Small-Scale Poultry Processing

Photo by Paul Heibert

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Introduction

A growing number of small producers are raising poultry outdoors on pasture, processing the birds on-farm, and selling the meat directly to customers at the farm or at a farmers' market. Many states allow up to 1,000 birds to be processed on a farm each year and sold directly to consumers with no inspection. Some of these small producers are going further—building government-licensed processing plants to supply regional or niche markets. Specialty "religious kill" is often done in small plants. "Kosher" is the term for Jewish slaughter and "halaal" for Muslim slaughter.

Access to processing is a critical issue for small producers. Consolidation in the meat processing industry has left very few small plants that will do custom poultry processing. (Large plants generally don't process for small producers; they can't keep track of a small batch of birds and can't make money on small-volume orders.)

This publication covers small-scale processing, both on-farm and in small plants. Relevant information on large-scale processing is also included for comparison, to provide context, and because small processors need to have some understanding of how large-scale processing works.

Related ATTRA publications

- *Sustainable Poultry: Production Overview*
- *Growing Your Range Poultry Business: An Entrepreneur's Toolbox*

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Table of Contents

Introduction 1
Table 1. Comparison of types of processing 2
Pre-slaughter 3
Immobilizing, Killing, and Bleeding 4
Feather Removal 6
Table 2. Scalding 7
Removal of Head, Oil Glands, and Feet 9
Evisceration 9
Washing the Carcass 10
Chilling 10
Cut-up, Deboning, and Further Processing 13
Aging 14
Packaging 14
Storage 15
Delivery and Distribution 16
Clean-up 16
Waste Management 16
Table 3. Processing Plant Waste Loads per 1000 Chickens 17
Equipment and Supplies 18
Processing Diverse Species 19
Batch vs. Continuous Processing 19
Processing Rate 19
Processing Setup 20
Economics 23
Resources 23
References 24
Appendix A. South Central New York RC&D MPU Layout 29
Appendix B. Kentucky MPU Layout 35
Appendix C. Small Plant Work Areas and Design 36
Attachment 38

Table 1. Comparison of types of processing			
	On-farm	**Small**	**Large**
Size	Outdoor or shed facility	2,000 to 3,000 sq. ft.	150,000 sq. ft.
Equipment	Manual	Manual/Mechanical	Fully automated
Cost	Less than $15,000	Less than $500,000	$25,000,000
Labor	Family	Family/hired	Hired
Capacity	50-100 birds per day	200-5,000 birds per day	250,000 birds per day
Operation	Seasonal; 1-30 processing days per year	Seasonal or year-round; 50-plus processing days per year	Year-round; process daily
Marketing	Product sold fresh, sometimes frozen; whole birds	Fresh and frozen, whole and parts	Mainly cut-up, sold fresh, further-processed
Comments	Independent operation; labor-intensive; low-risk; usually non-inspected, direct sales	Independent or part of a collaborative group; requires good markets and grower commitments	Part of an integrated operation including grow-out, processing, and marketing

During the first part of the 20th century, poultry was sold live to consumers who did their own processing. In the 1930s, only the blood and feathers were removed ("New York dressed"). As consumers demanded more convenience, the market grew for eviscerated or ready-to-cook (RTC) birds.

Producing ready-to-cook poultry involves:

- Pre-slaughter: catching and transport
- Immobilizing, killing, and bleeding
- Feather removal: scalding, picking
- Removal of head, oil glands, and feet
- Evisceration
- Chilling
- Cut-up, deboning, and further processing
- Aging
- Packaging
- Storage
- Distribution

Pre-slaughter

Broilers are usually processed at 4.5 lbs. live weight. Feed is withheld for 8 to 12 hours before slaughter to reduce the amount of feed in the gut and the possibility of tearing it during processing, which would cause fecal contamination of the carcass. Withholding the feed too long will result in watery guts that leak.

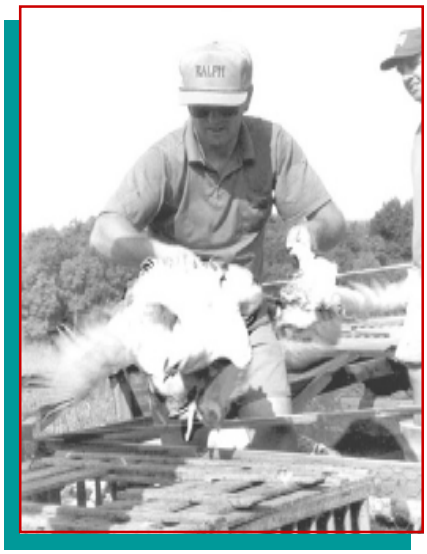
Catching and loading

Large producers harvest all their birds at once (all-in, all-out). Small producers often "skim" by harvesting larger birds and leaving smaller ones to grow. Birds are best caught at night or early in the morning when they are calm. For small producers, picking birds up individually by the sides is the best way to minimize stress and prevent injury. Of course, this is not feasible when you're dealing with thousands of birds (1). In large-scale production, chickens are caught by grabbing both legs, just above the feet. No more than three birds should be carried in one hand. Crews of 10 people catch and crate birds at the rate of 10,000 per hour, bruising up to 25% of them (1). In Europe, automatic harvesting machinery is increasingly used in large operations, because it is considered more humane than the rough treatment by catchers who handle several birds at once.

Transport crates are wooden or plastic. A typical crate can hold about 8 birds in the summer and 10 in the winter, depending on their size and on the weather. The crates usually have a

small opening, to help prevent escape during loading, but a small opening also increases the chance of physical injury to wings. Crowding of birds in crates is another welfare issue.

Kuhl Co. (2) and Brower Co. (3) sell transport crates. Used crates are sometimes available at lower prices. Small producers sometimes make their own wire crates from welded wire mesh and clips.



Catching and transport can be stressful for the birds.

Transport, Holding, and Unloading

Avoid holding birds in crates for too long or transporting them when the weather is too hot, cold, or wet. With on-farm processing, there is little or no travel time. If you have to transport in cold, wet weather, be sure to cover the birds—small producers typically cover the crates with a tarp.

You will need a full-size pick-up or larger truck—200 birds in 25 crates weigh about 1250 pounds. For more birds, you will need a trailer. If you need to transport 1000 birds at a time, you'll need a special vehicle such as a bob truck.

Birds are crated and transported to processing in this trailer.

Once the birds reach the processing facility, it is important to keep them comfortable in the holding area. Scheduling arrival at the plant can reduce waiting time. On-farm processors usually hold crated birds under trees or other shade.

The conventional industry typically produces birds within one hour of the processing plant. With two hours of travel, shrinkage or weight loss is about 1% (4). In Europe, special modules are used on transport trucks for even air flow and good ventilation. Companies are fined for arriving with dead birds. Large processors keep crated birds in a holding shed with fans and misters to keep them cool.

Care must be taken when unloading the birds from the crates to prevent bruises and broken bones. On-farm and small plants unload birds by hand. At large plants, broilers are unloaded onto conveyor belts. Transport crates should be washed after each use.

Catching, loading, transporting, and unloading expose birds to new environments and new sources of stress. This can negatively affect meat quality (see Aging section). During hauling, in particular, birds have to deal with heat or cold, feed and water withdrawal, motion, vibration, noise, and social disruption (1).

Immobilizing, Killing, and Bleeding

Small processors usually place birds in funnel-shaped kill cones after removing them from crates; large plants hang them on shackles and stun them before killing.

An overhead track is used to move carcasses through a plant. Keeping birds on-line throughout killing and dressing reduces labor since there is no handling. In many small plants, you just push the shackle along; in large plants, the track is motorized.

For on-farm processing, stainless steel kill cones, wrapped metal, or traffic cones are commonly used. A bucket or jug with a hole screwed to a board will also work. Birds are not stunned before killing and will jerk a lot during bleeding. Cones should be the proper size, and the bird's wings folded down when inserted, to prevent the bird from flapping its wings or backing out of the cone. Wing flapping can cause hemorrhages

in the muscle and broken bones (1). In large plants, birds are hung on shackles in a dark room to help calm them and ease handling. Special lighting, such as blue, will also keep them calm and prevent flapping and injury (1).

There are several ways of cutting blood vessels in poultry, the most common killing method. In the conventional industry, the carotid arteries and the jugular veins are cut on both sides of the neck by a deep cut in the front. In kosher and halaal slaughter, only one side of the neck is cut, so the birds bleed more slowly. The spinal cord should not be cut (as when the head is cut off), because the feathers "set" and are hard to pick (5). The esophagus should also not be cut, to prevent microbial contamination from leakage.

Making the cut.

Stunning

Stunning is not used in on-farm processing and is only sometimes used in small plants, where it is often impractical. Small-scale processor Aaron Silverman (6) does not stun. "I don't like the idea of my employees using an electrical implement in a wet environment." According to Silverman, if you do not stun, you should kill in cones to restrain the bird from convulsions and wing flapping. In some specialty religious processing, such as kosher and halaal, stunning is not permitted. However, stunning is very helpful when working with turkeys or geese because of their larger size. When using a stun gun, it is critical to set it at the correct voltage—110 volts. If you do not adjust the stun correctly, birds will be over- or under-stunned. Over-stunning results in hemorrhages and broken bones.

Stunning is the norm at large plants. It immobilizes the birds for the killing machine, provides a uniform heartbeat for better bleeding, and relaxes the feather follicles for easier picking (7). Furthermore, stunning is considered more humane than not stunning. U.S. law requires stunning of other livestock, though not of poultry.

In large plants, stunning works as follows. The heads of the birds are dipped into a saline bath with an electric current, rendering them temporarily unconscious (1–2 minutes—enough time for cutting and bleeding them to death) (7). The current is low-voltage and low-amperage (about 20 volts, depending on bird size, for 3–5 seconds; the amperage is 10–12 mA per bird) (7).

In Europe, stunning of poultry is required by law, and the stun, administered at higher voltage and amperage, is irreversible—birds cannot recover. Another method of stunning, more common in Europe than in the U.S., uses carbon dioxide or argon gas to anesthetize the bird. Gas stunning is expensive, but is useful if you are processing a variety of birds, since it can be difficult to adjust an electric stun for different species.

There are relationships between stunning, killing, muscle metabolism, and meat quality. These interactions have been studied mostly with stunned birds killed in shackles, since that is the typical practice in large plants. Less is known about the effects on meat quality of killing in cones with no stunning.

Bleeding

Small processors usually believe that the bleed-out is more thorough with no stunning. About 35–50% of the blood comes out of stunned birds, with the rest remaining mainly in the organs (1). Bleeding takes 1.5 to 3 minutes (7). According to industry thought, if the bird is not stunned, the bleed-out is slower and not as complete, because the bird is struggling and its organs are using blood. Maximum drainage of blood is desirable so there won't be dark spots on the meat, especially on wing veins.

Blood recovery

On the farm, blood is collected in a bucket or trough and used in composting; however, on a large scale, blood is a wastewater pollutant since it contains a lot of organic matter. On a shackle line, blood can be collected in a blood tunnel that reduces splashing.

Feather Removal

Scalding

Small processors remove the birds from the killing cones for scalding. In large plants, the birds stay on the shackles.

Table 2. Scalding

Types of Scald	Temperature	Length of time	Comments
Waterfowl (very hard)	160-180°F	30-60 seconds	Needed for waterfowl
Hard	138-148°F	30-75 seconds	Removes outer layer of skin
No Man's Land	130-138°F		Avoid: too hot to keep skin intact but too low to remove epidermis
Soft	123-130°F	90-120 seconds	Keeps skin intact

(Adapted from Tanner, James Jerrel. 1970. A Wastewater Characterization of the Poultry Processing Industry. Master's thesis, University of Arkansas. p. 20.)

Birds are scalded (immersed in hot water) to loosen the feathers. Heat breaks down the protein holding the feathers in place (5). Scalding is very temperature-sensitive.

In the U.S., a hard scald is used by small and large processors alike. It loosens the outer layer of skin, providing a better coating adhesion for fried foods (important for further-processing). After a hard scald, the skin must be kept moist and covered or it will discolor. A very hard scald is needed for waterfowl because their feathers are harder to loosen.

In Europe, soft-scalding is more common and used in conjunction with air-chilling (see the *Air-chilling* section below). The *Label Rouge* program in France, which focuses on gourmet meat quality, requires a soft scald. The skin remains intact and skin color is retained; however, picking is more difficult.

Scalding increases the body temperature of the carcass. In kosher processing, the bird is not scalded because it would partially cook the meat. As a result, the birds are harder to pick.

On-farm processors use a single tank of hot water, usually scalding one to four birds at a time. Labor is saved when a mechanism such as a basket or arm dunks several birds together. In small plants, scalders with such a mechanism can handle 12 birds at once. Some on-farm processors add dish soap to the scald water to help it better penetrate the feathers and facilitate picking; others do not find this necessary.

It can take a while to heat the water in a small scalder to the right temperature, and it can be tricky to maintain that temperature, especially when fresh water is added. Most on-farm processors don't replace the water during processing for these reasons. However, this can lead to another problem—the water gets too dirty. Some on-farm processors solve the dilemma by using two scalders at a time, rotating them as one reaches the correct temperature. Robert Plamondon in Oregon uses a water heater so he can replace the scalder water as often as needed. "When you have to wait a half-hour for the scalder to heat up, there is a temptation to scald more birds than is wise" (8). Bigger scalders have an overflow to add fresh water continuously.

Additional precautionary measures can reduce filth in the scalder. Wet birds in the field can pick up manure on the skin and feathers and this material can end up in the scalder. Large

Aaron Silverman's scalder (foreground) and picker handle about 12 birds at a time.

plants may use a bird scrubber (large rotating brushes on either side of the bird) and also spray the birds with chlorinated water before putting them in the scalder.

