Current Industry Issues: A Beef Safety Perspective

BSE, E. coli O157:H7, Irradiation

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Introduction

"Few environmental issues generate as much heat and as little light as controversies over food safety. It is ironic that the United States, which has one of the safest and most closely regulated food supplies in the world, should face a credibility problem on this issue."
)) William Reilly, administrator
Environmental Protection Agency

American cattlemen are committed to producing a safe and wholesome product for consumers. Experts describe the American food supply as "the safest in the world." No other country monitors food—both domestically produced and imported—as closely, and no country has the United States' safety record for food consumed. Despite successes, technological advances, and aggressive food safety programs of the U.S. Beef Industry, media attention (largely negative) focuses increasingly on food safety issues. Our consumers demand a safe and wholesome product and the beef industry must continue to address consumer concerns about the presence of contamination, especially microbial, in beef.

Recent research conducted by Hart Research Associates (1996) indicates that 75% of consumers are confident that U.S. beef is safe. Seventy-eight percent say beef steaks and roasts are free from bacterial contamination, where only 62% of all adults (54% for women) feel that way about hamburger. According to the Food Marketing Institute's 1997 Trendsurvey, 69% of consumers surveyed consider food spoilage to be the greatest food safety threat. Another 17% cited bacterial contamination. Foodborne illness remains the greatest of all food safety threats. The Centers for Disease Control and Prevention (CDC) reports that 97% of foodborne illness could be prevented with basic hygiene and improved food handling practices. In 1996, 36% of the 9,164 beef industry news media articles tracked by CARMA (in the top 64 media markets) were on beef safety issues, the number one media-covered issue.

Food safety issues, especially those associated with bacterial contamination, will continue to remain top-of-mind for U.S. and world consumers. However, issues such as bovine spongiform encephalopathy (BSE) and irradiation will increasingly attract consumer and anti-meat activist attention. BSE and irradiation represent areas of scientific "unknowns" to consumers and are met with skepticism. Recent NCBA consumer surveys indicate 63% of consumers are concerned about mad cow disease in the U.S., and 71% of consumers surveyed say the beef industry has dealt well with mad cow disease. Irradiation as a technology for reducing harmful bacteria present in fresh meats is met with acceptance only after consumers are educated about the safety of the process.

Bovine Spongiform Encephalopathy

Background

BSE is an extremely rare chronic, degenerative disease affecting the central nervous system of cattle. BSE is not present in the United States, but has been found in the United Kingdom and a few other European countries. BSE is one of a class of rare degenerative brain diseases called *transmissible spongiform encephalopathies* (TSEs), some of which affect animals while others affect humans. BSE is frequently and inappropriately re-

ferred to as "mad cow disease," a term initially applied by the British media when it was thought that afflicted cattle might have rabies. Rabies is a viral infection that can cause encephalomyelitis (inflammation of the brain and spinal cord) in a number of animal species.

Scientists suspect that, like all TSEs, BSE occurs when normal protein structures in brain cells change to an altered structure known as a prion. Scientists believe that when a prion comes in contact with a normal protein, it distorts the protein. As distorted proteins accumulate, they destroy brain neurons and result in neurological damage.

There are different hypotheses about the origin of BSE, and research continues in this area. One theory is that BSE in Great Britain may have been caused by feeding cattle rendered protein products from carcasses of sheep infected with scrapie—another type of TSE caused by prions. An alternate theory is that BSE had existed in undetectable levels in British cattle prior to its detection in 1986, and slight changes in rendering operations may have allowed the infective agent to be recycled to cattle.

There currently is no reliable test to detect BSE in a live animal. Farmers may suspect the disease based on a cow's behavior, but cases are confirmed when veterinary pathologists perform postmortem, microscopic examination of brain tissue.

Cattle with BSE may display changes in temperament such as nervousness or aggression, abnormal posture, coordination problems, difficulty in rising or walking, decreased milk production, severe muscular twitching, or loss of body weight despite a continued appetite. BSE is fatal and there is no treatment or vaccine to prevent the disease.

