PreHarvest Food Safety

Dan Schaefer
June 21, 2011
RMC
Manhattan, KS
Reciprocation-(def.)

Audience Participation Required
Cargill’s Commitment to Food Safety

• We believe:
  – Everyone has the right to consume safe food
  – In a systems approach including,
    • Science based decision making
    • Properly trained employees
    • Continuous improvement approach
  – Success is measured by positive Public Heath outcomes

• Technology development is a critical component to achieve these beliefs
Topics

• Physical
• Chemical
• Microbiology
Physical Hazards

• Broken Needles
• Buckshot
• Wire
Chemical Hazards

• Residues
  – Individual animal treatments
  – Mass feeding treatments
### Chemical Hazards

#### FSIS Residue Violation Information System

**June 16, 2011**

**Weekly Residue Repeat Violator for Use by FSIS Inspection Program Personnel**

Part I: This part is intended to assist Inspection Program Personnel to identify producers with more than one residue violation in the last 12 months either in the same establishment or different establishments.

<table>
<thead>
<tr>
<th>Source Name By State</th>
<th>Plant Name / ID</th>
<th>Sample ID / Date Collected / Tags</th>
<th>Tissue</th>
<th>Residue</th>
<th>Value (ppm)</th>
<th>Tolerance</th>
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<tbody>
<tr>
<td>Richard Anglin Dairy</td>
<td>California All Natural 725 Zeff Road Modesto, CA 40376 M</td>
<td>485179 01/18/11 BOB VEAL BACK TAGS 86DK9370</td>
<td>Kidney</td>
<td>Neomycin</td>
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<td>Alfredo Chavez</td>
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<td>3Bora Dairy Farms</td>
<td>Cargill Beef Packers Inc 3115 South Fig Avenue Fresno, CA 00354 M</td>
<td>518754 04/01/11 NON FORMULA FED VEAL BACK TAGS 93DF7519</td>
<td>Muscle</td>
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<td>3Bora Dairy Farms</td>
<td>Central Valley Meat Co. Inc. 10481 E 34 Ave Hanford, CA 05093A M</td>
<td>518718 03/04/11 NON FORMULA FED VEAL BACK TAGS 93EN1047</td>
<td>Liver</td>
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<td>C D F</td>
<td>J J Meat Company 25699 Ave S-1/2 Madera, CA 04993 M</td>
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<td>524545 10/26/10 BOB VEAL BACK TAGS 93 FL 2897</td>
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<td>Neomycin</td>
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</tbody>
</table>
Integrity to the Show Ring

Unfit for Food or Feed
Foodborne Pathogens of Concern

- **E. coli O157:H7**
  - Human pathogen (infection)
  - Other Serovars of concern (O26, O45, O103, O111, O121, and O145)
  - Harbored in ruminant lower GI tract
  - Transfer during slaughter from hide or viscera
  - Infection via undercooked meat consumption (primarily ground beef)
  - Very small infectious dose (10 cells)
  - Low frequency, High severity

- **Salmonella**
  - Human & animal pathogen (infection)
  - 2500+ Serovars (typhimurium, newport, dublin, enteritis, DT104)
  - Ubiquitous
  - Meat infection via feed, water, or environmental exposure to animal followed by slaughter. **Chronic animals are carriers via lymphatic infections.**
  - Infective dose approximately 60,000 cells
  - Very high frequency, Lower severity
To lower pathogen contamination on beef carcasses
Vaccines for Food Safety

- Vaccines are widely used:
  - For animal health
  - Have a long safety history
  - No environmental impact

- Vaccines for Food Safety are:
  - Emerging technology with great promise to improve Public Health
  - *E. coli O157:H7*
    - Bioniche---Econiche
    - Epitopix---SRP technology
      - Licensed and sold by Pfizer
  - *Salmonella*
    - Salmonella Newport Bacterial Extract (SRP)
      - Licensed and sold by Pfizer
SRP Vaccine Technology

- **Epitopix™ Product**
  - Targets Siderophore Receptors and Porins (SRPs)
  - SRPs are “highly conserved” outer cell membrane proteins that transport iron through the bacterial cell wall
  - Causes bacterial cell death due to inability to intake iron
  - Conditionally licensed in the United States
Vaccine Targets
Siderophore Receptors and Porins (SRPs)

