Meat & Food Irradiation:

Regulatory Update

&

Impact on Product Safety and Quality

Ronald F. Eustice

Executive Director

Minnesota Beef Council
What we will learn today

• Which Foods are Approved for Irradiation in the USA
• Pending Approvals
• What is Food Irradiation?
• How Does Irradiation Work?
• Effect of Irradiation
  – Pathogen Reduction
  – Nutrition
  – Taste
• Is Irradiation a Safe Process?
• Making Meat Safer…Progress Update
• Call to Action
<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>1964</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 (Flavoring Materials)</td>
<td>&lt; 30 kGy</td>
<td>Sanitization</td>
</tr>
<tr>
<td>1986</td>
<td>Dried Enzymes</td>
<td>&lt; 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>Seeds for Sprouting</td>
<td>&lt; 8 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
</tr>
<tr>
<td>2000</td>
<td>Shell Eggs</td>
<td>&lt; 3 kGy</td>
<td>Pathogenic Bacteria Reduction</td>
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<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 Irradiation

Approved on August 26, 2008
The American Meat Institute (AMI) has submitted a petition to the USDA's Food Safety and Inspection Service (FSIS) to recognize the use of low penetration and low dose electron beam irradiation on the surface of chilled beef carcasses as a processing aid.

*The Request was discussed at a Sept. 18 hearing in Washington, D.C.*
Carcass Irradiation

Research Summary

The carcass irradiation research was conducted on the surface tissue from chilled subprimal.

For the inoculation trial, cutaneous truncii from the beef plate were inoculated and treated at a dose of 1kGY. For the sensory work, flank steaks and beef plates that were then ground and formulated into ground beef patties.
Carcass Irradiation

Conclusions:

• Irradiation is exceptionally effective at reducing levels of *E. coli* O157:H7;
  • *E-beam irradiation reduced* *E. coli O157:H7* *by at least 4 log CFU/cm²*

➢ Irradiation does not have any effect on organoleptic properties or appearance;
➢ Does not have any lasting effect on shelf life;
➢ Does not produce significant losses of macro-or micro-nutrients.
Ready-to-Eat Foods

• Grocery Manufacturer’s Association (GMA) has petitioned FDA to allow irradiation of certain prepared foods including hot dogs, luncheon meats etc.
What is Food Irradiation?

• Food irradiation is a process in which food products are exposed to a controlled amount of radiant energy to increase the safety or extend shelf life of the food.

• Like pasteurization of milk and pressure cooking of canned foods, treating food with ionizing radiation can kill bacteria and parasites that would otherwise cause foodborne disease.
What is radiant energy?

The sun's energy, infrared waves, and microwaves are part of the electromagnetic energy spectrum.
Electromagnetic Spectrum

High Frequency
Short Wavelengths

Low Frequency
Long Wavelengths
Microwave ovens generate radiant energy
X-Ray Scanners at Airports
How does irradiation food processing operation work?

- Food is packed in containers and moved by conveyer belt into a shielded room.
- Food is exposed briefly to a radiant-energy source.
  (The amount of energy depends on the food.)
- Food is left virtually unchanged, but the number of harmful bacteria, parasites and fungi is reduced and may be eliminated.
3 types of ionizing radiation have been approved for irradiating food - -

- **High-Energy Electrons (Electron Beam)**
  - *Operated by electricity*

- **X-Ray**
  - *Operated by electricity*

- **Gamma Rays**
  - *Operated by radioactive isotopes (cobalt–60 created from non-radioactive Cobalt 59)*
Benefits of Irradiation

- Reduces or eliminates harmful food borne pathogens:
  - *E. coli O157:H7*  *Campylobacter*
  - *Salmonella*  *Trichinella*
  - *Listeria*  *Many others*

- Eliminates insects in fruits and vegetables
- Delays ripening of fruits and vegetables
- Inhibits sprouting in onions, potatoes, etc.
- Replaces chemical fumigation
- Extends freshness
How irradiation works