While small processors use a single-stage, static tank, large plants use long multiple tanks for multi-stage scalding. The tanks vary in temperature—the first is kept at a lower temperature since it can take 2 minutes for the track to carry the birds through. In that time, they would cook at 134° F. The tanks also have a countercurrent flow of water, which produces a dirty-to-clean gradient. The scald water flows in the opposite direction of the birds, so they are continually moving to cleaner water. Overflow adds fresh water continuously.

Water for processing

It is important to have an adequate supply of potable water for processing. If you have well water, it needs to meet drinking standards and should be tested. If the rate of water flow on your farm is slow, you may need to add a reservoir tank. Robert Plamondon put a sealed 1500-gallon plastic tank on a concrete slab close to his well. (He lives in a mild climate and does not have a freezing problem in winter or a heating problem in summer.) "The well pump pours water into the top of the tank, and a second pump (a jet pump) takes water out of the bottom of the tank" (9). He shock-chlorinates occasionally and flushes residues out of the bottom (8). He bought the tank from Snyder Industries, Inc. (10).

Picking

The quality of the pick is related to the scald. If the scald water was too cool, the feathers won't loosen; if it was too hot, the skin will tear in the picker. But if it was just right, the feathers usually come out easily and can even be removed by hand. However, hand picking is time-consuming. If you are planning to process very many birds, you will need a mechanical picker. Removing the feathers by abrasion, these machines can pick a bird clean in about 30 seconds (and will sometimes break the wings). Some on-farm processors skin the birds instead of removing the feathers. A drum picker—a cylinder with rubber fingers around the exterior—defeathers one bird at a time. The operator holds the bird above the cylinder, rotating it as the cylinder spins and picks off feathers. Drum pickers come in table-top or free-standing models. A tub or batch picker is a rotating tub with rubber fingers mounted on the inside walls; it can handle 2–12 birds at a time. Small processors carry the birds to the picker. Large plants use continuous, in-line pickers that look like a tunnel with rubber fingers. Birds pass through the tunnel on shackles.

A producer is trained to use a drum picker.

Turkeys and older laying hens are harder to defeather, and waterfowl feathers are especially hard to remove. Pinfeathers—immature feathers still in the feather shaft—can be hard to remove mechanically. Wax for removing pinfeathers is available from Pickwick/Zesco (11). "Pinning" is the removal of pinfeathers by hand. "Singeing" involves passing the bird through a flame to burn small hair-like feathers. Some on-farm processors use a propane torch to burn them off, being careful not to burn the skin. The feathers of colored birds may leave spots of pigmentation on the skin. Commercial poultry breeds have white feathers that do not leave stains. Consumers in the U.S. are accustomed to a carcass with a clean, unspeckled appearance.

Feathers are removed by the abrasive action of rubber fingers in this tub-style picker.

Scalding and Picking Equipment

The companies Pickwick/Zesco (11), Brower (3), and Ashley (12) have supplied small-scale poultry processing equipment for many years. Small scalders (one bird at a time) cost less than $200 and small pickers less than $400. These companies also offer many larger models. A 12- to 16-bird scalder costs about $10,000.

Some home businesses have emerged that sell relatively inexpensive processing equipment for on-farm processors.

- Kenneth King of JAKO, Inc. (13) sells a relatively low-cost scalder and tub picker of his own design. Each piece costs $1,700, compared to about $3,000 each for comparable equipment from conventional suppliers. The picker has a plastic barrel. JAKO also sells a small table-top picker (Lil' Pick) powered by a hand drill for $125.
- Eli M. Reiff of Poultry Man (14) has equipment made in a local farm shop. He offers a rotary scalder for $1,895 and a tub picker for $1,395. He says comparable equipment sells for $6,000. He also offers a smaller picker for $695.
- David Schaeffer (15) has developed the Featherman Jr., which picks three chickens or one turkey. It costs $715 with the motor (1 hp 115 Volt Dayton) installed and $520 with no motor. Schaeffer recommends pairing his picker with the Ashley M-38 scalder (40,000 BTU, 38 gallon tank, automatic temperature control, $1250).
- Rob Bauman of R & R Pluckers (16) builds pickers.

Note: Prices may have changed.

According to on-farm processor Jenny Drake, "I KNOW the stuff is expensive, but you will kick yourself over and over if you don't get equipment designed for the scale of operation. We bit the bullet and bought JAKO equipment, and it has been worth every penny."

Small processors can look for used equipment from sources such as *Grit*, the newsletter of the American Pastured Poultry Producers Association (17), or from Tom Neuberger of South Dakota Poultry Headquarters (18), but availability is limited. There may be old poultry processing equipment in your area from small plants of the past. Large plants in your area that are remodeling can be a source of used equipment. Large companies have graveyards with used equipment, some being turned into scrap metal. Keep in mind that while used equipment can help you cut costs, it may not meet the specifications your facility requires.

Homemade or Modified Equipment

Making your own equipment is another way to lower costs, but consider the time required to build or find parts. Again, make sure the design and materials meet the specifications you require. But be forewarned that homemade equipment is not likely to meet federal or state meat inspection requirements.

Homemade scalders: When first starting out, some small-scale producers use a large stockpot in the backyard heated with a fire. On-farm processors have also used propane burners (from outdoor turkey fryers), water-bath pots made for canning, and hospital sterilizers (common before the advent of the autoclave). A homemade scalder can be made with a utility sink, a heating element, and a thermostat for about $50 (19). On-farm processors also make large insulated scalders from old electric or propane water heaters. Some even have a dunker. It is especially important to use thermometers with homemade scalders to ensure a constant temperature.

For those making homemade equipment, it is very important to be aware of the danger of electrocution. Scalders and pickers are used around water, which makes improperly connected electrical parts even more dangerous. Important safeguards include using a competent electrician, following electrical code, installing ground fault circuit interrupters (GFIs), and making sure the power cord is of sufficient gauge to handle the current. Gas-powered water heaters are also used, but there is an explosion risk.

Homemade pickers: Many have converted old washing machines or plastic 55-gallon drum into pickers. On-farm processor Herrick Kimball has written *Anyone Can Build a Tub-Style Mechanical Chicken Plucker* (20). He estimates that this type of picker can be built for $500—much less than the typical $2,000. He also moderates a listserver called

Continued on page 9

Continued from page 8

whizbangchickenpluckers, accessible at <http://groups.yahoo.com>. Photographs are available. JAKO (13) and Stromberg's (21) sell picker fingers for about $1 each.

For internet pictures of a scalder being built, see Paul Helbert's (22) webpage <http://home.rica.net/phelbert/tub.html>.

Removal of Head, Oil Glands, and Feet

After feather removal, the heads, oil glands, and feet are removed. On-farm and small processors usually cut the head off; large plants have machines that *pull* heads off so that the esophagus is also removed.

Birds preen their feathers with an oil gland located on top of the tail. It is almost 1% of the carcass, but because of its odor and taste it is removed. Asian markets may prefer a carcass with the oil gland intact; government regulations permit it to remain under religious kill exemptions.

The feet are removed at the knee joint. In small plants, birds are put on evisceration shackles after scalding and picking. In large plants, after the feet are removed, the birds are rehung on the shackles. When birds are first hung, it is easiest to hang them by the feet, but during rehanging, they are hung by the knee joint. This process also keeps the dirtier kill shackles separate from the cleaner evisceration shackles. One kill line feeds several evisceration lines, since evisceration is relatively slow. In a small plant, nine shackles per minute is a good rate during evisceration (6).

Evisceration

To eviscerate manually, cut around the vent, open the body, and draw out the organs. Remove inedible viscera or guts (intestines, esophagus, spleen, reproductive organs, lungs). Loosen the crop so it will come out with the guts. The kidneys remain inside because they are hard to remove.

Instead of shackles, on-farm processors usually eviscerate on a flat surface, (stainless steel for easy cleaning or a disposable plastic sheet). However, some on-farm processors use an individual shackle on a rack or stand, available from Neuberger (18). According to small-plant processor Luke Elliott (23), it is easier and cleaner to eviscerate on shackles.

On-farm processors and small plants eviscerate manually with scissors, knife, or a handheld vent-cutter gun with a circular blade, and draw out the guts by hand. Large plants use automated machines that scoop out the guts; high-speed lines eviscerate 2,000–8,000 birds per hour (1). These automated lines are usually designed for one species, and uniformity in size is very important for proper operation.

For state and federal inspection, the guts usually remain attached. They can be separated but must remain alongside the bird so that the inspector can see both the inside and outside of the bird as they look for disease or other problems. Inspection requires bright light, a handwashing station, and places to put suspect birds and condemned birds (1). A mirror on the backside of the bird allows the inspector to examine it without touching.

If the gut is torn, microbial contamination will occur. One gram of gut content can carry a billion bacteria (1). In some countries a spill results in the whole bird being condemned; in other countries, including the U.S., washing is permitted. Small plants use spray bottles of chlorinated water to clean off fecal contents. In large plants in the U.S., 2.5% of birds are condemned because of contamination. (A torn crop is also a source of contamination.) It is unknown how often the intestines tear during manual evisceration. Silverman (6) can go all day at his 500-bird/day plant without a tear. Proper feed withdrawal

Eviscerating in a small plant.

before processing will help reduce tears; when the gut is full, it tears more easily.

The edible viscera or giblets (heart, liver, and gizzard) are collected. On-farm and small-plant processors peel the gizzards by hand. Many small processors simply discard the giblets. The lungs can be scraped out with a lung puller or a handheld gun used with a vacuum. Large plants automate harvesting of edible viscera and removal of lungs.

A pile-up of feathers and viscera can be a problem when processing a lot of birds. Some small plants have systems that expel the feathers from the picker to an outside container. Guts are collected in a trough and hauled away from the area in barrels. These are called "non-flow-away" systems. "Flow-away" systems in larger plants use water to continually remove feathers and guts.

New York dressed

Carcasses are sold with the guts in—"New York dressed"—mainly to ethnic markets. In the past, all poultry was sold like this in the U.S.; the USDA still permits it under specialty religious-kill exemptions.

Washing the Carcass

Washing can occur at different points in the slaughter process. The most common point is before chilling, when the carcass is washed inside and out. On-farm processors usually use hoses to wash. Small and large plants use food-grade hoses and sprayers. Large plants use additives to the water, such as chlorine, to reduce bacteria.

Chilling

The carcass temperature must be lowered quickly to prevent microbial growth. The USDA requires that the temperature of the carcass be lowered to 40° F within 4 hours (for 4-lb broilers), 6 hours (4- to 8-lb), and 8 hours (greater than 8 lbs or turkey) (5). Soaking the carcass in chilled water is the most common method of chilling poultry in the U.S.

According to Luke Elliott, "The temperature should be taken in the breast of the bird with a probe-type thermometer. Get a good thermometer (less than $20.00) that can be calibrated. Thermometers are calibrated to 32° F by placing the probe in a glass of ice water. Before my experience in the plant, I always just took the water temp and that does not give a good representation of the bird temp. We normally tested three birds out of the tank and tested the ones that went in last" (23).

An ice slush chill in a large bin.

On-farm processors use large plastic tubs filled with cold water and ice. Sometimes they have two tubs, using the first to remove the initial body heat and the second to chill the carcass. Carcasses usually stay in the water for about one hour. Small-plant processors use food-grade plastic or stainless steel bins filled with ice—a slush forms as the ice melts. The drainage holes in the bottom can be opened and the water drained out, leaving only ice, according to Elliott (23). "A bin size that holds 50 to 100 birds allows an hour's worth of processing to chill while birds processed later can go into a separate tank. This is also an easy-size bin to move when full" (23).

Ice is an important supply issue for on-farm and small processors. "More than 5-pound bags of ice will be needed," as one on-farm processor puts it. A rule of thumb is one pound of ice per pound of meat. In a small plant designed for 500 birds per day, 2000 lbs. of ice would be required. An ice machine with a bin capacity of 1800 lbs costs about $5,000 and has a recovery of 900 pounds per day. In order to process on consecutive days, a second ice maker would need to be mounted on the bin to allow sufficient recovery (23). One maker of ice machines is the A-1 Refrigeration Company (24). Crushed ice is more efficient than cubed ice, which always has pockets of warmth.

Some on-farm processors use dairy equipment—bulk milk coolers with stainless steel tanks—for chilling carcasses. The tank never gets below 32 degrees, and a submersible fountain pump keeps the water circulating to ensure that chickens don't freeze to the bottom. Missouri producer Kip Glass describes his dairy equipment:

> I purchased a used 250-gallon bulk milk cooler for $400...We don't have to buy ice, store ice, or worry about the high maintenance demands of an ice machine…We have done so far this year over 2000 broilers, and I know if we had to have bought the ice it would have been a lot more than a $1000 dollars for the 2500 birds we are doing. Figure 2500 birds at 4 lbs., at a 1 lb. of ice per pound of bird. That would be 10,000# of ice. At $1.00 per 10#, you do the math.
>
> We fill it up the night before processing, let it run, for approx. 4 hours to chill our water down to 36 degrees. Start processing the next morning and let it maintain the temp. all morning through processing, and all afternoon through customer pickup. Being it's insulated it doesn't run much to maintain that temp (25).

Water chilling is used in large plants. Carcasses are removed from shackles and put in large chill tanks filled with cold water. About one-half gallon of water is required per carcass for the initial tank of water (make-up water). Some chillers hold more than 300,000 gallons of water. They are either a through-flow type with paddles or rakes, or a counter-current-type with augers to move birds. The water is cooled to 32 to 39° F by a heat exchanger.

