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# Food Engineering

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## New Plant of the Year

# Future Beef Operations

Revolutionary from  
inception to ingestion

**ALSO THIS MONTH**  
**Site Selection Requires a  
Delicate Balance**

**Tech Update:**  
**Clean in Place Comes of Age**

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With several distinct value-added business operating under one roof and a state of the art carcass dehairing process that takes food safety to a new level, Future Beef redefines supply chain integration.

**By Kevin T. Higgins, Senior Editor**

**I**f any segment of the food industry is in need of a new business model, it's beef. Despite efforts to break out of the commodity mold, beef processors continue to operate on paper-thin margins.

Beef also is a business that is under the gun to deliver scrupulously safe products. Individual plants routinely get walloped with costly, potentially devastating product recalls when microbial contamination is even suspected.

Both of those issues are squarely addressed by Future Beef Operations LLC, a Parker, Colorado-based corporation that opened a \$94 million plant August 9, 2001, in Arkansas City, Kansas. More than a decade passed between construction of America's last new beef facility and the FBO plant. While other processors have retrofitted existing packing houses to meet contemporary standards, FBO's organizers started with a clean slate. The result is a mold-breaking facility that warrants being named Food Engineering's New Plant of the Year. In a commodity business, bigger is better. In a value-added operation, less can be more. With a capacity for 1,725 head of cattle a day, Future Beef handles a fourth of the volume of the country's largest slaughter facilities. But Future Beef is

not simply a packing house; several distinct businesses operate under its roof, including fabrication and further processing operations, case-ready and ready-to-eat meats, a pet-treats firm and a tannery unlike any other. Driving some of these activities is a carcass dehairing process that represents the first commer-

cially successful execution of this revolutionary beef-safety intervention.

The plant is also the fulcrum in a channel management strategy that is a blueprint for supply chain integration. True partnerships with a handful of customers replace spot-market selling of finished goods. Data capture systems yield detailed reports for ranchers and feed-lot operators on the quality of individual cattle. The ambitious goal: a quality-control feedback

loop that will improve the genetic engineering of packing houses' raw materials. It's been done with poultry and pork, and beef represents livestock's final frontier.

The carcasses of young steers and heifers typically range from 550 to 950 pounds, creating enormous raw-material sortation issues for plants. FBO's goal is to narrow that range to 725 to 750 pounds while also improving other carcass merits such as waste fat, yield, color, cutability and tenderness. Dozens of reports are generated daily for the plant's suppliers, providing merit data on just-processed cattle and recommending steps to improve future shipments.

"That kind of data is considered a secret in the beef industry and never fed back to the rancher because processors are afraid they'll get gouged

on price if ranchers raise better stock," points out Darrel Wilkes, FBO's vice president of supply. "But these guys can never raise better cattle if you don't give them the data."

Ear tags with electronic identity information on heads of cattle entering a packing house are not new, but the depth of data capture at FBO is



**About 50lbs. Of fat are trimmed from each head (above) in Future Beef's clean slaughter room, reducing cooler demand and employee stress on fabrication's tenderloin line. The dehairing cabinets (right) help deliver sanitary cattle to the dirty slaughter room. Source: FBO photos by Rex Stroman.**



New Plant of the Year

# **Future Beef Operations**

Revolutionary from inception to ingestion

## Startup difficulties don't alter FBO's vision

Sky-high raw material costs and mad-cow paranoia in the Japanese market conspired with the usual startup problems to create serious cash-flow difficulties at Future Beef Operations LLC. In March, the company began reorganization efforts under Chapter 11 provisions of the Federal Bankruptcy Code. Despite the rocky start, management continues to pursue a goal to remake the beef business into a disciplined, well-integrated industry.

Raw material variability is a challenge in every segment of food processing, and the problem is particularly acute when it comes to cattle. While processors of other types of livestock have refined the genetic management of their herds, the fragmented nature of cattle rearing leaves breeders in the dark as to the outcomes of their efforts. Future Beef hopes to change that by feeding back data on each head regarding yield, meat color, marbling and fat thickness, as well as the USDA-assigned grade of each head processed.

"If all of our cattle came from the top half of the available stock in terms of carcass merit, that would be the beef industry's equivalent of a grand slam," says Darrel Wilkes, one of FBO's founders. That's a reasonable near-term goal for us. Next, we'll set our sights on the top 20 percent."

