

## POULTRY PROCESSING

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### **Economic Importance**

Chicken and turkey production has increased dramatically in the United States since the 1980s. According to a US Department of Labor report this has been due to a change in consumer eating patterns (Hetrick 1994). A shift from red meat and pork to poultry is due in part to early medical studies.

The rise in consumption correspondingly has spurred an increase in the number of processing facilities and growers and a large rise in levels of employment. For example, the United States poultry industry experienced an increase in employment of 64% from 1980 to 1992. Productivity, in terms of pounds yield per worker, increased 3.1% due to mechanization or automation, as well as an increase in line speed, or birds per work hour. However, in comparison to red meat production, poultry production is still very labour intensive.

Globalization is also occurring. There are production and processing facilities jointly owned by US investors and China and breeding, grow-out and processing facilities in China export product to Japan.

Typical poultry line workers are relatively unskilled, less educated, often members of minority groups and much lower paid than workers in the red meat and manufacturing sectors. Turnover is unusually high in certain aspects of the process. Live hanging, deboning and sanitation jobs are particularly stressful and have high turnover rates. Poultry processing by its nature is a largely rural-based industry found in economically depressed areas where there is a labour surplus. In the United States many processing plants have an increasing number of Spanish-speaking workers. These workers are somewhat transient, working in the processing plants part of the year. As the region's crops near harvest, large segments of the workers move outdoors to pick and harvest.

### **Processing**

Throughout the processing of chicken, rigid sanitation requirements must be met. This means that floors must be washed down periodically and often and that debris, parts and fat must be removed. Conveyors and processing equipment must be accessible, washed down and sanitized also. Condensation must not be allowed to accumulate on ceilings and equipment over exposed chicken; it must be wiped down with long-handled sponge mops. Overhead, unguarded radial-blade fans circulate the air in the processing areas.

Because of these sanitation requirements, guarded rotating equipment often cannot be silenced for noise-abatement purposes. Consequently, in the majority of the processing plant's production areas, there is high noise exposure. A proper and well-run hearing conservation programme is necessary. Not only should initial audiograms and annual audiograms be given, but periodic dosimetry should also be done to document exposure. Purchased processing equipment should have as low an operating noise level as possible. Particular care needs to be taken in educating and training the workforce.

### ***Receiving and live hang***

The first step in processing involves off-loading of the modules and destacking the trays onto a conveyor system to the live hang area. Work here is in almost complete darkness, since this has a quieting effect on the birds. The conveyor belt with a tray is at about waist level. A hanger, with gloved hands, must reach and grab a bird by both thighs and hang its feet in a shackle on an overhead conveyor travelling in the opposite direction.

The hazards of the operation vary. Aside from the normal high level of noise, the darkness and the disorienting effect of opposite running conveyors, there is the dust from flapping birds, suddenly sprayed urine or faeces in the face and the possibility of a gloved finger being caught in a shackle. Conveyor lines need to be equipped with emergency stops. Hangers are constantly striking the backs of their hands against neighboring shackles as they pass overhead.

It is not uncommon for a hanger to be required to hang an average of 23 (or more) birds per minute. (Some positions on the hanger's lines require more physical motions, perhaps 26 birds per minute.) Typically, seven hangers on one line may hang 38,640 birds in 4 hours before they get a break. If each bird weighs approximately 1.9 kg, each hanger conceivably lifts a total of 1,057 kg during the first 4 hours of his or her shift before a scheduled break. The hanger's job is extremely stressful from both a physiological and psychological standpoint. Reducing workload could lessen this stress. The constant grabbing with both hands, pulling in and simultaneously lifting a flapping, scratching bird at shoulder or head height is stressful to the upper shoulder and neck.

The bird's feathers and feet can easily scratch a hanger's unprotected arms. The hangers are required to stand for prolonged periods of time on hard surfaces, which can lead to lower-back discomfort and pain. Proper footwear, possible use of a rump rest stand, protective eyewear, single-use disposable respirators, eyewash facilities and arm guards need to be available for the hanger's protection.

