



Best Practices for Beef Slaughter

Revised: February 2016



Introduction

This document is intended to be a resource for development of Beef Slaughter practices for the control of pathogens. These practices were developed based on current science and technology. There are multiple ways to reach the desired results, and each operator must be able to apply the practices that best fit their individual operation.

Carcasses and offal should be harvested in a manner to minimize and / or avoid contamination from the hide, viscera, environment or employees. This document is designed to identify areas where contamination may occur and methods that can be used to minimize or eliminate contamination.

Every facility should designate a Food Safety Team to assess their specific facility and develop procedures to control pathogens during harvest. This should include processes, procedures, training, methods of measurement and corrective actions for any deviations.

FOOD SAFETY SYSTEM

There is no one single thing that will control pathogens in the harvest process, but rather a Food Safety System that is designed as a multiple hurdle approach. This includes many aspects of this entire process:

- Pre-Harvest
- Physical Plant Design and Environment
- Hide Removal and Evisceration Procedures
- Harvest of Offal
- Intervention
- Process Monitoring and Control
- Training
- Verification and Validation

PRE-HARVEST PLANT

- BISFCo Best Practices for Pre-Harvest (www.bifsc.org) have been developed for strategies prior to receiving.
 - Assess the condition of the animal and establish a method of communication prior to harvest.
 - Plants should establish a system based on animal characteristics (mud, breed, size, animal stress, etc.) to allow adjustments be made to the process prior to harvesting. Adjustments are dependent on circumstance, but can include chain speed, crewing, washing, etc.
 - A pen-cleaning schedule should be developed to ensure that pens and troughs are kept as clean as possible irrespective of the season and condition of the cattle.
 - Treatments for live animals are available (e.g. Bacteriophage & Hide Cleansing). Anything that is used on a live animal must have welfare issues in mind (like eye irritation).
 - Misting and / or rinsing of the cattle often helps reduce airborne dust and dirt particles on the slaughter floor.
 - Properly designed, engineered and monitored cattle wash systems have been demonstrated to show a reduction in pathogen loads on hides as they start the de-hiding process.
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PHYSICAL PLANT DESIGN

Facilities should be assessed to ensure that the design, construction, product flow, personnel flow, and overall operation contribute to the production of safe and wholesome products. The process should be analyzed to determine areas of potential cross contamination. Some key areas to consider are:

- Slaughter Floor Design: Physical separation of hide on and hide off area is optimal.
- Air Management: Air should flow from Clean to Dirty (e.g. not pulled in from rendering or hides) and be from a clean source. Make-up air pulled in to plant should be assessed for source, environmental contamination potential and filtration.
- Roofs should be maintained in a manner to prevent leakage.
- Drains should be properly constructed and maintained in a manner to allow for adequate drainage and prevent access for pests.
- The process flow should allow employees to easily travel to and from workstations without potential for cross contamination. This includes physically touching product, foot traffic carrying debris throughout plant and openings to the exterior of the plant.
- Design of equipment in the plant should be assessed for appropriate construction to prevent contamination and ensure it can be appropriately cleaned.

HIDE REMOVAL and EVISCERATION

Previous versions of Harvest Best Practices included detailed step by step processes. FSIS captured these items in Directive 6410.1. <http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/6410.1.pdf>

Establishments should ensure that the facility is designed properly to provide sufficient sanitation stations, tools, gloves, equipment, etc., to allow the employees to properly conduct the recommended procedures. The hide removal personnel must follow procedures for hand washing, cleaning of arms and gloves based on the task being performed to prevent contamination. These practices will vary based upon the task and should be monitored and evaluated on a routine basis to ensure process control.

Establishments should have written sanitary dressing procedures during hide removal. The success of proper dressing procedures relies heavily upon the employees conducting the activities with a high level of skill and care. Therefore, the employees must be trained, supervised effectively, and evaluated routinely to ensure proper dressing.

Manual Hide Removal

- Hide opening patterns should be as clean as possible, and may require the removal of visible contamination before hide opening.
 - Clean and sanitized equipment should be used to prevent contamination of the carcass surface. If contamination occurs, it should be removed as soon as possible.
 - It is noted that it may be best if the contamination is removed at a subsequent step because it might not be possible to remove it at the point of occurrence without causing more contamination.
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Mechanical Hide Removal

- Mechanical hide pullers should be implemented in a manner designed to reduce hide slaps, splatters, and operator contamination from the hide onto the carcass.
- The operator should maintain clean hands and equipment to prevent contaminating the carcass during removal.
- Operators should closely observe the equipment to ensure that it is functioning properly to prevent cross-contamination of the carcass from the equipment.
- When using mechanical hide pullers, the tremendous energy exerted during the final removal of the hide can generate aerosols.
- Air flow at this step in the slaughter operation should direct any aerosols created away from the carcasses being skinned to prevent contamination of the carcasses.
- Operations may explore opportunities for using hooks for holding the hide or the use of paper/plastic on key areas (brisket, leg, etc.) and bags (tails and bungs) to reduce potential visible contamination.

