



For more information contact:

NATIONAL CATTLEMEN'S BEEF ASSOCIATION

9110 E. NICHOLS AVE., SUITE 300 • CENTENNIAL, CO 80112 • 303-694-0305 • www.beefresearch.org

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Beef Industry Safety Summit

EXECUTIVE SUMMARY



INTRODUCTION

E. coli O157:H7 and foodborne illness was one of the biggest news stories for 2006, but the beef industry was not the center of the storm. This time, it was the produce industry that faced significant challenges when *E. coli* O157:H7 once more reared its ugly head.

The media coverage of the 2006 *E. coli* O157:H7 outbreaks was telling in how much this pathogen has historically been associated with beef. During his keynote address, Dave Theno, Ph.D. and Senior Vice President, Quality and Logistics for Jack in the Box, Inc. told the summit participants, “In the spinach investigations, they went looking for cattle—they don’t even look alike.”

However, the media coverage was also telling in how much progress the industry has made in decreasing *E. coli* O157:H7 contamination in beef. Some of the beef industry’s most vocal critics of the past were now pointing to the beef industry as a model on how to solve pathogen issues in the U.S. food supply.

Collaboration among all sectors of the industry has been the key to that success. “Can you remember a time in this industry when collaboration has been better?” remarked Dave Theno. “Collaboration is the way progress occurs.”

While the progress in the beef industry has been significant, the fresh leafy greens outbreaks of 2006 demonstrate just how much work still needs to be done.

During the 2007 Beef Industry Safety Summit, participants once more had an opportunity to come together to not only discuss goals that have been met, but to also identify emerging

issues and create a road map to continue to provide the safest beef supply in the world.

A look back

“In 1993, we didn’t know how much we really didn’t know,” said Dave Theno, Jack in the Box, Inc. “Today we know a good bit about what we don’t know.” Theno’s comment is indicative of just how many resources the beef industry has devoted to addressing the challenges of *E. coli* O157:H7. Since 1993 more than 25 million dollars in Beef Checkoff funds have been devoted to beef safety research.

“Ninety-five percent of the beef plant improvements for food safety have been funded by The Beef Checkoff and coordinated by the National Cattlemen’s Beef Association. How about that for a return on your dollar?” said Theno.

And, he should know. Theno was involved in some of the initial strategy sessions to develop a plan to deal with pathogen issues in beef. He recalled how in the early nineties, there were only a few scientific studies and peer reviewed papers addressing *E. coli* O157:H7. That has changed, in large part due to beef industry-funded efforts. “We have not eliminated *E. coli* in cattle, but we have found ways to control it in our segment of the food supply,” he said.

“We picked *E. coli*, which was the worst actor in a gang of 20. The good news is that many of the interventions that work on *E. coli* also work on other pathogens, but we certainly haven’t solved the pathogen problem.” There is more work to be done and the 2007 Beef Industry Safety Summit marked another opportunity for all segments of the industry, from pasture to plate, to openly discuss beef safety issues.

E. coli O157:H7 was one of the biggest media stories of 2006, but the beef industry was not the center of the storm.

09/15/2006	World News This Morning	<i>E. coli</i> Outbreak now in 20 states
09/18/2006	Chicago Tribune	Bad Spinach Sign of Wider Problem?
09/19/2006	San Francisco Chronicle	Spinach Growers were warned about produce safety, State, Federal Officials concerned by 20 reports of tainted greens
09/21/2006	The New York Times	Leafy Green Sewage
09/22/2006	Los Angeles Times	Spinach Scare’s Larger Warning; Tight FDA Budgets have cut inspection, Compliance with safety rules is voluntary

Breakout Sessions



Every segment of the beef industry plays a role in beef safety, but not every segment can approach the challenges in the same manner. As in past Beef Industry Safety Summits, breakout groups encompassing the different phases of beef production met to discuss strategies and issues specific to their sector.

PRODUCTION

Group Leader: Ross Wilson, President and CEO, Texas Cattle Feeders Association

Summary: After listening to several presentations, the group spent a great deal of time discussing the produce *E. coli* O157:H7 outbreaks in California and ramifications for livestock operations. A list of knowledge gaps and research needs was also compiled to direct future advancements in this sector.

PRODUCTION PRESENTATIONS

***E. coli* O157:H7 on the Central California Coast**

Robert Mandrell, Ph.D., Research Leader, Produce Safety and Microbiology Research Unit, USDA, Agricultural Research Service, Western Regional Research Center

Migration of *E. coli* O157:H7 from CAFOs to Produce: Potential Pathways and Treatments

Scott Bradford, Ph.D., U.S. Salinity Laboratory, USDA, Agricultural Research Service, Riverside

Media Coverage of the 2006 *E. coli* O157:H7 Outbreaks

Michele Peterson Murray, Director, Public Relations, National Cattlemen's Beef Association

Environmental Policy Issues

Tamara Thies, Director of Environmental Issues, National Cattlemen's Beef Association

DISCUSSION ITEMS

After the presentations, there were lengthy discussions to better understand the role of cattle in the environment and the associated risks with ready-to-eat commodities. The following topics are not meant to be recommendations or construed as foregone conclusions, but rather, they represent points of discussion, many of which need to be investigated further.

Pathogen prevalence on and around produce fields in California

1. Determine risk factors for in-field contamination of lettuce with *E. coli* O157:H7. Sample water, soil, produce, livestock and wild animals to [understand the dynamics of the environment].
2. Disseminate recommendations [to livestock operations and produce growers] for risk reduction to prevent pre-harvest *E. coli* O157:H7 contamination.

E. coli O157:H7 on produce and possible pathways of contamination

1. The source of produce contamination is likely water that contains manure components.
2. Pathogen contamination can be most efficiently minimized by implementing best management practices (BMP) and treatments near the manure source [if feasible].
3. Computer models can be valuable tools to predict pathogen fate in the environment, to develop BMP, and to assess risk. However, models are only as good as the state-of-the-science.
4. Experimental and mathematical modeling studies should be integrated to advance understanding and to provide tools to tackle these challenging problems.
5. Guidelines for proper composting and application of livestock manure as a soil amendment for ready to eat crops are in place and should be followed.¹

KNOWLEDGE GAPS/RESEARCH NEEDS

- Grass-fed (roughage) versus grain feeding is still incorrectly considered by many to be a best management practice for reducing pathogen shedding in cattle, and as a result was quoted widely in media coverage of the produce outbreaks as a possible intervention.
 - Based on discussions, this appears to be an unwarranted extrapolation from a study conducted by Cornell University.
 - There may be a need to conduct a thorough literature review to develop science-based talking points to turn to when correcting media misinformation.

¹ Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens, Western Growers (<http://www.wga.com/LinkClick.aspx?link=DocumentLibrary%2fJune+6+LG+Metrics+Clean.pdf&tabid=250&mid=1646>)

*The “new” face of
E. coli O157:H7
A lesson to be learned...*

During the Opening Session of the Beef Industry Safety Summit, participants had an opportunity to hear from Mel Kramer, President, EHA Consulting. Kramer’s talk, “Insights from the FDA Investigation of *E. coli* Outbreaks Linked to Produce,” reminded Beef Industry Safety Summit participants that huge strides have been made in reducing *E. coli* O157:H7 incidence in beef products, but the industry still needs to consider its impact on other commodities.

Kramer also pointed out the huge challenges that the produce industry or any other ready-to-eat commodity faces when it comes to food safety issues. “Even in the early years of *E. coli* O157:H7 outbreaks, produce played a role, but beef was targeted as the primary culprit,” said Kramer. In 2006, that changed. The produce industry had already been targeted by the Food and Drug Administration (FDA) for past outbreaks, but the outbreaks that occurred in October 2006 brought the issue to a head.

