# Meat Messenger

North Dakota State Meat and Poultry Inspection Program 2012 Quarter 4

## E.coli and Interventions

By Arturo Tanus, Ph.D.

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Some strains of the enterohemorragic group of E. coli and other shiga toxin-producing serotypes (STEC), such as the O157:H7, O26, O91, O103, O111, O118, O145 and O166 serogroups, are capable of causing human illnesses ranging from bloody diarrhea and hemorrhagic colitis to a lethal condition identified as hemolytic uremic syndrome. Since 1994, when FSIS declared E. coli O157:H7 to be an adulterant in ground beef, a lot of resources have been focused on interventions (best slaughter, dressing and fabrication practices) to reduce the presence of E. coli O157:H7 in raw meat products.

There are several ways by which E. coli O157:H7 may be introduced into the fabrication process of meat products. Most of these contamination pathways have been extensively studied and researched, revealing that hides and skin, gastrointestinal tract contents, workers poor hygiene and environmental conditions are significant role players in the contamination process. Consequently, developing and implementing successful intervention strategies against E. coli has been the recent focus for the meat industry.

In general, chemical interventions are applications of chemicals approved for use in carcass surfaces to reduce or eliminate bacterial counts, and they are utilized in the meat industry as a component of a multi-hurdle strategy. Some of these hurdles include hide washing, sanitary hide removal, knife trimming, hot carcass wash, steam vacuum and steam pasteurization. These may be applied at different steps of the process: during dehairing and/or during hide washing, after dehiding and/or after evisceration and are intended to act by lowering the pH on the surface of the meat.

**Successful chemical intervention strategies:**

***Organic Acids***

Among the most effective interventions to control E. coli O157:H7 are organic acid washes. Lactic and acetic acids are the most frequently used in 1-3 percent solutions. These are effective when applied as a warm carcass rinse (122-131°F), but they may be corrosive on the equipment when used continuously. Research shows that lactic acid (2 percent) reduced E. coli O157:H7 on beef carcass tissue by 3.3 logs, and 2 percent acetic acid reduced it by 1.6 logs; other authors will disagree as their results show that lactic acid was ineffective in decontaminating beef tissue under commercial conditions; but the variability in reductions may be attributed to differences in concentrations and methods of application used.

In the U.S., organic acids are applied as part of a carcass wash pre-chill and are often applied at levels up to 2.5 percent. USDA has specifically approved lactic acid, acetic acid and citric acid as antimicrobial agents in the final wash that is applied to livestock carcasses after trimming and inspection but before chilling. Lactic acid is approved for use on beef carcasses, sub-primals and trimmings, offal and variety meats at levels up to 5 percent at temperatures not exceeding 131°F.

***Peroxyacetic acid (PA)***

Peroxyacetic acid is a powerful oxidizer mainly used as a carcass wash in commercial beef processing plants. Under laboratory conditions, a solution of 0.02 percent peroxyacetic acid (PA) has shown to achieve 1.0-1.4 log reductions in E. coli O157:H7

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# Meat Messenger

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## Regulation Reminder

North Dakota Administrative Code Chapter 7-13-08-02: Regulatory Enforcement Action

7-13-08-02. Regulatory enforcement action: The commissioner shall take regulatory control, withholding, or suspension action when necessary, in accordance with the provisions of the Code of Federal Regulations Title 9 part 500 (9 CFR 500), except that any complaint or hearing when allowed or required under such action will be conducted in accordance with North Dakota Century Code chapter 28-32.

***What this regulation means:***

The North Dakota Meat and Poultry Inspection Program (NDMPIP) may take regulatory enforcement action through regulatory control action, withholding action, suspension, withdrawal of inspection, refusal to grant inspection, and rescinding or refusing approval of marks, labels, and containers as defined in the Code of Federal Regulations Title 9 part 500 (9 CFR 500).

A regulatory control action is defined as the retention of a product, rejection of equipment or facilities, slowing or stopping lines, or refusal to allow the processing of specifically identified products.

A withholding action is defined as the refusal to allow the marks of inspection to be applied to products. A withholding action may affect all product in the establishment or product produced by a particular process.