Evisceration

- Procedures should be developed and implemented for proper sanitary dressing, including the proper weasand removal and bunging activities.
- The equipment should be sanitized to prevent contamination.
- An automated viscera table will often include automatic sanitation; however, establishments using carts/trucks should make sure that procedures are in-place to prevent cross-contamination.
- If there is a problem during evisceration that results in contamination, then the carcass should be identified and handled appropriately.
- Viscera should remain intact and all paunch opening and viscera processing should be conducted in an area/manner that will prevent contamination of the carcass by either direct or aerosol contamination.
- The actual removal of the viscera from the carcass is a critical phase of the dressing operation.
- Care should be taken to avoid cutting or breaking the paunch and intestines.

Post-Evisceration

- Split saws should be cleaned and sanitized as needed to prevent carcass contamination throughout the production day.
- Procedures should be in place to prevent split saws from cutting through contaminated areas of the carcass.
- Split carcasses should be presented for final inspection to FSIS free from feces, milk, or ingesta on the carcass.
- Employees should be trained on effective trimming techniques and should sanitize and clean any equipment that comes into contact with contamination as needed.
- Proper lighting should be available for employees to identify and remove contamination from carcasses prior to FSIS inspection.

Carcasses that are determined to need further trimming or splitting can be sent to an out rail for further processing just after FSIS final inspection. Out rail carcasses should be reconditioned in a timely manner and treated with an antimicrobial if time parameters identified by the establishment are exceeded. When

carcasses are determined to be properly reconditioned they can be presented to FSIS for final inspection. Once the carcass has passed FSIS inspection a critical control point antimicrobial treatment should be applied prior to chilling of the carcass.

Process interruption is defined as a period of time when production is stopped that could impact the microbial load of the carcass. Temperatures of the carcass surface on the harvest floor are conducive to microbial growth and should be mitigated during process interruptions. Procedures should be in place with established time limits that are monitored and actions to take when limits are exceeded. These actions could include reconditioning of carcasses, microbial sampling and/or added antimicrobial treatments.

HARVEST OF OFFAL (INTENDED FOR RAW GROUND BEEF)

Establishments should explore options for using microbial interventions to reduce contamination and procedures should be in-place to reduce the temperature of variety meats and by-products as quickly as possible to prevent pathogen growth. If products are destined for raw ground beef production, pathogen testing should be conducted using a robust sampling method and a laboratory methodology that is at least as sensitive as the FSIS method. (See Best Practices for Using Microbiological Sampling www.bifsc.org.)

From the point of head removal through head product harvest and packaging, procedures should be in place to ensure contamination is minimized. Based on the process flow, heads should be cleansed and at some point treated with an antimicrobial to reduce microbial contamination. Proper procedures for maintaining clean and sanitized equipment should be in-place throughout the process for removing and processing these products. It is important to chill these items in a timely manner to maintain product quality and safety. As stated previously, variety meats need to begin chilling as soon as possible after removal from carcass.

Due to certain offal products (e.g. Head Meat) being used in ground beef, consideration should be given to establishing a process to control and reduce microbial contamination. Establishments should explore options for using microbial interventions to reduce contamination and procedures should be in-place to reduce the temperature of variety meats and by-products as quickly as possible to prevent pathogen growth. If products are destined for raw ground beef production, *E. coli* O157:H7 testing should be conducted using a robust sampling method and a laboratory methodology that is at least as sensitive as the FSIS method. (See Best Practices for Using Microbiological Sampling www.bifsc.org.)

Whole Heads

- Proper procedures must be in place for handling whole heads. These include procedures for meeting SRM requirements, flushing nasal, throat, and mouth cavities, dropping and washing the whole head and tongue, prior to presentation for post-mortem inspection.
- Employees should work with inspectors to ensure these procedures occur in a timely manner.
- Heads can be treated with a microbial intervention.