- The role of “super shedders” in a pasture environment needs to be better understood.
- How much is rangeland contributing to pathogen populations in the food supply?
 - Is there a challenge with animals on pasture, and is it harder to control contamination?
 - If pathogen research is to be conducted in rangeland environments, then the studies need to look beyond cattle and involve wildlife and other potential vehicles that might carry *E. coli* O157:H7.
- At this point, it is difficult to know what should be measured in a rangeland environment and by sampling randomly, the industry will not be able to identify the best predictive outcomes that will influence beef safety.
- Should pathogen dissemination in rangeland environments be measured differently than it is in a beef processing facility?
- What are the sub-types of *E. coli* developing genetic dominance in certain environments?
 - Need to examine the dissemination of pathogens in the environment and examine prevalence in feed yards.
- Further examine ethanol byproducts and research that points to higher pathogen prevalence when feeding co-products.
- Develop a forum that will allow a variety of scientific disciplines to come together to discuss livestock production implications on produce and ready-to-eat commodity safety.
- Produce growers are looking at seven different areas with measures for improving process controls to improve food safety.
 - Their models are not validated; do studies need to be conducted to validate or determine the level of confidence in their results?
 - The relative contribution of different factors to risk should be evaluated.
- More work needs to be done to understand how cattle can contribute to the cause of produce or ready-to-eat commodity *E. coli* O157:H7 outbreaks.
- Develop a better understanding of how *E. coli* persists in the environment and how that affects potential produce safety.
- Lettuce and spinach producers can practice best management too; certain actions that they can control (land management) could affect safety and these should be researched more thoroughly.

ACTION ITEMS

Determine if risks involve just produce or include other food products, or if the focus should be on specific geographic areas where ready-to-eat commodities and cattle interact.

- Only limited actions can be taken in ready-to-eat commodities because it is raw product, however the focus should remain on raw fresh produce (leafy greens, strawberries, etc.).
- It is important to not just focus on *E. coli* O157:H7 because any of the pathogens of concern could become a produce issue (e.g. *Salmonella*).
- Better understand pathogen contamination of water, dust, and soil, as these are other sources of human exposure to pathogens, so the risks potentially include more than food.

HARVEST/FABRICATION AND PROCESSING

Group Leaders:

Dennis Johnson,
Olson, Frank and Weeda Mansour Samadpour, Ph.D.,
President and CEO, IEH, Inc.

Summary: As in past Beef Industry Safety Summits, the Harvest/Fabrication Group reviewed best practices for their segments. During this summit, the breakout group spent a great deal of time discussing beef trim sampling procedures and recommended that BIFSCo spearhead the development of best practices for trim sampling. The group also discussed safety issues associated with other categories of non-intact beef products and the need to focus more attention on *Salmonella*.

DISCUSSION/ACTION ITEMS

The group discussed the following topics under the umbrella of best practices and pathogen control procedures:

- Encourage two-way communication between buyer (grinder) and supplier.
- Execute proper administration of interventions (temperature, time, flow rate, etc.).
- Understand the human component in harvest/fabrication and processing, and work to minimize associated risks.
- Develop test and hold programs across all operations (including small and very small) to reduce the potential for recalls.
- Determine optimum methods for the industry to reach out to small and very small operations to disseminate best practices.

In discussing non-intact products, the group focused on the following issues:

- Determine an acceptable lot size for non-intact products.
- Determine the appropriate definition of non-intact products.
- Understand how to control the product enhancement process to ensure safety (i.e. incorporate all factors such as the solution, the equipment and employees).

Trim sampling was a key area of discussion for the group, and the following action items were developed:

- Test for other pathogens besides *E. coli* O157:H7, including *Salmonella* and other enterohemorrhagic *E. coli* (EHEC) in beef trim.
- Determine optimum lot sizes for sampling procedures to minimize recall ramifications.
- Develop best practices for trim sampling.

**KEYNOTE SPEAKER:
RETAIL INDUSTRY
PERSPECTIVES ON FOOD
SAFETY ISSUES**

*Payton Pruett, Vice President,
Corporate Food Quality and
Regulatory Compliance,
Kroger, Inc.*

Summary: A representative from the second largest retailer in the U.S. gave industry perspectives on food safety issues.

Key Points:

- Recent and emerging food safety issues at the retail level revolve around ready-to-eat products, controlling allergens and the growth of deli operations that mimic food service establishments and their associated challenges.
- More food preparation in-store has created new challenges with increased food handling by employees.
- Increased regulatory oversight from state health departments and the differences in how each state interprets the Food Code have created challenges for large retailers.
- Food safety is a primary focus at the individual store level and Kroger, Inc. has created guide-lines to address temperature control, sanitation and employee hygiene, as well as appropriate product separation, pest control programs, recall procedures and inventory management to reduce out-of-date items.
- It is important for retailers to re-evaluate their food safety programs and work with their industry partners to identify emerging risks. Food safety should not be a competitive issue for retailers.



Reciprocity Sessions



A new addition to the Beef Industry Safety Summit, the Reciprocity Sessions gave participants an opportunity to engage with colleagues in discussions on topics that affect their businesses and the safety of beef products.

TRANSPORTATION AND LAIRAGE EFFECTS ON PATHOGEN PREVALENCE ON BEEF HIDES

Speakers:

Mohammad Koohmaraie, Ph.D., USDA, Agricultural Research Service, U.S. Meat Animal Research Center, Clay Center

Mark Miller, Ph.D., Professor, Department of Animal Science & Food Technology, Texas Tech University

COLD CHAIN MANAGEMENT

Speaker:

Brian Covington, Senior Corporate Food Safety Manager, Keystone Foods

PACKAGING

Speakers:

Jeffrey Rhodehamel, Director of Sealed Air Applications Development & Support Group, Sealed Air Corp.

Mindy Brasbears, Ph.D., Director, International Center for Food Industry Excellence, Associate Professor, Animal and Food Sciences, Texas Tech University, Texas Tech University

COMMUNICATING BEEF SAFETY

Speakers:

Michele Peterson Murray, Director, Public Relations, National Cattlemen's Beef Association

Jacque Matsen, Director, Issues Management, National Cattlemen's Beef Association

JoDee George, Director, Safety Public Relations, National Cattlemen's Beef Association

The Reciprocity Sessions encouraged open discussion among the participants on topics that affect beef safety across many industry sectors. Through the sharing of research results and input from industry experts, attendees were able to take away information that can be used to enhance current beef safety systems, as well as develop research needs.

"The most productive session at the Beef Industry Safety Summit, is when we all come together as groups and summarize what we have learned, so we can prioritize how we need to move ahead, what interventions can be implemented and what can actually be used in the food industry."

Mindy Brasbears, Ph.D., Director, International Center for Food Industry Excellence, Associate Professor, Animal and Food Sciences, Texas Tech University



Research Update

Beef safety research has been the key driver in developing effective pathogen interventions in commercial settings. It is this research that has allowed for the significant progress in beef safety over the last decade, and it is research that will continue to drive that same level of progress in the future.

All of the Beef Industry Safety Summits have included an update on the latest in beef safety research. The updates not only provide the audience the latest information, but they also give the researchers an opportunity to interact with industry participants who will have to implement this knowledge in commercial settings.