An extremely important element to ensure the worker's health is a proper job conditioning programme. For a period of up to 2 weeks, a new hanger must be acclimated to the conditions and slowly work up to a full shift. Another key ingredient is job

rotation; after two hours of hanging birds, a hanger may be rotated to a less strenuous position. The division of labour among the hangers may be such that frequent short rest breaks in an air conditioned area are essential. Some plants have tried double crewing to allow crews to work for 20 minutes and rest for 20 minutes, to reduce the ergonomic stressors.

The health and comfort conditions for the hangers are somewhat dependent on the outside weather conditions and the conditions of the birds. If the weather is hot and dry, the birds carry with them dust and mites, which easily become airborne. If the weather is wet, the birds are harder to handle, the hangers' gloves readily become wet and the hangers must work harder to hold onto the birds. There have been recent developments in reusable gloves with padded backs.

The impact of airborne particulates, feathers, mites and so on may be lessened with an efficient local exhaust ventilation (LEV) system. A balanced system using the push-pull principle, which uses down-draft cooling or heating, would benefit the workers. Additional cooling fans placed about would upset the efficiency of a balanced push-pull system.

Once hung in the shackles, the birds are conveyed to be initially stunned with electricity. The high voltage does not kill them but forces them to hang limply as a rotating wheel (bicycle tyre) guides their neck against a counter-rotating circular cutting blade. The neck is partially severed with the bird's heart still beating to pump out the remainder of blood. There must be no blood in the carcass. A skilled worker must be positioned to slice those birds the kill machine misses. Because of the excessive amount of blood, the worker must be protected by wearing wet gear (a rain suit) and eye protection. Eye washing or flushing facilities must be made available also.

### **Dressing**

The conveyor of birds then passes through a series of troughs or tanks of circulating hot water. These are called scalders. Water is usually heated by steam coils. The water is usually treated or chlorinated to kill bacteria. This phase allows the feathers to be easily removed. Care must be taken when working around the scalders. Often piping and valves are unprotected or poorly insulated and are contact points for burns.

As the birds exit the scalders, the carcass is passed through a U-shaped arrangement which pulls the head off. These parts are usually conveyed in flowing water troughs to a rendering (or by-products) area.

The line of carcasses passes through machines which have a series of rotating drums fixed with rubber fingers which remove the feathers. The feathers drop into a trench below with flowing water leading to the rendering area.

Consistency in bird weight is extremely critical to all aspects of the processing operation. If the weights vary from load to load, the production departments must adjust their processing equipment accordingly. For example, if lighter-weight birds follow heavier birds through the pickers, the rotating drums may not get all the feathers off. This causes rejects and rework. Not only does it add to the processing costs, but it causes additional ergonomic hand stresses, because someone has to hand pick the feathers using a pincer grip.

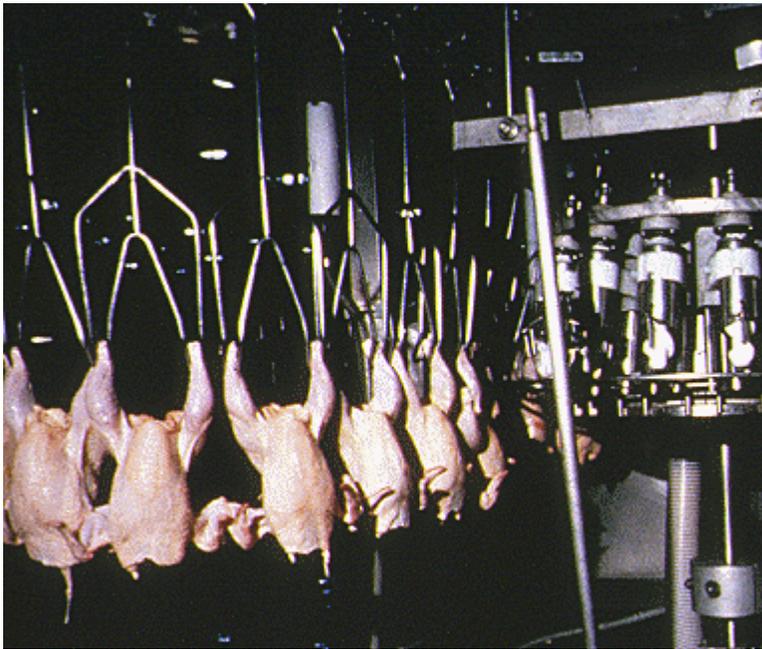
Once through the pickers, the line of birds passes through a singer. This is a gas-fired arrangement with three burners on each side, used to singe the fine hairs and feathers of each bird. Care must be taken to assure that the gas piping's integrity is maintained due to the corrosive conditions of the picking or dressing area.

