

Mobile Poultry Processing Unit

Food Microbiology Safety Manual

For small-scale poultry producers and processors using the West Virginia Farmers Market Association Mobile Poultry Processing Unit

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Foodborne Pathogen Concerns on Broilers

- ***Salmonella***, Gram-negative, rod shape, non-endospore forming, facultative bacteria, optimum growth temperature ranged from 35°C / 95°F to 37°C / 98.6°F, can be as low as 5°C / 41°F, and up to 47°C / 116.6°F.
- ***Campylobacter***, Gram-negative, curve, motile rods shape, non-endospore forming, microaerophilic bacteria, requiring 3%-5% of O₂, and 5%-10% of CO₂, optimum growth temperature 42°C (broilers intestinal gut temperature)
- USDA-FSIS Performance Standards for *Salmonella* and *Campylobacter* on Broiler carcasses are no more than **7.5%** and no more than **10.4%**, respectively.

Broilers Processing Outlines by using Mobile Poultry Processing Unit (MPPU)

Stunning /
Exsanguination



Scalding



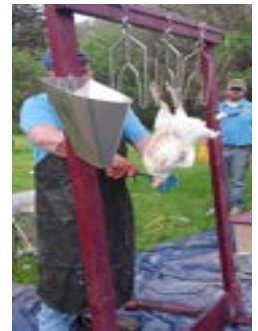
Defeathering/
Plucking



Evisceration



Chilling and
Packaging

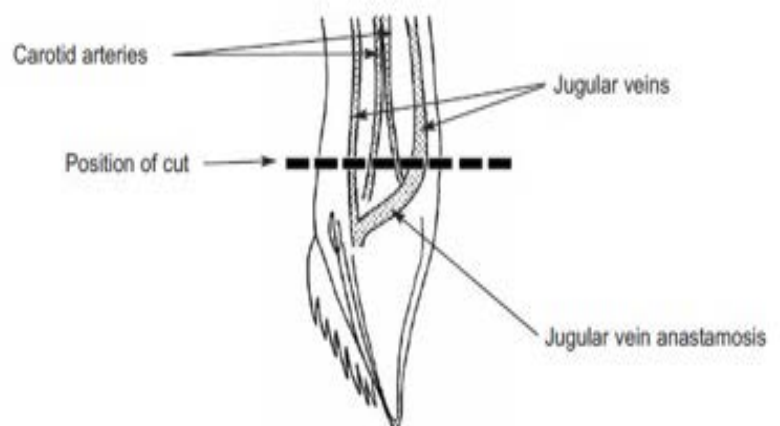


Feed withdrawal for processing

- **Time feed withdrawal can occur between 8-12 hours before slaughter**, which can ensure that birds have an empty gastrointestinal tract during transport, slaughter, and evisceration, which can reduce external contamination with fecal material.
- **Too late withdrawal (<6-7 h) may lead to** the birds consuming litter, which may lead to impactions and increase the likelihood that the bird will ingest pathogens and be contaminated at slaughter.
- **Extended feed withdrawal (>15 h) may also make internal organs more fragile**, increasing the likelihood that the crop or other organs will tear during processing and contaminate the carcass.
- Most studies support **8-12 hours** of feed withdrawal to prevent organ tearing.

Exsanguination/Bleeding

- If possible, use an electrical stunning device to induce unconsciousness prior to exsanguination as the most humane method for euthanasia.
- Both **carotid arteries and jugular veins** of birds should be severed using a sharp blade.
- Birds should **be bled within 15 seconds of electric stunning** and should bleed for **at least 90 seconds**.
- **Before proceeding to scald the bird, ensure the bird has been properly exsanguinated and has expired/dead.**



Scalding

- Scalding is typically done by **immersing the broiler carcasses in a tank of hot water**. This allows for partial cooking of the muscle surrounding the feather follicle and the easy removal of feathers.
- Two types of common scalding
 - » Hard scald with 138°F to 147°F (59°C to 64°C) for 30-75 seconds
 - » Soft scald with 123°F to 129°F (51°C to 54°C) for 90-120 seconds
 - » The optimal temperature for hard scalding ranges between 140°F-150°F
 - » Dunk the bird headfirst for 30 seconds to 2 minutes depending on the water temperature.
 - » During processing, water will adhere to feathers and may also splash out of the scalding tank. Water levels should be monitored intermittently and maintain a minimal level.
- **Temperature controls are important**, measure the temperature before scalding.
- **Do not submerge birds for too long and do not make hot water temperature more than 151°F**. Submerging birds in water over 151°F may start to cook the edible muscle tissue, which is undesirable. This may also cause the fat to be extracted from the broiler skin, resulting in organic matter accumulating in the chilling tank, which can cause microbial cross-contamination and decrease the efficacy of antimicrobials, such as chlorine water.