David Smith, D.V.M., Ph.D., Dipl. ACVPM (Epidemiology), University of Nebraska, Lincoln

Summary: Multi-phase research demonstrated that an experimental vaccine (Bioniche Life Sciences, Inc.) has the ability to reduce *E. coli* O157:H7 shedding in feedlot cattle by as much as 65 percent based on a stochastic model.

Key Points:

- Cattle are a key reservoir for *E. coli* O157:H7 and the pathogen is ubiquitous to cattle populations.
- Environments that increase bacterial survival and enhance fecal-oral transmission increase the probability that cattle will shed *E. coli* O157:H7.
- A multi-phase research project was initiated in 2004 and demonstrated that vaccination for *E. coli* O157:H7 is efficacious as a pre-harvest intervention. The studies involved more than 25,000 head of cattle.
- *E. coli* O157:H7 was less likely to be cultured from the mucosal cells of vaccinated cattle. In this study, the vaccine showed a 76 percent efficacy in a feedlot environment.

Mindy Brashears, Ph.D., Director, International Center for Food Industry Excellence, Associate Professor, Animal and Food Sciences, Texas Tech University

Summary: Researchers investigated both pre and post-harvest beef safety interventions.

Key Points:

- A study examining the effect of dust cloud exposure during load-out at feedlots found that the prevalence of both *Salmonella* and *E. coli* O157:H7 on cattle hides was greater after exposure. A controlled study found that cattle loaded on a clean, concrete surface had fewer percent positives than cattle loaded in a dirty, dusty facility.
- A study examining sampling methods found that *E. coli* O157 was more likely to be recovered from fecal grab samples than rectal and swab samples. If researchers had just used fecal grab samples, 45 percent and 50 percent of the animals positive for *E. coli* O157 and *Salmonella*, respectively, would have been missed. According to Brashears, in future research, the sampling location is a critical criterion to consider.
- A post-harvest research project investigated the use of lactic acid cultures and their ability to reduce *E. coli* O157:H7 in fresh meat, poultry and ready-to-eat meat products. The product has been approved for use as a surface application and a petition has been submitted to USDA to remove label requirements.
- Texas Tech researchers have also investigated packaging systems and their effect on *Salmonella* and *E. coli* O157:H7, as well as the ability of low oxygen, high oxygen packaging and rosemary extracts to reduce spoilage in ground beef patties. This research indicated that modified atmosphere packaging (MAP) decreased pathogens and also inhibited non-pathogenic organisms that can lead to spoilage.

KEYNOTE SPEAKER:
ECONOMIC FACTORS THAT
WILL AFFECT CATTLE AND
BEEF PRICES DURING THE
NEXT SEVERAL YEARS

Randy Blach, Executive
Vice President, Cattle-Fax

Summary: Blach outlined the current economic situation and discussed internal and external market factors that have the potential to influence the beef industry.

Key Points:

- Sharply higher corn prices will continue to have repercussions on the market for the near term. The 2007 corn harvest will be a key market fundamental.
- Export markets continue to rebound after their closure in December 2003, however Blach emphasized that they must be fully reopened to U.S. beef by the end of the decade to help offset increases in beef production.
- The consumer marketplace is demanding more high quality beef and producers, feeders and packers need to meet that demand.
- Drought in some of the largest cattle states in the U.S. led to the slowest herd expansion in history.
- The typical ten-year cattle cycle will likely be extended due to high corn prices and an ongoing drought in key cattle production regions.

- A separate sampling study conducted in commercial processing facilities found that the majority of contamination was occurring on the foreshank, hindshank and inside rounds. Pathogens levels were negligible on the neck and midline of carcasses sampled. After in-plant intervention were applied, *E. coli* O157:H7 pathogen positives were reduced most significantly on the foreshank, followed by the hindshank and inside round.
- Texas Tech University scientists are also researching the impact of stress on *E. coli* O157:H7 and *Salmonella* shedding; the risk of condensation in slaughter, fabrication and ready-to-eat environments; impact of carbon monoxide packaging on product quality and safety after temperature abuse events; interventions for use during needle tenderization; reduction of pathogens using microwave technology; cross resistance of multi-drug resistant *Salmonella* to lactic acid; and the use of ELISA tests for recovery of *E. coli* O157:H7 on hides, carcasses and ground beef.

Mohammad Koohmaraie, Ph.D., Center Director,
U.S. Meat Animal Research Center, USDA Agricultural Research Service
Summary: Koohmaraie presented results from several studies focusing on pathogen contamination during lairage and pre-harvest interventions. Researchers at the U.S. Meat Animal Research Center (USMARC) have also examined the incidence of *Salmonella* in the lymph nodes of cattle, various post-harvest interventions and multidrug-resistant *Salmonella*.

Key Points:

- A study investigating how *E. coli* O157:H7 loads on cattle hides is impacted by transport and lairage, found that hide prevalence was significantly higher on cattle after transport to a packing facility. As a result, Koohmaraie said that effective feedlot pathogen intervention measures may be negated by potential contamination during transport and lairage. The topic deserves more investigation, but USMARC researchers concluded that environmental contamination may be difficult to control at the pre-harvest level.
- Hide-on interventions were examined, including a hide wash system that incorporated 100 to 200 ppm of chlorine in a medium pressure spray. The data demonstrated a reduction in *E. coli* O157:H7 and *Salmonella*. Koohmaraie also stressed sanitary hide removal as a viable intervention method to reduce or eliminate the contamination of carcasses during hide removal.
- USMARC researchers are also examining commercial ground beef and beef trim for the prevalence (with enumeration) and serotypes of multidrug-resistant *Salmonella*. The project is part of the development of a BIFSCo *Salmonella* Database. As part of the project, researchers are also quantifying the prevalence of other *Enterobacteriaceae* to determine if there is a common gene marker for antibiotic resistance. The study, which is still in progress, is also determining the prevalence of *L. monocytogenes* and characterizing the isolates that show antibiotic resistance.

- In another study, researchers examined the effects of antimicrobial interventions on multidrug-resistant (MDR) *Salmonella*, non-MDR *Salmonella* and *E. coli* O157:H7. This study demonstrated that MDR *Salmonella* was reduced as effectively as *E. coli* O15:H7 when treated with antimicrobial interventions currently in use at most U.S. beef processing plants.

Keith Belk, Ph.D., Professor, Department of Animal Sciences, Colorado State University
Summary: Two studies were presented. The first focused on the prevalence of cattle that persistently shed *E. coli* O157:H7 and the second study examined the potential for central nervous tissue to enter cattle circulatory systems during routine slaughter, a risk factor in transferring BSE specified risk materials.

Key Points:

- A study with 788 Holstein steers was conducted to identify physiological and microbiological differences in the intestinal tract between cattle persistently shedding *E. coli* O157:H7 and those not shedding the organism. The ultimate goal of the project was to elucidate the ecology of *E. coli* O157:H7 in feedlot cattle, so that pre-harvest interventions can be applied in a more targeted manner.
- The researchers concluded that small subpopulations of cattle appear to be persistently colonized with *E. coli* O157:H7 (1 percent). Persistent and transient shedders may be colonized by a predominant *E. coli* O157:H7 molecular subtype, but express multiple other distinct, but closely related subtypes. Persistent and transient shedders appear to be predominantly colonized by *E. coli* O157:H7 subtypes that seem to express a greater ability to attach to intestinal epithelial cells.
- In a separate study, Colorado State University researchers identified humane cattle stunning systems that minimize the likelihood of central nervous tissue entering cattle circulatory systems. The researchers developed a marker for central nervous tissue (GFAP) and quantified its concentration in animals immediately after stunning. They also evaluated heart fibrillation as an intervention to reduce the likelihood of CNS tissue contamination.
- Under the experimental conditions, GFAP was not detected in the blood circulation of cattle and was not detected between stunning with a penetrating captive bolt (PCB) stunner and exsanguination. After PCB stunning, heart fibrillation did reduce heart activity and blood circulation prior to exsanguination. During the commercial studies, there was a low prevalence (0.28 percent) of GFAP in the blood circulation of cattle after stunning. GFAP was not detected in the blood of animals following Kosher slaughter.