- Electron or gamma rays disrupt the DNA chain either destroying or preventing reproduction of the organism
Normal bacteria with DNA strands

- DNA strands
- Cytoplasm
- Nucleus
Damaged DNA after irradiation

broken bonds in DNA strands
Damaged bacterial cell after irradiation

- damaged DNA strands after irradiation
- cytoplasm
- nucleus
A stream of high energy electrons, propelled out of an electron gun. Electron gun apparatus is a larger version of the device in the back of a TV tube that propels electrons into the TV screen at the front of the tube, making it light up.
Gamma Irradiation

A Gamma Irradiation Facility (Photo compliments of MDS Nordion)
Co-60 GAMMA RAY SOURCES

Photographs Courtesy of MDS Nordion
Co-60 SOURCE RACK UNDER WATER

Photographs Courtesy of MDS Nordion
Gamma Processing

Photographs Courtesy of MDS Nordion
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
Claims made by irradiation critics

- Nutritional loss
- Filthy food
- Chemical changes
- Flavor changes
- Unknown “Risks”
- Nuclear connection?
- False sense of security
Does irradiation reduce food’s vitamin and enzyme content?

All processing of food – cooking, canning, freezing decreases nutritional content.

• FDA has determined that nutritional loss from irradiation is insignificant.

• Irradiated fruit can be shipped riper than non-irradiated fruit, resulting in higher vitamin A and C content.
# 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 B⁶ (milligrams)</td>
<td>0.200</td>
<td>0.140</td>
</tr>
<tr>
<td>Vitamin B¹² (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**

Amounts are for 100 grams of fresh 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>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-2002*
Irradiated Ground Beef Education Initiative

In cooperation with Minnesota Beef Council
Irradiated Ground Beef Education Initiative

Which one word best describes the taste of the sample of irradiated ground beef?

Positive Comments: 3,286 out of a total of 3,347—98% Positive

<table>
<thead>
<tr>
<th>Positive Comments</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1382</td>
</tr>
<tr>
<td>Great</td>
<td>335</td>
</tr>
<tr>
<td>Very Good</td>
<td>186</td>
</tr>
<tr>
<td>Tasty/Very Tasty</td>
<td>168</td>
</tr>
<tr>
<td>Excellent</td>
<td>152</td>
</tr>
<tr>
<td>OK/Alright</td>
<td>138</td>
</tr>
<tr>
<td>Juicy/Moist</td>
<td>119</td>
</tr>
<tr>
<td>Delicious</td>
<td>95</td>
</tr>
<tr>
<td>Same/No Change</td>
<td>92</td>
</tr>
<tr>
<td>Beefy/Meaty</td>
<td>84</td>
</tr>
<tr>
<td>Yummy</td>
<td>88</td>
</tr>
<tr>
<td>Flavorful/Savory</td>
<td>81</td>
</tr>
<tr>
<td>Wonderful</td>
<td>37</td>
</tr>
<tr>
<td>10/10</td>
<td>25</td>
</tr>
<tr>
<td>Fine</td>
<td>23</td>
</tr>
<tr>
<td>Hamburger</td>
<td>18</td>
</tr>
<tr>
<td>Average</td>
<td>17</td>
</tr>
<tr>
<td>Tender</td>
<td>16</td>
</tr>
<tr>
<td>Fantastic</td>
<td>14</td>
</tr>
<tr>
<td>9/9</td>
<td>12</td>
</tr>
<tr>
<td>Normal</td>
<td>10</td>
</tr>
<tr>
<td>Lean</td>
<td>10</td>
</tr>
</tbody>
</table>

Total Positive:
3,286 out of a total of 3,347—98%
Irradiated Ground Beef Education Initiative

Which one word best describes the taste of the sample of irradiated ground beef?
Neutral Comments: 48 (1.4%)  Negative Comments: 25 (0.7%) out of a total of 3,347

