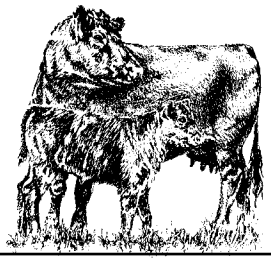

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Quality Assurance Section 213

Beef Safety and Quality Assurance from the Farm to the Table

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Beef producers ensure the quality of their products by following strict adherence to beef quality assurance guidelines. Consumers consistently purchase safe, healthy products including beef. The occurrence of one beef-related foodborne illness outbreak or other safety violation is quickly disseminated throughout the news media and Internet. Consumer reaction, both domestic and international, is to stop immediately the purchase of beef.

The correlation is significant between foodborne illness outbreaks linked to ground beef and the decrease in demand for beef. Research shows over a 0.5 percent reduction per capita of beef during recall events (Schroeder et al. 2000). In these dire situations, beef demand declines rapidly and recovery takes months and even years. Quality assurance practices by beef producers do reduce food safety concerns and help to ensure that consumers will confidently purchase beef in the future.

To help ensure the safety of beef products, the USDA's Federal Meat Inspection Service initiates such programs as Hazard Analysis Critical Control Point (HACCP), Sanitation Standard Operating Procedures (SSOP), and Zero Tolerance in all slaughter and processing plants. Additional recent governmental regulation requires slaughter plants to source verify their meat products. This new regulation requires traceability to the farm, ranch, and/or producer level, which adds greater responsibility for each producer to ensure a safe and wholesome product.

A beef producer's quality assurance program should address the following four food safety concerns: (1) foodborne illness, (2) physical hazards, (3) specified risk material, and (4) drug residues.

Foodborne Illness

Consumers in the United States have the safest food, including meat, in the world. Many activities such as driving a car or swimming are much greater risks to human life than eating a meat product. Modern consumers want zero risk of becoming sick from their food.

Beef producers must be aware of the major food pathogens that cause illness or death. Many pathogenic bacteria live in the intestinal tract of healthy livestock. The most common pathogenic bacteria include *Erscherichia coli, Salmonella,* and *Campylobacter.*

Erscherichia coli 0157:H7

The *E. coli* family occurs commonly in the gastrointestinal system of man and animals. In the early 1980s, *E. coli 0157:H7* emerged as a source of serious illness in humans who ate undercooked ground beef. *E. coli 0157:H7* causes acute bloody diarrhea, abdominal cramps, and hemolytic uremic syndrome (HUS) which may develop into chronic kidney failure or neurological impairment. Death occurs in approximately 3 to 5 percent of the persons with HUS (USDA Food Safety and Applied Nutrition 2001). Product contamination occurs during the hide removal and evisceration steps of the slaughter process.

Scientists do not know how livestock become carriers of *E. coli 0157:H7.* The bacteria can be spread from one animal to a whole herd, from wildlife (deer) to cattle, or from cattle to deer (Sargeant et al. 1999). Sporadic in livestock, *0157:H7* ranges from 0 to 28 percent infection rates in individual herds and has the highest rates in the summer months. Animals carrying *E. coli* do not show any signs of illness (Hancock et al. 1997a). Manure application to forage crops has had little effect on the incidence of *E. coli*, yet *0157:H7* can survive for almost 2 years in manure, which provides reason enough to manage manure properly (Hancock et al. 1997b and Kudva et al. 1996).

Salmonella

Salmonella has been recognized as a leading cause of gastroenteritis in humans for over 100 years. Salmonella

is widely dispersed with humans and animals being the primary hosts. The majority of illnesses are linked to poultry and poultry products. Livestock can harbor the bacteria and contaminate meat products during processing. One study discovered that 45 percent of the rumen contents of healthy cattle were found to have *Salmonella* (Grau and Brownlie 1986). In addition, livestock feeds are high in *Salmonella* with an incident rate of 49 percent (Graber 1991). Polluted water may also serve as source of this pathogenic bacteria.

Campylobacter

Campylobacter is an important cause of foodborne illness and may be the greatest cause of acute bacterial diarrhea in humans. A high percent of meat animals carry the organism in their intestinal tracts. One study indicates that 80 percent of dairy operations and almost 40 percent of individual livestock are positive with the organism (Wesley et al. 2000). *Campylobacter* contaminates many types of raw meats and traditionally has not been well understood. Recent advances in technology have made it easier and more cost effective to test for *Campylobacter* in raw meat products. Control of this organism will become more important in the future.

