Food Irradiation:
A Global Perspective & Future Prospects

Ronald F. Eustice
Executive Director
Minnesota Beef Council

October 18, 2010
What I will discuss today

- Why irradiation is necessary
- Commercial introduction of irradiated foods
- Consumer acceptance
- Current status of irradiated foods in commercial market
  - USA
  - Global Market
- Future prospects
  - Challenges & Opportunities
Meat Recalls

E. Coli O157:H7

Jack in the Box (1993)
Irradiation: A Food Safety Solution?

Could irradiation do for meat & poultry & produce what pasteurization did for milk?

1. Learn about the irradiation process
   1. Was it effective?
   2. Would irradiation affect taste, nutrition etc?

2. Determine Consumer Acceptance
“I can find very, very few issues in the area of medicine and public health that have unanimous agreement and support of every major public health, medical, and scientific organization in the world.”

Michael T. Osterholm, Former State Epidemiologist
Could irradiation do for ground beef what pasteurization did for milk?
Food Irradiation

Minnesota Steps Forward

A Food Safety Conference sponsored by the Food Safety Center of the Minnesota Department of Health in coordination with the Minnesota Department of Agriculture

Food Safety Conference
June 21-22, 1999

Northland Inn
Brooklyn Park, MN
Prevalence of *E. coli* O157:H7 in Ground Beef

Results of raw ground beef products analyzed for *E. coli* O157:H7 in federal plants. 2010 Data (12/31/10).
Unpublicised E coli outbreak leaves 250 ill and one dead
theguardian

An eight-month E coli outbreak across the UK left 250 people ill and one dead but was not publicised at the time because its origins were unknown, health officials say. After six months of investigations the infection was ultimately linked to ... [CLICK TO READ]

California Firm Recalls Beef Products Due To Possible E. Coli O157:H7 Contamination
USDA Food Safety and Inspection Services

WASHINGTON, Sep 30, 2011 - Manning Beef, LLC, a Pico Rivera, Calif. establishment, is voluntarily recalling approximately 80,000 pounds of beef products that may be contaminated with E. coli O157:H7, the U.S. Department of Agriculture ... [CLICK TO READ]

Kansas Firm Recalls Ground Beef Products Due To Possible E. Coli O157:H7 Contamination
USDA Food Safety and Inspection Service

WASHINGTON, Sep 27, 2011 - Tyson Fresh Meats Inc., an Emporia, Kan. establishment, is recalling approximately 131,300 pounds of ground beef products that may be contaminated with E. coli O157:H7, the U.S. Department of Agriculture ... [CLICK TO READ]

Texas Firm Recalls Ground Beef Due To Possible E. Coli O157:H7 Contamination
USDA Food Safety and Inspection Service

WASHINGTON, Sep 23, 2011 - Palo Duro Meat, an Amarillo, Texas, establishment, is recalling 40,000 pounds of frozen fine ground beef products that may be contaminated with E. coli O157:H7, the U.S. Department of Agriculture ... [CLICK TO READ]
### FoodNet Monitoring (2010)

<table>
<thead>
<tr>
<th></th>
<th>Illness</th>
<th>Hospitalization</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. Coli O157:H7</strong></td>
<td>442</td>
<td>184</td>
<td>2</td>
</tr>
<tr>
<td><strong>Non O157:H7</strong></td>
<td>450</td>
<td>69</td>
<td>1</td>
</tr>
<tr>
<td><strong>E. coli</strong></td>
<td>8250</td>
<td>2300</td>
<td>29</td>
</tr>
</tbody>
</table>

Remember:
This is data from 10 states representing 15% of US population.
The 10 states involved in FoodNet calculations represent 15% of the US population. (Snapshot).
Six non-O157:H7 shiga toxin-producing serotypes of E. coli (STECs) O26, O45, O111, O121, O145 & O103

Some non-O157:H7 shiga toxins do not cause illnesses and others are at least as virulent as E. coli O157:H7

Less than 10% of laboratories have capability to test For non O157:H7 STECS
Foodborne Illness in the USA

Estimates for 2011:

• The US Centers for Disease Control (CDC) estimates that one of every six in the US (or 48 million persons) becomes ill from food each year;

• 128,000 hospitalizations;

• 3,000 deaths.
Top five pathogens causing domestically acquired foodborne illness resulting in hospitalization