The birds then pass a hock cutter to sever the feet (or paws). The paws may be conveyed separately to a separate processing area of the plant for cleaning, sizing, sorting, chilling and packaging for the Asian market.

The birds must be rehung on different shackles before they enter the evisceration section of the plant. The shackles here are configured slightly differently, usually longer. Automation is readily available for this part of the process (see figure 67.7). However, workers need to provide back-up if a machine jams, to rehang dropped birds or to manually cut the feet off with pruning shears if the hock cutter fails to sever properly. From a processing and cost standpoint, it is critical that every shackle be filled. Rehang jobs involve exposure to highly repetitive motions and work involving awkward postures (raised elbows and shoulders). These workers are at increased risk for cumulative trauma disorders (CDTs).

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*Figure 67.7 The use of vacuum hoists for lifting boxes allows workers to guide boxes rather than load them by hand*



United Food & Commercial Workers, AFL-CIO

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If a machine goes down or gets out of adjustment, a great deal of effort and stress is applied to get the lines running, sometimes at the expense of workers' safety. When climbing to access points on the equipment, a maintenance worker may not take the time to get a ladder, instead stepping on top of wet, slippery equipment. Falls are a hazard. When any such equipment is purchased and installed, provisions must be made for easy access and maintenance. Lockout points and shut-offs need to be placed on each piece of equipment. The manufacturer must consider the environment and hazardous conditions under which their equipment must be maintained.

#### ***Evisceration***

As the conveyor of birds pass out of dressing into a physically separate part of the process, they usually pass through another singer and then through a rotating circular blade which cuts out the oil sac or gland on each bird's back at the base of the tail. Often such equipment's blades are free rotating and need to guarded properly. Again, if the machine is not adjusted according to the bird's weight, workers must be assigned to remove the sac by slicing it off with a knife.

Next, the conveyor line of birds passes through an automatic venting machine, which pushes up on the abdomen slightly while a blade cuts open the carcass without disturbing the bowel. The next machine or part of the process scoops into the cavity and pulls out the unbroken viscera for inspection. In the United States, the next few processing steps may involve government inspectors who check for growths, air sac disease, faecal contamination and a series of other abnormalities. Usually one inspector checks for only two or three items. If there is a high rate of abnormalities, the inspectors will slow the line down. Often the abnormalities do not cause total rejects, but specific parts of the birds may be washed or salvaged from the carcass to increase yield.

The more rejects, the more manual rework involving repetitive motion due to cutting, slicing and so on the production workers must perform. Government inspectors are usually seated on mandated adjustable elevating stands, whereas production workers called helpers, to their left and right, stand on grating or may use an adjustable sit stand if provided. Foot rests, adjustable height platforms, sit stands and job rotation will help relieve the physical and psychological stresses associated with this part of the process.

Once past the inspections, the viscera are sorted as they pass through a liver/heart or giblet harvester. The separated intestines, stomachs, spleens, kidneys and gall bladders are discarded and flushed into a flowing trench below. The heart and liver are separated and pumped to separate sorting conveyors, where workers inspect and pick by hand. The remaining intact livers and hearts are pumped or carried to a separate processing area to be bulk-packed by hand or later recombined in a giblet pack for stuffing by hand into the cavity of a whole bird for sale.

Once the carcass clears the harvester, the bird's crop is augured out; each body cavity is probed by hand to pull out the remaining viscera and gizzard if necessary. The worker uses each hand in a separate bird as the conveyor passes in front. A suction device is often used to vacuum out any remaining lungs or kidneys. Frequently, due to the bird's habit of ingesting small pebbles or pieces of litter during grow-out, a worker will reach into the bird's cavity and receive painful puncture wounds in the tips of the fingers or under the finger nails.