The firm's financial situation has forced FBO to be a little less selective in its cattle buying than planned, but management remains committed to reshaping the way cattle are reared, beef is processed and finished goods are brought to market. "There are a zillion skeptics," Wilkes allows, "but the rank-and-file ranchers have been very supportive of us. They want the industry to change along the lines of what we are trying to do."

unprecedented. As cattle move onto the kill line, the tag is scanned into an information system that tracks the carcass through evisceration and to the fabrication room. RF chips embedded in overhead conveyor trolleys allow the plant to accurately track the animal, even after it is split into two sides of beef. When the sides are graded, quality indicators such as degree of marbling and color are captured, along with a video image. Information is relayed back to FBO's 1,200 primary farmers and 14 feedlot

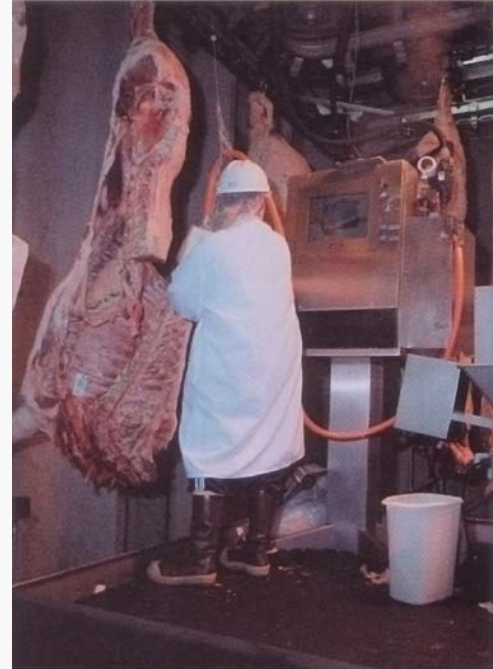
partners to give them guidance in improving the quality and consistency of future livestock. In effect, the plant closes the loop between cattle breeding and meat consumption.

### Handle with care

Six years of planning preceded the purchase and conversion of the Prairieland Processors plant in Arkansas City from a 40,000 sq. ft. boxed beef facility to the 450,000 sq. ft., fully integrated finished-goods operation it is today.

The new cattle holding area takes advantage of the natural slope of the 30-acre site, with the unloading dock at the low point. The stable measures 360 ft. long by 100 ft. wide and has the distinction of being America's first fully enclosed holding area for cattle. More remarkable is the absence of odor. After each group of cattle is taken to the kill area, sprinklers embedded in the floor of the corral pop up and wash down the stall. Helping make this procedure possible is the plant's wastewater plant, which can process 1.2 million gallons a day. The stable area's concrete floor resembles cobblestones: a grid was put in place when the concrete was poured to create one-and-one-half inch grooves, making it easier for the animals to walk through the area.

"The flush system is similar to what a dairy would use, but it's a first in cattle handling," according to livestock



**A digital image of each side of beef is scanned and stored in FBO's database, along with other product quality data that will be relayed back to ranchers and feedlot operators to help improve future raw materials.**

handling expert Temple Grandin, who helped design this area.

Attention to detail sets FBO apart. For example, belt drives for the room's huge fans slow blade speed and minimize noise, helping to keep the animals calm. "Animals are scared of the dark, they're scared of reflections and noises, and they pay attention to details," notes Grandin. "Managers said, 'Let's engineer for noise control,' and they did it. There are no shackles and chains banging around, the lighting is right and the cattle are calm when they walk up there. That's the way it should be." Cattle leave the kill floor via an overhead conveyor that carries them up approximately 20 ft. to the kill room. Before reaching the butcher, carcasses are routed through the dehairing chamber for a six-minute process that may be beef processing's most significant food-safety advancement in decades. Fecal contamination is the great challenge in beef processing. Waste is matted into the hair of the steers and cows coming through the kill line. While processors have devised multiple interventions to address the issue at various points in their production lines, cross contamination is virtually unavoidable.



**RF chips embedded in overhead trolleys preserve the identity of cattle, even after the carcass is split.**

## Employee welfare programs with meat

When corporations talk about how highly they value their workers, employees often listen with a healthy dollop of skepticism. Management at Future Beef doesn't dwell on the topic, but employee welfare is a cornerstone of the culture the company has built.

The eastern approach to the plant is marked by La Petite Academy, a 54-child pre-school staff and child-care center subsidized by Future Beef. To the south are the 120-unit MeadowWalk apartments, an amenity-filled complex built through an occupancy guarantee from Future Beef so that mobile homes and other transitory housing wouldn't be needed for its workforce of 950. Clergyman Steve Ward staffs the plant chaplain's office to minister to employees' personal needs.

The plant represents the first food-related corporate site for La Petite Academy, a national chain, according to Denys Golay, the center's director. It cares for children up to age 5 each day from 5:30 am to midnight, and a

growing waiting list attests to community perceptions of the quality of care. "We're not babysitting; we're trying to teach the kids," emphasizes Golay, a former high

school teacher who resigned from public education to take over the academy last year. "Being within a hundred yards of their children is a great draw for the people who work at the plant."