Key Facts

BSE was first identified in 1986 in Great Britain, and the majority of BSE cases have occurred in the U.K. Other countries, such as Ireland, France, Portugal and Switzerland have reported cases of BSE in native cattle, but the incidence rate in these countries is significantly lower than that in the U.K. BSE has never been detected in the U.S. and the U.S. government has taken a number of measures over the years to prevent BSE from ever entering the U.S. food supply, including the following:

- In 1989, USDA imposed a ban on imports of live ruminants and ruminant products from countries with confirmed cases of BSE. No beef has been imported from the U.K. since 1985.
- Since 1986, the USDA has conducted nearly 6,000 tests on brains from cattle that have shown any neurological signs that might indicate BSE, and all tests were negative.
- More than 60 veterinary diagnostic laboratories throughout the U.S. are participating in a BSE surveillance program along with the National Veterinary Services Laboratories in Iowa.
- In August 1997, an FDA rule became effective prohibiting use of mammal-derived protein so BSE would be prevented from spreading and eliminated, were it to enter the U.S. beef supply.

Creutzfeldt-Jakob Disease/New Variant Creutzfeldt-Jakob

Background

Creutzfeldt-Jakob Disease

First identified in the 1920s, CJD annually affects one person per million per year world-wide, usually striking those over the age of 50. CJD affects men and women of diverse ethnic backgrounds and lifestyles and is always fatal. Analysis of the global incidence rate of CJD cases shows it has remained constant for nearly 20 years. British researchers recently identified a new TSE disease, which is known as new variant CJD (nvCJD). New variant CJD has affected people under 40 and has

slightly different symptoms than CJD. While often confused for the same disease, CJD and nvCJD are distinctly separate conditions. CJD occurs in one of three forms:

- a familial, or genetically inherited, form;
- a sporadic form, which is of unknown origin and accounts for roughly 85% of all CJD cases;
- an acquired, or iatrognic, form due to inadvertent exposure to CJD-contaminated material as a result of brain surgery or corneal grafts, and through the use of growth hormones derived from human pituitary glands.

Early symptoms of CJD include poor concentration, a lethargic nature, and intermittent unsteadiness when standing or walking. As the disease advances, agitation, dementia, and chronic muscle spasms or twitching occur. The dementia advances rapidly, vision becomes impaired and the patient dies soon after, usually within one year of the onset of symptoms. No treatment or cure is available for CJD.

New Variant CJD (nvCJD)

New variant CJD was identified in March of 1996 after 10 Britons under the age of 40 displayed neurological and behavioral symptoms associated with a TSE. CJD was initially suspected but analysis showed a new form of TSE. Thus, because there are symptomatic differences as well as differences in the pathology of affected brain tissues, CJD and nvCJD are distinctly separate diseases. Their commonality is that both are in the class of diseases called transmissible spongiform encephalopathies. The nvCJD differs markedly from sporadic or accidentally transmitted CJD. It lasts longer—up to 14 months, compared with less than a year in other types of CJD—begins with psychiatric symptoms such as depression and occurs in much younger people than classic CJD. It is distinguished from classic CJD by distinctive amyloid plaques (protein deposits) that dot the brains of all victims and are surrounded by a halo of microscopic spongy holes, which gives it a daisy-like floral pattern of brain damage. To date, nvCJD has affected 24 people in the U.K. and one person in France. The specific cause of nvCJD is not known, and more research is needed before a definite cause can be determined. Recent research by Dr. Jeffrey Almond of the U.K. has found that strain typing of 7 strains of BSE showed that their PrP (prion protein) signatures were identical, clearly distinguishable from the signature of CJD but not distinguishable from the signature of new variant CJD.

Key Facts

(These are given in Table 1.)

E. coli O157:H7

Background

After more than 500 people became ill and 4 children died from *E. coli* O157:H7 contamination linked to undercooked hamburgers in late 1992 and early 1993, the meat industry took immediate action to bring national scientific focus to this virulent bacteria. While the beef industry is concerned with all hazards already existing or that may evolve in the future to pose a threat to the safety of the U.S. beef supply, immediate efforts target solving the problem of *E. coli* O157:H7 in beef.