The small wounds, if not treated properly, run the risk of serious infection since the bird's cavity still is not cleaned of bacteria. Since tactile sensitivity is necessary for the job, there are no gloves yet available to prevent these frequent incidents. A tight-fitting surgeon's type glove has been tried with some success. The line pace is so fast that it does not allow the worker to carefully insert his or her hands.

Finally, the carcass's neck is removed by machine and harvested. The birds go through a bird washer which uses chlorinated spray to wash out excess viscera inside and outside each bird.

Throughout the dressing and evisceration, workers are exposed to high levels of noise, slippery floors and high ergonomic stress on kill, scissor and packaging jobs. According to a NIOSH study, rates of CTDs documented in poultry plants can range from 20 to 30% of workers (NIOSH 1990).

### **Chiller operations**

Depending on the process, necks are pumped to a open-surfaced chiller tank with rotating arms, paddles or augers. These open tanks pose a serious threat to the safety of the worker during operation and need to be properly guarded by removable covers or grills. The tank's cover must allow for visual inspection of the tank. If a cover is removed or lifted, interlocks must be provided to shut off the rotating arms or auger. The chilled necks are either bulk-packed for later processing or taken to the gible wrap area for recombining and wrapping.

Once through evisceration, the conveyor lines of birds are either dropped into large, open-surfaced horizontal chilling tanks or, in Europe, pass through refrigerated, circulating air. These chillers are fitted with paddles which slowly rotate through the chiller, bringing down the bird's body temperature. The chilled water is highly chlorinated (20 ppm or greater) and aerated for agitation. Bird carcass residence time in the chiller may be up to an hour.

Due to the high levels of free chlorine released and circulated, workers are exposed and may experience symptoms of eye and throat irritation, coughing and shortness of breath. NIOSH conducted several studies of eye and upper respiratory irritation in poultry processing plants, which recommended that levels of chlorine be monitored and controlled closely, that curtains be used to contain the liberated chlorine (or an enclosure of some sort should surround the open surface of the tank) and that an exhaust ventilation system should be installed (Sanderson, Weber and Echt 1995).

The resident time is critical and a matter of some controversy. Upon exiting evisceration, the carcass is not completely clean, and the skin pores and feather follicles are open and harbour disease-causing bacteria. The main purpose of the trip through the chiller is to chill the bird quickly to reduce spoilage. It does not kill bacteria, and the risk of cross contamination is a serious public health issue. Critics have called the chiller bath method "faecal soup". From a profit perspective, a side benefit is the fact that the meat will absorb the chiller water like a sponge. It adds almost 8% to the market weight of the product (Linder 1996).

Upon exiting the chiller, the carcasses are deposited on a conveyor or shaker table. Specially trained workers called graders inspect the birds for bruises, skin breaks and so on and rehang the birds on separate shackle lines travelling in front of them. Downgraded birds may travel to different processes for parts recovery. Graders stand for prolonged periods handling chilled birds, which can result in numbness and hand pain. Gloves with liners are worn not only to protect the hands of workers from the chlorine residue, but also to provide some degree of warmth.

### **Cut-up**

From grading the birds travel overhead to different processes, machines and lines in an area of the plant called second or further processing. Some machines are hand fed with two-handed trips. Other, more modern European equipment, at separate stations, may remove the thighs and wings and split the breast, without being touched by the worker. Again, consistency in bird size or weight is critical to the successful operation of this automated equipment. Rotating circular blades must be changed every day.

Skilled maintenance technicians and operators must be attentive to the equipment. Access to such equipment for adjustment, maintenance and sanitation needs to be frequent, requiring stairs, not ladders, and substantial work platforms. During blade changing, handling needs to be cautious because of the slipperiness due to fat build-up. Special cut- and slip-resistant gloves with the fingertips removed protect most of the hand, while the tips of the fingers can be used to manipulate the tools, bolts and nuts used for replacement.