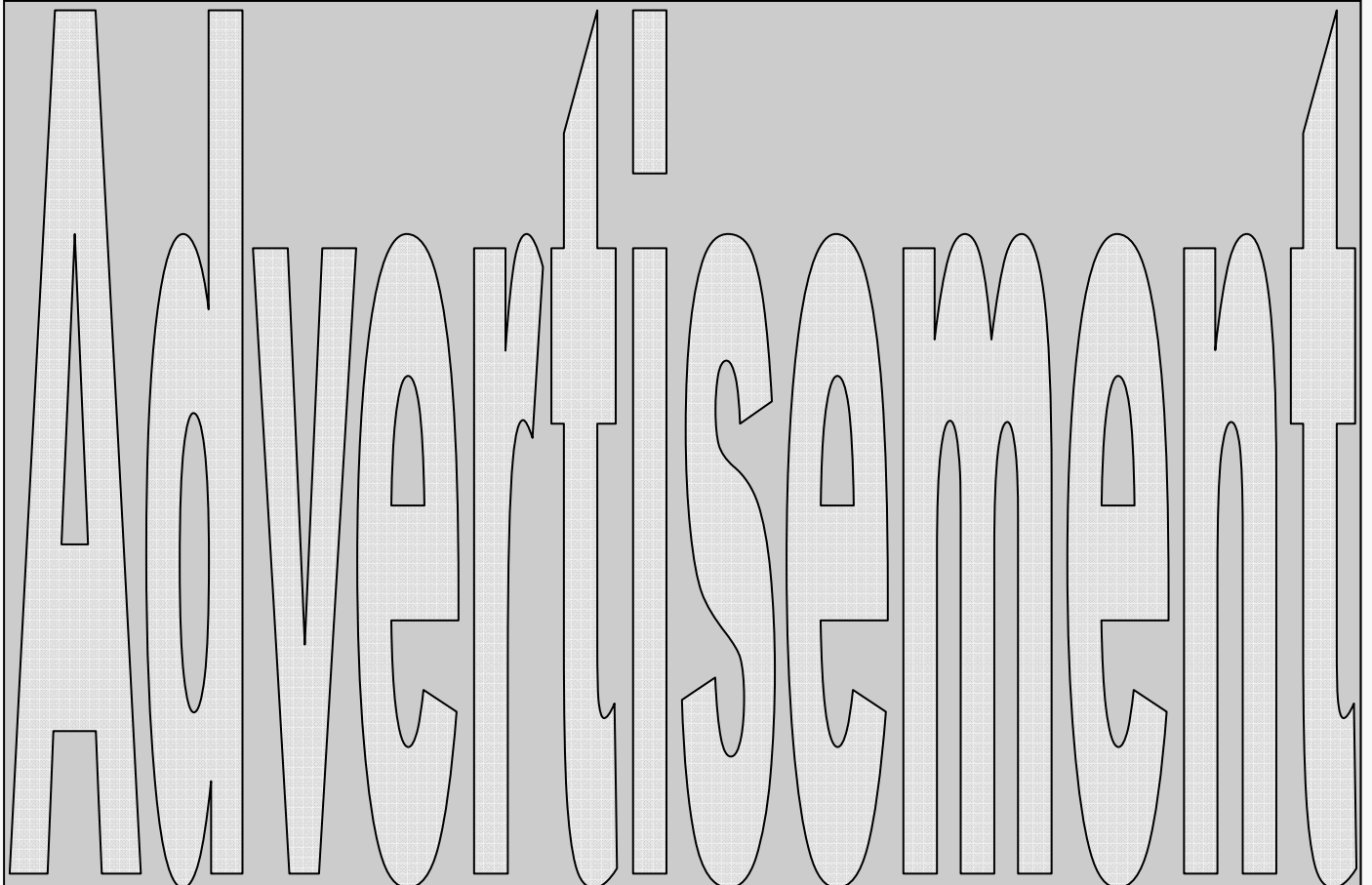
Up to 54 children from ages six weeks to kindergartners are served at any given time in Arkansas City's La Petite Academy. Plans call for a new center to care for 150.



Dehairing the animals before they are butchered remedies the problem, but previous attempts to do that had failed. Under the guidance of German scientist Rainer Dorstewitz, engineers from Suitt Construction Co., the A/E firm for the plant, and Vaughn Coltrane, Pharr and Associates installed a U-shaped series of cabinets where dehairing occurs.

A solution of sodium sulfide is sprayed on the animals as they enter the Chad cabinets. The carcass is subjected to several high-pressure rinse cycles with water and a neutralizer before exiting the cabinets, hairless and essentially sanitary. As it moves through hide removal, there's little chance that workers' knives will be contaminated with E. coli from one animal and transferred to others. The problem of airborne hairs settling on carcasses and cross-contaminating them also is eliminated.