Steve Carlson, Ph.D., Veterinary Medical Officer,
Pre-harvest Food Safety and Enteric Disease Research Unit,
National Animal Disease Center, USDA, Agricultural Research Service
Summary: Interventions that affect rumen protozoa were applied as a potential means of reducing virulent bacterial populations.

Key Points:

- In a study, characterizing the relationship between rumen protozoa and enhanced *Salmonella* virulence, researchers found that *Salmonella* DT104 and other serotypes possessed a specific gene cluster that can be more virulent after surviving within protozoa, especially rumen protozoa. Defaunation, or reducing the protozoa load, was evaluated as an intervention. The researchers investigated

“I think we’ve seen such success because of one, the research that has occurred and led to the development of multiple safety interventions. Secondly, the willingness of the packing and processing industries to implement those interventions in a very aggressive fashion was key. Producers have expended millions of dollars in research, and the packing and processing industries have taken the outcomes of that research and expended tens, if not hundreds of millions of dollars to implement interventions. We have a very strong partnership in trying to achieve our goal of beef safety.”

Ross Wilson,
President and CEO,
Texas Cattle Feeders
Association

several measures to reduce protozoa including using dioctylsulfosuccinate (DSS, detergent/surfactant capable of killing protozoa), yucca-based saponins and plant essential oils.

- Based on the results of this study, the DSS treatment decreased the systemic *Salmonella* DT104 load and also halted gene transfer events. The yucca-based saponins improved feed efficiency, but their effects on *Salmonella* virulence and gene transfer were unclear after the study. Essential plant oils did kill the rumen protozoa and also killed the pathogens hiding within the rumen protozoa. Essential plant oils also had a beneficial effect on rumination in cattle. Based on these data, the researchers recommended that producers should consider defaunation when a herd is persistently infected with *Salmonella* or if a herd has a history of DT104 or related pathogens. The researchers also recommended that defaunation deserves further study.

Guy Loneragan, B.V.Sc., Ph.D., Epidemiologist, Feedlot Research Group, West Texas A&M University

Summary: Through the course of several studies, researchers studied antimicrobial administration and the emergence of antimicrobial resistant bacteria.

Key Points:

- The role of antibiotics for animal health purposes and their potential relationship to antibiotic resistant bacteria has not been adequately understood. Loneragan's studies have evaluated injectable and in-feed uses of antibiotics, as well as the extent and duration of their effect.
- Based on a series of investigations, Loneragan said that use of any antibiotic creates a selection pressure favoring resistant bacteria, thus it is not surprising that resistance is detected among pathogens. Based on his research, Loneragan found the resistance to be short-lived, and in situations involving animal health, not near the point of harvest.
- Future research should be conducted to quantify the magnitude and extent of the effect.

Tom Edrington, Ph.D., Food and Feed Safety Research Unit, USDA, Agricultural Research Service

Summary: Researchers examined the prevalence of multidrug-resistant (MDR) *Salmonella* in dairy cattle, including calves, heifers, lactating cattle, dry cows and cull cows. Part of the research goal was to determine if commingling calves at heifer development lots serves as a transmission vector. They also examined the use of waste milk as a calf feed as a risk factor for MDR *Salmonella*.

Key Points:

- Four dairies were sampled that have a known *Salmonella* prevalence based on previous research. There was a high degree of variability in fecal shedding and significant differences in prevalence, serotype distribution and antimicrobial resistance patterns between two sample collections. The prevalence of MDR *Salmonella* was high in hutch calves and cows in the sick/fresh pen. The researchers did discover the existence of a new *Salmonella* serotype that had not been present previously (Reading). Typhimurium was found infrequently. Based on this study, it appeared unlikely that the transmission of MDR *Salmonella* to other dairies was due to the commingling of the heifers.
- Events prevented the researchers from collecting waste milk samples, however they did observe a seasonal difference in prevalence and incidence of MDR *Salmonella* from the fall to spring (October versus March). The heifer development lot began pasteurizing waste milk midway through the study (December) and reported a substantial decrease in calf *salmonellosis* after treating the waste milk.
- The researchers hypothesized that pasteurizing waste milk that is used as a feed source for dairy calves can reduce MDR *Salmonella* in calves and subsequently in all classes of dairy animals. The topic deserves further research and will be part of a study funded by The Beef Checkoff beginning in the spring of 2007.

- Researchers at the Food and Feed Safety Research Unit are also investigating use of bacteriophage to reduce *E. coli* O157:H7 on cattle hides; competitive fitness of MDR *Salmonella* enterica serotype Newport isolates from cattle; and genetic characterization of *Salmonella* enterica serovar Newport isolated from cattle using a DNA microarray. *Salmonella* Newport is being characterized through 350 genes to determine which genes are “turned on” and contribute to resistance and virulence.





Issues Update Forum



Staying abreast of emerging challenges to beef safety is key to maintaining the same level of progress the industry has so far achieved. During every Beef Industry Safety Summit, participants have had an opportunity to hear from leading researchers, industry experts and government officials to identify issues that may influence beef safety.

Multidrug-Resistant *Salmonella* in the Beef Chain: How Can We Address this Challenge?

Mohammad Koohmaraie, Ph.D., Center Director, U.S. Meat Animal Research Center, USDA ARS

Guy Loneragan, B.V.Sc., Ph.D., Epidemiologist, West Texas A&M University

Summary: In a joint presentation, Loneragan and Koohmaraie summarized their efforts to research multi-drug resistant (MDR) *Salmonella* in beef.

Key Points:

- In his research, Koohmaraie identified four regions of the country and sampled hides immediately prior to harvest and carcasses right after hide removal for MDR *Salmonella*. Loneragan conducted sampling programs in the Texas High Plains region on live cattle.
- The researchers found that healthy feedlot cattle shed the most *Salmonella*, however this contemporary group did not exhibit the most MDR *Salmonella*. MDR *Salmonella* was most prevalent in cull or mature cattle. More than 80 percent of the isolates recovered were resistant to only one antimicrobial.
- Koohmaraie also examined the incidence of MDR *Salmonella* in ground beef and beef trim using an enumeration technique developed at the U.S. Meat Animal Research Center. This project is still in progress and the researchers will serotype the samples that were collected from grinding operations from throughout the U.S.

The Merging of Safety and Nutrition

Mary Young, R.D., Vice President, Nutrition, National Cattlemen's Beef Association

Summary: Young discussed how the line between beef safety and beef nutrition has become blurred, largely due to the work of activist groups with an agenda to reduce red meat consumption.

Key Points:

- Young pointed out how activists have created distrust in beef production methods, which in turn affects beef's perceived healthfulness. The increased attention on animal production methods is subtly folded into health implications and covered extensively by the media.

The media has focused a great deal of attention on animal production methods and has confused those messages with potential health implications for consumers.