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Estimated annual hospitalizations</th>
<th>90% Credible Interval</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella</em>, non-typhoidal</td>
<td>19,336</td>
<td>8545-37,490</td>
<td>35</td>
</tr>
<tr>
<td>Norovirus</td>
<td>14,663</td>
<td>8,097-23,323</td>
<td>26</td>
</tr>
<tr>
<td><em>Campylobacter</em> spp.</td>
<td>8,463</td>
<td>4,300-15,227</td>
<td>15</td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>4,428</td>
<td>3,060-7,146</td>
<td>8</td>
</tr>
<tr>
<td><em>E. Coli (STEC) O157:H7</em></td>
<td>2,138</td>
<td>549-4,614</td>
<td>4</td>
</tr>
<tr>
<td>Sub-Total</td>
<td></td>
<td></td>
<td>88</td>
</tr>
</tbody>
</table>

Sub-total 88

Estimated annual hospitalizations are the number of reported hospitalizations for each pathogen, with a 90% credible interval to account for uncertainty. The percentage column represents the proportion of total hospitalizations attributed to each pathogen.
Salmonella infections in the U.S. have not declined in a decade, and should be targeted in new public health initiatives.

US Centers for Disease Control (June 8, 2011)
(In 2010) FoodNet detected over 8,250 cases of salmonella poisoning with almost 2,300 hospitalizations and 29 deaths. That’s up 10% from 2006-2008.
Foodborne Illness
The Tip of The Iceberg

We really do not know the actual number of illnesses caused by food poisoning because it is an under-reported disease.
Pathogenic bacterium sicken & kill
Victims of foodborne illness
Let’s do some research

• What is food irradiation?
• What are others saying about irradiation and why?
• Does irradiation impact nutrition?
• Does the flavor or texture of food change?
• Is irradiation safe?
• “Cover-up” for poor sanitation?
Food Irradiation

One Process:

Multiple Uses

Sprout Inhibition
Onion, Potato, Ginger, Garlic

Insect Disinfestation
Cereals, Pulses, Dry Fruits

Shelf-life Extension
Chicken, Meat, Fish

Quarantine Fruits

Pathogen Reduction
Spices, Meats & Poultry

Credit to Dr. Arun Sharma
Who Supports Irradiation?

- American Medical Association
- World Health Organization
- Centers For Disease Control
- American Dietetic Association
- Institute of Food Technologists
- American Council on Science and Health
- Food and Drug Administration
- American Public Health Association
- Every scientific & medical organization
Nutrition

Nutritional comparison of irradiated and non-irradiated cooked chicken (Amounts are for 1 kg. (2.2 Lbs)).

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Non-irradiated</th>
<th>Irradiated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>2200</td>
<td>2450</td>
</tr>
<tr>
<td>Vitamin E (International units)</td>
<td>3.3</td>
<td>2.15</td>
</tr>
<tr>
<td>Thiamine (milligrams)</td>
<td>0.58</td>
<td>0.42</td>
</tr>
<tr>
<td>Riboflavin (milligrams)</td>
<td>2.10</td>
<td>2.25</td>
</tr>
<tr>
<td>Niacin (milligrams)</td>
<td>58.0</td>
<td>55.5</td>
</tr>
<tr>
<td>Vitamin B6 (milligrams)</td>
<td>1.22</td>
<td>1.35</td>
</tr>
<tr>
<td>Vitamin B12 (milligrams)</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Pantothenic acid (milligrams)</td>
<td>13</td>
<td>17</td>
</tr>
</tbody>
</table>
Nutritional analysis of irradiated & non-irradiated ground beef Retail Frozen Product
Amounts are for 100 grams of frozen ground beef

<table>
<thead>
<tr>
<th>Nutrient/Vitamin/Count</th>
<th>Non-irradiated Sample</th>
<th>Irradiated Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (by Dumas)</td>
<td>16.6</td>
<td>16.7</td>
</tr>
<tr>
<td>Iron (milligrams)</td>
<td>2.19</td>
<td>2.31</td>
</tr>
<tr>
<td>Thiamin (milligrams)</td>
<td>.0400</td>
<td>.0400</td>
</tr>
<tr>
<td>Zinc (milligrams)</td>
<td>3.89</td>
<td>3.97</td>
</tr>
<tr>
<td>Niacin (milligrams)</td>
<td>4.68</td>
<td>4.82</td>
</tr>
<tr>
<td>Vitamin B$^6$ (milligrams)</td>
<td>0.200</td>
<td>0.140</td>
</tr>
<tr>
<td>Vitamin B$^{12}$ (milligrams)</td>
<td>1.60</td>
<td>1.70</td>
</tr>
<tr>
<td>Phosphorus (milligrams)</td>
<td>135</td>
<td>135</td>
</tr>
</tbody>
</table>