First the carcasses are placed in a pre-chiller to cool them down gradually. The carcasses are warm (107° F) when they enter the prechiller (55-60° F), where they stay for 15 minutes. The carcasses are then moved to the chiller tank (32° F) and kept there for 45 minutes. Counter-currents are used so the carcass moves continually to colder, cleaner water. An overflow continually replaces water with clean water (1/2 gallon for each bird coming in). Air bubbles agitate the water to improve heat exchange.

Cold shortening

Cold shortening is not a big problem with poultry since they have a fast rigor mortis process (1–3 hours after death) (1). Large animals have a slower rigor process and therefore more problems with cold shortening. Theoretically, if you dunk a warm, freshly processed bird in 32° F water, the muscles will contract, resulting in tough meat; however, small processors who practice this type of chilling do not report a problem with tough meat and prefer to reduce temperature quickly.

Water uptake

Gradual temperature reduction results in water uptake by the carcass. Most of this water is absorbed by the skin; not much goes into the meat. The cold water in the chiller seals the water gained during cooling into the carcass by closing the skin pores. The USDA permits poultry to contain 8–12% water when sold. This regulation was developed in the past to compensate processors when excess water dripped out of packages and was lost during marketing. Nowadays, poultry meat is allowed to have 8% water in tray packs and 12% in bulk packaging, but broilers typically contain 6% water (7). It is obviously an advantage to poultry companies to have high moisture in their products since it increases the weight—and the products are sold by weight. However, new regulations will require the moisture level to be printed on the label.

Small processors put the carcass directly into an ice slush (32° F). Although, theoretically, cold shortening can occur, the skin pores close from the cold, reducing water uptake. Most small processors report only about 1 to 4% water uptake. In large plants, the chill water has chlorine added. Most small processors simply use city water or treated well water with negligible chlorine. Some believe that preventing a high uptake of chlorinated water can improve the quality and taste of poultry meat. Low uptake of water is an important distinction in the marketplace for on-farm and small processors.

Air-chilling

Air-chilling of poultry is commonly practiced in Europe, Canada, and Brazil, and was once common in the U.S., where air-chilling is still the norm for beef, pork, and lamb. Air-chilling takes longer than water chilling, usually at least two hours.

Air-chilling takes place in an insulated room or tunnel in which the temperature is kept between 20 and 35° F by coolers in the ceiling (7). Air is blown from nozzles directly into the cavity of each bird or around it. An overhead track conveys the carcasses into the room. It saves labor to keep the birds on the shackles for chilling since there is no need to handle them, but sometimes they are removed and put in baskets or on racks. To prevent an upper layer of carcasses from dripping on a lower layer, the birds are usually not stacked. Heightened humidity or a water spray prevents the carcass from drying out. *Evaporative chilling* is a type of air-chill in which water is sprayed on the carcass; water absorbs heat during evaporation.

Air-chilling equipment requires more space and uses more energy than water-chilling equipment, and costs more. However, water use is low. Both types of chilling are effective and the choice depends on water availability, the market, etc. (1). Air-chilled poultry is usually sold fresh. Birds that are air-chilled should be soft-scalded—if they are hard-scalded, the meat may discolor.

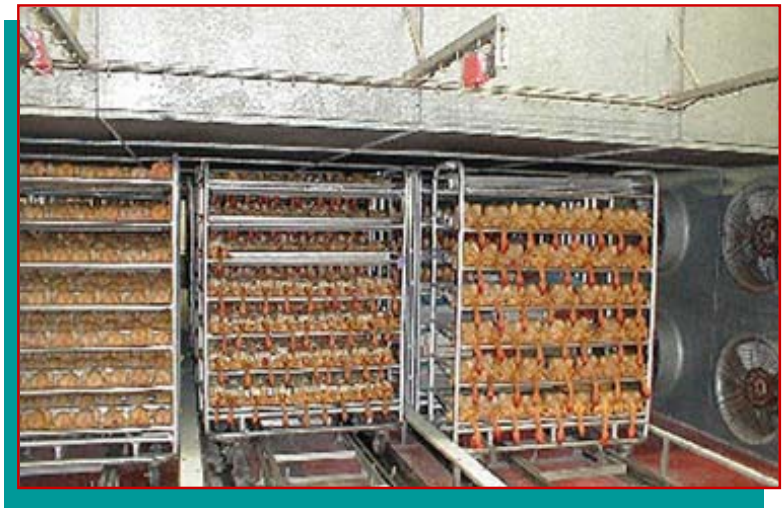
There is no water uptake with air chilling. In fact, there is water loss of 2–4%, and the outer skin is drier (7). Since air chill does not promote cold shortening as much as water does, a gradual temperature reduction is not as important. Birds encounter cold air in the first stage of entering the chiller (19 to 23° F). In the second stage, the air is warmer (25 to 30° F) (26).

There are currently only three air-chill poultry plants in the U.S.: MBA Poultry (Smart Chicken) (27) in Tecumseh, Nebraska, Maverick Ranch Natural Meats in Denver, Colorado, and Kadejan in Glenwood, Minnesota. Other plants are in the planning stages. In Canada, Mapleleaf Foods (28) has an air-chill plant.

Air-chill equipment is available from the following companies: Linco (29), Stork (30), and Meyn (31). The equipment is made in Holland and Denmark and shipped to the US. These companies can work with clients on the particular specifications desired, including size and scale. Shelly McKee (32) is a poultry-products scientist at Auburn University with expertise in air-chilling.

Chan Zuber at Pickwick/Zesco (11) can assist small processors who are interested in developing air-chill layouts with American equipment. Refrigerated rooms can be assembled from insulated panels, or used coolers can be bought from restaurant supply companies at reasonable prices. Pickwick-Zesco has a rack for air-chilling poultry that prevents the birds from dripping on each other.

Small poultry growers in the UK use 40-ft. refrigerated trucks for air-chill. The trucks must be fitted with racks, but they already have blowers. Some growers remove the wheels for a stationary set-up; others keep the trucks mobile. One producer reports keeping the temperature at 34° F and lowering the temperature of 500 chickens to 36° F in 3 hours. He does not spray water on the birds to increase humidity. A seasonal duck-processing facility in Arkansas bought a used 8′ x 18′ refrigerated truck for $3,000 and can run it for $175 per month in utility costs. Other types of refrigerated vehicles can also be used. For example, refrigerated containers for ocean transport hold potential for air-chill. Some are plug-in and some rely on diesel generators. TRS Containers (33) is a company that specializes in converting shipping containers to different uses.



Birds are air-chilled on racks in an insulated room with fans in France.

Cut-up, Deboning, and Further Processing

Yields

Average yields for poultry carcasses without the feathers, blood, and viscera:

- 75% for broilers with giblets
- 65% for broilers without giblets
- 78% turkeys with giblets (due to the larger neck)

Cut-up

On-farm processors generally sell carcasses whole—they do not offer cut-up. In a small plant, about 16 to 30% of the birds need to be cut-up because of bruises, broken bones in the picker, etc (23). U.S. customers are very accustomed to the convenience of cut-up poultry and parts. In the industry, about 70% of poultry is sold as parts or further processed. Boneless, skinless breasts are a particularly popular product, and dark meat is exported overseas. Large plants use automated equipment to cut-up, while small processors cut-up manually or use a saw.

Cut-up includes removal of the wings, legs, and front halves (breast). Whole legs and leg quarters can be cut into thighs and drumsticks. Common cut-up configurations consist of eight pieces (wings, breasts, thighs, drumsticks). The wings can also be cut into drumettes. The remaining racks are a by-product (e.g., soup stock, pet food, waste).

Deboning

Small plants that debone manually place the whole bird on a cone and cut off the wings, breast, and legs. Breasts and thighs are commonly deboned in large plants with automated equipment. Meat should not be deboned for at least 4 hours, since rigor mortis is occurring, and deboning early would toughen the meat. (See the *Aging* section below.)

A cone line in France for manual deboning.

Further processing

While the slaughter areas in large plants are kept at about 65–80°F, the temperature is 50°F or lower in further-processing areas. The cooler and the shipping dock are 34°F or lower.

"Further processing" includes not only cut-up and deboned, but also portioned, formed, cooked, cured, smoked, and brined products. Further processing seems like another world for most small processors today, but in the future it may be an important value-adding option for them. It's important to note that further processing requires government inspection.

Portioning and sizing are important in the conventional industry, since many restaurants only want to buy uniform portions of meat.

Formed products are made by reducing the particle size of the meat, adding ingredients for flavor or functionality, tumbling to increase penetration of brine, and forming with a stuffer or mold. Some products are also coated with breading and cooked. Formed products include the following:

- Whole (deli rolls and loafs); these have pieces that can still be recognized as meat.
- Comminuted (chicken nuggets, patties); the pieces of meat have been chopped and are smaller; breast meat or deboned meat and skin are used.
- Emulsified (hot dog, bologna, sausages); the pieces of meat are very small and, when mixed with fat and water, may not be recognizable as meat (7).

Curing and smoking are ancient ways of preserving meat that also contribute to flavor. Curing uses nitrites as a preservative. Smoking can be done without nitrites. Some small processors brine poultry. According to small processor Brandon Sussman,"while some salt and sugar is inevitably retained in the brining process, the reason for brining is to improve moisture retention and meat texture, not to 'enhance flavor'. I believe that there is a certain amount of blood stripping as well, though I try very hard to get a

good bleed out when killing." For home use, Sussman uses "1/4 cup Kosher salt + 1/4 cup white sugar to each quart of cold water…1 hour per pound up to 8 hours" (34). On-farm brining is usually done during chilling, but can also be done in the refrigerator. In kosher processing, the meat is salted to draw out all visible blood, because the Jewish dietary laws prohibit the eating of blood.

Aging

Tenderness is directly related to aging. Poultry meat needs to age for at least four hours before it is eaten or frozen, or it will be tough. This is because of rigor mortis—a temporary toughening—which is part of the process of muscle death, the natural biochemical process that converts the muscle to meat. Although the bird is dead, there is still energy in the muscle. The muscle cells continue metabolizing until this energy is used up, switching from aerobic metabolism to the less efficient anaerobic (without oxygen). Rigor mortis does not set in immediately after slaughter, but gradually as the muscles deplete their energy stores. "Cross bridges" form within the muscle structure, and the muscle cannot be extended. After a while, the muscle structure starts breaking down and the muscle becomes flexible again (1).

Rigor mortis is relatively brief in poultry; it is largely complete in 4 hours in chickens (6 to 8 hours in turkeys). Rigor is not *fully* complete for 24 hours, but tenderness only increases marginally after the initial 4 hours. According to Luke Elliott, "We normally advised people who bought birds on the day of processing to wait 24 hours before eating the bird" (23).

Rigor is dependent on temperature: at warmer temperatures, it occurs more quickly. However, carcass temperature must be kept low enough to prevent microbial growth.

Meat Quality Biochemistry

Meat quality is affected by any stress the bird experiences during catching, loading, transport, unloading, and immobilization before slaughter. After death, when energy metabolism switches from aerobic to anaerobic, lactic acid will accumulate in the muscle until the glycogen (stored energy) is depleted or the pH becomes too low for enzymes to work (1). Animals that were stressed before slaughter will have little glycogen in the muscles. The limited production of lactic acid and high ultimate pH that result make the meat dark, firm, and dry (1). On the other extreme, the pH can drop quickly and produce pale, soft, exudative meat.

Packaging

After the carcass is properly chilled, it is ready to be packed. Elliott recommends swift packing in a cool room once you take the birds off ice, to get them packed and into proper storage before they warm up.

On-farm processors usually don't have to refrigerate or deliver. They sell their birds fresh, immediately after slaughter, to customers who come to the farm to pick them up. They usually put the chicken in a plastic bag, close it with a twist-tie, and weigh the package. Labeling may be as simple as as marking the weight with a "Sharpie" marker on the outside of the bag. Consumers of fresh poultry must eat or freeze the birds within six days.

Bags are available from Koch (35), Freund Container (36), and Brower (3). Try asking for a sample of bags your first season, before buying in bulk.

Small processors also package in individual bags, but they usually shrink-wrap them. Dipping the bagged birds in hot water will cause the shrink-wrap to contract, removing the air. Cryovac Sealed Air Corporation (37) sells bags that shrink when exposed to heat. According to Elliott, "Minimum orders are 4,000 bags unless you ask for overstocks" (23). Another way to remove air is by vacuum.

Special bags shrink when dipped in hot water, removing air from the package.

A clip machine to close the bag costs about

$650 and speeds up packing. Kuhl Corp. (2) sells a smaller hand-held clipper. According to

Packages and plastic crates

Elliott, "Tipper Tie, a good packing machine that pulls a vacuum and drops a clip on the bag and cuts off the excess bag, can be purchased for around $5,000" (23). Expensive vacuum bagging machines can cost up to $60,000 and are not necessary for most small processors. The shelf life of vacuum-packed poultry is usually 5–12 days (1).

In addition to individual packaging, small processors also pack birds on ice in plastic crates that the customers return.

Dry tray packs—good for retail trade (in display cases)—may be an option for small processors. The bird is placed on a pad in a styrofoam

This scale prints a label with the weight

tray, which is wrapped with plastic film and heat-sealed. Brower Company sells a single-roll tray-wrap machine. However, this type of packaging is not suitable for freezing (23).

Scales that print out a label when the package is weighed are available from companies like Berkel Co. (38). Get labels designed for cooler and freezer use so they won't fall off.

In large plants, meat is packaged in dry tray packs or bulk ice packs. Birds are usually sold fresh.