A suspension is an interruption in the assignment of program employees to all or part of an establishment.

Withholding or suspension actions may be taken with or without prior notification to the establishment depending on the problem(s) found. Withdrawal of the grant of inspection results in the grant of inspection being removed.

Refusal to grant inspection occurs when an applicant applies for inspection and a grant of inspection is not awarded.

The NDMPIP may rescind or refuse approval of false or misleading marks, labels, or sizes or forms of any container for use with any meat or poultry product.

inoculated onto beef carcass tissue. However, researchers found little to no effects on total bacteria or E. coli. Peroxyacetic acid is approved for use in the US (21 CFR 173.370) for washing, rinsing, cooling, or otherwise processing fresh beef carcasses at maximum concentrations of 0.020 percent for peroxyacetic acid and 0.0075 percent for hydrogen peroxide.

***Acidified sodium chlorite (ASC)***

The antimicrobial activity of acidified sodium chlorite is attributed to the oxidative effect of chlorous acid generated from the conversion of chlorite ion into its acid form under acidic conditions.

Wash/spray aplications of acidified sodium chlorite have demonstrated reductions of 1.9-2.3 logs in E. coli O157 on beef carcasses. Other experiments have achieved up to 4.6 log reductions using a water wash followed by an ASC spray. In other studies, ASC was used as a sanitizer for beef trim, obtaining 1.4-2.3 log reductions of E. coli. Acidified sodium chlorite is approved for use in the United States at concentrations between 500-1200 ppm.

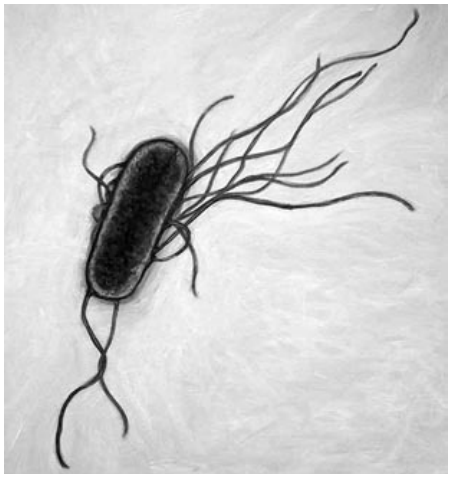
***Activated lactoferrin (ALF)***

Lactoferrin is a naturally occurring antimicrobial found in milk, saliva and tears, and in trace quantities in meat tissue. An activated form of lactoferrin at 2 percent can be sprayed onto a carcass to help prevent bacterial contamination during processing or it can be applied to a subprimal or finished beef surface prior to final packaging.

The recommended level is 2 percent. Lactoferrin binds iron and also specifically disrupts cell membranes, causing interference with the adhesion/colonization capabilities of microorganisms, allowing an easier detachment from biological surfaces, inhibiting growth, and neutralizing endotoxins activity. Recent studies showed a reduction of E. coli O157:H7 by approximately 2 logs on beef abused at room temperature for 18 hours and close to 3 log reductions on abused vacuum packaged beef left at room temperature for 48 hours. In the United States, ALF is approved for use on beef carcasses at concentrations of up to 2 percent in water and is recommended as a final rinse following hot water rinsing.

***Ozone***

Ozone is a water-soluble, naturally occurring gas, which is a powerful oxidizing agent. It destroys microorganisms by attacking and oxidizing the cellular walls and membranes. Ozone is very unstable, and upon exposure to air and water it rapidly decomposes to form oxygen.



Hence, it must be generated at the point of use. Ozone is an oxidized form of oxygen and converts readily to ordinary oxygen so there are no residual chemicals generated. Reductions of 1.3-2.5 logs have been reported on beef tissue using 0.5 percent ozonated water. Recently, researchers at Kansas State University combined ozone and ionization in a system to reduce pathogens in food processing plants. Essentially, the oxidizing gases are used to fumigate a room, but at levels that are safe and breathable. This research is not yet published.

***Conclusion***

Organic acids (acetic, lactic are the two most common), acidic calcium sulfate, acidified sodium chlorite, peroxyacetic acid-based solutions, are a few of the popular approved chemicals.