While the spray-and-rinse cabinets are dehairing's focal point, the heart and brains of the system reside one level



below. To be economically viable, the system must be able to recycle the sodium sulfide. Customized software and related controls regulate removal of 9 lbs. of hair for each carcass processed. A sophisticated network of filtration units and vacuum pumps accomplish this feat.

### Bug-free zone

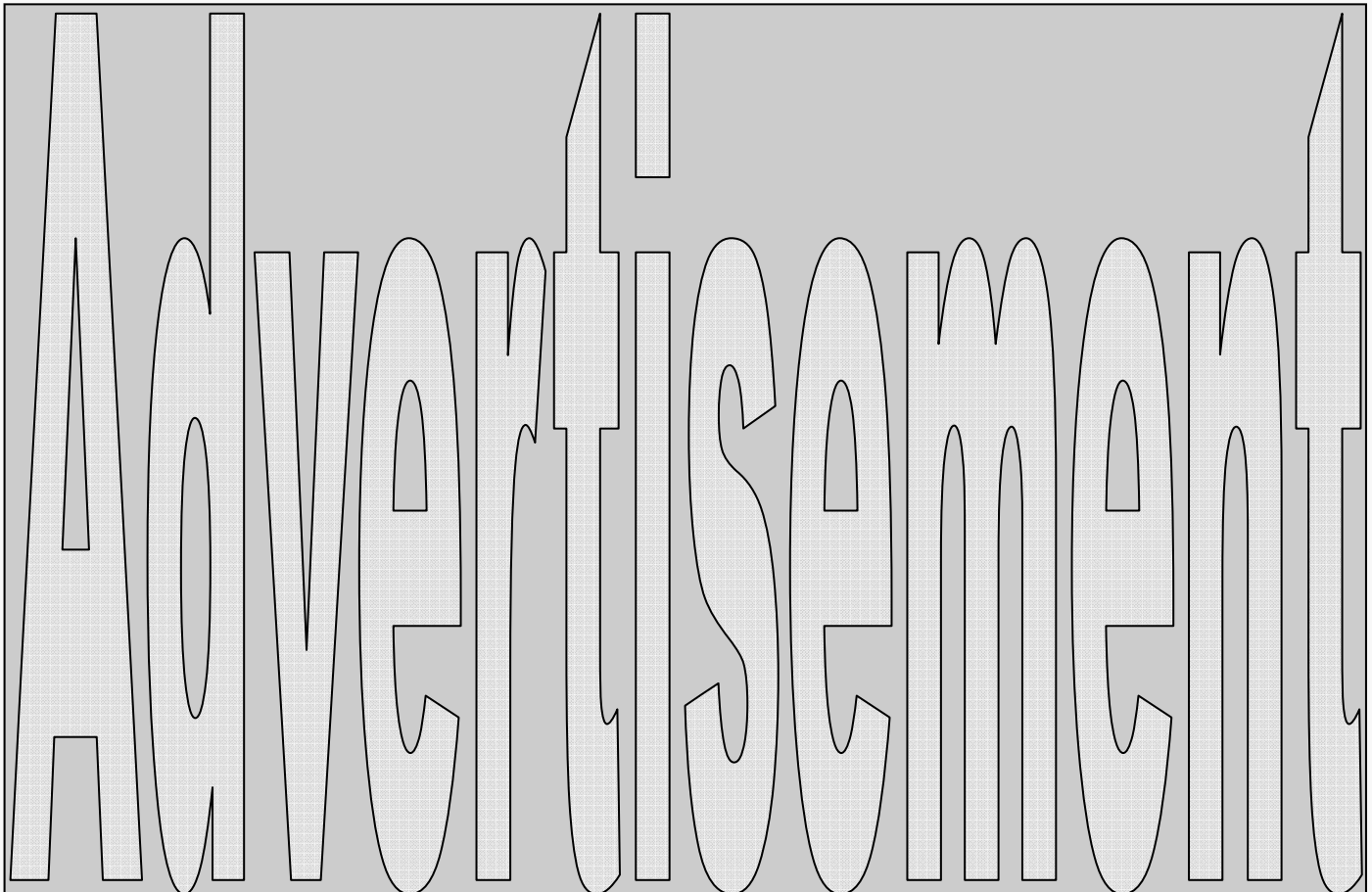
The plant is segregated into five zones, with separate washrooms and break rooms to prevent cross-contamination caused by employees. FBO carried this concept over to the kill area, creating a dirty slaughter and a clean slaughter room—essentially, the evisceration area. Before leaving dirty slaughter, carcasses undergo steam vacuum of the haunch area in what could be considered the first antimicrobial intervention. Hides are stripped before carcasses are conveyed to the clean slaughter room, where another series of cabinets await. The first unit administers a high-pressure water wash at 105°F degrees,