<table>
<thead>
<tr>
<th>NEUTRAL COMMENTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bland/Dull/Plain</td>
<td>15</td>
</tr>
<tr>
<td>Not sure/??</td>
<td>10</td>
</tr>
<tr>
<td>3/3</td>
<td>6</td>
</tr>
<tr>
<td>So So/Mediocre</td>
<td>4</td>
</tr>
<tr>
<td>Fair</td>
<td>8</td>
</tr>
<tr>
<td>Grainy</td>
<td>3</td>
</tr>
<tr>
<td>Different</td>
<td>1</td>
</tr>
<tr>
<td>Lack Flavor</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL NEUTRAL</td>
<td>48 (1.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEGATIVE COMMENTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>14</td>
</tr>
<tr>
<td>No!</td>
<td>3</td>
</tr>
<tr>
<td>2/2</td>
<td>3</td>
</tr>
<tr>
<td>1/1</td>
<td>2</td>
</tr>
<tr>
<td>Leather</td>
<td>1</td>
</tr>
<tr>
<td>Nasty</td>
<td>1</td>
</tr>
<tr>
<td>Rubbery</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL NEGATIVE</td>
<td>25 (0.7%)</td>
</tr>
</tbody>
</table>
Claim: There have been no “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 more than 500 scientific papers published on the safety and effectiveness of irradiation during the past 50 years.
**Objective:**
- To determine the wholesomeness of radiation sterilized chicken meat

**Background:**
- Started in 1976 and lasted 7 years
- US ARMY Medical Department / later transferred to USDA
- Cost 8 million dollars
- Consisted of 20 separate research projects, examining effect of consuming radiation sterilized chicken meat, with respect to:
  - Nutritional quality
  - Teratogenicity
  - Carcinogenicity
  - Reproductive performance
  - Genetic toxicity
  - General toxicity
- Test species: Dogs, rats, mice, hamsters, rabbits, fruit flies
RALTECH: Overview of the Study

Five diets compared:

- \( N \) 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 \( N \)

Magnitude of the effort:

- 230,000 chilled eviscerated broilers used / 300,000 kg of chicken meat
- Involved many labs and researchers

Types of studies

- Nutrition
- Genetic toxicity
- Teratology
- Chronic toxicity, oncogenicity, and multi-generation general health and reproductive function
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 showed NO 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 Study

Summary of Results (from Thayer et al, 1987)

- Overall the studies were consistent in producing negative results in all the variety of tests performed
- The results have been independently reviewed, and endorsed, by
  1. Division of Pathology, FDA Center for Food Safety and Applied Nutrition
  2. National Toxicology program, Technical Reports Review Subcommittee

CONCLUSION:
RALTECH studies confirm the safety and wholesomeness of chicken sterilized by irradiation to a maximum dose of 68 kGy
Critics Claim:

- Irradiation masks and encourages filthy conditions in slaughterhouses and food processing plants.
- Irradiation does nothing to remove feces, urine, pus, and vomit that often contaminates beef, pork, chicken and other meat.
Employees need not wash hands. We have food irradiation.
Filthy Food?

- **Irradiation is an additional step.**
- **Irradiation is NOT A REPLACEMENT FOR OTHER TECHNOLOGIES already in place.**
Claims made by irradiation critics

- **Nutritional loss** (Insignificant)
- **Lack of long term studies** (Most extensively studied food processing technology in history)
- **Chemical changes** (No different than from other processes)
- **Filthy food** (An additional step, not a replacement for)
- **Nuclear connection?** (Cobalt-60 is not used in nuclear plants Electron Beam uses electricity)
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)
The Cow Pock or the Wonderful Effects of the New Inoculation!
James Gillray (1757-1815) Photographic reproduction of an etching appearing in Vide-
The Publications of ye Anti-Vaccine Society, June 12, 1802, National Library of Medicine

Anti-Vaccination Cartoon (1802)
How Effective is Irradiation?