Evolving consumer tastes have affected the production process. In some cases, the products (e.g., drumstick, thighs and breasts) are required to be skinless. Processing equipment has been developed to efficiently remove skin so workers do not have to do so by hand. However, as automated processing equipment is added and lines are rearranged, conditions become more crowded and awkward for workers to get around, manoeuvre floor jacks and carry totes, or plastic tubs, of iced product weighing over 27 kg over slippery, wet floors.

Depending on the customer demand and product mix sales, workers stand facing fixed-height conveyors, selecting and arranging product on plastic trays. The product travels in one direction or drops from a chute. The trays arrive on overhead conveyors, descending so the workers can grab a stack and set them in front for easy reach. Product defects may be either placed on a counter-flow conveyor below or hung in a shackle travelling in the opposite direction overhead. Workers stand for prolonged periods of time almost shoulder to shoulder, perhaps separated only by a tote into which defects or waste are

dropped. Workers need to be provided with gloves, aprons and boots.

Some products may be bulk-packed in cartons covered with ice. This is called ice pack. Workers fill cartons by hand onto scales and manually transfer them to moving conveyors. Later in the ice pack room, ice is added, cartons recovered and the cartons removed and stacked manually on pallets ready for shipment.

Some workers in cut-up are also exposed to high levels of noise.

### ***Deboning***

If the carcass is destined for deboning, the product is tanked out in large aluminium bins or cardboard boxes (or gaylords) mounted on pallets. Breast meat must be aged for a certain number of hours before processing either by machine or hand. Fresh chicken is difficult to cut and trim by hand. From an ergonomic standpoint, meat ageing is a key point in helping to reduce repetitive motion injuries to the hand.

There are two methods used in deboning. In the manual method, once ready, carcasses with only the breast meat remaining are dumped into a hopper leading to a conveyor. This section of the line's workers must handle each carcass and hold them against two horizontal, in-running textured skinner rolls. The carcass is rolled over the rolls as the skin is pulled away and down to a conveyor below. There is a risk of workers becoming inattentive or distracted and having their fingers pulled into the rollers. Emergency stop (E-stop) switches need to be provided within easy reach of either the free hand or knee. Gloves and loose clothing cannot be worn around such equipment. Aprons (worn snugly) and protective eyewear must be worn due to the possibility of bone chips or fragments being thrown.

The next step is performed by workers called nickers. They hold a carcass in one hand and make a slice along the keel (or breastbone) with the other. Sharp, short-bladed knives are normally used. Stainless steel mesh gloves are usually worn over a latex- or nitrile-gloved hand holding the carcass. Knives used for this operation do not need to have a sharp point. Protective eye wear needs to be worn.

The third step is performed by the keel pullers. This may be done manually or with a jig or fixture where the carcass is guided over an inexpensive "Y" fixture (made out of stainless steel rod stock) and pulled toward the worker. The working height of each fixture needs to be adjusted to the worker. The manual method simply requires the worker to use a pincer grip with a gloved hand and pull the keel bone out. Protective eyewear must be worn as described above.

The fourth step requires hand filleting. Workers stand shoulder to shoulder reaching for breast meat as it travels on shackle trays in front of them. There are certain techniques that must be observed for this part of the process. Proper job instruction and immediate correction when errors are observed are necessary. Workers are protected with a chain or mesh glove on one hand. In the other, they hold an extremely sharp knife (with a tip that may be too sharply pointed).

The work is fast paced, and workers who get behind are pressured to take short cuts, such as reaching across in front of the associate next to them or reaching for and/or stabbing a piece of meat travelling by out of their reach. Not only does the knife puncture reduce the quality of the product, but it also results in serious injury to fellow workers in the form of lacerations, which are often subject to infection. Protective plastic arm guards are available to prevent this frequent type of injury.

As the fillet meat is replaced on the conveyor shackle, it is picked off by the next section of workers, called trimmers. These workers must trim excess fat, missed skin and bones out of the meat using sharp and adjusted shears. Once trimmed, the finished product is either tray packed by hand or dropped into bulk bags and placed into cartons for restaurant use.