Still, it is important to remember that any chemical applied directly to meat is considered either a processing aid or a food additive and may be subject to declaration on the product label.

## What is a Deviation? Part 1

By The Center of Meat Processing Validation

One type of HACCP system deviation occurs when a critical limit is not met at a Critical Control Point. For example if the critical limit for a cooking CCP is that the internal temperature of the product must be at least 145°F for at least 4 minutes, there is a deviation when:

- The internal temperature does not reach 145°F,
- The internal temperature is at 145°F or higher for less than 4 minutes, or
- The cooking is done correctly, but is not documented (no record is kept).

Another type of deviation occurs when a verification activity shows that monitoring is being done incorrectly. For example:

- A calibration test shows that a thermometer is inaccurate,
- Observation of a person monitoring a CCP shows that the person is monitoring incorrectly, or
- A review of records shows that record-keeping is not being done properly.

***What are the Consequences of a Deviation? Part 2***

It is important to realize that not all process deviations mean that a product is unsafe. However, you MUST take and document corrective actions that include the four activities described in section 417.3 of the HACCP regulation. These activities are:

- Identifying and eliminating the cause of the deviation,
- Ensuring that the CCP is back under control after the corrective action is taken,
- Preventing a re-occurrence of the deviation,
- Making sure that no unsafe product enters commerce.

Corrective actions MUST be thoroughly documented. These actions may include such actions as destroying product, holding product and testing it, re-processing product, or recalling a product.

***What Should I Do When I Realize a Deviation has Occurred? Part 3***

First, hold all affected product and, if possible, make sure that it does not enter commerce. If the affected product is in commerce, you may have to recall it.

Remember that the "affected product" is all products in the same HACCP plan category since the last time monitoring indicated that the critical limits at the CCP for that plan were met.

Next, evaluate the safety of the affected product. Gather as much information as you can about product. For most deviations, it is very helpful to know the amount of product involved and its time/temperature history. It may also be useful to have the product formulation handy, because the amount of salt and/or sodium nitrite in the product may affect safety.

***Who Should I Call for Help? Part 4***

Each state has individuals who are designated as HACCP Contacts and/or Coordinators. These people can provide technical advice and assistance, or they can direct you to the appropriate expert. People on the Contacts list are generally in the state meat inspection program and can best provide answers about applicable regulations and recalls, while coordinators are usually affiliated with the university in that state. Coordinators tend to be more involved in scientific research and extension and usually are experienced in helping processors evaluate deviations and justify the corrective actions taken.

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***What Can You Expect a Deviation to Cost? Part 5***

Expenses that you may incur in resolving a deviation may include loss of discarded product, costs of a recall, or costs of product testing. Chemical and microbiological tests can be expensive. Also, you may have to devote considerable time to performing corrective action and it may take your state's HACCP Coordinator a couple of days to evaluate your deviation.

When you have a deviation, follow these five steps:

- Maintain or regain control of the product.
- Gather as much information about the product as possible.
- Share this information with an expert and get help.
- Make sure your inspector agrees with your corrective action before you release any product to commerce.
- Keep very detailed records of the deviation and your corrective actions.

***Microbial Sampling Plan - Part 6***

When determining a deviation has occurred, it may become necessary to test product for microbial load to determine the safety of the product. There are a variety of ways to determine the number of samples and the colony forming units per gram (CFU/g) considered acceptable for different product. Below is an excerpt from Microorganisms in Food 7; a reference used to help determine the number of samples and potential limits based on the severity of the hazard and the state of the product.

- Step 1: Read the chapter.
- Step 2: Determine the Case number (Table 8-1, p. 153) based on the type of hazard and the conditions in which the food is expected to be handled and consumed after sampling, in the usual course of events.
- Step 3: Using the Case number determine the Sampling Plan (Table 8-3, p. 163); n = total number of samples needed, c = number of samples that may exceed your limit and still be considered acceptable. NOTE: With increased severity, c decreases meaning there is less room for error.
- Step 4: Using information from Step 3 sample product. NOTE: n = the number of INDIVIDUAL samples needed, meaning must come from different locations within the lot.
- Step 5: Send samples for testing and interpret the results.

