaks. It will become less and less a public concern, which is the way it should be. I suspect, that within the next 10 years, as the technology unfolds, people won't give much thought to going into a supermarket and buying certain products which are irradiated.

But, again, it's not going to be easy. If you've been in the field as long as I have, then you know the different technical and economic problems. I'll cite one. Let's say, for example, you decide that you are going to irradiate produce that has been the cause of *E. coli* outbreaks. And a particular grower says, "I want an *E. coli*-safe product. I want people eating our product to be absolutely certain that they don't have to worry about *E. coli,* or salmonella, or things like that. So, I want to irradiate my product." And if you get out to areas in California where they ship multi-multi-truckloads of the product every day, hundreds of thousands of pounds a day, and the harvest is going through the machine, and the product is prepackaged with a label that says, "This product is *E. coli* safe," or "This product is pathogen free," then according to U.S. law, you cannot transport across a state line a product that is adulterated, so that if you say a product is "pathogen free," then it better be pathogen free.

But, let's suppose that the irradiation facility is shut down for mechanical problems. You don't stop harvesting your lettuce, or whatever it is that you're harvesting. So, what are you going to do? That means that you need back-up facilities. You can't have just a single facility that is going to service all of that market, and then find out that you're down for three or four days or a week, and you can't process the product, because they can't ship with that bag saying it's pathogen free, if it isn't. So, now they'd have to ship product without that label, which would confuse the consumer, who is now expecting your product to be pathogen free.

So, these are issues that have to be addressed, I think, before you find an open field day for irradiated food everywhere.

EIR: I think it means that we need to build a lot more irradiation facilities.

Welt: It means that you have to build them sensibly. That instead of building perhaps the huge, giant facilities, that you build 10 smaller facilities. For example, our company has come up with designs for what we call a hybrid facility, where you can do different types of products, and have some capacity for changes in the throughput of your customers' products.

EIR: What about mobile irradiators?

Welt: Mobile irradiators are on everybody's wish list, but unfortunately, it just does not pan out. To put something in a mobile irradiator, you still have to put a great deal of shielding on it. To get sufficient source in there with sufficient power, it becomes a rather difficult movable device; it becomes a fixed device. There are some concepts that have been put forth. For example, building infrastructure in various locations, if you're using a cobalt-60 source, where you leave the infrastructure in place and simply take a special cask which contains the source material, and as the harvest moves north, as the season progresses, the cobalt is moved from one infrastructure to the next one. Essentially, you are irradiating in a fixed location with a movable source of cobalt that goes where it is needed.

This was one concept of a quasi-movable irradiator.

But for a field irradiator, I just don't see it happening with something that would have sufficient throughput to have any commercial value whatsoever.

On the other hand, if you're talking about a sea-borne device, there have been rumors for many years that the Russians have operated irradiation trawlers. I don't know that anybody has ever verified it; I haven't.

But, on irradiated fish: I know that we made the first international shipment of irradiated codfish fillets back in 1977, from the United States to Holland. The product was inspected by the Dutch health authorities, and released for public consumption 18 days later as being safe and efficacious for consumption. So, this is back in 1977. But aside from shrimp and frog's legs, and things like that in the seafood category, there hasn't been that much done in seafood irradiation. Our company has been doing work on a seafood petition to the Food and Drug Administration. It is rather difficult to have what we call an "omnibus petition" approved, because of the diversity of seafood varieties, their different fat contents, and other variables. It is difficult to make the petition broad enough to be of economic potential, and I don't know when that might be approved.

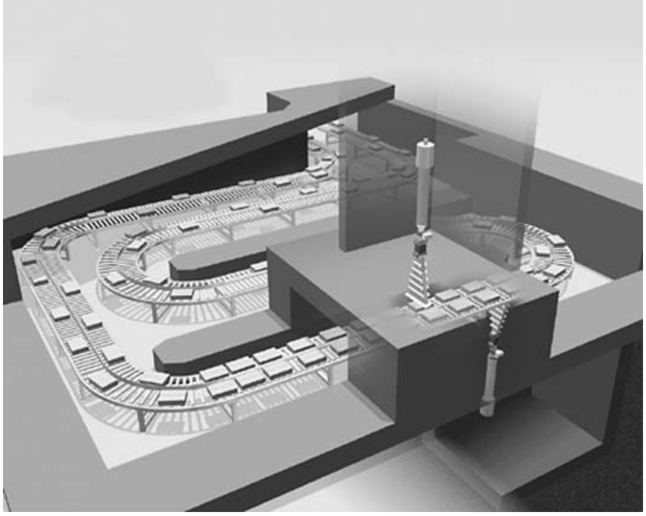
But a sea-borne irradiator, I do think is feasible. My son Andrew and I gave a paper on seafood irradiation at a conference in Maryland several years ago. We pointed out that an electron-beam device would probably be the most suitable, and the Coast Guard was quite excited about that approach, because they were concerned that if you did have a cobalt facility on board a ship or trawler, and you had an accident, that you would get radioactive material into the sea. It is certainly feasible to have a ship-mounted electron-beam unit; the fresh fish caught would be quickly put on ice and then irradiated. And you would have the best of both worlds—you'd have the best quality product and the longest shelf-life.