Control of Pathogenic Bacteria

Current control methods of pathogenic bacteria have been at either the processing facility or the consumer level. Many processors use top-of-the-line technology such as hot water or steam pasteurization cabinets, steam vacuums, pre-evisceration wash with organic acids, organic acid rinse cabinets, antimicrobial additives, and efficient chilling systems. Consumers should keep beef clean, refrigerate or freeze until cooking, and to cook to specific time temperature requirements.

A vaccine or feed additive is the most logical control method to prevent pathogenic bacteria at the farm or ranch level. A feed additive that looks promising for control of *E. coli 0157:H7* and *Salmonella* is sodium chlorate. Sodium chlorate could be added directly into the drinking water shortly before slaughter. Recent research shows this would reduce pathogenic bacteria 150-fold, is inexpensive, and causes no adverse effects to the animal (Mcgraw 2001).

On-farm sanitation practices prevent the spread of pathogenic bacteria. Regular cleaning of watering troughs, maintaining a clean water source, implementing a good pest (fly) control program, and protecting feed from rodents and birds prevent pathogen contamination at the farm level. The greatest source of bacterial contamination is from the hide during the skinning process.

Livestock producers have direct control over the cleanliness of their animals. Freezing, wet, muddy conditions for extended periods of time cause "tags" or manure clods to form on the hide. Tags can range in size between 1 to 6 inches in diameter depending upon the severity of the facilities and weather conditions. Heavy tagging on the hide makes skinning the animal quite difficult and causes excessive contamination during the hide removal process.

Tagging can be minimized by maintaining the feeding area. Properly constructed mounds, good bedding material, and controlled runoff ensure dry bedding areas for livestock. Winter snow removal of livestock pens prevents extreme muddy conditions and minimizes tag buildup. Good livestock husbandry practices equate to clean pens, clean hides, clean carcasses, and clean food.

Educating the consumer about foodborne illness is important. Consumers know that they must cook chicken thoroughly or there is a high probability of contracting Salmonellosis. Yet, it is still a common practice to eat ground beef products that are rare, or undercooked. Educating the consumer to cook ground beef products to an internal temperature of 165°F (well done) is a must and will be a continual process. The "Safe Handling Instructions" appears on every package of meat and informs consumers of their responsibilities of handling and cooking meat.

Safe Handling Instructions

This product was prepared from inspected and passed meat and/or poultry. Some food products may contain bacteria that could cause illness if the product is mishandled or cooked improperly. For your protection follow these safe handling instructions. Keep refrigerated or frozen. Thaw in refrigerator or microwave. Keep raw meat and poultry separate from other foods. Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry. Cook thoroughly. Keep hot foods hot. Refrigerate leftovers immediately or discard.

This statement is not intended to scare consumers away from meat products but serves as a reminder to use sanitary practices while handling meat products, thus preventing foodborne illness.

Foreign Object Contamination

Foreign objects may enter beef products during livestock processing, accidents, neglect, and poor management. Buckshot, injection needles, implant needles, scalpel blades, tranquillizer darts, archery broad heads, and .22 caliber and other bullets have been found inside meat during processing and consumption (Figs. 1, 2, and 3).

Buckshot, bullets and archery broadheads can enter the animal from hunters or from cowboys who use pistols loaded with buckshot to round up wild cattle in rough country. Accidents, such as breaking a needle while vaccinating livestock, also occur. Needle shafts that have been bent and then re-straightened are significantly weaker and break easily. Discard bent needles.

Fig. 1. Four .22 caliber bullets, a broken scalpel, buckshot, an implant needle, and an unidentified object were all recovered from beef carcasses during processing.

Fig. 2. A tranquilizer dart found imbedded next to the pelvis. Apparently, the animal was shot through the rectum.

Fig. 3. Two injection needles found in beef carcasses.

The larger meat processing facilities have metal detectors to locate and prevent larger objects from reaching consumers. However, small objects, such as buckshot or nonmetalic objects, are difficult to detect and may not be identified at the facility. If undetected at the processing facilities, almost always it will be detected by consumers.