- **Do not use lukewarm water, such as <117°F**, as this temperature can create a breeding ground for pathogenic bacteria.
- Scalding capacity should be limited to plucker capacity. Do not overload the scalding tank. Forcing too many birds into the scalding tank at one time may break the equipment. Two birds at a time, depending on their size, is recommended.



Defeathering/Plucking (Manual and Automated)

- Manual defeathering can be done by first hanging the bird upside down. Then start removing feathers around the drumsticks and work your way down to the feathers on the breast, back, and wings.
- If scalding was done properly, then the feathers should wipe off easily.
- Manual is the cheapest method but is more labor/time intensive.
- A tub-style plucker is the easiest/least labor-intensive way to pluck as these can hold and pluck two to three birds at a time.
- Rubber fingers inside the drum spin around and remove the feathers from the birds.
- The amount of time in the plucker can vary on how well the bird was scalded.
- Automated is the fastest method of plucking, these can be built or purchased ($\geq \$500$).



Evisceration

- **Evisceration** is the process of removing internal organs, trimming processing defects from the carcasses, and getting the carcass ready for chilling. The head and feet are removed after scalding.
- Processing knives should be kept sharp for ease of cutting and should be routinely cleaned.
- Feed withdrawal practices affect process control at this step.
 - » Limiting intestine tearing and excreta accumulation.



- Basic steps
 - » Cut the head off at the base of the neck (right above the body)
 - » Loosen the crop by tearing connective tissue with fingers placed through the cut created from head removal
 - » Cut the leg at the leg joint
 - » Remove the oil gland from above the tail
 - » Cut out the cloaca
 - » Open the whole-body cavity from where the cloaca was
 - » Extract the viscera
 - » Harvest the giblets (heart, gizzard, liver)
 - » Remove the trachea, esophagus, and crop
 - » Remove the lungs

National Chicken Council recommends that whole broiler carcasses be rinsed with water containing 20 ppm free chlorine for 60 seconds post-eviscerations to decrease microbial contamination.

How to prepare of 20 ppm free chlorine water rinse:

Commercial Clorox contains 8% of sodium hypochlorite, referred to as free available chlorine when dissolved in water.

Calculation Table in 1 gallon water = 3.67 Liter

$X * 0.08 / 3670 = 0.00002$, $X = 0.92$ ml in 1 gallon water

Water Amount	Volume of Clorox needed to add
5 Gallons	4.6 ml = 0.30 tablespoon
10 Gallons	9.2 ml = 0.60 tablespoon
20 Gallons	18.4 ml = 1.20 tablespoons
30 Gallons	27.6 ml = 1.80 tablespoons
40 Gallons	36.8 ml = 2.40 tablespoons

Chilling

- Chilling is the most effective approach to inactivate microorganisms, including foodborne pathogens on broiler carcasses.
 - » This is done by using antimicrobials, such as chlorine water, with prolonged contact times of at least 1 hour.
- A combination of ice, water, salt, and chlorine can be used in the chilling tank (large plastic tub or metal tub).
- Chill broiler carcasses to 0.5°C/ 33°F to 4.4°C / 40°F after evisceration, the duration of chilling time after evisceration depends on the weight of the carcasses:
 - » Carcasses less than 4 pounds should be 4.4°C / 40°F or below within 4 hours of processing.
 - » Carcasses less than 4 to 8 pounds, within 6 hours of processing.
 - » Carcasses weighing over 8 pounds, within 8 hours of processing.
- Use a digital thermometer to test the chill tank ice slurry temperatures.
- Test it once per hour of operation.

Chilling Water Bleach Preparation

- To achieve a 0.005% (≤ 50 ppm) chlorine solution using 8% Clorox bleach in a 32-gallon garbage would require 5 tablespoons. Do not exceed 50 ppm chlorine solution.
- An online link for calculating chlorine concentrations is provided below:
 - » <https://www.foodsafe.ca/dilution-calculator.html>
- Provided is an equation that can be used without online access
 - » $(\% \text{ Chlorine in liquid bleach}) / (\% \text{ Chlorine desired }) - 1 =$
Total Parts water for each part bleach
 - » An example with common household bleach (Clorox is 8% chlorine) and you want 0.005% (≤ 50 ppm)
 - » $[(8\%) / (0.005\%)] - 1 = 1600 - 1 = 1599$ parts water to one part bleach
- Calculation Table in 1 gallon water for 50 ppm free chlorine
 $X * 0.08 / 3670 = 0.00005$, $X = 2.3$ ml in 1 gallon water

Water Amount	Volume of Clorox needed to add
10 Gallons	23 ml = 1.56 tablespoons
20 Gallons	46 ml = 3.11 tablespoons
30 Gallons	69 ml = 4.68 tablespoons
40 Gallons	92 ml = 6.24 tablespoons
50 Gallons	115 ml = 7.80 tablespoons



Sample Daily Log of Chilling Tank Temperature Monitoring

Farm: _____ Date: _____ Time: _____

Chilling Tank	Time	Temperature	Corrective Actions	Signed

If using a digital thermometer to test the temperatures of the chilling tank, test once each hour of operation, and maintain a temperature between 0.5°C / 33°F to 4.4°C / 40°F.