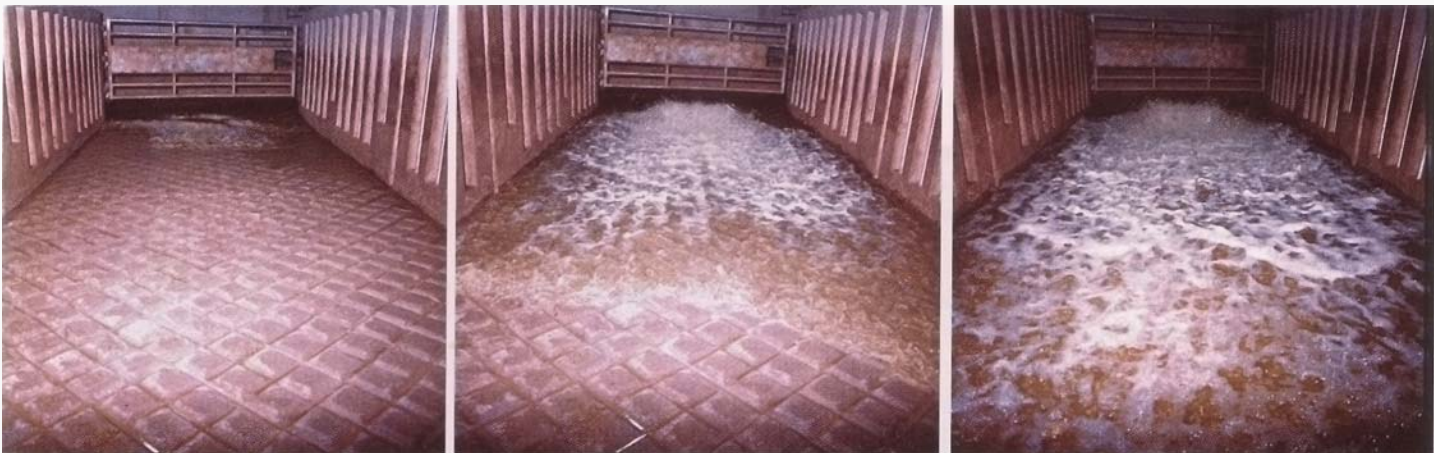
**Three pumps recirculate ammonia at different temperature points, a capital investment that should produce significant savings over time.**

followed by a pasteurization cabinet at 180°. Carcasses enter an acid wash cabinet, are rinsed and then are conveyed to high-voltage tenderizing station. While it's never possible to declare any slaughter facility pathogen-free, daily swab tests have yet to detect any microbial contamination in the clean slaughter room, according to Randal Garret, plant manager and FBO's vice president of operations. During the USDA inspection process, workers hot trim about 50 lbs. of fat from each animal. Besides reducing heat-removal demands in the coolers, this also simplifies the job of fabrication room workers who process



the valuable tenderloin primals. Within 45 minutes of slaughter, sides of beef are conveyed into coolers that will drop the meat's temperature from 102° at slaughter to 40° over the next 26 hours. Along the way, sides will swing by a platform where a USDA inspector will grade the beef, and FBO employees using a video camera will capture an image of the meat and record merit data. "It requires a big investment in computer technology and a higher level of





Pop-up sprinklers provide a wash down cycle in the cattle holding pens after each use. Open-sided pens aid in air circulation.