Offal Processing

- Proper procedures for maintaining clean and sanitized equipment must be in-place throughout the process for removing and processing the cheek meat, head meat, hearts, salivary glands, lips, tongue, tongue root, and weasand.
 - As these items may be considered for inclusion in ground beef, use of chemical processing aids should be considered and used according to the manufacturer's recommendation.
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- Employees must be trained in the proper handling and sampling procedures for these items.
- It is imperative to chill these items in a timely manner to maintain product quality and safety.

INTERVENTION

The term ‘intervention’ as applied to beef food safety best practices is intended to imply reduction of risk as for microbiological contamination. Effective intervention practices are based upon scientific support and practical on-site considerations that can be routinely monitored and evaluated for efficacy. For beef harvest practices, a ‘multiple-hurdle’ approach is advised to intervene early in the practice. These early multiple-hurdle steps provide an opportunity to address microbiological organisms early in the attachment phase. These intervention practices are ultimately cumulative with the final intervention, most likely a critical control point, immediately prior to chilling.

Establishing interventions for a given process should consider the ‘end-to-end’ expectations from an individual intervention step to the cumulative effect. Examples of commonly used interventions are:

- Bacteriophage
- Hide Washing
- Hide Opening Pattern Treatment
- Steam Vacuuming (Pattern Marks and Hocks)
- Trimming (Straight Knife or Circular Knife)
- Pre-Evisceration Carcass Wash (Hot Water and / or Chemical Antimicrobial)
- Post Final Rail Carcass Washing (Chemical Antimicrobial)
- Post Final Rail Thermal Treatment (Hot Water or Steam Treatment)
- Pre-Chill Treatment (Chemical Antimicrobial)

Intervention selection and validation studies must be considered with the end in mind. Some considerations to keep in mind when evaluating intervention options are:

- What are the potential hazards being addressed?
- What constitutes ‘acceptable reduction’ when applied to the given potential hazard?
- What are the critical operating parameters recommended with an intervention process or antimicrobial?
- Is the physical harvest or processing environment capable of executing the critical operating parameters validated in a given peer reviewed article or manufacturer recommendation?
- Is the Intervention selected capable of being maintained, monitored and controlled?
- Does the application of the intervention require labeling or is it classified as a processing aid?

Chemical Antimicrobial Considerations

Many antimicrobial solutions are available for use within a multiple hurdle system. Some common treatments include:

- Lactic Acid
 - Peroxyacetic Acid
 - Hypobromous Acid
 - Acidified Sodium Chlorite
 - Sulfuric Acid / Sodium Sulfate
 - Acetic Acid
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- Citric Acid
- Organic Acid Blends
- Consult FSIS Directive 7120.1 for full list of processing aids.

First, the vendor of a given antimicrobial must provide documents attesting to the safety and suitability of the solution applied to beef products. This documentation may reference FDA reviews including regulatory citations [21 CFR] or Food Contact Notification [FCN]. USDA-FSIS provides a listing of safe and suitable agents within Directive 7120.1. USDA-FSIS regulations [9 CFR 416.2 (c)(4) require that chemical antimicrobials be utilized within recommended conditions of use. The inclusion of an antimicrobial agent as 'safe and suitable' within FDA or FSIS publications is not a validation of the agent's efficacy but rather support that the solution itself does not present a potential food safety hazard when applied at approved concentrations.

Key Considerations

- Individual plant processes will have an impact on intervention selection, function and operation. Review of scientific studies or the vendor manufacturer recommendations may recommend an antimicrobial solution at a given concentration, dwell, application [spray, dip, etc] and temperature. Specific cautions or focus points will be identified below with individual processes.
 - Scientific studies commonly used within the beef industry identify many different concentration parameters for a given antimicrobial. The antimicrobial solution vendor should advise concentration, application method, temperature of solution and dwell time in concert with a scientific peer reviewed article.
 - Plant processes may need to increase concentration or dwell time in a given application [e.g. spray] if different from the vendor recommendation. Antimicrobial solution efficacy is a combination of contact time with the solution while in the cabinet, continued dwell of the solution once outside of the application. For example, if a 200 ppm concentration is recommended in a dip application for 10 seconds, it may be necessary to increase the concentration and dwell if going through a reduced flow spray application.
 - Temperature of antimicrobial solution must be considered. Some antimicrobial agents have enhanced efficacy given a specific temperature range- other antimicrobial agents have reduced or fleeting efficacy when exposed to certain temperatures.
 - Certain antimicrobial solutions are sensitive to the water quality in which it is mixed and applied. Vendors of antimicrobial solutions should provide any constraints related to water, such as the need for Reverse Osmosis Water systems.
 - Utilization of reuse procedures must be validated in the application considered dependent on the source of the antimicrobial solution provided and where the reused occurs within the process. As a general rule, reuse solution should proceed from 'clean to dirty'. Reuse of an antimicrobial solution initially applied to a raw product must never be re-used in a Ready-To-Eat process. USDA- FSIS identifies the regulatory requirements when water or antimicrobial solution reuse is considered within 9 CFR 416.2(g).
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PROCESS MEASUREMENT

