

Foodborne Pathogens

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It's good to have the opportunity to discuss with you some of the changes that have occurred in the area of food safety in the meat industry. I'll focus primarily in the beef area and address events during the last six months surrounding the outbreak of *O157:H7* in the Northwest. I'd like to thank Mike Doyle for initiating the food safety discussion today. If you have heard about *O157:H7* and pushed it to the side, not thinking a whole lot about it, I think after Mike's presentation, we should have your attention. It's a critical problem for us and it's a very major problem, since it occurs most of the time in children who are somewhere between one and eight years of age.

What I would like to do today is spend a little time discussing some of the significant changes that the meat industry has already undergone and those we expect to occur, giving primary attention to the rethinking of food safety in the meat industry.

One of the things that occurred to me as I was preparing for this presentation, going back through some of the news releases that had come over my desk over the past six months, was how today's headlines compare with those at the turn of the century when Upton Sinclair wrote *The Jungle*. We know how revolutionary that was and how devastating it was for the meat industry. The meat industry has undergone major changes since that time. I think back over the number of discussions I've had during the last six months with regulatory agencies, meat packers and others. I left some of those conversations thinking that this outbreak in January may be as revolutionary as what happened around the turn of the century.

Not A New Issue

For many people, food safety is something new, something that's come about within the last five or six years. If we look back in history, we find that in 1919 we had a worldwide flu epidemic. At that time, the public blamed many of the public health problems on the safety of meat products. As a result, the Public Health Services was formed in 1923; it's known as the CDC today, the Centers for Disease Control. Another thing that happened in the food safety area was the national meat boycott in 1973. It again came back to food safety as a health issue, and the meat and livestock industry was criticized severely. The most recent hit, of course, was in January, 1993. Throughout all of these public food safety issues,

the National Live Stock & Meat Board, founded in 1922, was at the forefront in addressing consumer concerns. In fact, one of the main reasons for founding the National Live Stock and Meat Board was that livestock producers wanted to have an organization that would represent livestock producers and relay product safety information to consumers.

Today, foodborne illness is a major problem for the industry and it's a major cost for our country. If you look at some estimates, there are about 12.6 million cases of foodborne illness a year. The cost is estimated to be about \$8.4 billion, including lost time at work, health cost, etc. Eighty-four percent of this cost has been related to bacterial or viral infections; *E. coli* infections, specifically, have cost about \$233 million.

Now I'd like to refer to something mentioned earlier. Mike Doyle said there are only 37 or 38 states reporting *E. coli* incidents. Next year, all 50 states will be reporting *E. coli*. Consequently, what we're seeing now with regard to the cost to the industry for *E. coli* infection is probably just the tip of the iceberg.

Industry Response

I'd like to spend a little time talking about the industry response to this outbreak and what it will do. The program that I will be talking about is industry-wide, farm to the fork.

On the Farm

One of the first facets that we need to talk about is: "What has been the on-the-farm response?" One thing that's happened on the farm is that there's a significant increase in awareness of the problem. I think there are some people that are having a hard time accepting the fact that his or her animals may be carrying *E. coli O157:H7*, and then "Where does my liability end?" "Is it my problem or is it the packer's problem?" "If someone cooks the meat correctly, will it be okay?" There's great concern by producers that the industry as a whole needs to do something about this food safety crisis.

There are some major challenges: researchers don't know a great deal about the ecology of this organism. Researchers don't know how it gets into the environment; they don't know how it's transmitted, or if it's transmitted from one animal to the other. Is it affected by management practices? If producers stress an animal, is that going to cause that animal to shed more *E. coli* than normal? There are so many questions. Meat Board staff and other industry experts have been working with scientists at the National Center for Animal Disease, Washington State University, and other research institutions, concentrating in this area. There definitely will be major efforts initiated in on-the-farm control mechanisms.

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In the Plant

Let's take a look at in-the-plant response and what's happening there. For this, we'll take two approaches: first, we'll look at carcass production plants and then we'll look at the processing and supplier areas.

Carcass production plant operations realize that there needs to be an overall reduction in pathogen numbers on the product as it moves through the plant. Carcass production facilities have taken many approaches to address the reduction in number, including education and training of workers, assuring that employees are made aware of the problem, and how their actions can affect the final product.

Need for HACCP Systems

The other thing that's happening is that carcass production plants are becoming aware of the need for HACCP systems. The carcass production plants have probably done more work in this area than any other area of the industry. They recognized this a number of years ago and started moving in that direction. They know that these systems need to be developed and implemented. I think most plant supervisors recognize that once they're developed and implemented, a HACCP system can't be put on the shelf. If it's going to be an effective HACCP system, it has to be a working system, one that is used every day.

One of the big changes for carcass production plants is that trim losses have gone up. Prior to the recent meat inspection changes, the average trim loss per head of cattle was 3 to 4 pounds. The people I've talked to lately now report trim loss figures ranging from two to three times that original 3 to 4 pound average. There are more workers out on the floor whose specific job is to trim any and all fecal contamination from the carcass. Another major change is that if there are any tagged cattle in the coolers, plants can no longer run a spray-chilled system. As a result, there's higher shrink losses in the cooler.

Organic Acid Rinsing

Plant operators feel there's a need for more intervention systems, and one that's being looked at very carefully is Organic Acid Rinsing. USDA approval for Organic Acid Rinsing was received in November of 1992. As of today, there are 17 systems that have been approved and operating in the industry. Additionally, there is much more microbial testing being conducted, more than ever before. Needless to say, a lot of that is testing for *E. coli* O157:H7.

The Processing Area

Another area that I want to talk about is the processing area. One initiative is increased microbiological testing. Presently, packers are testing every lot that comes in and they are testing specifically for *E. coli* O157:H7.

Processors are also reducing their number of suppliers. A processor who used to have 10 to 15 suppliers may now only have two or three. Processors are starting to keep records of what is coming in and from where. I had one person tell me, "You know, every once in a while we used to look at a stressed

load and pick those up real cheap. That's something that we don't even think about doing any more." So this is one practice that is going by the wayside. Many processors are tightening up their standards and realize the need for strong HACCP programs.

The Restaurant Industry

What about a quick-service restaurant? What's going on there? There have been many changes within the restaurant industry. If you look at the data reported by the Center for Disease Control, 77% of all foodborne illness occurs at the restaurant level, primarily in the quick-service restaurant area, from either mishandling or from improper cooking of the product. We are finding that quick-service restaurants are now strictly adhering to cooking guidelines, monitoring their grill temperatures regularly, and checking patties for endpoint temperature. Every cooked patty is being visually checked to be sure that there is no pink in the middle. Restaurant operators are checking the patty to see if the juices run clear. They are also educating their workers on good manufacturing practices. For example, "Employee A, your job is to work with fresh product, you put it on the grill. Your job is not to go from this point to help employee B put the sandwich together." In many cases, restaurant operators are setting up specific work stations within the facilities.

Due to the low dose levels that can lead to *E. coli* O157:H7 infection symptoms, it may only take from 1 to 10 organisms per gram to infect an individual, especially children, with *E. coli* O157:H7. Because of that, some strict storage regulations have come about that are being enforced within restaurant chains: 1) no longer will ground beef or any type of beef be stored above salad dressing, lettuce, or any other produce; 2) specifications on suppliers are tightening, they're dealing with fewer suppliers, they're talking partnering; 3) restaurant operators are being extremely vocal with suppliers; they tell us what level of bacteria that they will tolerate; and 4) they are looking at what they can do to widen their windows of safety. They're trying to do that through thorough cooking and the implementation of HACCP programs. This is one area that we have HACCP programs in place that are working quite well.

The Retail Industry

What is happening in the retail industry? Retailers are educating their workers. They are urging them to go out and meet the consumers, to try to educate the customer and let them know that the consumer has a role in maintaining the safety of the product. Retailers are distributing information about safe meat handling practices. I had one meat processor tell me that they generally do several programs a year where they work with the people they're supplying, such as retailers. In some instances, the requests for programs increased a hundred-fold, so there is a recognition that there is a food safety concern. As a result, I think we have developed closer working relationships.

When the industry traded hanging beef, before the boxed beef programs came about, there were many retailers who had strict specifications from the standpoint of average plate

counts. Those specifications fell by the wayside when the industry went to boxed beef programs. The predominant test that is being made now on incoming product is receipt temperature. But we're now hearing retailers discussing specifications again. What they're doing is going to the packer and saying they would like the packer to guarantee a certain level of quality in their products. To date, however, we know of no HACCP programs for retail.

Regulatory Issues

What is going on with regulatory issues? Dr. Russell Cross, FSIS Administrator, has been working diligently on a pathogen reduction program. The USDA/FSIS refers to this as their "War on Pathogens." You don't have to talk to Dr. Cross very long to know he's pretty serious and that he means business. They have introduced a two-track approach to addressing pathogen reduction. "Track One" is trying to restructure the inspection system that now exists. I think USDA is going to tighten plant sanitation dramatically. Our top carcass production plants around this country are in good shape. They are doing a very good job. It's not to say that there couldn't be some improvements. The major problem and challenge is to bring up the lower third of the plants, those that are not doing a very good job. Track One will focus there. In Track Two, the USDA will revolutionize the system. They are talking about building a meat inspection system from the ground up and there will be a great deal of discussion as to how to precisely get that done.

Association Activity

Unless you work closely with the National Cattlemen's Association, American Meat Institute or the Meat Board, you may not recognize the importance of this segment of our industry. You probably don't have an appreciation for the number of hours and the number of dollars that are committed each year in managing the various issues facing the industry. The *E. coli* O157:H7 issue has been an enormous one. There have been a large number of people at the Meat Board, AMI, and NCA that for three to four months, that's about all they did, 10 to 12 hours a day, 7 days a week. It's something that took a lot of hard work, but I think we're better off for it.

When everything was hitting the media, we needed immediate response. One of the ways used was to develop fact sheets, getting these out to people so that they would know more about the organism and what was being done to actually manage it. The Meat Board developed several brochures outlining food safety tips. We had some that were just for meat and how to handle it, how to thaw it and similar recommendations. We developed another set of safety recommendations specifically for ground beef. We worked with AMI and NCA to further distribute the consumer tips. The Meat Board, in cooperation with USDA, AMI and FMI, developed a publication called "*Safe Handling Practices for Meat*," which covered both ground meat and poultry. This is the main publication that's been going out to retailers for their customers and it does a good job of letting the consumer know that they do have a role in maintaining the safety of the product and giving them advice on how to carry out that role.

Issues Management

Many of you learned in the issues management sessions this week, which Wendy Pinkerton and C.J. Reynolds have been conducting, that we not only have to have a response, but it has to be consistent, and we need to reinforce it on a daily basis.

One of the initial actions of the National Live Stock & Meat Board, American Meat Institute and National Cattlemen's Association issues group was to gather risk-management experts to discuss food safety issues and develop a plan of action. As the industry representatives were revealing all that had happened, the pro-active work that had been done for the industry, these experts said that the industry needed to promote what had already been done. They were very impressed with the work that the Meat Board had done in the area of research, and many of you here have contributed heavily to this area, and deserve a pat on the back. The key consumer media response that was developed and reinforced at every opportunity was that within the past three years alone the livestock producers in this country have invested more than one million dollars of their own money in research to identify and control *E. coli* O157:H7. The objective of this message was to reassure the consumer that they should have confidence in the product.

Attitude Tracking

As a follow-up to the outbreak in early 1993, the Meat Board conducted a consumer attitude tracking study. We ran the first study in February with a follow-up study in March, to get an idea of what consumers were thinking. The study was conducted on a nationwide basis and we also conducted a concentrated West Coast study. From the standpoint of awareness, there was a greater awareness on the West Coast, compared to the remainder of the U.S. Consumers knew the restaurant chain that was involved, especially on the West Coast. We asked them "Do you believe that the ground beef in grocery stores is safe?" Nationally, about 86% agreed with that statement in February, which went up about 2% two months later. On the West Coast, even immediately after the outbreak, 82% continued to have faith in the product and a few months later it had moved up to 87%.

We asked consumers about their attitudes toward quick-service restaurants. How safe did they feel when eating beef products in quick-service restaurants? The results were interesting. About 71% to 72% of those surveyed felt it was safe — but that's still one out of four who did not. They did not have the same degree of confidence in the quick-service restaurants that they had in buying the product in the retail stores. This brings us back to the need for HACCP systems at the retail level — there are no formal systems established, but if consumers put that level of confidence in the meat products they buy at retail, perhaps it's time for a HACCP approach at retail.

Another question we asked was; "Has this incident had any effect upon your level of beef consumption?" Nationally, 86% of those surveyed said no, it hasn't. After two months of publicity, there was a slight drop in reported consumption by about 5%. The most positive thing, though, was on the West Coast; right after the incident, about 68% of the people said

they hadn't decreased their consumption. Two months later the response moved back up to 86%, an 18-point increase.

Research Commitment

What about research initiatives? The meat and livestock industry can be proud of the commitment to *E. coli* research, totaling over a million in checkoff dollars. If we look at the industry's commitment to food safety in general, both state and national contributions, there has probably been close to 2 million dollars devoted to food safety research over the last 6 years.

HACCP/Organic Acid Rinse Project

One of the projects that the Meat Board has devoted many hours to planning and implementing is the HACCP/Organic Acid Rinse project. It was designed with the active participants of a task force established by the National Live Stock and Meat Board. The task force worked with FSIS, Ag Canada, many equipment and chemical companies, a number of universities, and several private labs to conduct this study. The study's objective was to look at the effectiveness of using some type of organic acid rinse to reduce pathogens on beef and pork carcasses. Specific acids studied were acetic, citric and lactic. The acid rinses were found to be effective in reducing average plate count. We also found that there was a reduction in coliforms and there was some reduction in *E. coli*. The roadblock that we had with *E. coli* O157:H7, in a follow-up study that the University of Georgia conducted, we found that the acid rinses did not completely kill O157:H7. It appears that none of the acids will completely kill *E. coli*, but we may get a one to one and one half (1 to 1-1/2) log reduction in some cases.

We did find an improvement in environment evaluations and that there were no residues on the carcasses as a result of using these acid sprays. One thing that FSIS watched closely was the possibility of carcass weight increase. The study showed that acid-rinsed carcasses showed no weight gain.

Food Safety Roundtable

Another thing that the Meat Board is pleased to highlight is the Food Safety Roundtable. This forum actually resulted from the HACCP project because as we were working with FSIS, the packing industry and others, it became evident that the meat and livestock industry needed a place to go where they could shut the door, roll up their sleeves and talk honestly to each other about problems, and what could be done to solve them. Through an effort of the Meat Board Product Technology department, a Food Safety Roundtable was formed. The first meeting was in July of 1992, with the purpose of establishing a committee to serve as a unified force to prioritize strategies for the industry and to ultimately develop an overall food safety program for the meat industry. Recently, there was another meeting of the Roundtable, this one focused on *E. coli*. Roundtable members represented USDA/FSIS, FDA, quick-service restaurants, industry associations, packers, processors and physicians. Also, there were several leading sci-

entists from academia in attendance.

One of the initiatives from the first Roundtable was the agreement that any time a project was developed, it would be reviewed and approved by FSIS. Also, representatives of FSIS would be on the task force all the way through the planning and development of that project.

One of the objectives of the second Roundtable was to wade through some of the myths about O157:H7. We wanted to develop a list of known facts and strategies. The participants agreed that the infectious dose of O157:H7 is low, 1 to 10 organisms per gram. We also agreed that the prevalence in food is low and that the industry is doing a good job of testing. However, there is a concern with regard to how effective some of our tests are. Participants reiterated the need for improvement in the area of rapid, accurate testing. The Roundtable agreed that cooking is an effective way to control the pathogen. Participants said, however, that the industry must assume that the customer will undercook the product. Consequently, how do manufacturers guarantee the safety of the product? The Roundtable agreed that cattle are a reservoir for the pathogen and that there is a need for more animal studies. They also revisited the thermal death curve for this organism. If ground beef is cooked to an 140°F internal temperature, it must be held for 8.3 minutes to get a 4-log reduction. This is one of the reasons for the recommendations to cook all products to at least 155°F until the center is no longer pink and the juices run clear.

Identifying Needs

Research Voids

During the Roundtable, participants set up long-term, medium-term and immediate needs of the industry while identifying research voids. The Roundtable concurred that there is a need to know more about the ecology of the organism in animals. How does this organism colonize in an animal? How does it get there? There is also the need to know more about the dynamics of O157:H7 in our production plants. We need to know more about the vectors associated with this organism. One of the major problems we have had today is "what if you test for it and it's positive?" "What do you do with the load of meat?" This is a major problem that we've got to come to terms with in the near future.

Develop HACCP

Another need is to develop HACCP systems all the way from the farm to the fork. The meat and livestock industry needs to improve the effectiveness of test and release programs. Do you realize that if you go back and look at the data between 1987 and 1990, FSIS ran over 200,000 samples and had one positive for O157:H7. This year, baseline data indicate zero positives to date. How effective are the tests that we have? The food industry, as well as consumers, need easy cooking indicators.

Other Needs

The industry also needs to continue to develop intervention strategies. There is also the need for indicator organisms

that are easier to isolate and easier to grow that will give an indication of the existence or levels of *E. coli*. There is also the critical need to know more about the incidence levels. Some early data suggest 10% of dairy herds might have one case of *O157:H7*, other data say it could be as high as 20%.

If there has been one lesson we have learned through this latest food safety crisis, it is that our future industry food safety program must be proactive, it must look ahead. There will always be the need for part of the program to be reactive; there's no way to avoid that. But it is absolutely necessary for it to be 90% proactive so that before a problem arises, we know the problem is coming and we have a plan to address it.

In Conclusion

What I would like to do is leave you with some thoughts: Where are we going? What do we need to be doing? In the last six months, we've seen a lot of changes, and we're going to continue to see a lot of changes. There may be fewer plants, there will be more partnering between and among industry businesses and organizations. We need to get down to single-digit numbers for *E. coli*. Windows of safety need to be widened. Development and implementation of HACCP outreach programs will move forward quickly. As we look at food safety for the industry, there has to be a microbiological mindset. Food safety will continue to be a priority for the meat and livestock industry. All of us will certainly be a part of the plan, and a part of the solution.