*Paper Reference:* Selection of Cases and Attributes Plans. in Microorganisms in Food 7: Microbiological Testing in Food Safety Management. ICMSF. Kluwer Academics/Plenum Publishers. New York, New York.

***Recalling a Product - Part 7***

Cooling and cold storage are essential for producing safe high-quality meat products. Cooked products must be properly cooled to prevent the growth of spore-forming pathogens such as Clostridium perfringens, and raw products must be kept properly refrigerated to minimize growth of the significant microbiological hazards associated with them (Salmonella and Staphylococcus aureus for all products, E.coli O157:H7 for beef).

*The goals of a product recall*

A product recall is intended to protect public health. Your first goal is to regain control of all potentially hazardous products. If this goal is met, the recall is successful. Sometimes you'll have to also work toward a second goal: telling the public about the potentially hazardous product and how to dispose of it.

Basic principles of conducting a product recall:

1. Use a lot or date code on all products.
2. Designate (ahead of time!) a person who will be in charge of the recall.
3. Designate (ahead of time!) a person who will talk with the media.
4. Keep good records of your wholesale customers so you can easily contact them.
5. Have a plan for informing the public.
6. Have model press releases and customer-contact scripts ready (ahead of time!).
7. Work with (not against!) regulators.
8. Act quickly – If in doubt take the safer course of action.
9. Be honest with those who ask questions.
10. Practice your recall plan with a "dry run."

## Avoiding E. coli Contamination in Injected and Needle-Tenderized Cuts

By Ana Elia Rocha McGuire Published 10/15/2012

Although there are fewer food safety concerns on whole muscle cuts and whole muscle products compared to ground meat products when they are either mechanically tenderized and/or needle-injected, bacteria from the surfaces of the meat may be introduced inside the muscle; additionally, needles may carry surface contamination from one meat piece to another, spreading pathogens.

It is widely known that Escherichia coli is particularly prevalent in beef, and because of its threat toward human health, measures should be taken to avoid contamination with this particular pathogen.

***Best practices***

In 2005, FSIS required re-evaluation of HACCP plans for E. coli O157:H7 for those processors who produce mechanically tenderized beef. To reduce the risk of contamination processors must implement best practices, and the Beef Industry Food Safety Council has developed best practice guidelines to improve food safety in these types of products.

Processors should also pay attention to the quality of raw materials (meat, brine and ingredients) and plant/equipment sanitation.

***Temperature control***

Constant monitoring of temperature is a must. Cold chain management should be a continuous process throughout the different steps required to manufacture needle-tenderized/injected products, from raw materials reception to product distribution and retail display. The goal of temperature monitoring is to achieve and maintain a temperature that will prevent microorganisms – particularly pathogens – to grow. It is recommended to keep meat and product temperature at no higher than 40ºF (4ºC) as Salmonella and pathogenic E. coli start growing at 44ºF (6.6ºC).

Raw material received should never be above 45ºF (7ºC), but it would be optimal for it to be at 40ºF (4ºC). Also, any process water and brine/marinade temperature should not exceed 45ºF (7ºC). Transportation and retail temperature should also not exceed 45ºF (7ºC).

***Variety of interventions***

Direct application of artificial and natural compounds is a common practice during some stages in meat and poultry processing, such as carcass washes with chlorine or lactic acid solutions. Specifically for whole muscle products, application of microbial interventions on subprimal cuts prior to injection has been suggested, as well as the addition of some antimicrobials in brine/marinade formulations. Luckily for processors, some of the solutions offered to extend shelf life in the marinated products, such as sodium lactate, are also effective at killing bacteria.

For treatment surface of subprimal cuts, the use of lactic acid at concentrations from 2.5 percent to 5 percent has been reported to effectively decrease E. coli levels to undetectable in needle/blade tenderized meat. Also, sprayed acidified sodium chlorate (ASC) and peroxyacetic acid (PAA) have shown to reduce levels of E. coli O157:H7 by 0.63-0.71 logs.