In order to effectively determine if the harvest process is in control, plant teams should develop methods to measure the process. These methods include:

- Monitoring of employees performing each task. Each task should be accompanied by individual work instructions specific to the Food Safety aspects of that job. This can be accomplished through on-site monitoring with plant personnel or even using video / camera assessments.
- Monitoring of the skinning line and evisceration process.
- Microbiological testing may augment monitoring procedures and help verify effective implementation of SOP's at multiple points in the harvest process. These should be used for on-going trend analysis for continual process improvement. Further information on microbial sampling can be found at AMSA in the document The Role of Microbiological Testing in Beef Food Safety Programs.

Regardless of which process measurement technique is chosen, trends should be identified through analysis and effective process actions must be implemented to correct deficiencies and continually improve the process.

TRAINING

Documented training programs should be in place to ensure that employees know, understand, and can fully execute appropriate tasks for their specific position.

Each establishment should develop the training program in a manner that is effective for their facility. The training program may consist of the following:

- Initial training includes general procedures and specialized procedures per position.
- Refresher training should be conducted at least annually or a process change is made.
- Retraining as needed per employee to become proficient at their position.

Document Training

- Written Training Module
- Progress of Initial Training to measure employee grasp of the training.
- Training Records should be maintained. Include a method to evaluate the effectiveness of the training to ensure that the employee has a working knowledge of what he/she is supposed to do. This can be a supervisory review after the completion of the training to confirm that the employee is following the defined procedures.

Key Tasks of Consideration

- Prevention of Visible Contamination
 - Washing and Sanitizing of Equipment
 - Prevention and Removal of Contamination
 - Procedures for Notifying Management of Process Deviations
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VALIDATION AND VERIFICATION

Validation includes scientific support that closely relates to the plant process and identification of critical operating parameters based upon needed plant operating parameters necessary for the optimum intervention function. Initial scientific support may include peer reviewed scientific literature, expert advice from process authorities, in-plant data, and other technical support materials.

After selection of the initial scientific support, in-plant, ongoing validation must be established. This may include documentation of observations related to operational parameters, microbiological data, or other key operating settings. Intervention operating parameters may include: time, temperature, pH, concentration, dwell time, flow rate, pressure and product coverage. Review of this ongoing data must be reviewed regularly to determine if the process is having the expected, intended effect.

If undertaking in-plant validation studies, it is best to define the steps through a detailed, written protocol. Critical operating parameters observed during the validation should be documented through the study and then incorporated into the finished summary with the original protocol and data summaries. This ensures that future readers and evaluators of the validation will understand the initial focus, the controlled parameters of the study and/ or review and will be able to better relate information to the process itself in the future.

Validation is the step for each plant that evaluates the overall food safety system and is a required component of the plant's HACCP plan. The entire HACCP plan, as well as individual process control points, must be validated, or proven to be designed and implemented as intended, as achieving their intended control of hazards. Validation can be broken down into the following two elements:

- The initial technical data gathering that demonstrates a hazard can be prevented, reduced, or eliminate at a particular. Technical data includes scientific literature, expert process authority document, or other technical information. The plant must identify the specific hazard to be addressed at the processing step and the critical operating parameters for the processing step to be effective in their process. All decisions made must be supported with technical documentation. Every plant and process are unique; therefore, it will be necessary for a plant to assemble information from several technical documents and build a logical and rational basis for their decisions.
- The in-plant demonstration the processing step is preventing, reducing, or eliminating the hazard. The plant will implement the critical operating parameters of the processing step identified in the first element of validation. Quantitative or qualitative observations are collected and analyzed to show effectiveness of the processing step to control the hazard. Ultimately, these observations are proof that processing step is effective as designed.

The USDA-FSIS has published the guidance document [FSIS Compliance Guideline HACCP System Validation](#), which give an in-depth explanation of validation.

Questions or suggestions are welcome and should be addressed to:

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