- *Dry tray packs*: The meat is packed on overwrapped trays. Only the top quarter inch of meat is frozen ("crust frozen") to help insulate the product. Shelf life is 21 days (when stored at 28° F).
- *Bulk ice packs*: Meat that is destined for wholesale and restaurants is packed in boxes of 40 and 70 pounds with ice on top. There are drainage holes in the boxes. The shelf life is 7 days (when stored at less than 39° F). Modified atmosphere packaging (MAP) may be used in large plants to increase shelf life. Bulk packaging may use CO_2 snow to increase shelf life to 14–21 days and eliminate the nuisance of water dripping. However, CO_2 can be a hazard to work with. Other gases such as N_2 and O_2 are used with a vaccum and back flush to increase shelf life up to 28 days (stored at 28-32 F) (7).

Storage

Product being held on racks in a small plant's cooler.

On-farm processors store the carcasses for their customers in refrigerators or freezers. If storage is limited, it is best not to slaughter too many birds at a time. Loading birds that have not chilled to 40° F in your refrigerator or freezer may drive up the temperature and allow microbes to grow on the carcass. One option is to rent freezer space at another location.

Freezing

Although U.S. consumers are accustomed to buying poultry fresh—80% of poultry is sold fresh (5)—freezing will extend the shelf life. Meat does not freeze until it gets below 28° F because of its salt content, which suppresses the freezing point. Poultry meat kept above 26° F can still be marketed as fresh (5).

Frozen poultry will stay flavorful for about 6 months, but after that it may become rancid. Don't store poultry for more than 12 months (1). Freezing does not kill all the microbes; some will survive and grow after thawing.

Storage recommendations:

- At 10° F, limit storage to 2 months.
- At -0.4° F, limit storage to 4 months.
- At -11° F, limit storage to 8 months.
- At -22° F, limit storage to 10 months (1).

The rate of freezing affects the meat:

- Slow freezing (3–72 hours) results in large ice crystals, which damage cells and membranes. Upon thaw, there is more drip loss.
- Fast freezing, which lowers temperature to -22° F in 30 minutes, results in small crystals (1).

Methods of freezing poultry include:

- *Still air* is a slow method used by home freezers.
- *Blast freezing* uses cold air circulated by fans for rapid air movement. The industry uses blast freezing to form a frozen crust on a product to insulate it.
- *Liquid immersion* or spray: the product is immersed in a freezing liquid (1).

The packaging material used for frozen meat should be strong, because the meat will dehydrate and get freezer burn if exposed to cold air (1). Some bags are made for cooler use and some for freezer use. One on-farm processor recommends a bag of at least .002 mil thickness (39). The material should be moisture-proof and stretchable so that it will cling to the meat (1). If meat will be frozen for a long time, it is better to vacuum-pack it. This removes the insulating air, makes a skintight package, and prevents water evaporation and ice formation inside. Removing the oxygen also helps reduce oxidation and rancidity (1).

Bone darkening is sometimes seen in young chickens after freezing. "This shows as a dark/bloody appearance of the tips of the bones and muscle areas close to bone. Myoglobin squeezed out from the bone marrow, through the relatively porous bone structure of young chicken, during the freezing process causes this" (1). It is usually seen around the leg, thigh, and wing bones, and is unappealing to consumers (1).

Delivery and Distribution

For on-farm processing, there is usually no delivery: customers come to the farm. However, some producers deliver to farmers' markets or other places in iced coolers. Small plants may have a refrigerated truck or trailer.

Clean-up

On-farm processors usually clean with water hoses, using hot water and soap, followed by a water rinse and a sanitizing rinse. Small and large plants clean with pressure washers. When processing under inspection, written sanitation procedures are required.

Waste Management

Waste from processing includes offal, feathers, and blood. On-farm processors usually compost their waste. ATTRA's *Farm-Scale Composting* publication provides a list of information resources and suppliers.

Small plants usually pay rendering companies to pick up barrels of waste, often at a flat rate (the same price whether they pick up one barrel or several). Because of the high expense, some processors are considering switching to large-scale composting or to incineration.

Small processors are also exploring ways to market the waste as natural pet food, raw or cooked. There are websites such as <http://www.willowglen.com/barf.htm> that describe feeding dogs "Bones And Raw Food" (BARF). Large plants usually render wastes, turning them into a by-product such as pet food or meat- and bonemeal for livestock or fish.

Wastewater

A lot of water is used in processing, especially for scalding, washing carcasses, chilling, and clean up. Large plants use about eight gallons per bird. The wastewater "cannot simply be discharged into lakes and rivers because of the relatively high content of organic matter such as protein and fat and the microorganisms present" (1).

On-farm processors often apply the wastewater to a garden. Small-plant processors may discharge into a municipal sewage system, but a municipality can charge high fees for treating water with a lot of organic matter. Some initial treatment at the plant will lower this cost. In fact, most large plants—and some small ones—have extensive water-treatment facilities. At large plants, water and its associated treatment as waste costs $5.00 per 1,000 gallons (5).

Methods for measuring the contents of wastewater include:

- *Biochemical oxygen demand (BOD)* measures the amount of oxygen consumed by microbes as they digest organics in wastewater. This measurement requires five days to complete. If wastewater entering a river or lake had a high BOD, microbes would rapidly deplete the oxygen, and fish and other aquatic life would not have enough oxygen to live.
- *Chemical oxygen demand (COD)* is a similar test that takes only a few hours.
- *Suspended solids (SS)* measures nonfilterable residue, like fats and fine solids.
- *FOG: Fat, oil, and grease content* is determined by extracting the FOG from wastewater with an organic solvent (5).

There are standard lab procedures for making these wastewater measurements.

How dirty is the wastewater in a small plant? The chart below indicates the amount of BOD and SS typical for plants in 1962—a time when there were still many small plants. Two important questions should be considered.

- *Is the blood recovered?* Blood has high pollution potential (15 lbs BOD per 1,000 birds) (40). Therefore, most plants try to recover or catch as much blood as possible, so it does not become part of the wastewater.
- *Does the plant have a flow-away system?* Flow-away systems use large amounts of water to remove feathers or offal.

The access to an underground fat trap in a small plant.

Wastewater Treatment

Treating wastewater starts with screening out big chunks and ends with the breakdown of dissolved organic matter by microorganisms. Treatment methods must be able to handle fluctuations in waste load, which can vary depending on what is occurring in the plant (e.g., slaughter, clean-up, or downtime). Treatment also takes into consideration the use of cleaning agents in the plant.

Preliminary treatment removes large particles by screening.

Primary treatment removes small particles suspended in the water. Fats and fine solids are removed by means of fat traps or dissolved air flotation.

- *Fat traps* work on the principle of gravity separation in a flow-through tank. Heavy solids (dirt, crop content) settle out on the bottom, while fat and fine solids rise to the surface. A moving belt with paddles scrapes the solids off the bottom, moving them to a collection area.

Table 3. Processing Plant Waste Loads per 1000 Chickens

Type of Plant	Wastewater in gallons	BOD, lbs	Suspended solids, lbs
Flow-away	7000		
With blood recovery		25	13
All blood wasted		41	23
Non-flow-away	4500		
With blood recovery		23	12
All blood wasted		35	21

As cited in Tanner, James Jerrel. 1970. A Wastewater Characterization of the Poultry Processing Industry. Master's thesis, University of Arkansas. p. 20.

The solids are then removed by pump. Floating material is skimmed off the top with a continuous-skimming device (1).

- *Dissolved air flotation* uses microbubbles to speed the rise of lightweight particles to the surface—the bubbles attach themselves to the suspended material and lift it. Chemicals can be added to make the process more efficient.

BOD is reduced by 30% in primary treatment. Energy costs are low since gravity and flotation do much of the work (1).

After primary treatment, the wastewater is either discharged onto land ("land treatment") or given secondary treatment. Land treatment requires large tracts of land, but has several advantages: both plant nutrients and water are recycled, surplus nutrients can be removed by crops, and the methods used—irrigation, overland flow, and high-rate percolation—are relatively inexpensive to install and operate. Land treatment may not be an option near urban areas because of odor and drift (40).

Secondary treatment puts biology to work—microorganisms break down the organic matter suspended in the water. The result is the growth of microorganisms and production of gases such as carbon dioxide. Biological treatment is used because it is easier and cheaper to filter out the microorganisms than the suspended organic matter (1). Biological treatment can be aerobic or anaerobic.

- *Aerobic lagoons* rely on microorganisms that use oxygen, so these lagoons use mechanical aerators to help keep oxygen in the water. The lagoons are usually 10 ft deep. The total BOD reduction is 70–90%. The solid sludge can later be removed in a polishing pond.
- *Anaerobic lagoons* do not use oxygen. Fermentation produces methane and carbon dioxide (as in a cow's rumen). Anaerobic lagoons cost less because mechanical aerators are not required. BOD is reduced by 60 to 80% in 1 to 3 weeks (when temperature is greater than 72° F).

Another form of biological treatment is a "trickling filter." Wastewater is aerated as it passes over a large surface area (rocks or other materials).

Tertiary treatment removes odors and color from the water. Sand and coal filters are commonly used.

Disinfection, using chlorine and hydrogen peroxide to kill pathogens, is the last stage of treatment. The wastewater is then discharged, either into a stream or sewer or onto land.

Sludge from biological treatment is most often buried at landfills, spread on land, or dried and incinerated (40). It can also be composted (1).

When planning waste management, it is critical to be aware of federal, state and county regulations regarding waste disposal.

Equipment and Supplies

Since birds are small, processing them doesn't require a saw, track, or other heavy-duty equipment needed for slaughtering larger animals. Equipment used by on-farm processors includes poultry crates, killing cones, scalder, thermometer, picker, stainless steel eviscerating tables or shackles, and a chill tank. Plastics, including the water hoses, should be food-grade. Many sources of this equipment have already been discussed.

Large-scale plants use costly automated equipment that is highly specialized. Industry magazines list equipment suppliers. An Internet search for poultry processing equipment will also yield suppliers and prices. Information on used equipment is available at the Equipment Exchange Company of America, Inc. (41). An excellent opportunity to view automated equipment is at the annual International Poultry Exhibition in Atlanta; information is available through the U.S. Poultry and Egg Association (42).

Small equipment and supplies include sanitizers, brushes, soap, paper towels, buckets, pans, brooms, mops, knives, pinning knives, lung puller, ice, scales, bags, staples, clips, plastic gloves, metal mesh gloves, hair nets, aprons, rubber boots, etc. Koch Supplies (35) sells many of these items.

On-farm processor Karen Black in Oregon has this to say about knives:

I use a Heinkel paring knife (about 2" long

with a reverse curve) for killing, and a 3" knife for eviscerating. I really like the Heinkel's because they are stainless, hold an edge well, and have a good grip that doesn't slip in my wet hand. They are pretty expensive, and I'm sure there are less-expensive knives that do a fine job.

I also bought a Chef's Choice electric sharpener, and now all my work knives are kept sharp (a steel at my worktable keeps the edge honed while I work). It's gotten to the point where I can feel when the knife needs a little steeling.

Here's a website that has a lot of useful information about sharpening knives: http://www.ameritech.net/users/knives/index.htm (43).

Processing Diverse Species

Because they slaughter manually, on-farm and small-plant processors can handle a wide variety of poultry. In addition to broilers, they may process large roasters and stew hens and small Cornish game hens, or other poultry species, such as turkeys, ducks, geese, quail, squab, guineafowl, and pheasant. In contrast, large plants cannot handle much diversity because their automated equipment fits one size only. Large plants may have two separate lines: for example, large birds (6.5 lbs) for further processing and small (3.4 lb) birds for fast-food restaurants.

Turkeys vary widely in size, from small hens weighing 17 lbs. to big toms weighing over 40 lbs. The range in weight is so great that turkey processing is usually not automated, even in large plants. Turkeys are also very heavy, an important consideration for manual slaughter, especially if you do not have an overhead track. Feathers and crops are harder to remove, and more ice is required.

Plants may process a diversity of species in France.

Processing plants in France that participate in the *Label Rouge* program may process a number of types of products. For example, *Fermier Landes* processes chicken, guineafowl, squab, cockrels, and rabbits, as well as capons and turkeys for Christmas. The birds are processed in different ways: ready-to-cook, *efilee*, or feet and head left on. *Efilee* is a specialty dressing; the bird is eviscerated but the crop is left in. The feet and heads are often left on the carcasses of specialty poultry so that customers can verify the color of the shanks and feathers. Even though *Fermier Landes* is a large plant, they put together small orders and do custom processing.

Multispecies processing

In Kansas, Diana Endicott (44) processes beef, pork, and poultry in the same plant. She says it can be difficult to "cash-flow" a plant on poultry alone. Endicott keeps the products separate by processing on different days and using separate equipment, aprons, etc. Rabbits and specialty poultry are sometimes processed in the same plant. Keep in mind that regulators in your state may not allow—or may just be unfamiliar with—multispecies processing.

Batch vs. Continuous Processing

Birds are processed in batches during manual processing on the farm and at small plants. Processors usually do one activity at a time. For example, all the birds may be killed, eviscerated, and chilled during the first hours of operation, and packaged during the last hours. Workers usually perform a variety of duties. On the other hand, large plants use automated, in-line equipment for continuous processing, killing birds throughout the day. Workers usually perform

only one duty over and over.

Processing Rate

The rate of processing depends on the workers, the equipment, and the set-up. The workers' level of proficiency is especially important. Eviscerating is usually the most time-consuming part of manual processing, but an experienced worker can eviscerate two birds per minute. Manual cut-up and deboning requires skilled labor.

The type of equipment you buy depends on your chore cycle: whether you process a few birds often or a lot of birds infrequently. However, if the scalder is too small, it will cause a bottleneck down the line.