- At doses that are commonly used to irradiate ground beef, we can expect the following levels of pathogen reduction:
  - *E. coli O157:H7*  99.99% to 99.9999%
  - *Salmonella*  99% to 99.9%
  - *Listeria*  99.9% to 99.99%
Why are we interested in meat irradiation?

- Irradiation is an additional tool to reduce/eliminate E. coli O157:H7
- Beef industry has invested millions of dollars in E. coli O157:H7 food safety research.
  - Lactic acid carcass wash
  - Steam vacuum
  - Hand trimming to remove fecal contamination
  - Acidified sodium chlorite spray
  - Steam pasteurization
  - Vaccines
“Like finding the needle in the haystack.”
Random Test Results: Usually Negative

• It would take several hundred samples from a single 2,000-pound combo to gain a 95 percent confidence that the product is E.coli O157:H7 free.
“You can’t find it, you can’t see it, yet we need to get it out of the system”

“Searching for E. coli in the packing plant is like searching for Osama bin Laden. You don’t know where it is at. You can’t find it, you can’t see it; Yet we still need to find it and get it out of the system.”

Dr. Dell Allen, Excel Corporation
Since 1993, the Beef Checkoff Program has funded more than $25 million in beef safety research, leading to best practices which serve as a road map in reducing *E. coli* O157:H7 and other foodborne pathogens. This investment has helped the incidence of *E. coli* O157:H7 in ground beef decline more than 80 percent between 2000 and 2005, according to USDA.
Multiple-Hurdle Technology

Colorado State University
Center for Red Meat Safety
Slaughter Best Practice

- Employee training
- Hygienic sanitary hide removal and evisceration
- Equipment sanitation and personal hygienic practices
- Physical barriers; e.g. brisket opening covers, tail and bung bags, round covers, brisket covers, hide stretchers
- Sterilizer dips for utensils between each carcass, e.g. two-knife system

Courtesy Dr. Randall Huffman, American Meat Institute Foundation
Steam vacuum

- Focus on pattern marks where the hide was penetrated.
- Dorsa et al. (1996) demonstrated steam vacuum is effective at removing visible contamination and can achieve a ~1 log reduction in APC.

Courtesy Dr. Randall Huffman, American Meat Institute Foundation
Pre-evisceration organic acid rinse

- Lactic and acetic acid are most frequently used.
- Generally provides a 1-1.5 log reduction in APC in controlled studies (Hardin et al. 1995).
Thermal treatment of carcass

- Steam and hot water proven effective
- Water temperature @ >165°F has a sanitizing effect (USDA-FSIS, 1996)
- Focus on both exterior and interior of carcass.
- Effective log 1.0-1.5 reduction in APC (Graves Delmore et al., 1997)
Post harvest intervention strategies

Organic acid rinses, steam pasteurization, steam vacuuming etcetera, are estimated to obtain a 2 to 3 log kill which results in a 99 – 99.9 % reduction in bacterial load and means that 1 in 100 to 1 in 1000 bacteria remain.
• FSIS says that 0.17% of the ground beef samples tested positive for E. coli O157:H7 in 2006.
  – In 2005, 0.17% of samples tested positive;
  – In 2004, 0.17% of samples tested positive;
  – In 2003, 0.38% of samples tested positive;
  – In 2002, 0.78% of samples tested positive;
  – In 2001 0.84% of samples tested positive.
Multiple Hurdle Intervention

‘Firewalls for Microbial Control’

- Live Animal Steam Treatment
- Pre-Evisceration Carcass Spray
- Thermal Treatment
- Antimicrobial Rinse
- Hide Removal
- Steam Vacuuming
• Beef checkoff funding is instrumental in establishing best practices, including the “Best Practices for Controlling \textit{E. coli} O157:H7”, which have been shown to reduce bacteria during processing by 99.99 percent.