Key Facts

The beef industry is putting incidence in perspective:

- The *E. coli* O157:H7 pathogen has triggered foodborne illness outbreaks from consumption of foods as diverse as unpasteurized apple juice, lettuce, alfalfa sprouts, ground beef, and strawberries.
- USDA has tested more than 17,000 random ground beef samples over the past 3 years and

Table 1. Classic Creutzfeldt-Jakob Disease (CJD) and new variant CJD (nvCJD) are distinctly different diseases

Classic CJD	nvCJD
Discovery: Identified by German psychiatrists Hans Gerhard Creutzfeldt and Alphons Maria Jakob in the 1920s.	**Discovery:** Documented in Great Britain in 1996.
Transmission (3 forms): Sporadic form, which is of an unknown origin and accounts for about 85% of CJD cases. Familial, or genetically inherited form. Acquired form from exposure to CJD-contaminated material as a result of brain surgery, corneal grafts, dura matter grafts, and human growth hormone.	**Transmission:** Research from the Institute of Animal Health in Edinburgh, Scotland, indicates a strong likelihood that nvCJD developed in the U.K. as a result of people consuming products containing central nervous system tissue from cattle infected with bovine spongiform encephalopathy (BSE).
Incidence: Affects approximately 1 person per million world-wide each year. CJD patients are typically over 55 years of age.	**Incidence:** Has affected 24 people since 1996 (23 in the U.K. and 1 in France) as of January 1998. *NO REPORTED CASES IN THE U.S.* Disease has struck people under the age of 45, a number of whom were teenagers.
Symptoms: Includes poor concentration, a lethargic nature and unsteadiness followed by agitation, dementia and chronic muscle spasms. Symptoms last less than one year, with average duration between 4 to 6 months.	**Symptoms:** Patients experience early psychiatric symptoms, earlier loss of coordination and later onset of dementia. Symptoms last up to 14 months.
Diagnosis: Sharp-wave complexes present in EEG. In autopsy, absence of amyloid plaques on brain.	**Diagnosis:** Lack sharp-wave complexes in EEG In autopsy, amyloid plaques are extensively distributed throughout the cerebrum and cerebellum. Plaques typically have a dense center surrounded by spongiform change, which give the plaque a daisy-like floral pattern.

only 10 (1 in 1,700) have been positive for *E. coli* O157:H7. This is an extremely low incidence, only about .0006 of the total random samples.

- The industry's efforts to educate consumers about proper handling and preparation of food, as well as industry support of new processing technologies, appear to be paying off in reduced incidences of foodborne illness from *E. coli* O157:H7. After the 1993 Jack-in-the-Box incident, more states required cases of *E. coli* O157:H7 to be reported (44 states now report their numbers to CDC). It was therefore expected that the number of reported cases of *E. coli* O157:H7 would increase significantly. That has not occurred.
- In 1994, there were 34 outbreaks of *E. coli* O157:H7 and a total of 543 cases of illness reported to CDC. Of those cases, 121 (23%) were attributable to beef.
- In 1995, there were 31 reported outbreaks in which 455 people became ill. A total of 98 cases (22%) were traced to a beef source.
- In 1996, there were 29 outbreaks with a total of 488 illnesses. Only 21 (4%) of the 1996 illnesses were attributed to ground beef and, of this number, 14 were because of improper

handling and cooking in the home. By contrast, in 1996, there were 91 reported illnesses from apple juice and apple cider, 73 from person-to-person transfer in schools and day-care facilities, 47 from lettuce, and 30 from swimming.