There are other limiting factors. If your overhead track is not motorized, the speed at which the plant operates will be no more than the speed of the slowest person. Is your cooler or freezer large enough to allow you to process daily? Can you empty it daily? Set-up is discussed in the next section.

Typical processing rates:

- Working alone with minimal equipment: 6 birds per person per hour.
- Using equipment that handles at least 4 birds at a time: 15 birds per person per hour.

Good layout, design, and standard operating procedures in a small plant can improve efficiency.

Tip: The rates for equipment are sometimes given in terms of eviscerating speed. When evaluating processing rates, find out what the estimate includes. Is it for evisceration only, "kill-to-chill," or does it also include set-up, packing, storing, clean up, and paperwork time? The numbers above include all of these.

When processing turkeys on-farm, Marcey Nameth found that although the evisceration time was comparable to that for chickens, "everything else was slower." Her scalding and picking equipment could handle 12 to 16 broilers in one batch but only two turkeys. She could process only one-third the number of turkeys compared to broilers. "I found turkeys to be exhausting work. At least this year I wasn't shredded by their feet—last year my shirts were torn to pieces."

Processing poultry can be hard work. Robert Plamondon has this to say about on-farm processing: "Exhaustion at the end of a processing day is not a sign of commitment and a good work ethic; it's a symptom of bad management. Heroic efforts aren't called for except in a crisis. Processing day shouldn't be a crisis – it should be something to look forward to (45)."

A typical on-farm processing setup.

Processing Setup

Processing can be done on-farm, at a live market in a city, in a mobile processing unit, or in a processing plant.

On-farm Setup

On-farm processors usually work outdoors, under a tree or in a shed. They use existing outbuildings or build a dedicated area, often just a concrete pad with a shed roof. These are generally not enclosed areas and are rarely screened to keep out insects.

An on-farm processing setup usually includes a combination of new, used, and homemade equipment. Costs range from $100 to $500 for minimal equipment up to $4000 for a specialty line such as the one offered by Brower for

An on-farm setup with a concrete pad and shed roof.

pastured poultry production. According to Tim Shell, "A 100 bird/hour scalder can be built for less than $100. A two-bird picker is less than $1000, used stainless steel tables and chill vats are cheap at second hand restaurant supply dumps. You can get set up very well in processing for $2000 if you already have the shed on the farm to process in (46)." Crews are anywhere from one to six people.

Upgrading equipment is a common strategy for on-farm processors. Many start out with minimal equipment, sell it, and buy a better set of equipment. It is usually not difficult to resell used equipment.

A typical mobile processing unit for poultry.

On-farm facilities have limitations. The facility lies unused for several months of the year, since it is too cold in winter to process outdoors. Also, it is not legal in some states to sell meat from on-farm facilities.

Live Market Setup

At live markets in larger cities, birds are sold live to consumers, usually from ethnic groups. After a customer chooses a bird, it is processed at an on-site facility, usually state-licensed. These facilities generally process only about 50 birds per day. The customer has the option of taking home the head, feet, and blood along with the carcass.

Mobile Processing Unit (MPU) Setup

MPUs are a way for producers to work cooperatively, sharing equipment and labor, with portable equipment mounted on a trailer. MPUs have typically been used with game animals or tribal processing of large animals, but interest is growing for poultry MPUs. Most MPUs for poultry cost $7,000 to $12,000 to outfit, and the capacity is about 400 birds per day.

Examples of active MPU groups include:

- The Northeast Pastured Poultry Association MPU (48) was built with help from the nonprofit Heifer International.
- The Nebraska Pastured Poultry IMPACT group (47) has a 15-minute video.
- The South-Central NY RC&D's MPU is photographed and described at http://www.ibiblio.org/farming-connection/grazing/pastpoul/resource.htm; the lay-out is in Appendix A. Contact Jim McLaughlin (49) for details.

The MPUs listed below have government licensing—something few have, since meat inspection authorities are not accustomed to them.

- Tom Neuberger (18) has a federally exempt MPU in South Dakota, an 8' x 48' refrigerated truck that cost $25,000 to outfit.
- The Wagbo Peace Center (50) in Michigan has a state-licensed MPU that serves 12 families.
- The Island Grown Farmer Cooperative (51) in Lopez Island, Washington, has broken new ground with a red meat MPU that is federally inspected.
- Terry Swaggerty's collaborative group in Washington (52) has a grant to build a licensed poultry MPU.

Kentucky MPU Case Study

The nonprofit organization Heifer International, along with Partners for Family Farms and the Kentucky Department of Agriculture, built an MPU in Kentucky and has served as a guide for others. The MPU is a federally exempt facility that is licensed by Kentucky's Cabinet for Health Services and cost about $70,000 to build. It is an enclosed gooseneck trailer 20' long and 8' wide that can be pulled with a half-ton truck. The trailer has a collapsible canopy that extends on one side to make a screened area for killing, scalding, and picking. The carcass is then passed inside the trailer through a small door for evisceration.

Continued on page 22

Continued from page 21

The trailer is air-conditioned inside and has hot and cold water. It has a capacity of 500 birds per day.

The Kentucky MPU can only be used at approved docking stations with a level pad to park the unit and another concrete pad that is sloped to drain for the slaughter area. Appropriate electrical, water, and propane hookups are required. Electrical requirements are a 200 amp service panel that is either waterproof or covered. Water must be from an approved municipal source or a tested well, and flow rate must be at least 10 gallons per minute. The setup also requires a 750-gallon grease trap and a 1500-gallon septic tank for wastewater. The wastewater holding tank must have a float sensor with an alarm or light as a fill indicator, and the water must be pumped out and hauled to an approved wastewater treatment plant. The MPU user must bring a 100-lb. propane cylinder to provide heat for the scalder. MPU users take the feathers and offal back to their farms for composting.

The Kentucky MPU's outside kill area is screened; birds are eviscerated inside.

The MPU has a rental fee and user agreement. Producers wanting to use it must be trained as facility managers. A manual provides instructions for use and plans for sanitation and avoiding the introduction of contaminants into the food. This MPU takes a lot of work to set up and take down. See Appendix B for the layout of the Kentucky MPU. Steve Muntz and Jeff Dombroskas of Heifer International (53) are contacts.

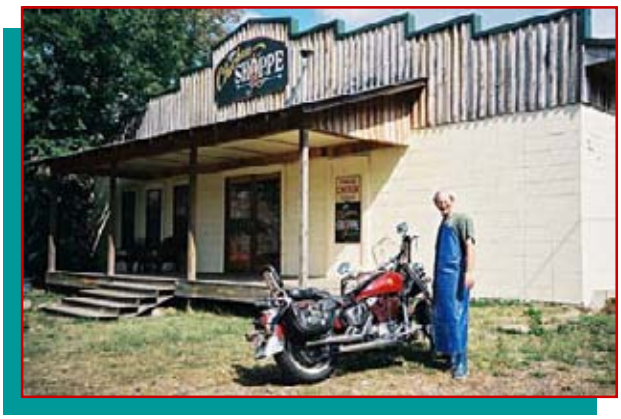
Small Plant Setup

Small plants are generally specialized buildings; however, some small plants are former dairy parlors or other renovated buildings.

Pickwick/Zesco Co. (11) can send you a booklet called *Planning the Small Poultry Processing Operation* that includes equipment plans for four different volumes (50 birds/day, 50 to 200 birds/hour, 200 to 500 birds/hour, and 500 to 1200 birds/hour). This guide is also available at the following website: <http://www.zesco-inc.com>. Brower Co. (3) can send you plans for processing 400 birds/hour, 600 birds/hour, and 1200 birds/hour; available at <http://www.browerequip.com>.

Small Plant Case Study: Luke Elliott

Luke Elliott's (23) USDA–inspected plant was designed to handle 500 birds per day. The 2,500-square foot plant cost about $80,000, using an existing building shell that required concrete to be poured for the floor and all internal walls and ceilings to be finished. If he had built it from the ground up, it would have cost $120,000. His equipment cost about $45,000 (new) and was rated for 150 birds per hour, but he actually processed less than that during the course of the day. In batch processing, you need to finish the kill operations in the morning to allow sufficient time for chilling, packing, labeling, preparing for shipment, cleaning up, and doing paperwork later in the day. With a crew of four, Elliott's plant



Luke Elliott owned and operated a small USDA plant in Arkansas.

processed 18 birds per person per hour.

The USDA inspection process was time-consuming. Under bird-by-bird federal inspection, Elliott could process only 200 birds per day. Because of pre-operation inspection, he couldn't start killing before 9 a.m. The inspection process reduced line speed. Also, his overhead track was not motorized—"motorizing is a key factor to increase the production capacity (23)."

Plants should have separate rooms for killing and evisceration to help prevent the edible product from being contaminated by raw or inedible products.

Small Plant Layout and Construction

Plants are designed for efficiency, sanitation, and adequate work space. For an outline of work areas and design considerations for small plants, see Appendix C. A sample floor plan is also included.

The USDA used to print construction guidelines for plants intending to operate under inspection. However, the USDA no longer makes prior approval decisions. It now relies on the company, through the company's Hazard Analysis Critical Control Point (HACCP) plan, to produce a product under sanitary conditions. The last guidebook was *U.S. Inspected Meat and Poultry Plants: A Guide to Construction and Layout* (54) from 1984. It applies to large and small plants processing red meat or poultry.

The Virginia Department of Agriculture and Consumer Services (55) offers the *Establishment Design and Construction Guidebook*, also available on-line at their website. The publication was drawn from USDA information and is an excellent resource for those planning a plant.

Large Plant Setup

Large, automated plants usually cost about $25 million and can process one million broilers per week. Industry uses three line speeds (SIS—70 birds/min, NELS—91 birds/min, and High-speed—140 birds/min or 8400 birds per hour). Turkey plants are manual and process about 42 birds per minute with a very large crew. If you want to see what processing looks like at a large plant, you may be able to arrange a visit or at least buy slides for viewing. Layouts of large plants are available in textbooks.

Economics

Refer to *Growing Your Range Poultry Business: An Entrepreneur's Toolbox* for budgets for processing on the farm, in an MPU, and in a small plant.

It costs at least $1.50 to process a bird in a small plant. It only costs large processors about $0.30 per bird for processing, because of increased mechanization, greater scale economies, better use of capacity, and more efficient transportation and distribution.

Resources

Most small processors recommend learning from an experienced processor. See ATTRA's *Internships and Apprenticeships* for a listing of farmers seeking interns; some of the farmers process poultry. Experienced small processors like Luke Elliott (23) and Aaron Silverman (6) offer consulting services for a fee.

Books on backyard poultry production describe the on-farm butchering process, especially the evisceration. *Pastured Poultry Profits* (56), by Virginia poultry producer Joel Salatin, includes photographs that show how to eviscerate. Salatin's video is also useful for learning to eviscerate by hand.

Some Extension materials that offer how-to information for on-farm slaughter include:

- *Home Processing of Poultry*, available from the University of Minnesota Extension Service (57) <http://www.extension.umn.edu/distribution/livestocksystems/DI0701.html>.
- *Home Processing of Chickens*, available from the University of Nebraska Extension Service (58) <http://www.ianr.unl.edu/pubs/foods/

heg144.htm>.

- *Food*A*Syst: A Food Safety Risk Management Guide for the Producer*, with good sections on processing setup and procedures, delivery and storage, and disposal of waste, is available from Kansas State Extension Service (59) <http://www.oznet.ksu.edu/library/fntr2/foodasyst/foodasysbook.pdf>.

Information on low-volume processing on a small commercial scale is hard to find. A dissertation titled *Economics of Establishing a Low-Volume Poultry Processing Plant* (60), written by a Michigan State student, examines four plants: with capacities of 200, 350, 500, and 1200 birds per hour.

Books about processing in large plants offer useful cross-over information:

- *Poultry Meat Processing* (5), by Alan R. Sams
- *Poultry Products Technology* (61), by George J. Mountney and Carmen R. Parkhurst
- *Processing of Poultry* (62), by G.C. Mead
- *Poultry Processing Systems* (1), by Shari Barbut

In the past, the American Association of Meat Processors (63) membership included many small poultry processors. As the number of small poultry plants grows, trade associations can help further their interests. The American Pastured Poultry Producers Association (APPPA) (17) is one such networking resource.

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P.O.Box 26
Flemington, NJ 08822
908-782-5696
908-782-2751 Fax
http://www.kuhlcorp.com

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P.O. Box 2000
Houghton, IA 52631
319-469-4141
http://www.browerequip.com

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Creative Growers
88741 Torrence Rd.
Noti, OR 97461
541-935-7952
E-mail: cgrowers@epud.net

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P.O. Box 4583
Lincoln, NE 68504
402-467-5221
402- 465-1220 Fax
http://www.snydernet.com

11) Pickwick/Zesco
Chan Zuber, General Manager
7887 Fuller Road #116
Eden Prairie, MN 55344
952-906-3333
952-906-3335
E-mail: Chan@zesco-inc.com
http://www.zesco-inc.com

12) Ashley Company
P.O. Box 2
Greensburg, IN 47240
812-663-2180

13) Jako, Inc.
Kenneth King

6003 E. Eales Rd.
Hutchinson, KS 67501
316-663-1470
E-mail: poultry@jakoinc.com
http://www.jakoinc.com

14) Eli M. Reiff
Poultry Man
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Mifflinburg, PA 17844
570-966-0769

15) David Schafer
56 SW 52nd Ave.
Trenton, MO 64683
660-359-6545
E-mail: dna76@juno.com
dna76@grm.net

16) R and R Pluckers
Rob Bauman
RD 1
Oxford, NY 13830
607-843-7415

17) American Pastured Poultry Producers Association
PO Box 1024
Chippewa Falls, WI 54729
715-577-5966 (cell)
Contact: Jody Padgham
E-mail: Grit@apppa.org
http://www.apppa.org
Membership is $20 per year and includes quarterly newsletter Grit.