***Lower cook temps don't reduce pathogen***

A recent study presented at the International Association for Food Protection conference compared different antimicrobial spray treatments to reduce E. coli O157:H7 and non-O157 STECs on beef subprimal cuts after 14 days during vacuumed, refrigerated storage. The study also evaluated the effect of cooking to reduce E. coli O157:H7 and non-O157 STECs in needle tenderized meat. Spray treatment of water, 5 percent lactic acid (LA), 0.02 percent hypobromous acid (HB2), or 0.02 percent peroxyacetic acid were applied to inoculated beef strip loins (cocktails of either E. coli O157:H7 for study 1, or non-O157 STECs for study 2).

After 14 days, E. coli O157:H7 was reduced by LA with 2.3 log10 CFU/50 cm2, while non-O157 STECs was reduced by HB2 with 1.0 log10 CFU/50 cm2. Regardless of spray treatment, lower cooking temperature did not

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significantly reduce the non-O157 STECs, with serotype O103 being the most prevalent strain found in cooked samples. Cooking to 158°F was effective in controlling O157:H7 to non-detectable numbers.

Another study showed that both combinations of sodium citrate + sodium diacetate (0.5 percent NaCl, 0.4 percent STPP, and 1 percent solution of 80 percent sodium citrate + 20 percent sodium diacetate) or sodium citrate + buffered vinegar (0.5 percent NaCl, 0.4 percent STPP, and 1 percent solution of 80 percent sodium citrate + 2 percent buffered vinegar) may be used as hurdles against E. coli O157:H7 in enhancement solutions for whole muscle, non-intact beef top rounds and top sirloins.

These combinations also demonstrated growth control of psychotropic organisms during aerobic storage of the injected steaks.

## Classified Ads

We are always looking for industry related items to advertise in the Meat Messenger. We post sale and want ads FREE. If you would like to put something in the Meat Messenger classifieds contact Jerry Sauter at (701) 328-4767 or e-mail description with contact information to jdsauter@nd.gov.

**Offal (gut) cart:** Made of galvanized steel, two wheels, good condition. Please contact Kelly for price and more information at (701) 254-4950. Located in Linton.

**Sipromac one truck smokehouse:** Smokehouse has a Juno microprocessor and liquid smoke attachment. Included are two trucks and many sticks and screens. $20,000. Please contact Calvin or Alex for more information at (701) 743-4451. Located in Parshall.

**True Brand cooler:** Cooler has two sliding doors and was manufactured in 2001. $1,000. Please contact Calvin or Alex for more information at (701) 743-4451. Located in Parshall.

**One-quart plastic containers with lids:** Containers and lids are brand new. $20 per lot of 50. Please contact Calvin or Alex for more information at (701) 743-4451. Located in Parshall.

**Prairie Packing Inc.:** Slaughter and processing plant in Williston, ND. USDA #7644. 10.43 acres of land with 20,000 sq. ft. building and garage. 15,000 sq. ft. is leased. City sewer and water. Work is divided into 70% rancher/producer and 30% retail sales. 10 employees. Please contact Dave Slais for more information at dslais04@live.com.

**Handtmann Stuffer VF 50:** Very low hours, excellent condition. Linker, gear box, and several horns included. $20,000. Please contact Wade for more information at (701) 255-4534. Located in Bismarck.

**Slaughter/processing business:** Located near Maddock, ND. Fully operational meat processing facility, all equipment and supplies included. Currently custom-exempt, with option for retail and/or state inspected status, many equipment/facility upgrades last 4 years. Very strong customer base. Please contact Denise for more information at (701) 438-2334.

**Walk-in freezer and components:** Three phase Copeland compressor Hp p62 Freon, new 2005. Model 4RA3-100A-TSK-800, serial 05A66497R. Single phase Bohn cooling unit model 2402B serial DCD4540. Larkin single phase outside evaporator. Walk-in freezer with shelves/baskets, sharp freeze shelves and cooling unit, has 4-glass doors, free standing unit, walls snap together. Please contact Denise for more information at (701) 438-2334. Located in Esmond.

# In this Meat Messenger



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