Medallion Laboratories (2002)
# Nutritional analysis of irradiated & non-irradiated ground beef

**Foodservice Fresh (Refrigerated) Product**

<table>
<thead>
<tr>
<th>Nutrient/Vitamin/Count</th>
<th>Non-irradiated Sample</th>
<th>Irradiated Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (by Dumas)</td>
<td>18.1</td>
<td>20.0</td>
</tr>
<tr>
<td>Iron (milligrams)</td>
<td>2.07</td>
<td>1.98</td>
</tr>
<tr>
<td>Thiamin (milligrams)</td>
<td>.0500</td>
<td>.0500</td>
</tr>
<tr>
<td>Zinc (milligrams)</td>
<td>4.09</td>
<td>3.96</td>
</tr>
<tr>
<td>Niacin (milligrams)</td>
<td>4.16</td>
<td>4.32</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;6&lt;/sub&gt; (milligrams)</td>
<td>.230</td>
<td>0.220</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;12&lt;/sub&gt; (milligrams)</td>
<td>1.96</td>
<td>1.78</td>
</tr>
<tr>
<td>Phosphorus (milligrams)</td>
<td>150</td>
<td>142</td>
</tr>
</tbody>
</table>

**Medallion Laboratories-**
Are there “long term” studies on the safety of irradiated foods?

The process of irradiation has been more thoroughly studied than any other food preservation method.

There have been many hundreds of scientific papers published on the safety and effectiveness of irradiation during the past 50 years.
“Irradiation is the single most-studied food safety process in the history of humankind.”

Dr. Michael T. Osterholm
The RALTECH Study

The largest study ever undertaken to evaluate the safety and wholesomeness of irradiated food
RALTECH: Perspective on the Study

• **Magnitude of the effort**
  – 230,000 chilled eviscerated broilers used /
  – 300,000 kg of chicken meat
  – Involved many labs and researchers

• **Types of studies**
  – Nutritional adequacy
  – Genetic toxicity
  – Teratogenicity
  – Chronic toxicity, oncogenicity, and multi-generation general health and reproductive function
RALTECH: Treatments Compared

- **Diet N** control diet (dog chow or rodent chow)
- **FC** 35% frozen control chicken; 65% diet N
- **T** 35% thermally processed chicken; 65% diet N
- **E** 35% electron beamed chicken (~60 kGy); 65% diet N
- **G** 35% gamma rayed chicken (~60 kGy); 65% diet N
Genetic Toxicity Tests

• Four tests used:
  – Ames test (*Salmonella typhimurium*)
  – Sex-linked recessive lethal mutations (*Drosophila melanogaster*)
  – Heritable translocation mutations (mice)
  – Dominant lethal mutations (mice)

Conclusion:
All four tests failed to reveal any mutagenic activity present in irradiated chicken meat (Note that this is for doses approximately 20-fold greater than those used for meat and poultry pasteurization)
RALTECH: Cancer Incidence Data

Tumor Incidence (all types)

Fraction of mice with tumors

Diet Group

CLD  FC  TP  GAM  ELE
Irradiation does not replace hygiene & sanitation

- Irradiation is an additional step.
- Irradiation is NOT A REPLACEMENT FOR OTHER TECHNOLOGIES already in place.
employees need not wash hands. we have food irradiation
Arguments against...

This is little more than an excuse for the sale of contaminated (food).

(This process) will be used to mask low-quality foods. Better controls and inspection are what is needed.

(This process) decreases the nutritional value of (food).

It leads to formation of harmful products in (food). Possibly dangerous substances could be formed.

This (process) will increase the price of the product. It is not necessary. We have a direct and prompt food distribution system.
Arguments against pasteurization

This is little more than an excuse for the sale of contaminated milk.

Pasteurization will be used to mask low-quality foods. Better controls and inspection are what is needed.

Pasteurization decreases the nutritional value of milk.

It leads to formation of harmful products in milk. Possibly dangerous substances could be formed.

This process will increase the price of the product.

It is not necessary. We have a direct and prompt food distribution system.

Sources:
- Milk Pasteurization, Hall & Trout (1968)
- Technology Review (December 1997)
Food Irradiation Update is published by the Minnesota Beef Council

Quotable Quotes:

According to the USDA, combining chlorination and irradiation can be an effective way to kill E. coli and Salmonella on alfalfa sprouts. In 1999, USDA Agricultural Research Service found that a treatment of irradiation and chlorine solution not only killed both organisms, but extended the shelf life of sprouts from about five days to more than a week.