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South Dakota Poultry Headquarters
Rt. 1, Box 303
Canistota, SD 57012
605-296-3314

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Back Forty Books
Natures Pace Sanctuary
Hartshorn, MO 65479
573-858-3559
$39.50 (plus $4.50 s/h)
E-mail: Herm.NaturesPace@EarthLink.net
http://www.back40books.com http://www.free-rangepoultry.com

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Herrick Kimball
Tradesman Publications
P.O. Box 1117
Moravia, NY 13118
315-497-9618
$19.95
E-mail: Hckimball@baldcom.net

21) Stromberg's
P.O. Box 400
Pine River, MN 56474
218-587-2222
http://www.strombergschickens.com/products/processing.htm

22) Paul Helbert
12558 North Valley Pike
Tenth Legion, VA 22815
540-896-7107
http://home.rica.net/phelbert/chickens.html

23) Luke Elliott
P.O. Box 76
Fox, AR 72051
870-746-4604
Lelliott@mvtel.net

24) A-1 Refrigeration Company
11212 Wright Road
Lynwood, CA 90262
323-979-2244
310-639-9910
310-604-1596 Fax
800-669-4423 outside California
http://www.A1flakeice.com

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333 South Third Street
P.O. Box 257
Tecumseh, NE 68450
402-335-2501
402-335-2502 Fax
http://www.smartchicken.com

28) Maple Leaf Foods Inc.
30 St. Clair Avenue West, Suite 1500

Toronto, Ontario
Canada M4V 3A2
http://www.mapleleaf.com

29) Linco USA, Inc.
6245 Shiloh Road, Suite A
Alpharetta, GA 30005-8348
770-844-8000
E-mail: lincousa@mindspring.com
Contact: Tom Tieleman
120 Park Ave.
Seaford, DE 19973-9479
302-628-9150
404-915-5732 (mobile)

30) Stork Gamco Inc.
Airport Parkway
P.O. Box 1258
Gainesville, GA 30503
770-532-7041
770-532-5672 Fax
Contact: Felipe Herrera
E-mail: f.herrera@gamco.storkgroup.com

31) Meyn Food Processing Technology B.V.
P.O. Box 16
1510 AA Oostzaan
The Netherlands
31 (0) 75-6843355
31 (0) 75-6844150 Fax
http://www.meyn.nl

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33) TRS Containers
P.O. BOX 188
Avenel, NJ 07001-0188
732-636-3300
732-750-1642 Fax
http://www.trscontainers.com
http://shippingcontainers.com/cstmized.htm
E-mail: TRScontainers@worldnet.att.net

34) Brandon Sussman
1482 Pleasant St.
Webster, NH 03303-7613
603-648-2595
E-mail: http://WebsterRidge.com/email.shtml
http://www.websterridge.com/recipes/brining.html

35) Koch Supplies
1411 West 29th St.
Kansas City, MO 64108
800-777-5624
816-561-9783 Fax
http://www.kochequipment.com

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155 West 84th Street
Chicago, IL 60620
800-363-9822
773-224-8812 Fax
http://www.freundcan.com

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Building A
Rogers Bridge Road
Duncan, SC 29334
Contact: Don Smith
800-845-7551 ext. 2969
800-662-9335
http://www.cryovac.com

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4406 Technology Drive
South Bend, IN 46628
800-348-0251
888-888-2838 Fax

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10042 Keystone Dr.
Lake City, PA 16423
814-774-0888
814-774-0880 Fax
E-mail: info@eeclink.com
http://eeclink.com

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1530 Cooledge Road
Tucker, GA 30084-7303
770-493-9401
770-493-9257 Fax
http://www.poultryegg.org

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Rt. 1, Box 117
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IMPACT
402-462-9424
$22.50 for a 15-minute video

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c/o Hudson-Mohawk RC&D Council, Inc.
1024 Route 66
Ghent, NY 12075
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49) Jim McLaughlin
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607-334-2833
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http://www.cornerstone-farm.com
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5745 N. M-66
East Jordan, MI 49727
616-536-0333
Contact: Rick Meisterheim

51) Island Grown Farmers Cooperative
c/o Lopez Community Land Trust
360-468-3723
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52) Terry Swagerty
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53) Steve Muntz, Heifer International Appalachia Program Manager
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800-359-9581
E-mail: steve.muntz@heifer.org
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U.S. Government Printing Office
Washington, DC 20402
866-512-1800 (toll free)
202-512-1800
202-512-2250 Fax

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Office of Meat and Poultry Services
1100 Bank St., Suite 614
Richmond, VA 23219
804-786-4569
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Order from:
The Stockman Grass Farmer
P.O. Box 2300
Ridgeland, MS 39158-2300
800-748-9808
Book $30 plus $4.50 s/h
Video $50

57) University of Minnesota Extension Service
Office of the Director
240 Coffey Hall
1420 Eckles Ave.
St. Paul, MN 55108-6068
612-624-1222
800-876-8636 (to order publications by credit card)

58) Extension Publications
IANR Communications & Information Technology
Box 830918
Lincoln, NE 68583-0918
402-472-9712 (warehouse)
402-472-0542 Fax
Home Processing of Chicken

59) Production Services
Kansas State University
24 Umberger Hall
Manhattan, KS 66506-3402
785-532-5830 (10 or fewer titles)
785-532-7938 Fax

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P.O. Box 269
Elizabethtown, PA 17022
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717-367-9096 Fax
http://www.aamp.com
E-mail: info@aamp.com

Appendices:

Appendix A: South Central New York RC&D MPU Layout

Appendix B: Kentucky MPU Layout

Appendix C: Small Plant Work Areas and Design

By Anne Fanatico
NCAT Agriculture Specialist

Edited by Luke Elliott, Lance Gegner, and Richard Earles
Formatted by Gail M. Hardy

May 2003

Appendix A. South Central New York RC&D MPU Layout

PASTURED POULTRY MOBILE PROCESSING UNIT (MPU)

South Central New York Resource Conservation and Development Project has been involved with the startup and expansion of Pastured Poultry Production in central New York since 1994. Through the SOCNY RC&D Office in Norwich, NY, funds were garnered to build a Pastured Poultry Mobile Processing Unit (MPU). The MPU was designed and built by SOCNY RC&CD staff to help demonstrate how to reduce off farm expenses incurred in the raising and processing of pastured poultry on the farm. This MPU allows small producers and those interested in raising pastured poultry access to the equipment necessary to undertake on-farm processing. The unit is available for a rental fee based on the number of birds processed and the distance traveled to deliver it.

One of the important aspects of raising pastured poultry in a financially successful manner is to maintain low off-farm inputs. There are certain inputs that must be purchased off farm such as feed, and various manufactured items (i.e. poultry wire). However there are many on-farm resources that can be utilized other than grass (i.e. rough cut lumber, aluminum cage roofing, etc.). Pastured Poultry is a sustainable agriculture practice in that it returns to the land: fertilizer in the form of nitrogen; compost from the brooder bedding, and compost from the offal derived from the slaughtering process. A key component for successful economic return is to do all processing on the farm. The current rate for processing poultry in a New York State licensed facility is between $1.00 and $1.75 per bird. The average number of birds a couple can process on the farm with the correct equipment is 20 birds per hour; this equates to a $27.50/hour wage for home processed birds. In addition, the producer has the compost available for returning organic matter to the soil.

The MPU consists of 5 poultry crates for containing live birds; 5 poultry kill cones to ensure correct bleeding; a scalder (capable of doing 4 birds at a time); a 3-4 bird barrel type feather picker; stainless steel table, processed bird chill tanks, knives and scales. A 20-foot long tarp is included to provide shade and protection from the elements. There are also hookups for 110 volt electricity and water. The 25-foot long unit can be towed to the desired location with a ½ ton pickup truck.

Approximate construction cost for the MPU was $3000 not including 70 hours of labor. The initial idea was to use a camper trailer keeping the shell intact. The interior was to be gutted and the processing components mounted inside. It was hoped that leaving the shell intact would allow for processing in any weather condition. However, several problems arose as construction began. The first concern was that it would become too hot inside the trailer, as the scalder unit is propane fired and has to maintain a temperature of 145-150° F. The second problem arose when gutting the trailer. It soon became apparent that the floor and structural integrity left much to be desired. Other concerns were the problem of maintaining a sanitary environment and the necessary maneuverability due to the physical layout and size of the trailer. As a result, it was decided that it would be better to completely strip the trailer down to the frame. Expanded metal was then welded to the frame and additional angle iron for reinforcement was added. The various processing components were then attached, which allows the unit to be put into operation with minimal assembly. This design allows for more space and an open, comfortable work environment.

The purpose of the MPU is to allow new producers the opportunity of processing poultry on their farm without having to purchase the equipment themselves. Purchasing processing equipment can cost several thousand dollars. The MPU is not intended to be used by producers year after year, but on a trial basis to help to meet the initial need. Currently the SOCNY RC&D Office is underwriting the cost of maintaining the equipment.

Grant moneys provided by Heifer Project International, and the USDA-NRCS GRAZE NY Program, allowed this project to be completed. The Pastured Poultry Initiative is made possible through the support of Heifer Project International, which assists rural families in the United States, Canada and Countries throughout the world. For more information on the MPU, Heifer Project International, or GRAZE NY, contact the SoCNY RC&D office at 607-334-3231 Ext. 4 or 99 North Broad St., Norwich, NY 138125. E-mail: socnyrcd@norwich.net.

Appendix A continued on page 30

PASTURED POULTRY MOBILE PROCESSING UNIT
Fact Sheet

The Mobile Processing Unit (MPU) was conceived and designed for the on-farm processing of pastured poultry. It is intended to assist first year poultry producers with processing, helping producers learn safe and sanitary procedures. The MPU is not intended to be used by individual producers year after year, but as a trial to help producers start up their businesses.

The MPU is capable of processing up to 40 birds and hour with experienced help. It consists of poultry crates for containing live birds, poultry kill cones to ensure correct bleeding; a scalder (capable of handling 3 to 4 birds at a time), a 3 to 4 bird barrel type feather picker; stainless steel table; chill tanks for processed birds; knives- and scales. A 20-foot long tarp is included to provide shade and protection from the elements. There are also hookups for 110 volt electricity and water. The 25-foot long unit can be towed to the desired location with a pickup track. A ½ ton pickup truck with trailer light wiring and a 21-inch ball is necessary if the MPU will be picked up.

The current cost for the use of the MPU for a Pastured Poultry Association Member first year user is $25.00 for the first 100 birds and 25 cents per bird over 100 birds and 31 cents per mile (round trip) for delivery. The cost for a second and successive year user is $35.00 for the first 100 birds and 35 cents per bird over 100 birds and 31 cents per mile (round trip) for delivery. The cost for non-members if $45.00 per 100 birds and 45 cents per bird and 31 cents per mile delivery.

The unit is available for rent from May 1 through Oct. 15.

The MPU is delivered to the farm clean and ready to use and must be clean upon pickup. This includes the kill cones, picker, scalder and tables. The unit must be free from feathers and viscera. Stainless steel and galvanized equipment must be washed completely with chlorine bleach prior to return. There is a $50 fee if the unit is not returned in clean condition. This requirement is for your health and safety, as well as for the continuation of on farm processing. It is imperative that we as producers and processors take the initiative to maintain absolutely sanitary slaughter conditions to insure that disease free poultry is being sold to the public.

Reservations for use of the MPU must be made at least 4 weeks in advance to insure the processing date. The MPU will be scheduled on a first come first served basis. First time processors are entitled to a brief introduction of the MPU and equipment by a staff person. The introduction will cover proper killing, scalding, picking and evisceration. If you are a first time processor and would like this training please notify the RC&D secretary when the MPU is scheduled. Training is done the day of delivery.

The costs for 1999 have yet to be established and may change. Any broken, damaged or missing equipment will be billed at the replacement cost to the producer. Mileage is based on the actual miles traveled, this may not necessarily be the way a producer would travel, but is left up to the discretion of the driver.

For more information on the MPU, contact the SoCNY RC&D office at 607-334-3231 Ext. 4 or write to: 99 North Broad St., Norwich, NY 13815. E-mail: socnyrdc@norwich.net

Material List for Chicken Spin Picker and Scalder/Dunker

2X4 for frame

1-55 gal. Plastic drum

100 plucker fingers for drum and bottom plate

1 – 1 ½ hp motor

1 – 20” pulley for plate
(Pulley sizes depend on motor you use)
1 – 2” pulley for motor

1 – aluminum disk that will fit inside of your drum for bottom spinner. Keep gap between drum sidewall and plate as small as possible. I have seen people use plywood with a piece of thin aluminum bolted to it.

1 – 1 ¼” pipe approximately 12”

1 – 1 ½” pipe approximately 12”

Waterproof electric box and switch GFI.

12/2 w/ground wire.

1 – appropriate size v belt

Misc. metal pieces.

Scalder/Dunker

1 – 55 gal steel drum

1 – 35 gal drum (to make cage for birds to go in) [or egg basket?]

1 – propane fired unit. Can be purchased new or use an old hot water heater burner. You may also use electric heating elements (are more accurate)

1 – reduction unit of you own choice. Examples: silo distributor drive, manure spreader reduction unit, snow blower or rototiller reduction unit, etc.