INCREASING ATTENTION TO FOOD PRODUCTION & HEALTH

Chicago Tribune — *"All stewed and ground beef in patient meals is pure grass fed beef, without growth hormones or antibiotics... 'It's a little bit more expensive but we feel it's worth it to provide the health benefits of tallgrass beef to our patients.'"*

Aberdeen American News — *"They are not fattened on grains in feed lots, nor given growth hormones to speed the process. McMaken's animals take more than 2 years to reach slaughter weight. But the wait is worth it to producers such as McMaken, whose beef is snapped up by consumers who want the pleasure of beef without the health drawbacks."*

“The beef industry is a very segmented industry. We can’t do the best we can if one part of the chain is not working. We all have to play our part when we move beef through the production system.”

Guy Loneragan, B.V.Sc., Ph.D., Epidemiologist, Feedlot Research Group, West Texas A&M University

“No matter how good a product is, no matter how cost-effective it is to produce it, no matter how nutritious it is, if it’s not safe, people are going to have a problem with it.”

Mel Kramer, President, EHA Consulting

- Media and consumer research has revealed that “back to nature” influences are expected to play an increasingly important role in consumers’ meat protein selections. It is anticipated that organic foods will capture an increasing share of the general market in response to concerns about the risks of chemical, biological and hormonal contamination in food production. Grass-fed and free-range meats are expected to attract a larger segment of the general public, as they are “perceived” by consumers to have a lower risk of contamination than conventionally raised meats.
- The activist agenda has been fueled by a recent study published in the Archives of Internal Medicine (*Red Meat Intake and Risk of Breast Cancer Among Premenopausal Women*).
- The World Cancer Research Fund (WCRF) and American Institute for Cancer Research (AICR) will be releasing its Report on Cancer Risk in November 2007. The 1997 report already indicted red meat as a primary risk factor for cancer. Industry observers anticipate that the new report will try to demonstrate an even stronger link between red meat and cancer. NCBA, on behalf of The Beef Checkoff, has been developing an outreach strategy in anticipation of the WCRF/AICR report.
- NCBA is also addressing other factors that show the potential to merge beef safety and nutrition in consumers’ minds. The organization’s efforts include continuing influencer and thought-leader outreach to address activist “noise” and educating health professionals, media and consumers on health and safety of all beef, regardless of how the cattle were raised.

Foot and Mouth Disease Preparedness: Are We Prepared for an Outbreak?

Guy Loneragan, B.V.Sc., Ph.D., Epidemiologist, Feedlot Research Group, West Texas A&M University

Summary: While not a food safety threat, an outbreak of foot and mouth disease (FMD) in the United States could have devastating effects on the livestock industry. In 2006, the Animal Health Network and the National Cattlemen’s Beef Association hosted a Foot and Mouth Disease Summit that was funded in part by The Beef Checkoff. Loneragan presented findings from the summit.

Key Points:

- \$4 to \$13 billion impact on the U.S. economy is estimated in the event of an FMD outbreak in the U.S.
- There are two challenges in addressing FMD in the U.S.—mitigating the real risk of the disease and managing the *perceived* risk of FMD. Beef Checkoff-funded research has demonstrated that more than 70 percent of consumers think FMD affects humans and 69 percent of consumers say people can get the disease by eating infected meat.
- Loneragan described several collaborative efforts to prepare for FMD, including the FMD Summit and Operation Palo Duro, a Texas Animal Health Commission (THAC) and Animal Plant Health Inspection Service (APHIS) functional exercise.
- At the FMD Summit, participants took part in an open dialogue to coordinate crisis plans and identify specific action items. The discussion built on four tenets of crisis preparedness—prevention, detection, response and recovery.

- Four working groups were formed to discuss: 1) the role of science in prevention, 2) disease detection, 3) stopping disease progression and 4) outbreak communications.
- A full copy of the FMD Summit Executive Summary can be accessed at: www.fmdinfo.org
The industry needs to capitalize on relationships and common needs established at the FMD Summit and achieve a plan that can work efficiently at the local level in the event of an outbreak.

***Clostridium difficile*: It’s a Public Health Concern, but Does It Relate to Beef?**

Fred Angulo, Ph.D., Acting Deputy Branch Chief, Enteric Diseases Epidemiology Branch, Centers for Disease Control and Prevention (CDC)

Summary: Angulo described the growing prevalence of *C. difficile* infections in human populations and the concern that it might be present in the food supply.

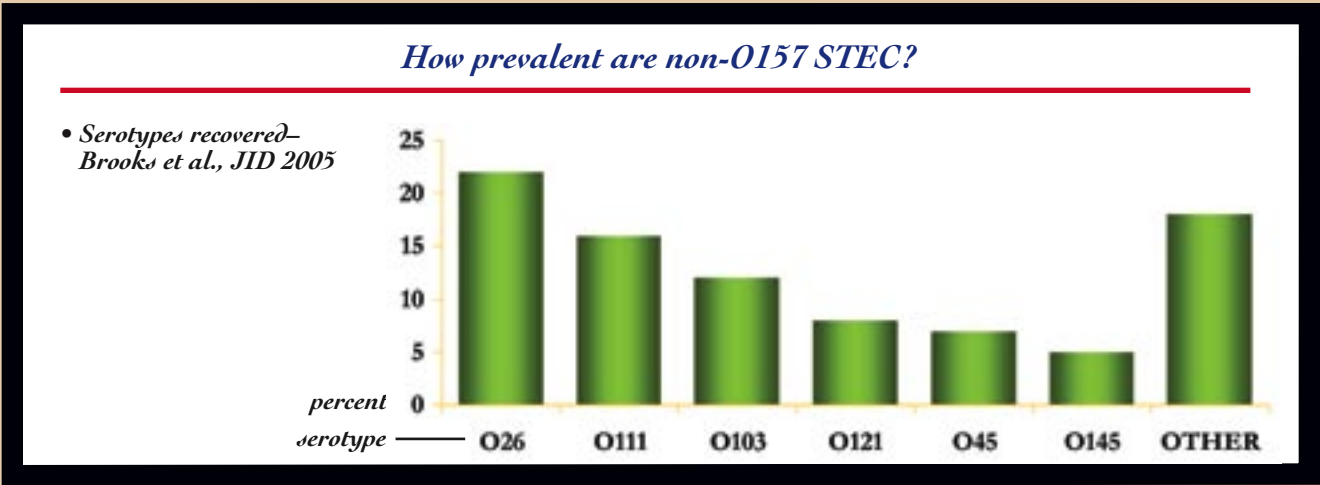
Key Points:

- *Clostridium difficile* has become an organism of importance in emerging disease issues. Typically associated with a fecal-oral transmission from a contaminated environment and healthcare personnel, antimicrobial exposure is a major risk factor for disease due to the suppression of normal flora in the colon.
- While the majority of *C. difficile* infections are acquired in healthcare facilities, researchers have noted an increase in the number of cases among people who have had no recent contact with a healthcare facility.
- In evaluating how a strain of *Clostridium difficile* could be so widely disseminated, so rapidly, researchers have also noted that *C. difficile* associated disease (CDAD) is emerging in food producing animals. This observation has led to concerns that *C. difficile* might be present in the food supply.
- *C. difficile* has been long recognized as a pathogen in horses, rabbits, hamsters, and various other animals. Some recent reports have focused on disease or carriage being found among companion animals. However, reports indicate that since 2000, outbreaks of CDAD have been occurring in food producing animals including neonatal pigs and, more recently, beef and dairy calves. The strains infecting animals are genetically different from the most common human strains.
- In finding similar *C. difficile* strains in food producing animals and humans, CDC investigators have hypothesized that the disease occurring in food animal production facilities is the result primarily of animal-to-animal transmission. This would be similar to what occurs in human disease in that the majority of human cases result from patient-to-patient transmission.
- There is now growing evidence suggesting emerging community-associated human disease but investigators do not yet have much data on the responsible strains. Also, they do not know whether environmental sources or reservoirs exist for strains responsible for disease in these populations. Finally, they have no information on transmission dynamics between food animals and humans. To answer these questions, CDC is actively investigating community-associated CDAD.