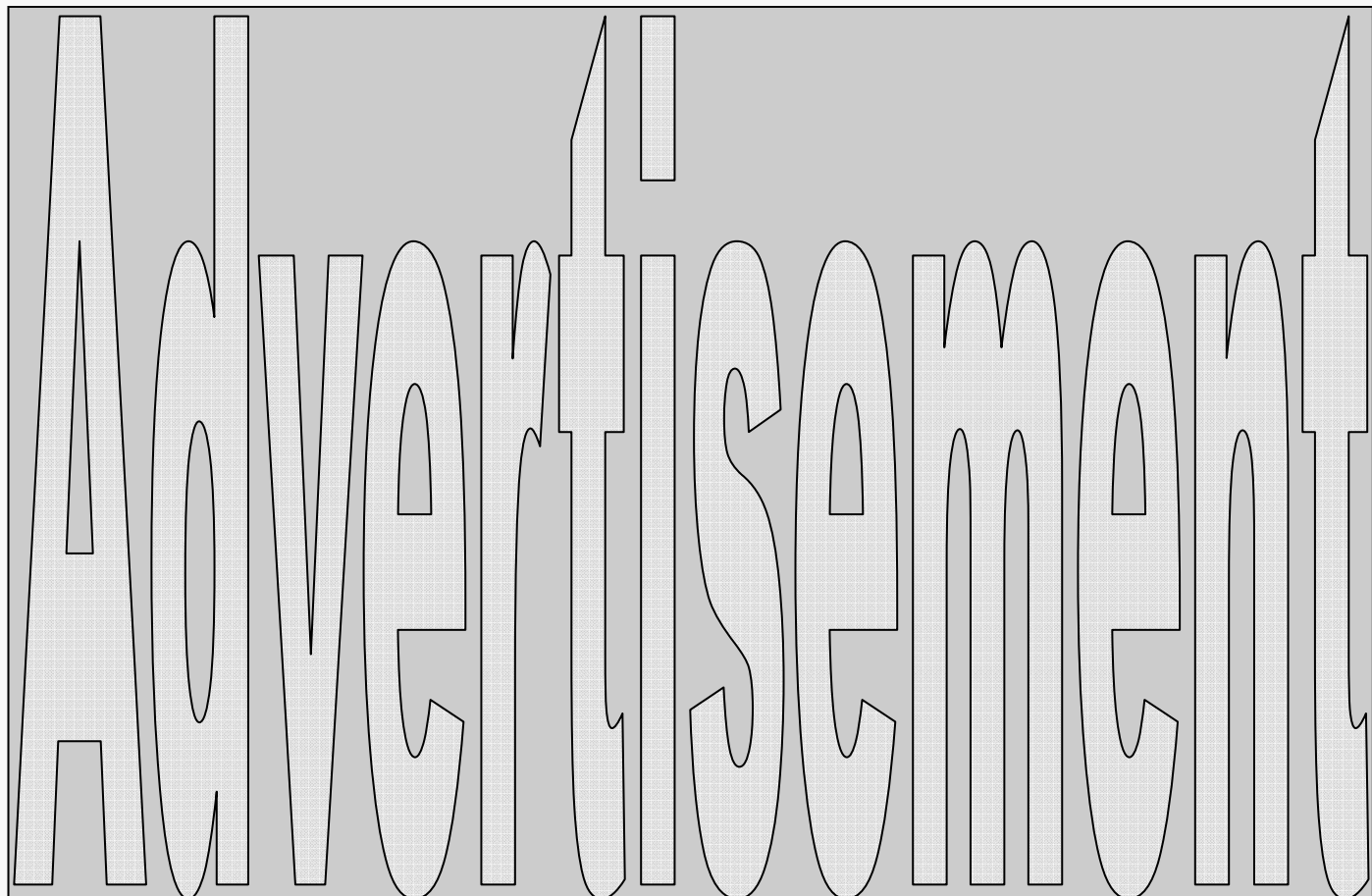
management, particularly at the feed lot, to proactively manage individual heads of cattle and deliver the cuts of meat that a handful of customers want,” says FBO’s Wilkes. It also requires a massive database, and the grading platform is where that database is being built.

Two shifts of 180 workers staff the fabrication room, where four lines produce the four primal cuts (round, loin, rib and chuck). Further processing can be done in an adjacent fabrication area, the first stage of value-added processing. FBO’s founders believe this is a sign-

ificant efficiency, since it eliminates the raw material freight costs, product shrink and repackaging required when these processes are done at remote locations, as is common in beef processing.

“When all value-added profit centers become a part of the slaughter/fabrication earnings, incentives to share the value created can be spread backward through the supply chain to drive quality, yield and safety to the entire system,” according to Frank Holley, operations executive for Suitt Construction’s food group.

Deli roasts, pastrami and vacuum-packed variety meats such as corned beef already are being produced in this area, with a wide range of marinated and fully cooked products yet to come. Safeway supermarkets has an ownership position in FBO, and it accounts for the vast majority of FBO’s retail sales. The Primo Taglio line of beef deli meats come from this plant, along with 160,000 packages of case-ready ground beef a day. Production of kabobs, cube steaks and other thin meats is expected to be start soon.



Adjacent to the further processing area are glycol-jacketed tumblers, brine mixers and a marinade injection system. Finer needles and a pressure system that more evenly distributes marinades than a conventional stroke-pump system swayed the equipment-selection decision.