Steel for frame

2 2-3” pulleys

Cable to run from reduction unit up to top pulleys then down to lowest point cage will be in tank

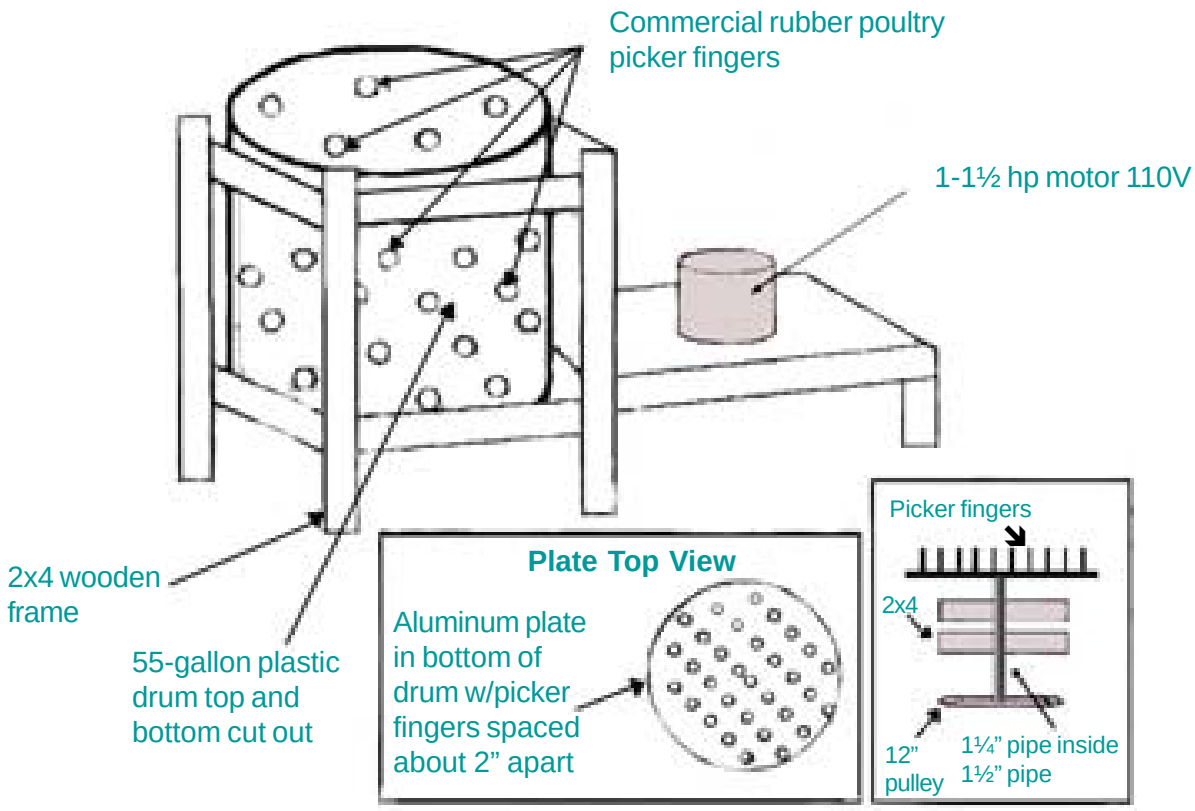
4 – ¾” square stock for air space between drums.

1 – appropriate size v belt

Misc. metal pieces.

Appendix A continued from page 31

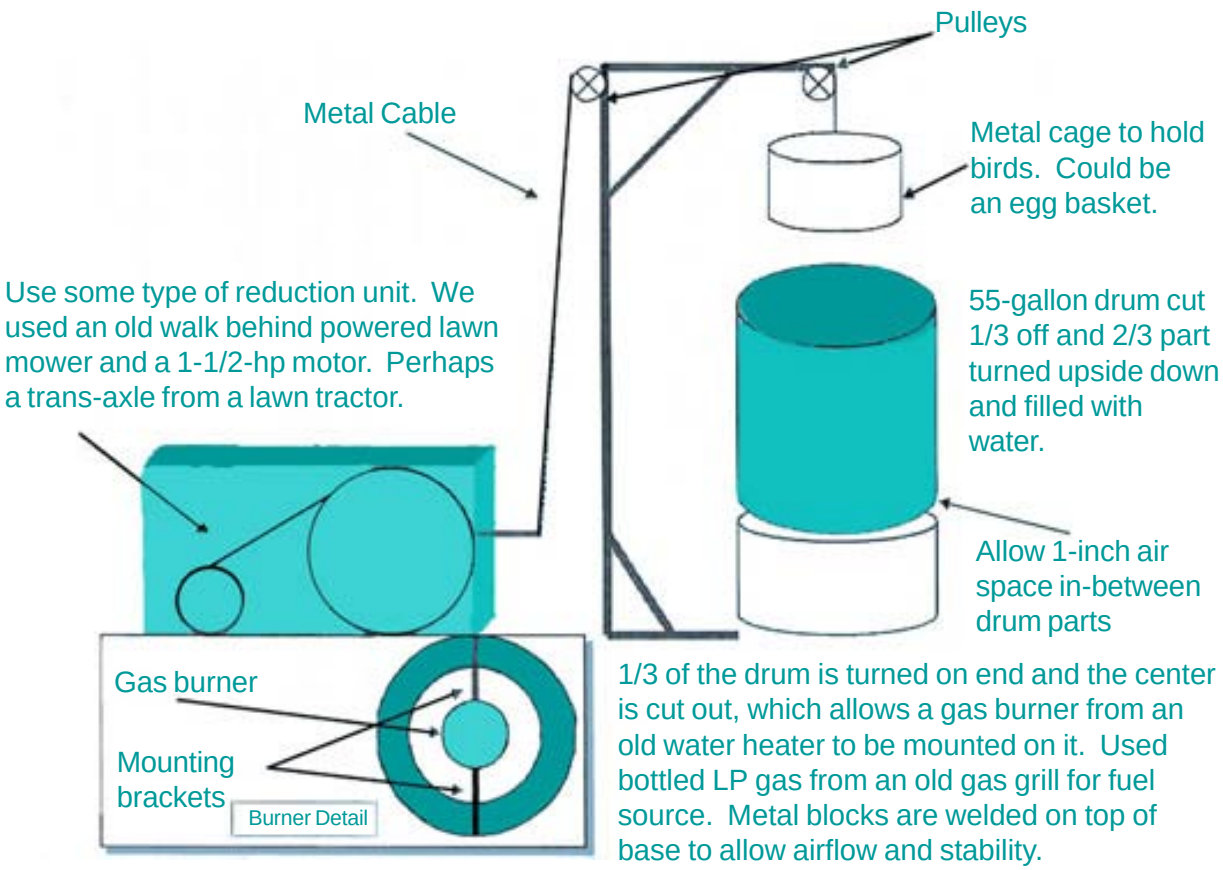
SoCNY RC&D Picker Plan



Appendix A continued on page 33

Appendix A continued from page 32

SoCNY RC&D Scalder/Dunker Plan

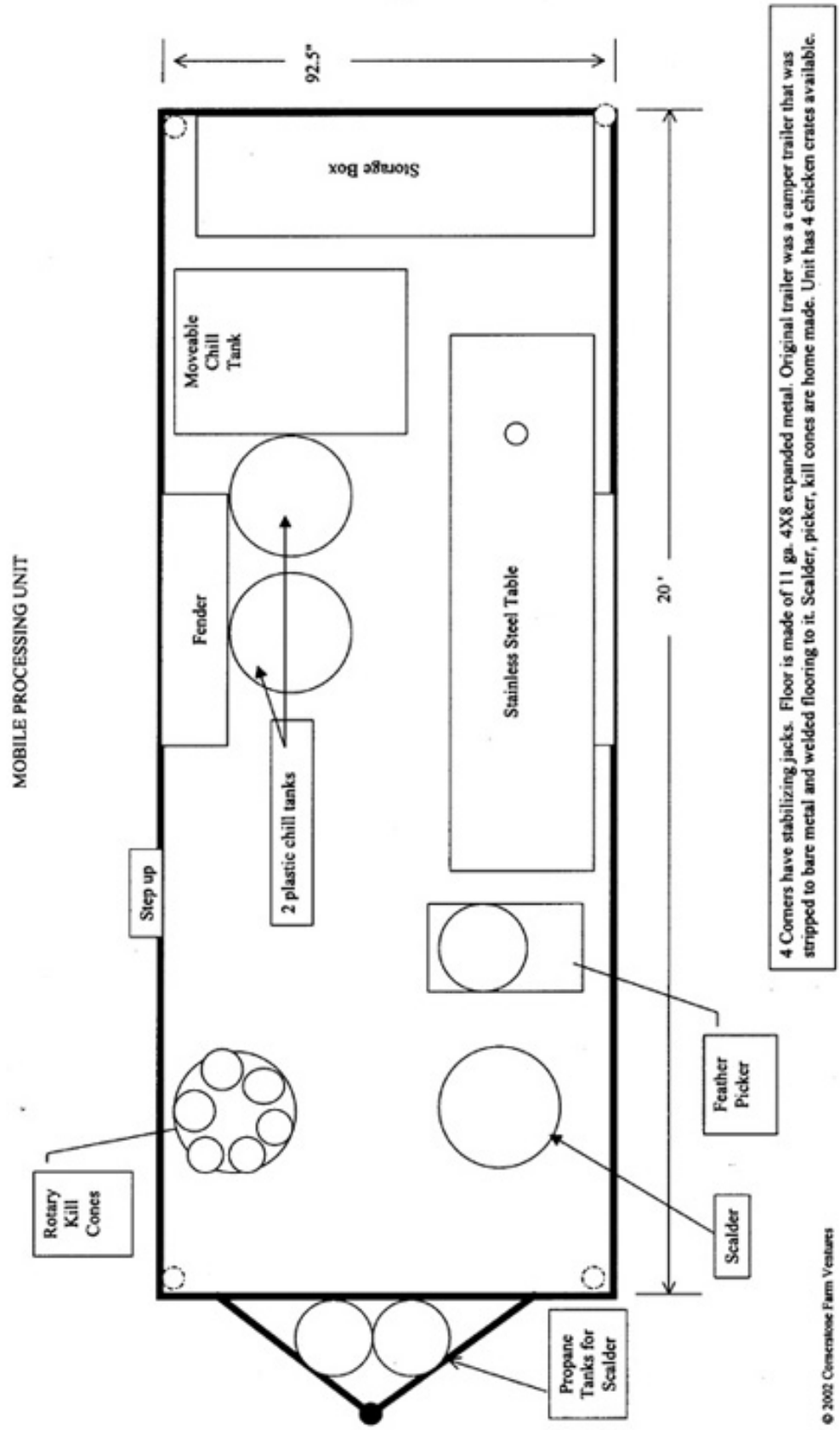


1/3 of the drum is turned on end and the center is cut out, which allows a gas burner from an old water heater to be mounted on it. Used bottled LP gas from an old gas grill for fuel source. Metal blocks are welded on top of base to allow airflow and stability.

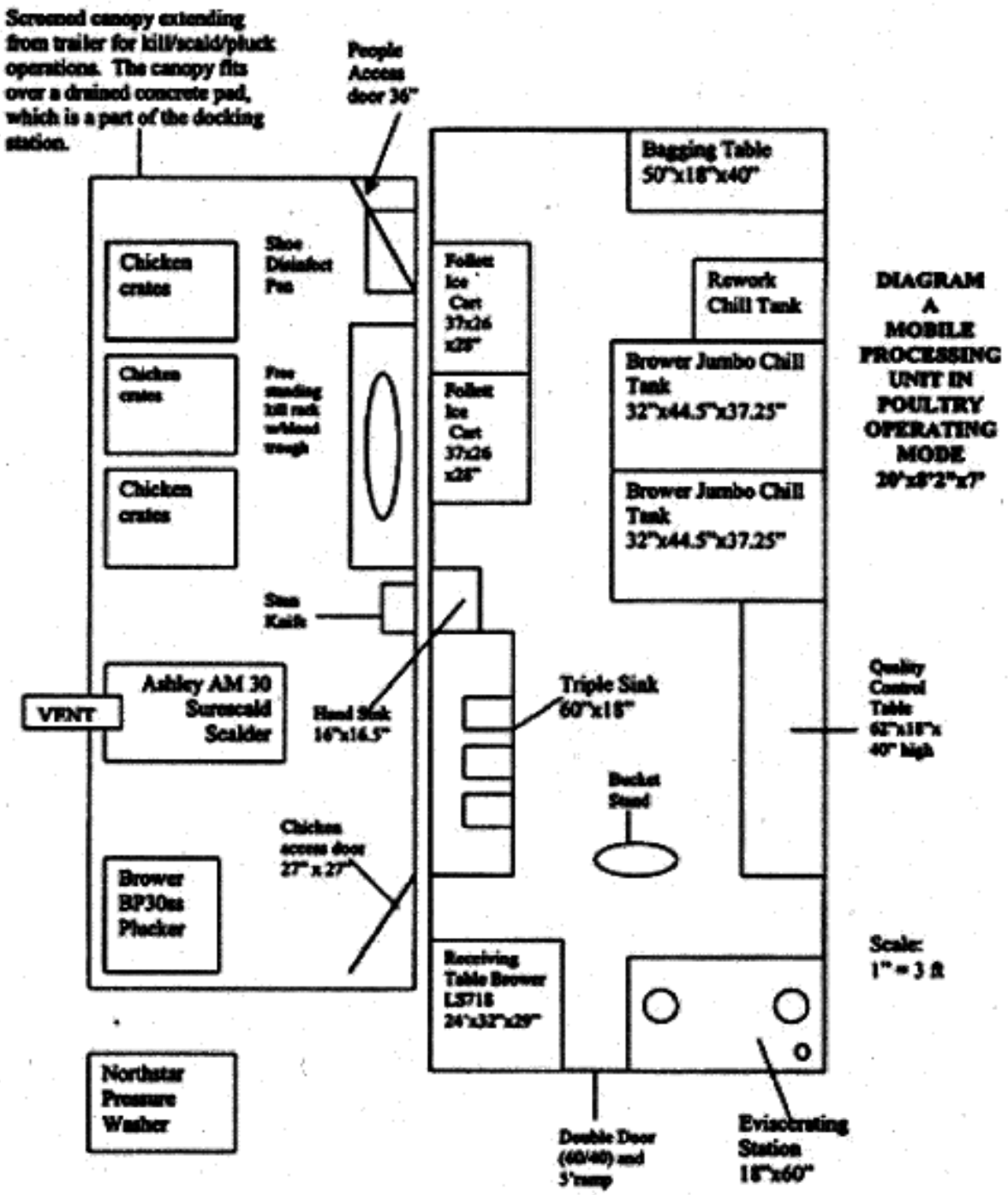
Designed and built by Bob Banta

Appendix A continued on page 34

Appendix A continued from page 33



Appendix B. Kentucky MPU Layout



Appendix C. Small Plant Work Areas and Design

The following outline of work areas and design considerations is adapted from *Poultry Products Technology* (Mountney and Parkhurst, 1995). You may be required to follow some of these recommendations if you are operating under state or federal inspection or in a federally exempt plant. Plants should be constructed to provide space for future expansion. The main point of the design is to keep edible products from coming in contact with raw or inedible products.