In the tests, they used the same dose of irradiation as approved for irradiating meat. They also subjected the alfalfa seeds to various levels of chlorinated water. According to the research results, the best way to eliminate pathogens would be a combination of irradiation and sanitation treatments. That’s because sprouts can be contaminated internally, which would prevent a surface disinfectant from working effectively.

USDA Agricultural Research Service scientists Donald W. Thayer, Kathleen T. Rajkowski and William F. Fett

"Dr. Mansour Samadpour of IEH Laboratories and Consulting Group in Seattle reported at the "7th International Symposium on Shiga Toxin Producing E. coli" that his lab tested approximately 5,000 samples of ground beef purchased at retail stores and found non-O157 STECs in 1.9 percent of the samples. One positive out of every 50 packages sampled suggests a high rate of contamination. It is more proof that the pathogens exist in our food supply and make people sick. We urge the President, his appointees and the industry to join us in supporting FSIS's efforts to get non-O157 STECs out of our ground beef."

Dr. Richard Raymond & Corol Tucker-Foreman

"In the wake of Europe's recent E. coli outbreak, in which sprouts contaminated with a particularly vicious strain killed 36 people and sickened thousands, food safety officials are asking once again what more can be done to curb the spread of food-borne illnesses. Some experts say part of the solution lies with food irradiation — an effective, underused method of prevention that's been around for more than 100 years."

Los Angeles Times

"It is practically impossible to prevent at least some bugs getting into food in the field, no matter how stringent the hygiene rules. And washing fresh produce removes little more than surface dirt. The only answer is irradiation. That means treating food with high-energy bursts of electrons or photons to attack the micro-organisms' DNA, preventing them from spitting out dangerous toxins and proliferating."

The Economist

"If even 50% of meat and poultry consumed in the United States were irradiated, the potential impact of food borne disease would be a reduction [of] 900,000 cases and 300 deaths."

Michael Osterholm, director of the Center for Infectious Disease Research and Policy at the University of Minnesota."
People buy foods, not technologies

Dr. Christine M. Bruhn,
Department of Food Science & Technology,
University of California at Davis
Don’t confuse consumer response with activist’s statements;

- Consumers are currently buying significant volumes of irradiated meat and produce;
- Education and promotion will increase the number who select /prefer irradiated food.
Consumer Reaction

• Generally positive or neutral;
• Many are undecided & want to know more;
• A small minority are opposed;
  — (Many of these folks are opposed to other technologies, not just irradiation...)
Acceptance Increases

• When people hear about the safety testing;
• When people hear who endorses safety;
• When people see the product;
• After a foodborne illness outbreak that irradiation could have prevented.

– Dr. Christine Bruhn, University of California, Davis
Recently a major food company conducted focus group research to determine consumer attitudes toward food irradiation.

“The results came back very positive and some of our executives were skeptical. So we repeated the research and the results were even more positive.”
Education is the key to consumer acceptance.
Food Irradiation 101

Ronald F. Eustice
Executive Director, Minnesota Beef Council
Consultant, Food Irradiation Processing Alliance (FIPA)
Name ____________________  Date __________

IRRADIATION

Ron Eustice – Executive Director, Minnesota Beef Council & Amy Halvorson, RD – Minnesota Beef Council

- Before the Presentation:
  - Circle a Number

Con Irradiation of Food

1
2
3
4
5
6
7

Pro Irradiation of Food

1
2
3
4
5
6
7

- After the Presentation:
Ron Eustice – Executive Director, Minnesota Beef Council & Amy Halvorson, RD – Minnesota Beef Council

Before the Presentation:

Circle a Number

Con Irradiation of Food

3
1

Pro Irradiation of Food

51
4

5

3

After the Presentation:

Circle a Number

Con Irradiation of Food

3
1

Pro Irradiation of Food

16
4

5

63

Comments:

http://www.mnbeef.org/index.htm
## Foods Approved for Irradiation in the USA

<table>
<thead>
<tr>
<th>Year</th>
<th>Food</th>
<th>Dose</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>Wheat Flour</td>
<td>0.2-0.5 KGY</td>
<td>Control of Mold</td>
</tr>
<tr>
<td>1964</td>
<td>White Potatoes</td>
<td>0.05-0.15 kGy</td>
<td>Inhibit Sprouting</td>
</tr>
<tr>
<td>1986</td>
<td>Pork</td>
<td>0.3-1.0 kGy</td>
<td>Kill Trichina Parasite</td>
</tr>
<tr>
<td>1986</td>
<td>Fruits &amp; Vegetables</td>
<td>&lt; 1.0 kGy</td>
<td>Insect Control/ Extend Shelf Life</td>
</tr>
<tr>
<td>1986</td>
<td>Herbs &amp; Spices</td>
<td>&lt; 30 kGy</td>
<td>Sanitization</td>
</tr>
<tr>
<td></td>
<td>(Flavoring Materials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>Dried Enzymes</td>
<td>10 kGy</td>
<td>Bacterial Reduction</td>
</tr>
<tr>
<td>1990</td>
<td>Poultry</td>
<td>&lt; 3 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>1995</td>
<td>NASA/Meat</td>
<td>&gt; 44 kGy</td>
<td>Sterilization</td>
</tr>
<tr>
<td>1997</td>
<td>Fresh Meat</td>
<td>&lt; 4.5 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2000</td>
<td>Frozen Meat</td>
<td>&lt; 7 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2000</td>
<td>Sprouts</td>
<td></td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2000</td>
<td>Shell Eggs</td>
<td>3 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2001</td>
<td>Pet Treats/Animal Feed</td>
<td>&lt; 50 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2006</td>
<td>Molluscan Shellfish</td>
<td>&lt; 5.5 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2008</td>
<td>Fresh Spinach &amp; Iceberg Lettuce</td>
<td>&lt; 4.0 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
</tbody>
</table>
FDA Approval of Ingredients
(Partial List)

Approved
• Seeds & seed products
• Grains & grain products
• Spices/herbs
• Dry vegetables
• Fruits & fruit products
• Enzymes & rennet

To be determined
• Yeast & extract
• Dried egg products
• Dried meat products
• Gums/thickeners
• Coconuts
• Dairy ingredients
• Soy
• Gelatin
• Chocolate & products
• Nuts & nut products
Labeling Requirements in the U.S.A

Labeling

At Retail:
Radura, symbol and “Irradiated for Safety”

Additional Terminology: Reduced, Eliminated, or Free of (OK, if it can be proven or justified).

If an irradiated product is used as an ingredient it must be identified on the ingredient label.

Restaurants

Radura symbol and word irradiated must be on the outside package or carton.

Notification of customer is not required.
Schwan's Burgers always cook up tender, juicy, and full of big, beefy flavor! At Schwan’s, we're very proud of our dedication to bringing you quality, great taste and convenience. In keeping with this tradition, we utilize USDA/FDA-approved irradiation, the latest in food safety technology. This innovative process continues our commitment to superior quality and safety by ensuring that all our beef burgers are the best they can possibly be.

Stack a couple of these Quarter-Pound Burgers with crisp slices of our hickory-smoked Thick Sliced Bacon (440) and tangy triangles of our American Processed Cheese (661) for a truly memorable burger!
Labeling
Mango Packaging
Treated with gamma radiation
To control insect infestation

Mangosteen
Treated with irradiation
Product of Thailand
3042
Labeling

- “Treated by Irradiation to Improve Microbiological (or Food) Safety“

- “Treated by Irradiation for Disinfestation”

- “Treated by Irradiation to Prevent Sprouting”
Labeling

- “Treated by Irradiation to Protect American Agriculture from Harmful Foreign Insects”

- “Treated by Irradiated to Increase Shelf Life”
Recent Approvals: Food Safety

Approved on August 26, 2008
On 12 June 2009 Food Technology Service Inc. (FTSI) Florida became the first licensed facility to make raw oysters safer by irradiating them.

FTSI applies a proprietary dose to eliminate *Vibrio vulnificus*, which is a naturally occurring marine bacterium that can make some people very sick or can kill them.
Ready-to-Eat (RTE) Foods

- Grocery Manufacturer’s Association (GMA) has petitioned FDA to allow irradiation of certain prepared foods including hot dogs, luncheon meats, bologna etc.
It is estimated that approximately 80,000 metric tons (175,000,000 pounds) of commercial spices are irradiated annually in the USA.

One-third of total US production.
Current Meat Applications of Irradiation in the USA
Schwan’s markets irradiated beef patties nationwide. All raw ground beef at Schwan’s is irradiated.

**Ground Beef**
Specially designed to be moist and juicy with 85% lean beef making it a versatile ingredient, perfect for recipes. Irradiated for your safety.
4-8 oz. packs, 2 lbs.
WAS $7.99 | NOW $7.89

**Black Angus Steak Burger**
Fans of Black Angus beef will love this juicy, one-third pound burger. Irradiated for your safety.
8-5.3 oz. burgers, 2.65 lbs.

**Quarter Pound Beef Patties**
Our classic quarter pound burger, full of big, beefy flavor. 90% lean, irradiated for your safety.
8-4 oz. patties, 2 lbs.

**LIVESMART**
Breakfast Steaks
Steak and eggs define the hearty breakfast. These just-right portions of beef let you create a sizzling breakfast right at home. Just add your favorite eggs.
8-2 oz steaks
cal 90  fat 4.5g  sodium 105mg  carbs 0g

**New!**

**Schwan’s**
HOME DELIVERY OF FINE FOODS
• Mail order nationwide
• 81 retail stores in 29 states
• Expanding by 4 to 5 stores per year
Irradiated ground beef is a value-added product, and we are proud to offer this alternative to our customers.

Mary Ellen Burris, Director of Consumer Affairs
Irradiated Ground Beef
Wegmans Markets, Rochester, New York
Colorado Boxed Beef
Irradiated Meat in the US Space Program (NASA)
Irradiated pet treats & toys

18,000-20,000 MT
In USA
18,000-20,000 MT
In USA
(40 million pounds)
Animal Feedstuffs

- Colostrum
- Whey
- Whey Protein
Irradiated Fruits & Vegetables in USA

15,000 MT (35,000,000 Lbs.) Annually

Boniatos
Boniato de Okinawa
Lychee
Rambután
Hawaii Pride
Hawaii Pride
Hawaii Pride
Irradiated Fruit
APHIS proposes adding irradiation facilities

• A proposal by the Animal and Plant Health Inspection Service to allow food irradiation facilities to operate in 15 states in the South could be very good news for importers and consumers who have a taste for fresh produce year-round.

• The agency of the U.S. Department of Agriculture published the proposed rule in the Federal Register on Sept. 29, 2011.
APHIS proposes adding irradiation facilities

APHIS has received a petition for permission to open an irradiation facility in McAllen, Texas, to treat foods coming into the U.S. and those being moved from state to state.

- There is a growing market in the U.S. for fresh guavas from Mexico and that any move by APHIS to expand technological applications to remove marketplace restrictions would be good news.
USDA Framework Equivalency Work Plans (FEWP)

- India
- Mexico
- Thailand
- Philippines
- Viet Nam
- Laos
- Malaysia
- Pakistan
- South Africa.
India
China

200,000 MT of food irradiated annually (2009)
Irradiation provides a solution that increases the shelf life and the microbiological safety while fully preserving the sensory qualities. The products are sold throughout China with the mention of irradiation on the package.

Fermented spicy chicken feet and wings, a typically Chinese delicacy is now irradiated in very large volumes.
Queen of Fruits: The Mangosteen

Thailand

Available From:

Frieda’s

MANGOSTEEN
Treated with irradiation
Product of Thailand
3042

www.melissas.com
Isotron (Thailand) Ltd & Fruits Irradiation

- Mangosteen
- Longan
- Rambutan
- TOTAL

1,400 M.T. in 2008

2,100 M.T. in 2009
Viet Nam

5,300 METRIC TONS

DRAGON FRUIT
After a 74 year ban, fresh guavas are arriving in the USA from Mexico thanks to mandatory use of irradiation.
In 2010 more than 7,500 metric tons (16.7 million pounds) of irradiated guavas and mangoes entered the US from México. All was sold at retail.
**Exportation of Irradiated Mexican Fruit to the USA:**

<table>
<thead>
<tr>
<th>Product</th>
<th>Total 2010</th>
<th>Total 2011 (estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pounds (Tons)</td>
<td>Pounds (Tons)</td>
</tr>
<tr>
<td>Guava</td>
<td>16,000,000 (7,260)</td>
<td>17,500,000 (7,950)</td>
</tr>
<tr>
<td>Mangos</td>
<td>350,000 (160)</td>
<td>400,000 (182)</td>
</tr>
<tr>
<td>Peppers</td>
<td>350,000 (160)</td>
<td>400,000 (182)</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>0</td>
<td>100,000 (45)</td>
</tr>
<tr>
<td>Total</td>
<td>16,700,000 (7575)</td>
<td>18,400,000 (8,347)</td>
</tr>
</tbody>
</table>
Production is expected to reach 25 – 40,000 Metric Tons in 2011 (and double that amount in 2012-2013)
Brazil

- Animal Feed
- De-hydrated (dried) products
- Pet Food & pet toys
- Spices

25,000 MT
Irradiated Fruit Exportation
Australia to New Zealand

Mangos are irradiated every day during the 90-120 harvest.

1,205 Metric Ton Irradiated in 2010

Steritech
Exportation of Irradiated Australian Fruit to New Zealand (2004-2010) Metric Tons

<table>
<thead>
<tr>
<th></th>
<th>2004-06</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>256</td>
<td>228</td>
<td>261</td>
<td>585</td>
<td>1095</td>
</tr>
<tr>
<td>Papaya</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Litchi</td>
<td>0</td>
<td>10</td>
<td>21</td>
<td>57</td>
<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>256</td>
<td>251</td>
<td>283</td>
<td>642</td>
<td>1205</td>
</tr>
</tbody>
</table>
Turkey

- Irradiated Food Volume (2010):
  - Gamma Pak: 3.625 Tons
  - TAEK (Government): 1.200 Tons

Total: 4.825 Tons
JAPAN
# Quantity of Foods Irradiated Commercially in some Asian & North & South American Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Metric Tons*</th>
<th>Main Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1,200</td>
<td>Mango, papaya, litchi</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>N/A</td>
<td>Spices, potatoes</td>
</tr>
<tr>
<td>China</td>
<td>200,000</td>
<td>Garlic, spices, dried vegetables, cooked meats</td>
</tr>
<tr>
<td>India</td>
<td>10,000</td>
<td>Spices, spice mixes, dried vegetable seasonings, mango</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2,265</td>
<td>Spices, dried vegetables, dehydrated products, frozen products (shrimp, fish, frogs legs)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>826</td>
<td>Spices, herbs, vegetable seasonings, cocoa</td>
</tr>
<tr>
<td>Pakistan</td>
<td>(i) 147 tons (ii) 560,000 packets</td>
<td>(i) Dehydrated foods (ii) Ready-to-eat meals</td>
</tr>
<tr>
<td>Philippines</td>
<td>345</td>
<td>Spices, dehydrated vegetables and fruits</td>
</tr>
<tr>
<td>Korea (Rep)</td>
<td>2,500</td>
<td>Dried vegetables, spices</td>
</tr>
<tr>
<td>Thailand</td>
<td>2,100</td>
<td>Nham, spices, herbs, vegetable seasonings, sweet tamarind, mango, mangosteen and longan</td>
</tr>
<tr>
<td>Vietnam</td>
<td>5,300</td>
<td>Spices, frozen foods and dragon fruit</td>
</tr>
<tr>
<td>Mexico</td>
<td>7,500</td>
<td>Guavas, mangoes</td>
</tr>
<tr>
<td>Brazil</td>
<td>25,000</td>
<td>Animal feed, dehydrated products, pet food, Pet treats, spices</td>
</tr>
<tr>
<td>USA</td>
<td>120,000</td>
<td>Spices, meats, produce, animal feed, pet treats</td>
</tr>
</tbody>
</table>

* approximate values for 2009 or the latest year available; Dr. Arun Sharma and others
Irradiation in the USA Today

- Approximately 8,000 MT (15-18,000,000 pounds) of ground beef irradiated annually in USA.

- Approximately 14,000 MT (30,000,000 pounds) of produce irradiated annually.

- Approximately 70-80,000 MT (175,000,000 pounds) of spices irradiated annually.

- Approximately 18,000 to 20,000 MT (40 million pounds) of irradiated pet treats.
Asparagus

Comparison of asparagus tips by treatment group at day 0

Control  X-ray 400Gy  X-ray 1,000 Gy
Shelf Life Extension

Control
36 days at 34F

Irradiated at 400Gy
36 days at 34F
Can This Meat Still Kill You?

Yes, This Meat Can Still Kill You!
Yes, Meat Can Still Kill You!!

• So can;
  – Spinach
  – Lettuce
  – Peppers
  – Peanut Paste
  – Bean Sprouts
  – Alfalfa, Bean & Radish Sprouts
  – Pistacios
  – Etcetera, etcetera, etcetera
Germany
May/June 2011
“Yes, and so can…….."

“There has not been such an outbreak before that we know of in the history of public health.”