• Source: BEEF CHECKOFF TALKING POINTS (May 2007)
• A plane crash every week at Chicago’s O’Hare Field.
• One million checks deducted from wrong bank accounts every week.
• 18,000 incorrect drug prescriptions would be written in next 12 months.
What if a Detroit automaker sold a line of vehicles fully aware that between 0.17% and 0.24% of those vehicles had a production defect that each year could potentially lead to thousands of injuries and scores of deaths among its customers?
FSIS Prevalence of *E. coli* O157:H7 in Ground Beef*

*Results of raw ground beef products analyzed for *E. coli* O157:H7 in federal plants. 2007 Data 29 positives out of 12,200 samples*
<table>
<thead>
<tr>
<th>Date</th>
<th>Product</th>
<th>Pounds</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 5</td>
<td>Ground Beef</td>
<td>156,235</td>
<td>Company Sample</td>
</tr>
<tr>
<td>July 17</td>
<td>Ground Beef</td>
<td>315</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>July 30</td>
<td>Ground Beef</td>
<td>120</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>August 4</td>
<td>Ground Beef</td>
<td>13,078</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>August 5</td>
<td>Ground Beef</td>
<td>4,337</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>August 18</td>
<td>Non-Intact Beef</td>
<td>909</td>
<td>Company Sample</td>
</tr>
<tr>
<td></td>
<td>/Ground Beef</td>
<td></td>
<td></td>
</tr>
<tr>
<td>October 6</td>
<td>Ground Beef</td>
<td>5,226</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>October 23</td>
<td>Ground Beef</td>
<td>1,680</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Date</td>
<td>Product</td>
<td>Pounds</td>
<td>Cause</td>
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<td>------------</td>
<td>--------------------------------</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>Jan. 29</td>
<td>Ground Beef</td>
<td>4,240</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Mar. 2</td>
<td>Ground Beef</td>
<td>16,743</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Apr. 20</td>
<td>Needle Tenderized /Ground Beef</td>
<td>259,230</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>Apr. 20</td>
<td>Ground Beef</td>
<td>107,943</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>May 10</td>
<td>Trim for Ground Beef</td>
<td>117,500</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>May 11</td>
<td>Needle Tenderized /Ground Beef</td>
<td>120,000</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>June 8</td>
<td>Ground Beef</td>
<td>40,440</td>
<td>Company Sample</td>
</tr>
<tr>
<td>June 9</td>
<td>Ground Beef</td>
<td>5,700,000</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>June 8</td>
<td>Ground Beef</td>
<td>26,669</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>July 21</td>
<td>Ground Beef</td>
<td>26,669</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>July 25</td>
<td>Ground Beef and Buffalo</td>
<td>5,920</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>Sept. 5</td>
<td>Ground Beef</td>
<td>884</td>
<td>Company Sample</td>
</tr>
<tr>
<td>Sept. 29</td>
<td>Ground Beef</td>
<td>65</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Oct. 6</td>
<td>Ground Beef</td>
<td>845,000</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>Oct. 13</td>
<td>Ground Beef</td>
<td>173,554</td>
<td>Sample due to Illness Investigation</td>
</tr>
<tr>
<td>Oct. 13</td>
<td>Ground Beef/Veal</td>
<td>1,900</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Oct. 24</td>
<td>Ground Beef</td>
<td>8,200</td>
<td>Company Sample</td>
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<tr>
<td>Oct. 27</td>
<td>Ground Beef</td>
<td>50</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Nov. 3</td>
<td>Ground Beef</td>
<td>1,084,384</td>
<td>FSIS Sample</td>
</tr>
<tr>
<td>Dec 17</td>
<td>Ground Beef</td>
<td>102</td>
<td>FSIS Sample</td>
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</tbody>
</table>
Number of beef recalls for E. coli contamination

Source: USDA FSIS & New York Times
### E. coli O157:H7 Recalls

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Recalls</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>No. of Recalls due to Illness Investigation (%)</td>
<td>9 (45%)</td>
<td>0</td>
</tr>
<tr>
<td>No. of Recalls due to FSIS/Company Sample (%)</td>
<td>11 (55%)</td>
<td>8 (100%)</td>
</tr>
</tbody>
</table>
...DID YOU SAY, "RECALL?"
20 Recalls in 2007
Nearly 34,000,000 Pounds
(This compares to 8 recalls in 2006)
‘It’s not something we can fully explain,’ says top USDA official

Rising E. coli cases a danger, a mystery

St Paul Pioneer Press, November 11, 2007
E. coli O157:H7 still poses biggest risk

Being halfway home in terms of pathogen management still is not a comfort zone.