Although it is of extremely low incidence, foreign object contamination must be eliminated. Cattle producers should visit with their veterinarian ahead of time about how to handle the situation in which a needle would break off in a muscle. Broken needles migrate in muscle tissue, with its movement, and if not removed immediately, the broken needle will be almost impossible to find in the live animal. This would require that the animal be removed from the regular market channels and slaughtered at a facility where instructions could be given for a large mass of meat around the injection site be condemned and not used for consumption.

Foreign Object Prevention

- Do not use buckshot to round-up livestock.
- Only allow responsible hunters on your property, and ensure they will not be hunting around livestock.
- Do not market any animal in the regular market channels that has a known foreign object imbedded in the animal.
- If an animal has a known foreign object inside its skin, mark the site on the hide by clipping a small area of hair and have a veterinarian immediately remove the object(s).
- Purchase and use needles that are of adequate size and quality to avoid breakage but small enough to properly complete the injection.
- Don't straighten and/or use a needle that has been bent. Straightening a bent needle weakens the needle, potentially causing it to break with additional use.

Specified Risk Materials

Bovine Spongiform Encephalopathy (BSE), commonly known as "mad cow disease," was first identified in Europe in 1987. BSE, similar to the long recognized sheep disease "Scrapies," is a fatal neurodegenerative disease in cattle that causes a spongy degeneration of the brain and spinal cord. BSEs incubation is long, approximately 4 years, and all breeds are equally susceptible to the disease. During the early 1990s scientific opinion suggested that the disease transmission route was feeding ruminant by-products, meat and bone meal most likely from sheep, back to ruminants.

In 1994, the European Union announced a ban on feeding ruminant by-products back to ruminants. In 1996, the United States instituted a voluntary exclusion of meat and bone meal from livestock rations and in 1997 the voluntary exclusion was changed to a mandatory ban. This ban continues today and remains effective at reducing the incidence of BSE in beef and dairy cattle.

Beef producers must be vigilant in complying with this ban. The swine and poultry industries are excluded from this ban and can still feed meat and bone derived from ruminants in their rations.

In 2008, the Food and Drug Administration amended this regulation to prohibit BSE positive cattle, brains, and spinal cords from cattle 30 months of age and older, cattle not inspected and passed for human consumption that did not have brains and spinal cords removed, and tallow from BSE positive cattle to be used as food or feed

for all animals (Federal Register 2008). Although these regulations are important, producers must be aware that contamination with ruminant by-products could occur at a mixed species feed mill and must verify that feed purchases are free of mammalian tissue by-products.

In the mid 1990s, BSE was linked to the new variant Creutzfeldt-Jakob disease (vCJD), the human form of BSE. Limited knowledge is available on how the disease is transmitted from one species to another species, however, there is a strong association between humans infected with vCJD and exposure to BSE-infected beef products.

The BSE infective agent has been found to concentrate in specific tissues of the central nervous system but not in the meat of diseased animals. These tissues are called "Specified Risk Materials" (SRMs). To prevent exposure to SRMs, the World Organization for Animal Health established the following tissues are SRMs and should be removed from all meat products: the skull, brain, trigeminal ganglia (nerves attached to brain and close to the skull exterior), eyes, spinal cord, distal ileum, and the dorsal root ganglia (nerves attached to the spinal cord and close to the vertebral column) (FSIS Directive 2007). Beef producers must realize that these procedures will ensure the safety of consumers from being infected with vCJD.

Drug Residues

Consumer and industry concern for product residue continues to be one of the areas identified in industry survey and audits. During the National Market Cow and Bull Beef Quality Audit (National Market Cow and Bull BQA Audit 2007), the dairy and beef cattle sectors identified antibiotic residues as one of the *"Top Quality Challenges"* in 1997 and 2007. These findings point to the need for additional effort related to prevention of antibiotic residues in beef.

When understanding the possible reasons residues might become a concern in food-producing animals, producers need to become familiar with some common terms used with pharmaceuticals. All pharmaceutical products used in food-producing animals must contain a label that indicates withdrawal times for meat and/or milk. Withdrawal times are usually indicated in hours or days from the last treatment. These guidelines are minimum standards that provide time for the product to clear from the system and not show up in the meat or milk. Fig. 4 provides an example of a label warning for slaughter and milk withdrawal on a class and type of drug commonly used on Utah beef and dairy operations.