The beef industry is combating this pathogen:

- No one cares more about the safety of U.S. beef than America's one million cattle producers. Raising safe beef is not only our livelihood, but our heritage and life.
- In a show of unprecedented commitment by the entire industry, the Beef Industry Food Safety Council (BIFSC) formed in October 1997 to develop industry-wide, science-based strategies to solve the problem of *E. coli* O157:H7 and other foodborne pathogens in beef. The Council will identify, fund, and prioritize research priorities from farm to table; develop programs to help industry segments operate in today's business environment; speak with one voice in seeking regulatory and legislative solutions; develop consumer education programs; and develop and implement industry education programs to assist in the transfer of technology into the marketplace. In short, the focus will be on prevention at all stages to significantly reduce and possibly eliminate problems. NCBA's CEO, Chuck Schroeder, has been appointed as chairman.
- The beef industry has invested more than $8.4 million dollars since 1993 in *E. coli* O157:H7 food safety applied research. Techniques resulting from this research include vacuuming beef carcasses with steam or hot water, which effectively removes *E. coli* O157:H7 and a host of other harmful bacteria. Rinsing beef carcasses with hot water and mild organic acid solutions also reduces pathogens.
- The beef industry created the Blue Ribbon Task Force in 1993 to aggressively address the *E. coli* problem. The best scientists from the beef industry, academia and government developed a "blue print" of actions, from farm to fork. Some accomplishments thus far include steam vacuuming and safe-handling labels on consumer packaging. The beef industry continues to make progress.
- A new USDA rule now requires all slaughter facilities to test raw carcasses for generic *E. coli*, beginning January 1997. The rule also requires the USDA to test raw carcasses and ground meat and poultry for *Salmonella*, to be phased in beginning January 1998.
- The new Pathogen Reduction/Hazard Analysis Critical Control Points (HACCP) Rule for meat and poultry requires plants to have HACCP systems in place by January 1998, phased in by plant size. Many plants already voluntarily use such systems, which set strict process control criteria designed to prevent foodborne hazards from occurring.
- The beef industry supports new technology to improve food safety, including radiation pasteurization, which has finally won FDA approval. Using low doses of gamma rays, x-rays or electrons, radiation pasteurization has proven effective in destroying foodborne pathogens including *E. coli* O157:H7. The beef industry also supports research and development of new processing technologies such as steam pasteurization, steam vacuuming, hot water decontamination, and organic acid rinses.

The beef industry is educating the consumer:

- NCBA is one of six industry associations funding the Partnership for Food Safety, which is one of five areas in President Clinton's food safety initiative. The Partnership for Food Safety brings together industry, government, and consumer groups whose goal is to develop consistent and memorable messages about the importance of handling food properly. Its

"Fight BAC!" consumer education campaign even has a web page (www.fightbac.org).

- Consumer surveys have shown that the vast majority of consumers believe the most effective way to reduce the risk of foodborne illness from bacteria in meat is for people at home to take more care to properly prepare and cook meat. In support of this, NCBA also has developed a wide range of consumer food safety education programs, which this year have reached consumers with safety messages 580 million times.
- NCBA's consumer food safety education programs have focused on delivery of safe food handling messages. The "Mr. Food" segment on cooking and safety tips aired on 150 television stations, and created more than 550 million "consumer impressions." A video news release, Avoiding Barbecue Blunders, reached an audience of 24 million over the summer grilling season. In addition, 6 million supermarket customers picked up Perfect Burger tip sheets in grocery stores.

Irradiation

Background

Although irradiation has been approved for use on certain foods in the U.S. for more than 30 years, the FDA's recent authorization for irradiating red meats has brought this issue to the forefront of the industry agenda. NCBA supported the action by FDA and, at the Centennial Convention in February, passed a resolution to

1) encourage implementation of irradiation technology.
2) encourage USDA to develop and implement rule-making to allow use of this technology.
3) educate consumers, food service groups, retailers, and producers about irradiation.
4) establish consistent terminology for this technology.

Food irradiation is the exposure of food to low doses of gamma rays, x-rays, or electrons to destroy pathogenic foodborne bacteria and parasitic organisms. Because the results are similar to pasteurization, but without using heat, irradiation is sometimes referred to as "cold pasteurization" or "ionizing pasteurization." The term "ionizing" means that this form of radiation has sufficient energy to create positive and negative charges, leading to the death of bacteria and other pathogens on food.