Computer terminals give workers ready access to recipes and ingredient needs for the products produced here, "and we create a record of what we make and the yield data," says Joseph Lafleur, manager of the value-added meats area. Positions for 54 industrial terminals are situated throughout the plant. Captured data helps shape processes downstream. The fab room/ground beef interface is an example: all the trim for ground beef comes from fabrication, not outside sources, and it's usually less than 24 hours old. "They have to do a mass balance of the trim with customer orders," explains Suitt's Bob Albert, the project manager. "The mathematics of that process are very interesting." In-line

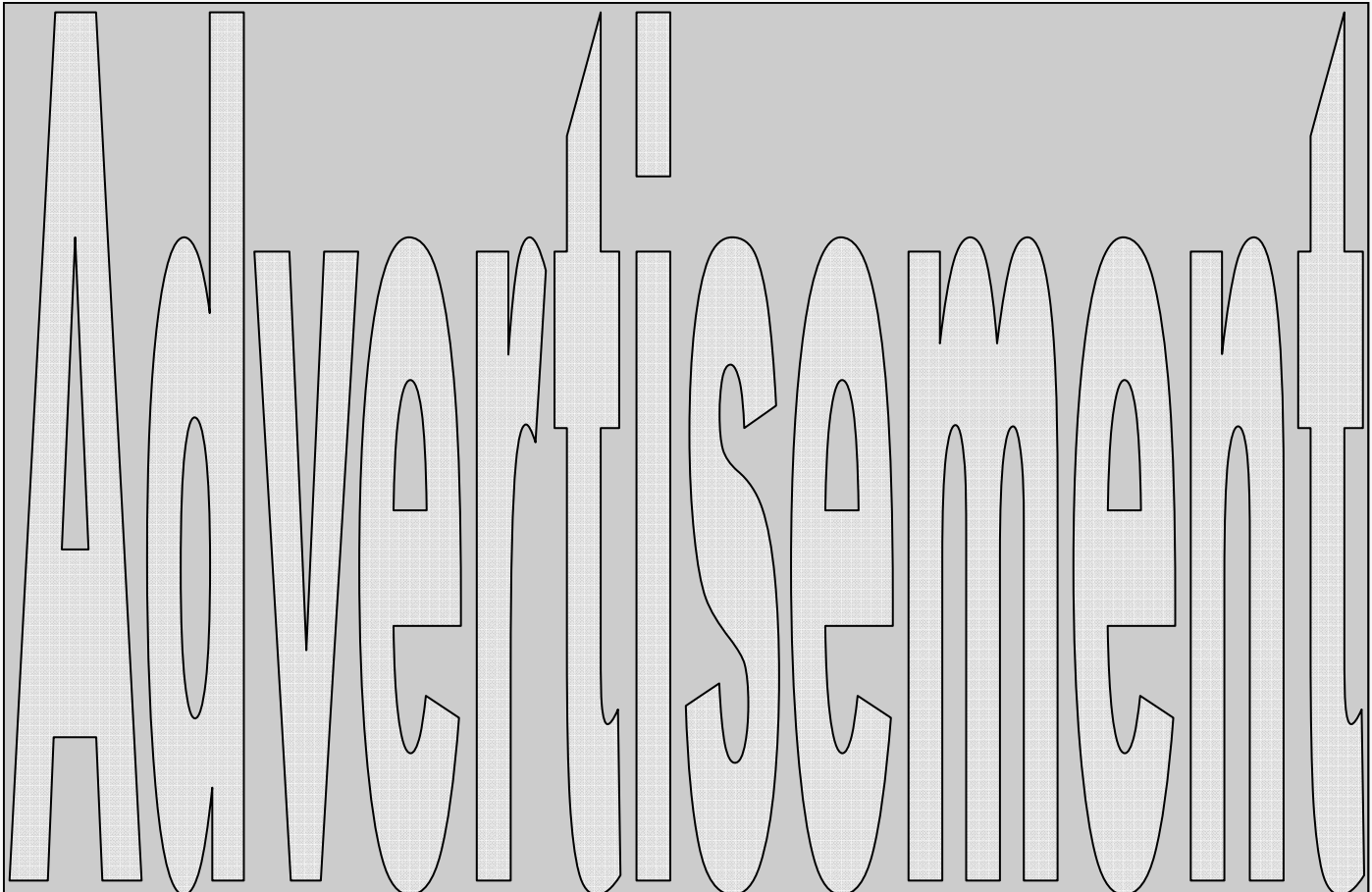
**Blue-chromed hides are graded and sorted before leaving the plant's tannery to be turned into finished leather goods.**

fat analyzers confirm that the right blend is output, and CIP features in augers, blenders and belts allow ground beef to execute a mid-shift washdown and switch from, say, 1 lb. loaves of 80 percent lean to 5 lb. loaves of 90 percent lean production. Between further processing and the cooked meats area is a 7,000-lb. capacity cook house. "We can do a natural smoke, a dry bulb roast or a wet bulb cook," says Garrett. Strict isolation rules apply to the ready-to-eat area on the other side of the ovens, with Lafleur and a quality assurance inspector the only plant personnel authorized to move from further processing to ready-to-eat, and then only after a clothing change. White boots and blue frocks are reserved for personnel in the cooked area, making any breach of work-zone restrictions easy to spot.