Emerging EHECs: Are There Other Threats that We Need to Evaluate?
Guy Loneragan, B.V.Sc., Ph.D., Epidemiologist, Feedlot Research Group, West Texas A&M University
Summary: *E. coli* O157:H7 has been the primary pathogen of concern in beef industry intervention efforts. The industry has been successful in addressing this strain, however there is concern that other strains of *E. coli* may create new challenges.

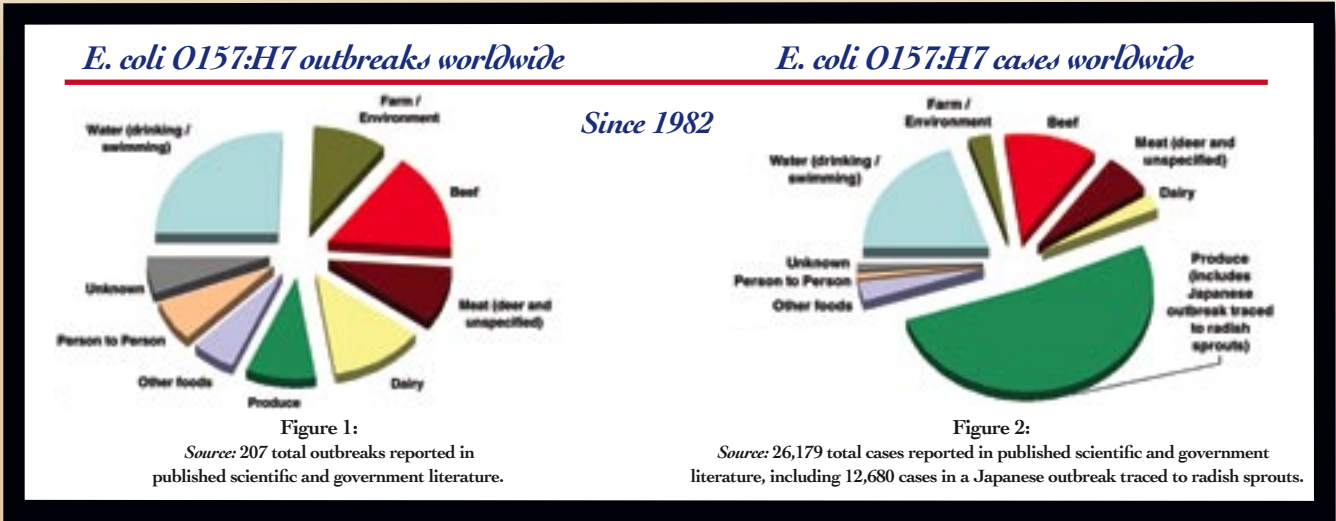
- Key Points:**
- E. coli* O157 is not the predominant shiga-toxin *Escherichia coli* (STEC) affecting humans in all countries.
 - There are challenges in obtaining accurate information about how often an illness can be attributed to *E. coli* O157:H7 or another non-O157 STEC. If a case of human illness is not severe enough, the patient will not be likely to pursue treatment, thus reducing the opportunity for diagnosis. The Centers for Disease Control and Prevention (CDC) are expanding efforts to better attribute causes of diarrhea that are non-O157 STEC.
 - The number of reported non-O157 STEC cases has increased, however the prevalence demonstrates a similar seasonal pattern to *E. coli* O157.



- It will be important to understand the ecology of non-O157 *E. coli* in cattle, and to differentiate between enterohemorrhagic *E. coli* (EHEC) and Shiga-toxin producing *E. coli* (STEC) in research, as STEC are widely prevalent.

Human Illness Caused by *E. coli* O157:H7
Ron Weiss, Ph.D., University of Wisconsin-Madison
Summary: A white paper was developed that summarized historical data on human illness caused by *E. coli* O157:H7. The paper included a historical timeline of major events related to *E. coli* O157:H7 and human illness and also identified data gaps and possible research needs.

- Key Points:**
- More than 970 references were collected and 377 were actually cited in the white paper. *E. coli* was first identified as a possible human pathogen in 1975 and was first associated with a foodborne disease outbreak in 1982. *E. coli* O157:H7 is estimated to cause approximately 73,500 cases of illness and 60 deaths annually in the U.S.
 - In certain populations, *E. coli* O157:H7 can cause illness with fewer than 40 cells. There are over 200 different serotypes of *E. coli* that produce Shiga-like toxins and many have been implicated in outbreaks of hemolytic uremic syndrome (HUS) worldwide.
 - Unlike other pathogens, *E. coli* O157:H7 is considered an “adulterant” in raw ground beef by USDA-FSIS.



Timeline of important U.S. outbreaks and new regulations to control *E. coli* O157:H7

Vehicle (Reference)		New Regulations
spinach (373)	2006	
lettuce (252)	2005	FDA warning letter to lettuce producers
	2004	All plants producing raw ground beef products or components to be tested for <i>E. coli</i> O157:H7
blade tenderized beef (212)	2003	Downer cattle not allowed in food
beef (370)	2002	HACCP and pathogen reduction required for juices
beef (319;346)	2001	
beef (370)	2000	
beef (370)		Irradiation for ground beef
beef (182;187)	1999	
beef (370)	1998	Revised testing requirements Zero tolerance for feces on carcasses Guide to minimize microbial food safety hazards for fruits and vegetables
beef (318)	1997	
apple cider (170)	1996	HACCP required for meat processors Warning labels required on unpasteurized juices
apple juice (14;105)		
beef (79)	1995	
meat (9;144)	1994	Testing required for <i>E. coli</i> O157:H7 Safe handling labels for raw meat <i>E. coli</i> declared an adulterant
beef (300; 340)	1993	
ground beef (341)	1982	
apple cider (59)	1991	
	1990 to 1983	
ground beef (54;238;270;273;302;303)		
ground beef (299;353) First <i>E. coli</i> O157:H7 outbreak	1982	

Update on FSIS Regulatory Sampling Data
Denise Eblen, Ph.D. Food Safety Microbiologist, Office of Public Health Science,
USDA Food Safety Inspection Service

Summary:

Key Points:

- The FSIS Salmonella program samples are being collected in a “risk-based” manner, rather than randomly, following a February 2006 Federal Register Notice. The results are published quarterly and the program will be reassessed in July 2007.