The second method of deboning involves automatic processing equipment developed in Europe. As with the manual method, bulk boxes or tanks of carcasses, sometimes with wings still attached, are loaded into a hopper and chute. Carcasses may then be picked manually and placed into segmented conveyors, or each carcass must be placed manually onto a shoe of the machine. The machine moves rapidly, carrying the carcass through a series of fingers (to remove skin), cutting blades and slitters. All that remains is a meatless carcass that is bulked out and used elsewhere. Most of the manual line's positions are eliminated, except for the trimmers with scissors.

Deboning workers are exposed to serious ergonomic hazards from the forceful, repetitive nature of the work. In each of the deboning positions, especially filleters and trimmers, job rotation may be a key element to reducing ergonomic stresses. It must be understood that the position a worker rotates to must not use the same muscle group. A weak argument has been made that filleters and trimmers may rotate to each other's position. This should not be allowed, because the same gripping, twisting and turning methods are used in the hand not holding the tool (knife or scissors). It may be argued that the muscles holding a knife loosely for twisting and turning while making fillet cuts are used differently when opening and closing scissors. However, twisting and turning of the hand is still required. Line speeds play a critical role in the onset of ergonomic disorders on these jobs.

### ***Overwrap and chilling***

After the product is tray packed in either cut-up or deboning, the trays are conveyed to another step in the process called overwrap. Workers retrieve specific product in trays and feed the trays into machines which apply and stretch printed clear wrap over the tray, tuck it under and pass the tray over a heat sealer. The tray may then pass through a washer, where it is retrieved and placed in a basket. The basket containing a particular product is placed on a conveyor where it passes into a chiller area. Trays are then sorted and stacked either manually or automatically.

Workers in the overwrap area stand for prolonged periods of time and are rotated so the hands they use to pick up the product trays are rotated. Normally the overwrap area is relatively dry. Cushioned mats would reduce leg and back fatigue.

Consumer demand, sales and marketing can create special ergonomic hazards. At certain times of the year, large trays are packed with several pounds of product for "convenience and cost savings". This added weight has contributed to additional repetitive motion-related hand injuries simply because the process and conveying system is designed for one-handed pick-up. A worker simply does not have the strength necessary for repeated one-handed lifts of overweight trays.

The clear plastic wrap used in the packing may release slight amounts of monomer or other decomposition products when heated for sealing. If complaints arise concerning the fumes, the manufacturer or supplier of the film should be called in to help assess the problem. LEV may be necessary. The heat-sealing equipment needs to be maintained properly and its E-stops checked for proper operation at the beginning of each shift.

The chilling room or refrigeration area poses a different set of fire, safety and health risks. From a fire standpoint, the product packaging poses a risk since it is usually highly combustible polystyrene. The wall's insulation is usually a polystyrene foam core. Chillers should be properly protected with pre-action dry sprinkler systems designed for extraordinary hazard. (Pre-action systems employ automatic sprinklers attached to piping systems containing dry air or nitrogen as well as a supplemental detection system installed in the same area as the sprinklers.)

Once the baskets of trays enter the chiller, workers must physically pick up a basket and lift it to shoulder height or higher to a stack on a dolly. After so many baskets are stacked, workers are required to assist each other to stack the baskets of product higher.

Temperatures in the chiller may run as low as  $-20^{\circ}\text{C}$ . Workers should be issued and instructed to wear multilayered clothing or "freezer suits" along with insulated safety-toed footwear. Dollies or stacks of baskets must be physically handled and pushed to various areas of the chiller until called for. Often, workers attempt to save time by pushing several stacks of trays at one time, which can result in muscle or lower-back strain.

Basket integrity is an important aspect of both product quality control and worker safety. If broken baskets are stacked with other full baskets stacked on top, the entire load becomes unstable and is easily tipped over. Product packages fall on the floor and become dirty or damaged, resulting in rework and extra manual handling by workers. Stacks of baskets may also fall on other workers.

When a particular product mix is called for, baskets may be destacked manually. Trays are loaded onto a conveyor with a scale which weighs them and attaches labels marked with the weight and codes for tracking purposes. Trays are packed manually in cartons or boxes sometimes lined with impermeable liners. Workers often have to reach for trays. As in the case of the overwrap process, larger, heavier packages of product can cause stress to the hands, arms and shoulders. Workers stand for prolonged periods in one spot. Antifatigue mats can reduce leg and lower-back stresses.

As the cartons of packages pass down a conveyor, liners may be heat sealed while  $\text{CO}_2$  is injected. This, along with continued refrigeration, prolongs product shelf life. Also, as the carton or case continues its progress, a scoop of  $\text{CO}_2$  nuggets (dry ice) is added to prolong shelf life on its way to a customer in a refrigerated trailer. However,  $\text{CO}_2$  has inherent hazards in enclosed areas. The nuggets may either be dropped by the chute or scooped out of a large, partially covered bin. Though the exposure limit (TLV) for  $\text{CO}_2$  is relatively high, and continuous monitors are readily available, workers also need to learn its hazards and symptoms and wear protective gloves and eye protection. Proper warning signs should also be posted in the area.

Cartons or cases of trayed product usually are sealed with hot-melt adhesive injected onto the cardboard. Painful contact burns are possible if adjustments, sensors and pressures are improper. Workers need to wear protective eyewear with side shields. The application and sealing equipment needs to be completely de-energized, with pressure bled off, before adjustments or repairs are made.

Once the cartons are sealed, they may either be manually lifted from the conveyor or run through an automatic palletizer or other remotely operated equipment. Due to the high rate of production, the potential for back injuries exists. This work is usually performed in a cold environment, which has a tendency to lead to strain injuries.

From an ergonomic standpoint, carton retrieval and stacking is easily automated, but investment and maintenance costs will be high.

### ***Thigh deboning and ground chicken***

No part of the chicken is wasted in modern poultry processing. Chicken thighs are bulk-packed, stored at or near freezing and then further processed, or deboned, either with scissors or pneumatically actuated hand-operated trimmers. Like the breast deboning operation, thigh deboning workers must remove excess fat and skin with scissors. Work area temperatures may be as low as  $4$  to  $1^{\circ}\text{C}$ . Despite the fact that trimmers may wear liners with gloves, their hands are sufficiently chilled to restrict

blood circulation, thereby magnifying the ergonomic stresses.

Once chilled, the thigh meat is further processed by adding flavours and grinding under a  blanket. It is extruded as ground chicken patties or bulk.

#### ***Deli processing***

Necks, backs and remaining carcasses from breast deboning are not wasted, but dumped into large paddle grinders or mixers, pumped through chilled mixers and extruded into bulk containers. This is usually sold or sent for further processing into what is called “chicken hot dogs” or “frankfurters”.

The recent development of convenience foods, which require little processing or preparation in the home, has resulted in high-value-added products for the poultry industry. Select pieces of meat from breast deboning are placed in a rotating vessel; solutions of flavouring and spices are then mixed under vacuum for a prescribed length of time. The meat gains not only flavour but weight as well, which improves the profit margin. The pieces are then packaged individually in trays. The trays are sealed under vacuum and packed off in small cases for shipment. This process is not time dependent, so workers are not subjected to the same line speeds as others in cut-up. The final product must be handled, inspected and packed carefully so it presents well in the stores.

#### **Summary**

Throughout poultry plants, wet processes and fat can create very dangerous floors, with a concurrent high risk of slipping and falling hazards. Proper cleaning of floors, adequate drainage (with protective barriers placed on all floor holes), proper footwear (waterproof and anti-slip) provided to workers and anti-slip floors are key to preventing these hazards.

In addition, high levels of noise are pervasive in poultry plants. Attention must be paid to engineering measures that decrease noise levels. Earplugs and replacements must be provided, as well as a full hearing conservation programme with annual hearing exams.

The poultry industry is an interesting blend of labour-intensive operations and high-tech processing. Human sweat and anguish still characterize the industry. The demands for increased yield and higher line speeds frequently overshadow efforts to properly train and protect the workers. As the technology improves to help eliminate repetitive-motion injuries or disorders, the equipment must be carefully maintained and calibrated by skilled technicians. The industry generally does not attract highly skilled technicians because of the mediocre pay levels, extremely stressful working conditions and often autocratic management, which also often resists positive changes that can be achieved with pro-active safety and health programming.