Work Areas

- Receiving and holding area: for unloading crates and hanging birds or putting them in cones.
- Dressing area: for killing, bleeding, scalding, and picking.
- Eviscerating area: for eviscerating, inspecting, and chilling; separated from the dressing room by a wall.
- Packing area: for packing and sometimes cutting up.
- Refrigerated area: for chilling or freezing.
- Shipping area: for moving product onto trucks.
- Other areas are needed for offices, inedibles, cleaning, maintenance, toilets, dressing, lunch, and supplies.

Design Considerations

- Structural materials: These include concrete, brick, glazed tile, and steel.
- Floors: Floors are concrete, smooth for easy cleaning, and sloped to floor drains or central gutter drains to prevent water from puddling. Floors have an abrasive covering in wet areas to prevent slipping.
- Walls, ceilings, posts, and doors: Surfaces are smooth and impervious to water for easy cleaning. According to small processor Luke Elliott, "A common material used for walls and ceilings is glass board like what you may see in a restroom or a restaurant kitchen. The material comes in sheets and has a stippled surface that may be washed down." Ceilings generally need to be 10 feet high. Windowsills should be sloped at a 45-degree angle. The junction of floors and walls should be covered to a radius of at least 2 inches. Windows, doorways, and other openings should have screens to exclude insects and rodents.
- Plumbing: Prevent contamination from cross-connections, back-siphonage, backflow, leakage, or condensation. Toilet soil lines should be separate from floor drainage lines to a point outside the building. Water should be delivered to convenient outlets for washing carcasses, walls, floors, and equipment. Pressure should be at least 30 pounds per square inch. According to Elliott, "You will want large water lines to supply your plant. Even in small plants the main water line may be 1 ½ inches or more in diameter, and the feeder lines are typically 1 inch and no less than ¾ inch. Depending on local codes, copper may be required. All lines should be insulated and covered with a special plastic jacket to prevent condensation from dripping on the product. Exposed lines must be offset from the wall or ceiling to allow cleaning and washdown behind the lines."
- Ventilation: Ventilation is required to remove dust, moisture, and gases. "A filtered air positive-pressure type system provides clean air from the outside and prevents recontamination with dust and dirt (Mountney and Parkhurst, 1995)." A counter-flow air system (from finished product area to raw) is needed. Air conditioning or a fan and duct system can be used. According to Elliott, "This is especially true in the kill room. I suggest a separate heating and cooling and ventilation system for the kill room—it is a climate unto itself. A restaurant-type vent hood over the scalder is nice, with the ability to bring in outside air to the kill room."

Appendix C continued on page 37

Appendix C continued from page 36

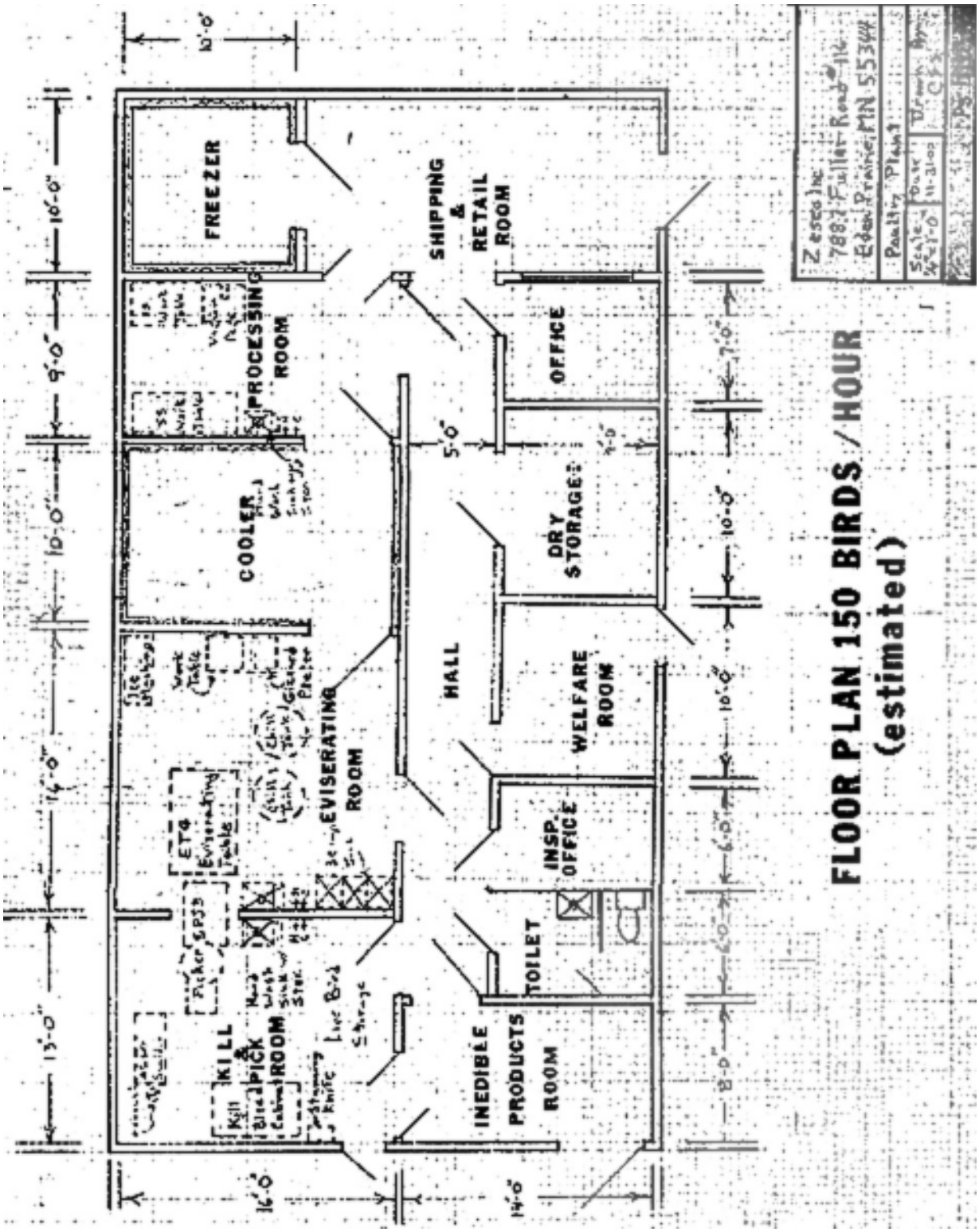
- Lighting: Lights should be covered with a nonshattering and watertight cover. Use at least 50 foot-candles in inspection areas.
- Equipment design: Equipment should allow easy cleaning and inspection and safe operation. It should be installed for maximum efficiency to reduce reach distances and permit smooth hand motions patterns. Equipment used for inedible products must be marked. Slaughtering and processing rooms and toilets must have foot-pedaled hand-washing facilities with hot and cold water, soap, and individual towels.
- Plant safety: Poultry processing has a high rate of accidents, so plan for safety. Fire extinguishers and first aid should be close by.

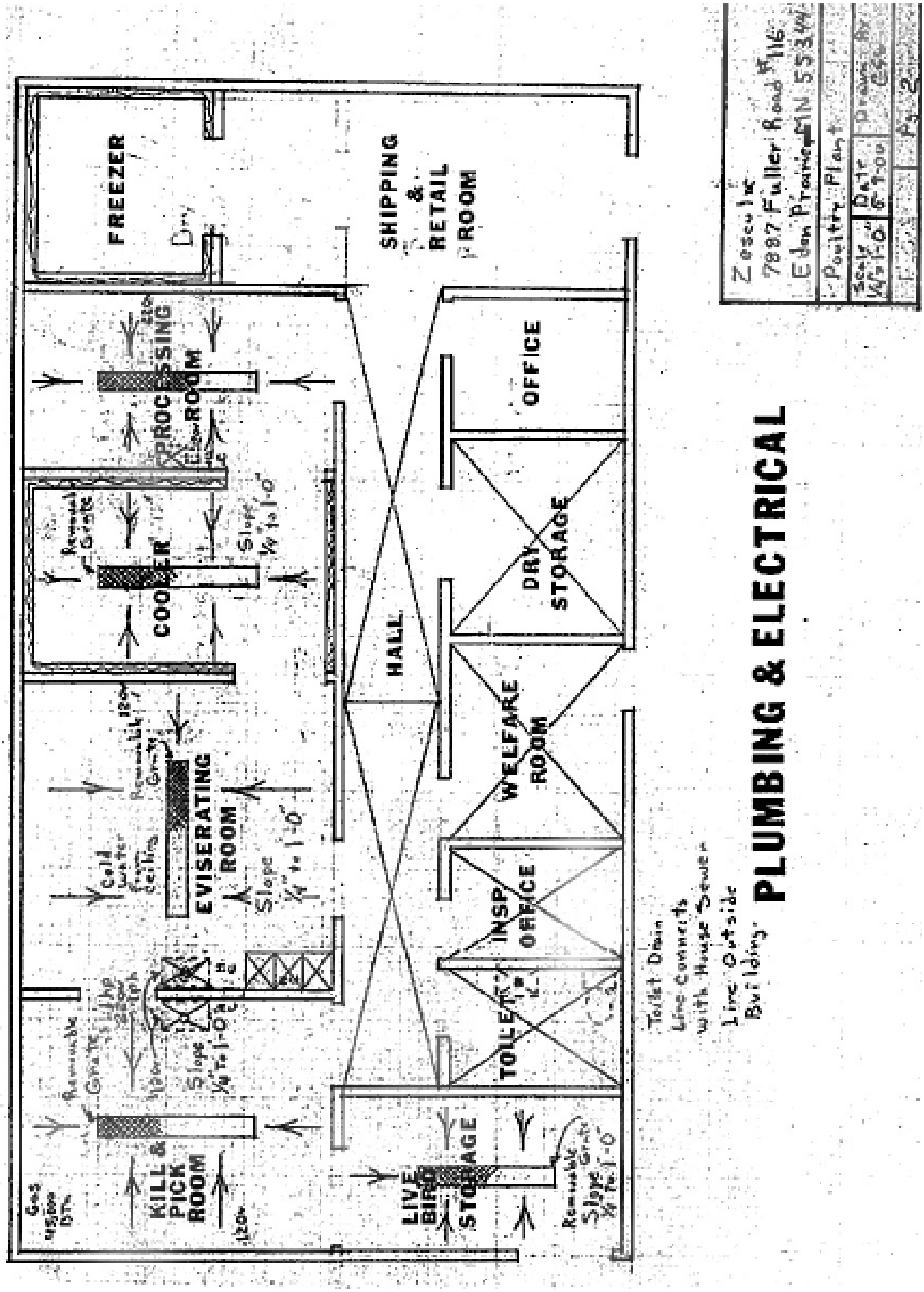
Adapted from: Mountney, George J., and Carmen R. Parkhurst. 1995. Poultry Products Technology. 3rd Edition. Food Products Press, New York, NY. 446 p. With comments by Luke Elliott, Fox, Arkansas.

See Attachment.

Attachment

Attached is a generic floorplan of a small plant, developed by Chan Zuber at Pickwick/Zesco. The floorplan should not be considered approved for licensing; you should check with your state and federal authorities for licensing.




FREEZER
Dry
SHIPPING & RETAIL ROOM
PROCESSING ROOM
COOLER
Removal Grate
Slope ¼" to 1'-0"
HALL
OFFICE
DRY STORAGE
EVISERATING ROOM
Cold Water
Removable Grate
WELFARE ROOM
INSP OFFICE
TOILETS
KILL & PICK ROOM
Gas Water Drs
Removable Grate
LIVE BIRD STORAGE
Toilet Drain Line Connects with House Sewer Line Outside Building
PLUMBING & ELECTRICAL
Zesco Inc
7887 Fuller Road #116
Eden Prairie, MN 55344
Poultry Plant
Scale ¼"=1'-0"
Date 6-7-00
Drawn By
Page 2

IP231/233

The electronic version of **Small-Scale Poultry Processing** is located at:
HTML
http://www.attra.ncat.org/attra-pub/poultryprocess.html
PDF
http://www.attra.ncat.org/attra-pub/PDF/poultryprocess.pdf