EIR: Sure, because it would be irradiated absolutely freshly caught.

Welt: That would be ideal, and I suspect that that will happen if we don't exhaust our sea-borne resources too quickly.

EIR: Would you like to say something more about what you see as the future of food irradiation in the United States?

Welt: I believe that there will be certain areas, certain food products that will benefit more than others from food irradiation, and be easier to get into the mainstream more quickly. Hamburger patties and luncheon meats are certainly things that we will see. The listeria, which is a very difficult microorganism to control, can be easily controlled with ionizing radiation. To have luncheon meats and hot dogs processed—it would almost appear that if a plant had the capability of using ionizing radiation, it should almost be dictated that it do so. I don't think there will be much of a market in meat cuts as a whole—there isn't much of a problem there. But in boxed



Artist's conception of the Titan Corp.'s "SureBeam" electronic pasteurization plant in Sioux City, Iowa, which can process 80,000 hamburger patties per hour.

beef, which is a precursor to a lot of the hamburger patties, that's where the market exists, and that's where the market will be in the gamma sphere. And this will have to be done carefully; otherwise, there will be off-taste in the meat.

EIR: But that's something that has been particularly researched.
Welt: It has been researched, and the technology is there. I think that a lot of people who are going around now, talking this up, don't make it clear to the meat industry, and I think that there has been some confusion about the throughput. In other words, are they going to put through 2,000 pounds an hour, or 500 pounds an hour—the economics are going to vary greatly. That's why we have told them, that before they make these commitments, do the proper testing, design the test matrix in such a way that you are able to do all the food science work ahead of time.

The irradiation is the easy part. The verification of dose, that's easy today. It's the food science—certain additives that you may want to put into the food, antioxidants, perhaps, or certain spices, which the meat industry may normally want to have. They have to remember: If you irradiate raw meat, and you get an approval from the FDA to do so, that's one thing. But if you now take that same raw meat, and you decide that you are going to add spices to the product, you have to make certain that the FDA is going to consider that to be the same safety approval that they just gave for the other product. You can't keep adding things without going back to the FDA, and then you have to recheck with the USDA to make sure that they are in agreement for marketing that "new" product.

So, it's not easy. The food industry has a lot of work cut out for itself. It's not going to be this slam-dunk that a lot of people have said. I don't think you're going to see any public companies whose stock will just soar overnight. It's going to take a growth period. It's a good technology. It has to be put in place in a sensible way. It takes people who understand the business. I think one of the dangers in this industry, is that a mistake could be made, and if a food industry gets burnt, that could have a great impact on their desire to move ahead in this area.

I conclude by simply saying, the law of the land is still the same. If your product can cause injury, and you have a technology that can avoid the injury, and you fail to use it, you are liable for damages. And that's a hard nut for the industry to swallow, because a company could be put out of business with a class-action lawsuit, or something like that. And the only one who benefits from that is you know who, and it's not the public.

EIR: Lawyers. . . .

Interview: Wil Williams

Titan ready to process 80,000 burgers per hour

Wil Williams is a vice president of Titan Corp. in San Diego, which has built the first electron-beam food irradiation plant in the nation, in Sioux City, Iowa. He was interviewed by Marjorie Mazel Hecht in December 1999, shortly after the U.S. Department of Agriculture (USDA) published its final regulations for the irradiation of red meat.

EIR: What are Titan's plans, now that the USDA regulations were announced on Dec. 14?
Williams: The regulations allow the electronic pasteurization of red meat, which is the only proven way of killing *E. coli*. They had already previously approved chicken. So, after the 60-day waiting period, we intend to go right into production, full throttle, so that they can do the test marketing.

EIR: Is your new plant in Sioux City ready to go?
Williams: Our plant is ready to go right now. In fact, we are starting immediately on testing, to make sure that everything is tweaked out, so that on day one, on the first day that we are allowed to do it, we'll be in full production.

EIR: What's the capacity of the plant?
Williams: It can process 250 million pounds of beef—or other products—per year. I did a quick calculation, and that's something like 80,000 hamburgers an hour. Now, of course,