Packaging

- After being chilled, broilers should be packaged, then shipped or stored at $\leq 4.4^{\circ}\text{C}$ / 40°F .
- Maintain farmers market cooler temperature at 0.5°C / 33°F to 4.4°C / 40°F for fresh products. Record cooler temperatures at the start and the end of the day.
- Make sure the carcasses are dry before packaging them. This can be done by putting them on a rack for a brief period.
- Packaging can consist of using a gallon freezer bag, using a vacuum sealer, or even using a freezer bag and a clean shop vac. Do not stick the end of the shop vac hose into the bag due to sanitation concerns.
- West Virginia Department of Agriculture (WVDA) requires frozen carcasses to be sold at a farmers market.
- Basic labeling is required and should include:
 - » Processor's name
 - » Processor's address
 - » Common name of the product
 - » Net weight of the product
 - » Safe-handling instructions (i.e., Cooking to an internal temperature of 165°F)
 - » Pack date

Safe-handling instructions example



- The vendor shall receive a Farmers Market Vendor Permit from WVDA by March 1 each year to avoid a late fee or before the date of sale. As part of the routine inspection, the local health department may coordinate with WVDA and/or inspect the storage space of the product off-premises of the sales area. Off-premises storage should be in separate designated cold-holding equipment that is stored in a clean, safe, and secure environment.

Poultry Processing Selling within West Virginia

Producer/Grower 1,000 Poultry Limit Exemption Requirements

- 1. Poultry must be healthy**
- 2. Birds must be slaughtered and dressed in a sanitary manner**
- 3. Birds must be slaughtered on same premises where grown**
- 4. Cannot cross state line**
- 5. Can sell to distributor**
- 6. Can sell to restaurant**
- 7. Can sell to any customer within the state**
- 8. Label must have:**
 - Processor's name
 - Processor's address
 - Product name
 - Net Weight
 - Safe handling instructions (uninspected product)
 - Pack date
- 9. Label must not have raising claims (free-range, non-GMO, grass-fed) or nutritional claims.**
- 10. Records must be kept related to the number of birds raised and to whom they were sold.**
- 11. Processing of poultry is limited to basic cut-up of carcasses (chicken thighs, chicken wings, chicken breast, etc.). Grinding, the addition of ingredients, or any other further processing is not allowed.**

Producer/Grower 20,000 Poultry Limit Exemption Requirements

1. The producer/grower slaughters/processes no more than 20,000 healthy birds of his/her own raising, on his/her premises in a calendar year.
2. The producer/grower sells/distributes only poultry products he/she prepares under the Producer/Grower 20,000 Poultry Limit Exemption. He/she may not buy or sell poultry products prepared under another exemption in the same calendar year.
3. The poultry products can be sold only within the State of West Virginia. The poultry products may not move in interstate commerce.
4. The poultry are healthy when slaughtered.
5. The slaughter and processing at the producer/grower's premises is conducted according to sanitary standards, practices and procedures that produce products that are sound, clean, fit for human food and not adulterated. (Basic Sanitary Standards)
6. Processing of poultry is limited to basic cut-up of carcasses (chicken thighs, chicken wings, chicken breast, etc.). Grinding, the addition of ingredients, or any other further processing is not allowed.
7. The producer/grower only distributes poultry products he/she produced under the Poultry/Grower Exemption. Note: The producer/grower can also distribute poultry products that he/she raised and had slaughtered /processed under USDA inspection.
8. With the exception of mobile slaughter units, the facility/location used to slaughter or process the poultry is not used to slaughter or process another person's poultry unless the State Director of Meat and Poultry Inspection grants an exemption.
9. All poultry or poultry products produced under this exemption must be labeled with the following:
 - a. Processor's name
 - b. Address
 - c. Product name
 - d. Net weight
 - e. Safe Handling Instructions (uninspected product)
 - f. Pack date
10. Label must not have raising claims (free-range, non-GMO, grass-fed) or nutritional claims.
11. The producer/grower keeps accurate and legible records necessary for at least two years necessary for the effective enforcement of the Act.
12. A poultry producer who otherwise meets the requirements of the exemption and that slaughters or processes 20,000 or fewer birds per calendar year under the federal Poultry Products Inspection Act, 21 U.S.C. 464(c)(3), may not keep a poultry flock of more than 3,000 birds at any one time.