99.99% Is Not Good Enough!

Dr. Russell Cross, Deputy Vice Chancellor, Texas A & M University & Former Head, USDA Food Safety & Inspection Service
Problem Solved?

E. coli Outbreak in Oklahoma is Largest of its Kind in U.S. History

Associated Press
(September 3, 2008)
Today in our hospitals:

- Approximately 2% of patients experience post surgical site infections
- Conducted in “clean surgical procedure”
- Cannot eliminate contamination in a sterile surgical field...
- How can we completely eliminate pathogens from an animal carcass in slaughter plant?
Silver Bullet?

1. “Hurdle” Intervention Strategies
   - Organic Rinse
   - Steam vacuuming
   - Steam cabinet etc, etc.
   - 1 log reduction = 1 in 10 remain
   - 2 log reduction = 1 in 100 remain
   - 3 log reduction = 1 in 1000 remain
   - 2 to 3 log kill results in a 99 – 99.9 % reduction

2. Irradiation:
   - 1 log reduction = 1 in 10 remain
   - 2 log reduction = 1 in 100 remain
   - 3 log reduction = 1 in 1000 remain
   - 4 log reduction = 1 in 10,000 remain
   - 5 log reduction = 1 in 100,000 remain
   - 3 to 5 log kill results in 99.9 - 99.999 % reduction

Using Strategy # 1 plus Strategy # 2 the killing is additive, so that we expect 99.999% to 99.999999 % reduction…….. 
……..1 in 100,000 to 1 in 100,000,000 bacteria remain alive
Multiple-Hurdle Technology

- Knife Trimming
- Pre-Evisceration Wash
- Chemical Dehairing
- Acetic Acid Rinse
- Chlorine Dioxide
- Steam Vacuuming
- Final Wash
- Sodium Biospinne
- Steam Pasteurization
- Lactic Acid Rinse
- Hot Water Wash
- Irradiation
According to the Centers for Disease Control and Prevention (CDC), 900,000 cases of illness, 8,500 hospitalizations, and 404 deaths could be avoided annually if just 50 percent of raw meat and poultry consumed in the U.S. were irradiated.

Dr. Robert V. Tauxe, Centers for Disease Control and Prevention, Atlanta
Food irradiation: Potential annual public health benefits by specific pathogen

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Prevented cases</th>
<th>Prevented hospitalizations</th>
<th>Prevented major complications</th>
<th>Prevented deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em> O157:H7 and other STEC</td>
<td>23,000</td>
<td>700</td>
<td>250 HUS cases</td>
<td>20</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>500,000</td>
<td>2,600</td>
<td>250 GBS cases</td>
<td>25</td>
</tr>
<tr>
<td>Salmonella</td>
<td>330,000</td>
<td>4,000</td>
<td>6,000 RA cases</td>
<td>140</td>
</tr>
<tr>
<td>Listeria</td>
<td>625</td>
<td>575</td>
<td>60 miscarriages</td>
<td>125</td>
</tr>
<tr>
<td>Toxoplasma</td>
<td>28,000</td>
<td>625</td>
<td>100-1,000 cases Cong. toxo</td>
<td>94</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>881,625</strong></td>
<td><strong>8,500</strong></td>
<td><strong>6,660 major illnesses</strong></td>
<td><strong>404</strong></td>
</tr>
</tbody>
</table>

R. Tauxe, CDC. 2001
“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
Contact Information

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(952) 854-6980
ton@mnbeef.org

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