### **Chewies for bowser**

Washdown procedures in the cattle-holding area are one factor in the absence of offensive odors at FBO. The other is Performance Pet Products, the business-within-a-business that takes the plant out of the rendering game. Rendering produces meat plants' most obnoxious odors, but Performance Pet Products spares Ark City residents. It



# AWESOME TREATS

**Multi-flavored cow ears are packaged in FBO's Performance Pet Products division. Cattle parts that typically go to rendering are turned into high-margin retail goods.**



also represents a breakthrough in value-added processing: instead of selling waste parts for 1.5 cents a pound, FBO invests 40 cents a pound in manufacturing costs to create pet treats that will fetch several multiples of that at retail.

“Used today, made today” is this profit center’s slogan. Ears, tendons, metacarpal bones, tails and other byproducts of processing are ferried to this area from slaughter. “Food safety is every much an issue in pet foods as it is with human products,” maintains John Francis, FBO’s vice president of sales, and rapid processing minimizes the likelihood of bacterial contamination on rawhide chews. A separate HACCP plan and processes such as 24-hour oven drying and a smoke house also distinguish Performance.

More than 60 Performance products have been created, estimates Supervisor Del Thompson, with more on the way. Fifteen tons of material move through this area each day, and Performance could handle another 15. Whimsical names like Texas Toothpicks (tail) and Twisted Pizzlers (a gender-related body part) have been created for some of the items.

Value also is added to the animal hides that move through the area unofficially known as “the naked truth tannery,” a reference to the dehairing process. Typically a packing house will cure its hides in a salt brine solution, then fold and ship them to a tannery where they will be dehaired before undergoing a day-long blue-chrome process before being split. “By dehairing at the time of slaughter, we’ve basically moved part of the tanning process from the tannery to the animal,” Garrett says. FBO also green-splits the hides as a first step, with the grain side receiving blue-chrome treatment and the flesh side undergoing a liming process in a separate drum. Flesh sides are harvested for their collagen, the structural protein used to make sausage casings and gelatin and used increasingly in cosmetic surgery.

The absence of hair enables FBO to grade the hides as native, collies and so on because brand marks and other imperfections are revealed. The blue-chrome process results in a bright blue hide with the look and feel of suede. Each day, enough blue-chromed hides to shoe an army of Elvis impersonators are processed in a bolunga-wood tumbler. The identity of the cattle from which each hide comes is preserved.

# Arkansas

**Steve Endres, production supervisor in the cooked and marinated meats department, places a rack of ready-to-eat deli meat in a staging area.**



## **No-skimp policy**

On a project as ambitious as the Ark City plant, the tendency is to trim costs and make compromises to lower final costs. To its credit, FBO resisted the temptation.

The electrical system is an example. An estimated 150,000 labor hours went into wiring service to more than 40,000 termination points. A Kansas Gas & Electric substation brings 12,470 volts to the plant. It is routed through 10 panel rooms and then distributed throughout the plant. Except for gas-generated hot water and steam, the plant is all electric. “We had very few electric start up problems, considering the magnitude of the project,” reports Steve McGowen, assistant vice president of engineering. Service is stepped down to 4,160 volts to the plant’s 10 compressors. Three pumps recirculate ammonia for the refrigeration system at three different temperatures—an approach that meant greater capital investment up front but long-term savings for the facility. Likewise, Allen-Bradley controls and Square D electrical components were used throughout.

FBO constructed a sophisticated three-lagoon water treatment plant and recruited top talent to run it. The plant not only gives FBO the ability to carry out the pen-washing regimen in the cattle holding area, it honors a good-neighbor commitment to the community. A four-mile-long underground pipeline carries treated water from the plant to the Arkansas River on the other end of town. Water-quality monitoring suggests the discharge is cleaner than the water in the river.

The treatment plant generates 160,000 cubic feet of methane a day, only enough to run FBO’s twin 1,000 horsepower Johnston boilers for about 35 minutes, McGowen says. As the culture of anaerobic bacteria in the treatment ponds develops, the quantity of gas is expected to increase and may eventually help run those boilers, instead of being burned off.

More than a hundred pieces of air-handling equipment were lifted by helicopter to the plant’s roof during construction. Because of the multiple heat zones throughout the plant, air can’t be forced from the cleanest area to the dirtiest. Instead, the plant is divided into 11 different air divisions.

The startup issues at FBO are not uncommon, and the original ownership group has maintained control through the early phases of a financial reorganization. However the situation plays out, the owners succeeded in building a plant that is not simply state of art but actually advances the science of beef processing.