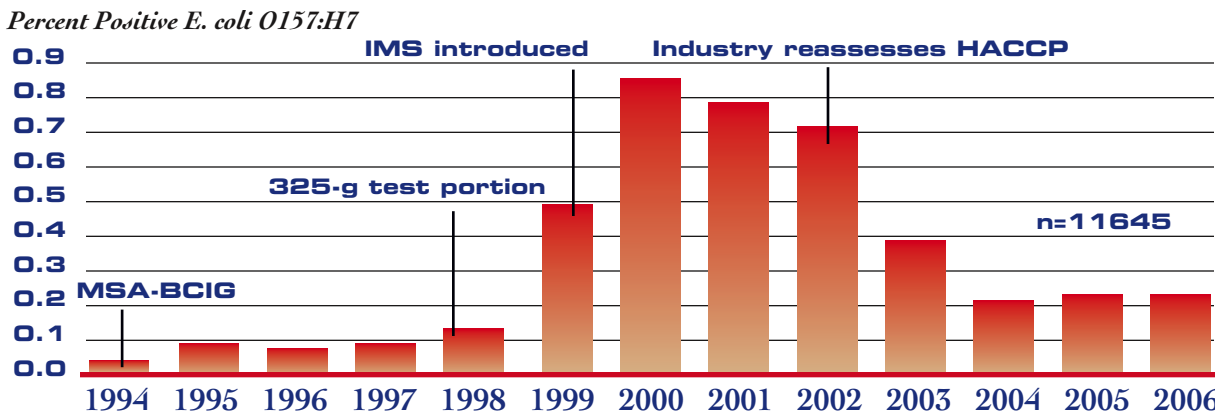
Preliminary Pathogen Reduction/Hazard Analysis Critical Control Point (PR/HACCP)
Salmonella data, percent positives, calendar year 2006

Product Class	Baseline Prevalence	Establishment Size			
		Large # samples (% positive)	Small # samples (% positive)	Very small # samples (% positive)	Total # samples (% positive)
Cows/Bulls	2.7%	235 (0.0%)	1,338 (0.9%)	673 (1.0%)	2,246(0.8%)
Steers/Heifers	1.0%	1,142 (0.1%)	1,277 (0.6%)	1,255 (0.1%)	3,674(0.3%)
Ground Beef	7.5%	605 (3.3%)	9,584 (2.3%)	7,660 (1.4%)	17,849(2.0%)

Note: Data from ALL sets, not just “A” sets, are included.

- In raw ground beef and raw ground beef components (RGBC) sampling, “E. coli O157:H7” is defined as E. coli that is “O157” and Shiga Toxin and/or stx-positive (i.e., “H” antigen is no longer relevant for testing purposes). The agency is also exploring different options for testing to offset the use of an enrichment broth that does not allow for rapid growth, and may affect the limit of detection.

Raw ground beef samples positive for E. coli O157:H7 by calendar year



- USDA FSIS baseline studies were initiated by the agency in the early 1990s to support the Hazard Analysis Critical Control Point (HACCP) Final Rule. The primary objectives of the studies were: 1) estimate the national prevalence and levels of specific pathogens and indicator bacteria, 2) develop informed risk assessment using microbiological data, 3) inform risk-based sampling programs, and 4) inform policy and regulatory decisions.

- Previous baseline studies are available on the FSIS Web site at: www.fsis.usda.gov/Science/Baseline_Data/index.asp
- Current inspection procedures depend on risk-based selection of establishments for *Listeria monocytogenes* and *Salmonella* testing. Policies are being developed for risk-based selection of establishments for *E. coli* O157 testing, so that higher risk establishments will be sampled more frequently. This change will allow less trend analysis than previous procedures that sampled all establishments equally.

Bacteriophage Technology: A New Technology that Could be Used as an Intervention

Justin Reber, President and CEO, Omnilytics, Inc.

Summary: A representative from a private company that specializes in the commercialization of bacteriophage as a food safety intervention discussed the basis for such an application, validation studies, and future industry opportunities.

Key Points:

- Bacteriophage application as a food safety intervention was first commercialized in 1990, however research into this type of application has been conducted since 1954. Omnilytics has been treating tomato and pepper crops since 1994. According to Reber, the primary reason for a delay in the commercial use of phage was the introduction of antibiotic therapy in the 1940s and the difficulty of controlling bacterial mutations.
- Bacteriophage are considered a virus and are a natural predator of bacteria, thus they have the ability to control destructive plant, animal and human bacterial pathogens.
- Phage were characterized as a safe intervention as they exist naturally in water, cheese, fruits and vegetables; humans consume them daily in high quantities; they exist naturally in the human intestinal tract, bloodstream and brain and they show no adverse effect on humans, animals, the environment or beneficial micro flora and fauna.
- Bacteriophage have the advantage of being specific to their host bacteria, so they do not affect nontarget organisms. Application does not alter taste, texture, color or the aging process of food products.
- Reber emphasized that bacteriophage interventions are not an “off the shelf” solution and that customization of the product over time is necessary.
- Reber described both university and company-conducted research that demonstrated the effectiveness of bacteriophage in reducing pathogen contamination. The company has developed a hide-wash system for cattle that is applied immediately before slaughter. The procedure does not require additional labeling based on communication received from USDA in the latter part of 2006.

Animal Biotech: The Latest Information on Cloning and Transgenics

Barbara Glenn, Ph.D., Managing Director, Animal Biotechnology

Summary: Animal biotechnology offers new opportunities for animal breeders to select and multiply animals of superior genetic potential. The field includes genomics, cloning and transgenics. None of these reproductive technologies has implications for food safety, which has been validated through the Food and Drug Administration’s (FDA) recent draft risk assessment.

Key Points:

- Animal biotechnology presents tremendous opportunities to improve animal health, develop more nutritious food, conserve environmental and animal resources, and advance human health. The animal biotechnology industry provides industry leadership on science and regulatory issues for the ethical application of biotechnology used to improve animal and human health for the public good. Industry priorities center around enhancing public confidence in biotechnology food products.
- Animal biotechnology includes three primary areas: 1) genomics, 2) cloning and 3) transgenics. Genomes have been sequenced for the three major livestock species (cattle, swine, and poultry). Genetic markers for selection purposes are being developed.

BEEF INDUSTRY FOOD
SAFETY COUNCIL:
PAST, PRESENT
AND FUTURE

James “Bo” Reagan, Vice President,
Research and Knowledge Management,
National Cattlemen’s Beef Association

The Beef Industry Food Safety Council (BIFSCo) has achieved a great deal in its short history. The concept of bringing together major competitors in the beef industry to discuss food safety issues was once considered controversial, but has now been heralded as a model that other commodities should look to as they fight their own food safety battles.

Since its inception, BIFSCo has led the development of proactive efforts to promote and enhance the safety of U.S. beef. Most notable, have been the Beef Industry Safety Summits that began with the *E. coli* O157:H7 Summit in 2003. These forums have created a dialogue of open communication between all sectors that has helped overcome significant challenges. The development of Best Practices documents for all segments has been one of the most important achievements. BIFSCo has also addressed other safety issues by creating the Bovine Spongiform Encephalopathy (BSE) Working Group, spearheading a Non-Intact Products Workshop in 2006, and initiating the development of a *Salmonella* serotype database specific to the beef industry.

The work is not done. BIFSCo leadership is already looking to develop more opportunities to disseminate the Best Practices documents and create education modules to benefit smaller processors. Future Beef Industry Safety Summits are already being planned. The creation of a Web site that will be the definitive resource for beef safety information is also a key priority.

Some battles have been won, but the war continues and BIFSCo will continue to lead the charge to address beef safety issues.



Timeline of technologies in animal agriculture

• Artificial Insemination	1950s
• Embryo Transfer	early 1980s
• Embryo Splitting & Cloning	late 1980s
• In Vitro Fertilization	early 1990s
• Genetic Preservation late	1990s
• Somatic Cell Nuclear Transfer	early 2000s
• Transgenic Technology	In Research

- Cloning is an assisted reproductive technology that allows the production of offspring that are genetically identical to the single donor animal (i.e., identical twins separated in time).
- FDA released its Draft Risk Assessment of Animal Cloning in December 2006. The report determined that the food products from cloned animals and their offspring are as safe as those derived from conventionally bred animals (<http://www.fda.gov/cvm/CloneRiskAssessment.htm>). FDA has had a voluntary ban on releasing cloned animals into commerce. This voluntary ban will stay in place until the agency has completed the risk assessment process.
- Transgenics offer the opportunity to genetically alter the makeup of livestock species to potentially increase the rate and quality of milk and meat production, increase disease resistance, produce human medicines (animal-generated pharmaceuticals) and produce organs for human transplant that are less likely to be rejected by the recipient.
- To assure safety, the animal biotechnology industry supports strong, science-based federal regulation of products from transgenic animals, including mandatory regulation and public transparency.
- The animal biotech industry seeks to work in partnership with the livestock and food industries to finalize the regulatory processes, and use this technology in a manner that provides consumer benefits.

Growing Popularity of Choices of Beef:
What Does it Mean to the Industry?

Rick McCarty, Vice President, Public Opinion and Issues Management, National Cattlemen’s Beef Association
Summary: Many consumers do not understand how beef gets to their plates, so it is important that industry stakeholders fill in key information gaps before others, such as activists provide inaccurate information. Consumers

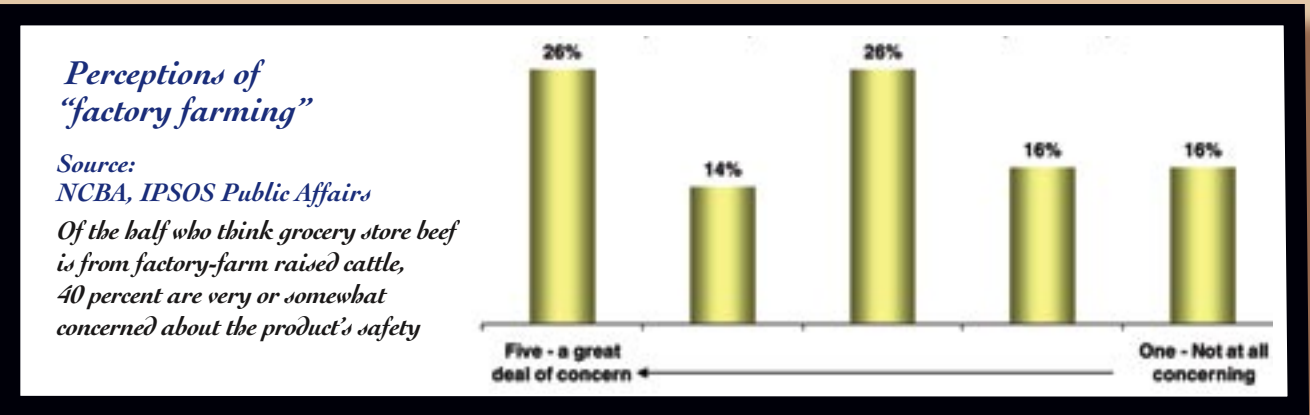
need to understand the sound practices used to produce safe, wholesome and nutritious beef, so that activist and special interest messages don’t cloud their trust in the safety of beef.

Key Points:

- McCarty cited several examples of messages from activists that cloud the picture of the safety of U.S. beef. He also discussed how marketing messages for natural, organic and grass-fed (finished) beef products may also create confusion in consumers’ minds about the safety of conventionally raised beef.
- Based on Checkoff-funded research, consumers are familiar with the different types of beef as they relate to natural beef production claims. Consumers are also willing to pay more for these types of products. The natural and organic market segment is growing at a greater rate than total beef in the retail channel, and on average, receives a 46 percent price premium at the retail level. Overall, the natural and organic beef market share is less than two percent of the entire market.



- Production practices commonly referred to in natural and organic beef marketing messages (i.e. hormone use, antibiotics, etc.) are commonly associated with “factory farming” by consumers. According to a Checkoff-funded survey, half of consumers think the beef they buy at the grocery store is from animals raised in a factory farm setting.



- There are numerous challenges in communicating accurate messages about beef production to the media and consumers because organic and natural products are often associated with local food production. The general public does not consider antibiotics and growth promotants safe and as a result, niche products are perceived to be healthier and safer.
- The beef industry, supported by the Beef Checkoff, has initiated a multi-pronged strategy to better communicate modern beef production practices to consumers, foodservice operators and retailers. Several cattle producers throughout the country have been identified and trained as industry “spokespeople.” A multifaceted toolkit and Web site (www.BeefFromPasturetoPlate.org) have been developed. NCBA staff members are also conducting Web and media monitoring and are developing response strategies as needed.
- McCarty emphasized the importance of putting a face on the industry.

KEYNOTE SPEAKER:
EMERGING TRENDS AND THE TOOLS THAT CDC USES TO
TRACK FOODBORNE ILLNESSES

*Fred Angulo, Ph.D., Acting Deputy Branch Chief, Enteric Diseases Epidemiology Branch,
Centers for Disease Control and Prevention*

Summary: Angulo described CDC surveillance programs and their implications.

Key Points:

- *Listeria* infections saw a similar decline in 2006 as they did in 2005. Compared to 1996-1998 base-line data, *Listeria* infections decreased 34 percent.
- The Healthy People 2010 Objective set by the government established a goal of 2.5 Listeriosis cases per 1,000,000 persons. In 2004, there were 2.7 cases, in 2005, 3.0 cases and in 2006, 3.1 cases per 1,000,000 persons.
- The decline in STEC O157 infections that has previously been observed in national surveillance data, was not sustained in 2006. However, compared to 1996-1998 baseline, STEC O157 decreased 15 percent in 2006.
- Coordinated efforts by regulators and industry have been effective in reducing contamination and illness related to ground beef. The decline in human illness has been consistent with USDA FSIS ground beef sampling data. The CDC is working with the American Meat Institute to document changes in industry practices and to determine what additional interventions are needed for further reductions. There also needs to be a better understanding of the role of produce in *E. coli* illness rates. Unfortunately, according to Angulo, the successes of the beef industry in reducing the incidence of *E. coli* O157:H7 has been obscured by the large produce outbreaks.
- Angulo also described the USDA initiative to reduce the presence of *Salmonella* in raw meat and poultry products, and to better understand the source of human infections. There is currently good attribution data available for *E. coli* O157, however he said that attribution for *Salmonella* is more complex. A wide variety of food-animal products can lead to infection and the information for attribution differs by serotype.
- In 1996, the FDA Joint Advisory Committee recommended the creation of a surveillance system to monitor development of antimicrobial resistance among foodborne bacteria. The effort is financially supported by the FDA Center for Veterinary Medicine.
- Angulo also described future issues, including an emphasis on working with the production sector to address antimicrobial resistance, especially in the dairy industry (Get Smart on the Farm). Predictors for multidrug-resistance also need to be developed.

Effect of Outbreaks on STEC O157 rates

Year	Incidence (ALL cases)	Incidence (Removing foodborne outbreak cases)
2004	0.90	0.86
2005	1.05	0.93
2006	1.31	1.16

Healthy People 2010 Objective Goal:
1.0 case STEC O157 infection/100,000 for all food sources

Healthy People 2010 Objective

GOAL:
1.0 case STEC O157 infection/100,000 persons*

- 2004: 0.90 cases/100,000 persons
- 2005: 1.05 cases/100,000 persons
- 2006: 1.31 cases/100,000 persons

*Goal incidence numbers are for all foods, not just beef.

Conclusion



The 2007 Beef Industry Food Safety Summit marked another opportunity for all segments of the industry to once more come together and pledge their commitment to beef safety. In his closing remarks, Warren Mirtsching, Quality and Food Safety, JBS Swift e3 Company, said, "It took action and collaboration to get the successes that we have. We can't rest now."