Dr. Robert Tauxe, US Centers for Disease Control (CDC)
European E. Coli Outbreak

Latest Statistics
(August 15, 2011)
Sick: ±4,200
Hemolytic Uremic Syndrome: ± 900
Dead: 53

E. coli 104

Deadliest E. coli outbreak in history
So here we go again: agitation for more money and regulation, though agricultural authorities still believe where the German farm erred. Sprouts require warm and humid farm environments, which make particularly hospitable to bacteria. But both harmful and harmless E. coli strains are present in the most animals, as well as human beings. No amount of standardizations or certifications will guarantee eradication from food.

The best practice for doing so would be, well, irradiation, which involves sending gamma rays or other radiation into meat, poultry and produce. The process can deactivate up to 99.999% of E. coli, and was declared safe by the U.S. Food and Drug Administration almost 50 years ago. Even so, less than 10% of the global population is irradiated.

The problem is largely that the term "irradiation" sounds like what might have happened to Blink, a three-eyed fish that Bart Simpson caught downstream from the Springfield Nuclear Power Plant in "The Simpsons".
Yield of Irradiated Alfalfa Seeds

Fan et al., 2003
Rajkowski et al., 2003

Dose (kGy)
0 1 2 3 4 5

Yield (g sprout/g seed)
4
6
8
10
12
14

4 days
6 days

Fan et al., 2003
Rajkowski et al., 2003
Sprouts from Irradiated Seeds (6 days)

Mung bean

Radish

Broccoli

Alfalfa

Bari et al., 2009.
“Spices — this is, I think, this is the emerging issue.”

Michael P. Doyle, Ph.D., regents professor of food microbiology and director of the Center for Food Safety at the University of Georgia
Spices in many countries are dried on the ground and exposed to many food safety risks.
These nasty critters won’t go away easy
Cargill recalls ground turkey over salmonella fears
36 million pounds
Recall of 36 million pounds of ground turkey over a salmonella outbreak that sickened 76 people, killing one.

"It is regrettable that people may have become ill from eating one of our ground turkey products; And for anyone who did, we are truly sorry."

Steve Willardsen, president of Cargill's turkey processing business
Cargill announces second ground turkey recall over salmonella fears
Multiple Hurdle Intervention

‘Firewalls for Microbial Control’

- Antimicrobial rinse
- Live animal steam treatment
- Pre-evisceration carcass spray
- Steam
- Vacuuming
- Hide removal

Thermal treatment
Multiple-Hurdle Technology

- Knife Trimming
- Pre-Evisceration Wash
- Chemical Dehairing
- Acetic Acid Rinse
- Sodium Phosphate
- Steam Pasteurization
- Final Wash
- Steam Vacuuming
- Lactic Acid Rinse
- Hot Water Wash
- Irradiation
How effective is Irradiation?

- At the doses commonly used to irradiate ground beef we can expect the following reduction in bacteria counts:
  - *E. coli O157:H7* 99.99% to 99.9999%
  - *Salmonella* 99% to 99.9%
  - *Listeria* 99.9% to 99.99%
Cantaloupe outbreak is deadliest in a decade

- As on October 12, 2011, a total of 116 persons infected with any of the four outbreak-associated strains of *Listeria monocytogenes* have been reported to CDC from 20 states. At least twenty three have died.
Cantaloupe Recalls are not new!!

The FDA has announced a Dole cantaloupe recall due to possible contamination with Salmonella Litchfield. Dole Fresh Fruit Company, a subsidiary of Dole Food Company, Inc., has voluntarily recalled all Honduran Cantaloupes. Fifty persons sickened.

March 31, 2008
Prevention & Elimination

versus

Reduction & Infection

How close to zero can we get?
Which tools can help us get there?
Canning eliminates bacteria
Irradiation of Poultry

Three biggest points:

• Equality between ground beef and other meats;
• Packaging materials
• Packaging atmospheres
From the Centers for Disease Control

• If 50% of poultry, ground beef, pork, and processed meats in the U.S. were irradiated, the potential benefit would be a 25% reduction in the morbidity and mortality rate caused by these infections.

Dr. Robert Tauxe, US Centers for Disease Control
From the US Centers for Disease Control

• Irradiation could prevent nearly 900,000 cases of infection, 8,500 hospitalizations, more than 6,000 catastrophic illnesses, and 350 deaths each year.

  *Dr. Robert Tauxe, CDC*
We are at a Crossroads

Recalls
Illness
Death
Litigation
Bankruptcy

Make Food Safer by Routine Irradiation
It’s time to seriously consider using the silver bullet!
“Why do we need to wait until the train hits us before we put up a stop light at the railroad tracks?”

Dr. Michael Osterholm, Director, University of Minnesota Center for Infectious Disease Research & Policy
THANK YOU

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