Poultry Processing Selling Outside West Virginia

- Poultry processed on-farm in the state cannot be sold across state lines.
- Only poultry that were processed at a USDA-inspected plant (none in the state process poultry for independent producers) can be sold outside of West Virginia.
- Live birds would have to go across state lines to be processed at a USDA-inspected facility to be sold outside the state.
- Make sure the facility in the neighboring state is not only state-inspected, but USDA-inspected, as birds processed here would not be able to be sold in West Virginia.

Post-Processing Sanitation Standard Operation Procedure

1. **Frequency:** After MPPU processing
2. **Responsible Person:** Poultry Processors who used the MPPU equipment.
3. **Procedure:**
 - A. **Overall procedure**
 1. Pick up feathers, dust, and all other organic matters.
 2. Pre-rinse all dirty areas with tap water, which starts from the top, and work all material down to the floor.
 3. Apply detergents and/or sanitizers as directed for all contact surfaces.
 4. Observe and re-clean any missing areas.
 5. Squeegee standing water to the floor.
 - B. **Processing Area**
 - 1. Observe and pick up any pieces of leftover bones, fat, meat, or other matter and deposit them into the container for inedible material.
 - 2. Briefly pre-rinse all soiled areas with warm water. Start the process at the top and work all material down to the floor.
 - 4. Apply approved antimicrobial soaps as directed.
 - 5. Rinse all equipment from top to bottom.
 - 6. Inspect and re-clean any missed areas.
 - 7. After equipment and work areas have been cleaned, apply sanitizer to all contact surfaces.
 - 8. Squeegee any standing water on the floor to drainage areas.
 - 9. Remove, clean, and sanitize any waste conduits or drains.
 - 10. Apply edible oil to all surfaces that are subject to corrosion.
 - 11. Finally check all the following items are treated appropriately
 - All the blood of birds was washed from the equipment.
 - All offal was removed from the equipment.
 - Feathers should be removed with a few remnant feathers being unavoidable and acceptable.
 - Any mechanical issues post-use should be communicated.
 - C. **Video link for Sanitizing of a tub-style plucker**
 - <https://bit.ly/3UeYnkW>

Frequently Asked Questions

1. **Should Dawn dishwashing liquid be used in the scalding to remove oils from the chickens?**

Answer: Yes, we need it to remove oils from the chickens, otherwise the oil/fat from the chicken skin will be floating in the final chilling tank, which could affect the antimicrobial efficacy of the chlorine water.

2. **Should thermometers or timers be added to scalders, pluckers, ice baths, etc.?**

Answer: Absolutely. Thermometers need to be used for scalders and ice baths. A timer is less important because time will change based on the temperature of the scalding and ambient conditions.

3. **Any concerns about wastewater from the trailer?**

Answer: This should not be an issue if processing is occurring on-farm and on a small scale.

4. **Recommendations on feathers? What about a farm compost pile as the destination?**

Answer: Yes, that is the best that a person can do. The feathers will break down very slowly. The commercial industry renders their feathers using equipment that resembles a large pressure cooker. A small-scale farmer would not have this type of equipment.

5. **For cooling the birds, bleach is standard across post-harvest processing. Are there other chemicals we could add to a cleaning list for this portion of the process?**

Answer: Bleach is the standard with concentrations ranging from 5 to 50 ppm. However, organic producers do not use bleach. Some producers also use peroxyacetic acid (PAA) 50-75 ppm. Dr. Shen's lab is currently doing validation studies for using white vinegar for the chilling process.

6. **How long should birds be kept in ice after the cooling bath? Is there a general time range recommended before packaging for sale?**

Answer: It is all about getting the carcass temperature down. Chilling carcasses to 40°F or below depends on the size and weight. Carcasses weighing under 4 pounds should be 40°F or below within 4 hours of processing; Carcasses weighing 4 to 8 pounds, within 6 hours of processing; Carcasses weighing over 8 pounds, within 8 hours of processing.

7. **How about packaging?**

Answer: Once chilled, poultry to be packaged and shipped are to be stored at 40°F or less. Packaging can consist of letting the carcass or parts dry for a short period of time on a rack and using a gallon freezer bag, using a vacuum sealer, or even using a freezer bag and a shop vac. WVDA required all birds to be frozen before selling at farmers markets in West Virginia. The vendor shall receive a Farmers Market Vendor Permit from WVDA by March 1 to avoid a late fee or before the date of sale. As part of the routine inspection, the local health department may coordinate with WVDA and/or inspect the storage space of the product off-premises of the sales area. Off-premises storage should be in separate designated cold-holding equipment and stored in a clean, safe, and secure environment. Basic labeling should include: processor's name; processor's address; common name of the product; net weight of the product; safe-handling instructions (cook to an internal temperature of 165°F); pack date; contacting your local health department to see if there are any more requirements for your county would be a good idea.