Epitopix, LLC
Cargill’s *E. coli* O157 SRP Vaccine Trial

- Approximately 58,000 head on feed in NE and CO.
- 100% of the cattle have been vaccinated at least once in each of the 10 participating feedlots.
- Measure effects on:
  - Antibody titers
  - Feedlot environment
  - Beef trimmings
- Harvest Summer 2010—May 1st thru Aug 27th
10 Feedlots in NE and CO

5 Feedlots

All other time-matched cattle

Plant

Feces

Hides
Sera
Trim
Pre-Harvest Intervention—Emerging Technology

SRP Titer Level

Vaccinate: 0.622
Control: 0.075

P < .001
Feces

- Vaccine effect detected and varied across time ($P<0.01$)
- Across time, prevalence among vaccinates and controls was 12.8% and 20.4% ($P<0.01$)
Effect on Beef Trimmings

• Test protocol was designed to detect a difference of 0.5% prevalence of E. coli O157:H7 in trimmings
  – 3,000 lots of trim from vaccinates
  – 10,000 lots of trim from controls

• The prevalence was several magnitudes lower than expected and did not allow for accurate or meaningful comparisons on beef trimmings
Summary

- Two dose regimen produced antibody titers in range with previous research
- Seasonal fecal prevalence of E. coli O157:H7 was “moderate”.
- The vaccine produced a directional effect on fecal prevalence
- Beef trim prevalence was too low for a meaningful comparison
- Additional research:
  - Effect on non-0157 serovars
  - Additional commercial settings
2008 Field Study: *Salmonella* in Cull Dairy Cows

- Enrolled 9 West Texas dairies
  - All large dairies milking >2,000 cows
  - Sampled 706 culled cows from the dairies
    - On site or at regional sale barn

- Cultured for *Salmonella*
  - Serotype, susceptibility testing, quantification

- *Salmonella* recovered from 32.6% of samples
  - Varied by month and dairy
  - Dairy burden ranged from 4.4% to 86.3%
  - Within-herd burden remained relatively constant over time of study
Salmonella Prevalence in Cull Dairy Cows

Guy Loneragan, WTAMU
Salmonella SRP Vaccine

- Decreased prevalence in cows
  - Lactating—Animal Health and Well Being
  - Cull cows—Public Health

- Productivity
  - Additional 2.5lbs milk/head/day = >600lbs/lactation (estimated $78 more revenue/cow/year)

- Quality
  - Lower somatic cell counts

How do we influence vaccine adoption throughout the Dairy industry?
Feeding Sodium Chlorate

- **Intended Usage**
  - To be fed the day prior to slaughter
  - Feed additive
  - No withdrawal

- **Regulatory Clearance**
  - In progress, Pivotal study Spring 2011 (?)
  - Demonstrate efficacy on fecal shedding
Sodium Chlorate

• Mode of action
  – Under anaerobic conditions, Gram negative bacteria utilize a nitrate reductase enzyme to respire by converting
    \[ \text{Nitrate (NO}_3\text{)} \rightarrow \text{Nitrite (NO}_2\text{)} \]
  – The enzyme will also convert
    \[ \text{Sodium Chlorate (NaClO}_3\text{)} \rightarrow \text{Sodium Chlorite (NaClO}_2\text{)} \]
  – NaClO\textsubscript{3} is inert to bacteria & organisms lacking nitrate reductase enzyme
  – To bacteria with the enzyme the resulting NaClO\textsubscript{2} is **Cytotoxic**
Sodium Chlorate

- **Challenge Study**
  - Experimentally challenged cattle with a 3-strain cocktail of *E. coli* 0157:H7
  - Administered via water
    - 24-hours prior to slaughter
  - Decreased *E. coli* 0157 strains by 3 logs (10^6 to 10^3) in fecal samples

Reduction of *E. coli* O157 in Beef Feedlot Cattle Using a High (1 x 10^9 cells/head/day) and Low (1 x 10^7 cells/head/day) Dose of NP 51

Younts-Dahl et al., 2004
## Direct Fed Microbials

<table>
<thead>
<tr>
<th>Feedlot</th>
<th>Total Test</th>
<th>Total Positive</th>
<th>Positive %</th>
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<tr>
<td>a</td>
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<td>23</td>
<td>39</td>
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<tr>
<td>b</td>
<td>81</td>
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Questions?