In this particular example (Fig. 4) AGRIMYCIN® 200 treatment should be discontinued for at least 28 days before slaughter. Furthermore, milk should be discarded during treatment and for 96 hours after the last treatment.

> **WARNING:** Discontinue treatment at least 28 days prior to slaughter of cattle and swine. Milk taken from animals during treatment and for 96 hours after the last treatment must not be used for food.

Fig. 4. Label warning found on typical long-acting tetracycline (AGRIMYCIN® 200).

Another common term used is "extra label" drug use. When a drug is used for a condition or on a species for which there is no label indication or claim, a licensed veterinarian may prescribe the drug in an "extra label" manner, provided a few conditions are met. With extra label drug use in food producing animals, a new label—generated by the veterinarian—is placed over the existing manufacturer's label. This new label will include the indicated use and any withdrawal times for slaughter or milk. Even drugs purchased over the counter (OTC) by a producer rather than through a prescription that are used in an extra label use will need a new label placed by a veterinarian. In other words, this use negates the OTC standard originally prescribed to the animal.

The label also contains the approved route of administration in which the product is to be used. The common routes are subcutaneous (just under the skin), intramuscular (IM), or intraveneously (IV). There can also be *per os* (by mouth), intramamary, or intrauterin routes.

Routes become an issue with residue when the product is administered by a route that is not indicated on the label. The slaughter and milk withdrawal times are all based on the product being used by the route indicated on the label. Use of the product outside the indicated route could influence the slaughter and milk withdrawal times. For example, tilmicosin (MICOTIL® 300) is an injectable antibiotic used to treat respiratory disease in cattle. Its label indicates the route of administration to be **subcutaneous only** (Fig. 5). Should this product be given IM, not only could a serious tissue reaction occur causing a potential blemish in the meat, but the withdrawal time would also be influenced (most likely extended).

More thought and vigilance is given to the prevention of residues when antibiotics are used. Other pharmaceutical agents can have label withdrawal times of which producers may not be aware. A common example is with vaccinations. The common upper respiratory

> **RESIDUE WARNINGS:** Animals intended for human consumption must not be slaughtered within 28 days of the last treatment. Do not use in female dairy cattle 20 months of age or older. Use of tilmicosin in this class of cattle may cause milk residues. Do not use in lactating ewes if the milk is intended for human consumption.

Fig. 5. Label warning found on MICOTIL® 300.

vaccination combination (IBR, PI_3, BRSV, BVD) may contain a slaughter warning. Fig. 6 is an example of this warning. The label precaution indicates that the vaccine not be given 21 days before slaughter. See Fig. 6 for simple guidelines when using pharmaceuticals in food producing animals.

PRECAUTIONS:

Do not use in pregnant cows (abortions can result) unless they were vaccinated, according to label directions, with any Bovi-Shield FP or PregGuard FP vaccine within the past 12 months. Do not use in calves nursing pregnant cows unless their dams were vaccinated within the past 12 months as described above.

Consistent with good vaccination practices, it is recommended that heifers receive at least two doses with the second dose administered approximately 30 days prebreeding.

Store at 2° to 7°C. Prolonged exposure to higher temperatures and/or direct sunlight may adversely affect potency. Do not freeze.

Use entire contents when first opened.

Sterilized syringes and needles should be used to administer this vaccine. Do not sterilize with chemicals because traces of disinfectant may inactivate the vaccine.

Burn containers and all unused contents.

Do not vaccinate within 21 days before slaughter.

Contains gentamicin as preservative.

Fig. 6. Label precaution found on a common upper respiratory modified live product (BOVI-SHIELD Gold® FP®5).

1. Read and follow label directions and warnings.
2. Use the pharmaceutical only in animals and for the condition indicated on the label.
3. If using the product in an "extra label" manner, make sure that use is under the direction of a licensed veterinarian and they have provided a clear label with directions and withdrawal times.
4. Keep records on all pharmaceutical use. Records should include animal, date, location and route given, and product used.
5. Develop a consistent method of identifying animals that have been treated until withdrawal dates have been reached (e.g., colored leg bands on dairy cattle).
6. Develop routine treatment protocols to be used for commonly seen conditions. These should include product(s) use and handling of animal (i.e., isolation or sick pen).

By using and adhering to these basic guidelines, the risk that meat or milk will become inadvertently tainted with residue will be minimized.

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