The FDA has previously approved three types of irradiation for the treatment of foods:

1) gamma rays produced by natural decay of radioactive isotopes of cobalt-60 or cesium-137;
2) x-rays with a maximum energy of 5 million electron volts (MeV); and
3) electrons with a maximum energy of 10 MeV.

One electron volt (eV) is the amount of energy acquired by an electron when it is accelerated by one volt in a vacuum. USDA currently is establishing irradiation specifications for beef.

The level of energy used for food irradiation affects only live organisms such as bacteria, insects, and protozoa that may be present, significantly reducing the chances of foodborne illness. Because harvested meat is no longer "living," there is very little effect on the meat's appearance, taste, or nutritive value. The food never touches a radioactive substance; therefore, it does not retain any energy waves or radioactive residues.

Irradiation extends the shelf life of certain fresh foods by attacking the proteins that regulate ripening, aging, and spoiling; thereby inhibiting sprouting and mold growth. This means irradiated

fruits and vegetables can be picked vine-ripe and still be fresh, nutritious, and colorful when marketed.

Irradiation was previously approved in the U.S. for spices, fruits, grains, vegetables, pork (trichina control), and poultry. A petition to irradiate seafood is pending. The technology is more commonly used outside the U.S. Irradiated foods are commercially available in 28 countries.

The technology has been endorsed as a method of enhancing food safety by FDA, USDA, U.S. Department of Health and Human Services, U.S. Public Health Service, U.S. Army, National Association of State Departments of Agriculture, the American Medical Association, the American Dietetic Association, and the Institute of Food Technologists. In addition, the United Nations Food and Agricultural Organization, the World Health Organization, and the Codex Alimentarius Commission support the use of irradiation to preserve the wholesomeness of food.

Where are we now?

Currently there are about 40 irradiation facilities in the U.S., mostly for medical instruments and supplies such as intravenous fluids, gowns, and drugs. Certain consumer items also are irradiated such as contact lenses, cookware, and baby products. Although some universities are testing various types of food irradiators, there are few facilities in the U.S. approved for commercial food irradiation. The Nuclear Regulatory Commission oversees the construction and operation of all irradiation facilities.

USDA is now preparing proposed rules for irradiating red meats. These rules will cover procedural details such as temperatures, dosage, and record-keeping and labeling requirements. The National Food Processors Association (NFPA) has petitioned USDA to eliminate the requirement for irradiated food to carry the "radura" symbol and label statement. NFPA believes this labeling is unwarranted for a technology that has been proved safe, and fears consumers might view it as a message of warning rather than reassurance.

Once the rules are written and published, there will be a public comment period followed by a response by USDA. When all of the federal regulations are in place, consumer acceptance and demand will largely determine the speed with which irradiated food products will be available to consumers.

Key Facts

- Each of the FDA-approved types of ionizing radiation for foods—gamma rays, x-rays, and electron beam—has advantages and disadvantages such as efficiency, penetration of the food item, processing speed, and cost of construction and operation of the facility.
- The radiation dose can be varied depending on the desired results. Relatively low doses are sufficient to control foodborne pathogens and preserve freshness. (Foods irradiated at this level are not sterile; therefore they must be properly refrigerated, handled, and cooked the same as non-irradiated foods.) Higher doses of radiation can sterilize foods for specific purposes, such as for astronauts and for patients in nursing homes and hospitals whose immune systems are weakened.
- Food can be irradiated when fresh or frozen, whole or packaged.
- The increased cost for irradiated ground beef is estimated to be about 1 to 5 cents/lb. Benefits to retailers and consumers may offset this cost. According to *Food Technology* magazine (January 1998), "When informed of the benefits of irradiation, consumers are willing to purchase irradiated foods, even at higher cost."

Retailers also benefit from reduced spoilage and reduced liability risk.

- In various test markets and in the four U.S. retail stores that continuously offer irradiated foods, consumer acceptance has been high, particularly when education on the technology precedes the supermarket choices.

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NOTES: