follow-up analyses and trend analysis might be performed to verify process control.

Other possible CCP's in beef slaughter are described in the "Generic HACCP for Raw Beef" (see Appendix).

## The HACCP System for Poultry Slaughter

The current systems of postmortem inspection for poultry share elements of a HACCP system approach, such as critical limits, monitoring, corrective action plans, recordkeeping, verification tasks, critical limits or tolerance levels, monitoring tasks, corrective actions, and recordkeeping. However, these components are not arranged in the highly organized systematic manner that is evidenced in a HACCP system.

Major differences between a HACCP system and the present poultry slaughter systems are hazard identification and analysis, and the specific identification of critical control points which are not a part of current poultry slaughter systems. The progression to a HACCP system in poultry slaughter would cause some significant changes to emerge. These changes would include more industry involvement and responsibility for control of processes executed to produce an end product that is safe, wholesome, and unadulterated.

Under HACCP, the establishment would define processing steps where control can be exerted to effectively prevent, eliminate, or reduce food safety hazards. Because *Salmonella* is a significant microbial hazard in raw poultry, establishments would be expected to target measures that prevent contamination and control the growth of *Salmonella* throughout the slaughter process.

For example, under a HACCP system, the establishment may set criteria for maximum permissible levels of *Salmonella* in a flock presented for slaughter. CCP's for control of this enteric pathogen may include requiring that flock health records be reviewed, that the level of *Salmonella* on each flock brought for slaughter be monitored, and that corrective action be taken when appropriate levels are not met.

At evisceration, critical limits would be set for fecal or other intestinal contamination present on the carcass. Monitoring would be conducted at a set frequency, the results would be recorded after observing the carcasses, and corrective action would be taken if the limits were exceeded.

In addition, control of *Salmonella* may include targeting the chlorine level in the rinse water required for automatic evisceration equipment, the level of antimicrobial treatment in the chiller, and/or the temperature of the chill water. These would constitute CCP's identified by the establishment.

Critical limits would be set based on allowable levels and types of antimicrobials used, monitored by testing at appropriate frequency, and recorded in a log or other record.

Corrective action taken may include more frequent changes of chill water, better temperature control to preclude the growth of pathogens, or use of an alternate antimicrobial rinse.

Currently, some establishments rely on FSIS personnel to detect contamination by visual examination of the carcass or by using chiller water temperatures as an indicator of less than satisfactory conditions. This would occur as a result of end product examination. The HACCP approach requires the establishment to implement effective preventive measures.

Industry would follow a similar protocol for all points in the poultry slaughter process where a potential hazard can be prevented, eliminated, or reduced to an acceptable level. This demonstrates CCP's in an establishmentcontrolled HACCP system.

## The HACCP System for Cooked Sausage

For the development of a HACCP plan, an establishment producing a cooked sausage must evaluate the entire manufacturing process. The focus of a HACCP plan on the prevention of food safety hazards requires defining where unsafe conditions can occur, setting target limits, and defining corrective action.

Cooked sausage is a broad category which includes frankfurters (hot dogs and wieners), vienna sausage, bologna, knockwurst, braunschweiger (liver sausage), and similar products. In this example, assume that the establishment produces bologna.

Because HAČCP is a hazard prevention process control system, processing hazards must now be identified. The finished product bologna—is a fully cooked product that can be consumed without further safety treatment (i.e., cooking).

Consequently, raw materials (meat and other ingredients) must be handled to reduce the opportunity for microbiological growth. CCP's requiring limits would include ensuring that incoming ingredients are adequately packaged to prevent contamination, and perishable ingredients are kept within temperature limits that assure their safety.

Cooking is considered a primary kill step in processed products where

microbiological hazards can be controlled. Critical limits must be set by an establishment to assure that the product has been sufficiently heat treated to preclude the growth of pathogenic microorganisms. The manufacturer of a poultry bologna may set 160 °F as the critical limit for the internal temperature and test a set amount of product, recording the internal temperature, time the temperature was recorded, and the lot number and size.

If the product does not meet the critical limit set by the establishment, corrective action can be instituted that could include recooking the lot of product or chilling and reworking the lot into subsequent production.

The cooling process is another example of a CCP in the processing of a cooked sausage product. Improper chilling after the lethal heat treatment is applied can result in the growth of microorganisms (particularly vegetative spores) which may have survived the heating process. Improper chilling will permit the growth of these microbes and render the product unsafe.

The HACCP approach would ensure that an establishment targets chilling as a CCP, sets critical limits including time and temperature parameters (e.g., 5 hours to reach and maintain 40°F internally), monitors the temperature at frequent intervals, records the results, and takes appropriate corrective action if the critical limit is exceeded. Corrective action might include recooking the lot of product and recooling.

In addition to microbial hazards, physical and chemical hazards must be identified. The use of nitrite in cooked sausages serves two functions-color development and some protection against the outgrowth of anaerobic organisms. Under HACCP, an establishment would set a critical limit for nitrite in the product, monitor the formulation of each batch of product produced, record the exact amount of each ingredient used, and take appropriate corrective action if the limit were exceeded. Corrective action might include the addition of other ingredients, such as meat, to offset the addition of excess nitrite.

Therefore, it becomes the responsibility of the establishment under HACCP to identify CCP's, monitoring procedures, and corrective action that specifies what would happen to product that is or may be affected and what would happen to prevent the violation from recurring. Finally, all HACCP plans must identify the documentation that would occur to