

# **QUALITY MANAGEMENT (HACCP) IN MEAT PROCESSING**

Suey-Ping Chi  
Taiwan Livestock Research Institute  
112, Mu Chang Rd.  
Hsin Hua, Tainan County, Taiwan ROC

## **ABSTRACT**

*HACCP (Hazard Analysis Critical Control Point) was a system originally set up when food was being produced for astronauts in the United States space program. The system was made public in 1971, and has since been adopted by many countries around the world, including many in Asia. HACCP is basically a preventative system, designed to correct problems before they affect the safety of food products. The paper discusses procedures involved, from assembling the HACCP team to describing the food, developing the process flow diagram and deciding how products can be grouped. After these preliminary steps, there follow the seven steps of the HACCP program, beginning with hazard analysis and ending with verification.*

## **INTRODUCTION**

The Hazard Analysis Critical Control Point (HACCP) system is a scientific approach to quality control. It is designed to prevent problems by making sure that controls are applied at any point in a food production system where hazardous or critical situations could occur. Both the concept and practice of the HACCP system began with the Pillsbury Company's projects in food production and research for the space program. The HACCP system was first made public during the 1971 National Conference on Food Protection. Since then, it has been adopted by many countries around the world.

### **PRELIMINARY STEPS BEFORE DEVELOPING AN HACCP PLAN**

Most experts believe that a company will do a better job of developing an HACCP plan if it first takes some preliminary steps.

#### **Assemble the HACCP team**

Assembling a HACCP team may seem a daunting task, especially for the owner of a small family company. However, it is strongly recommended that companies have more than one person working on the development of

their HACCP system. It is one of those tasks that is probably best done by more than one person, even in a small company.

HACCP is an overall process control system. We believe it takes different kinds of knowledge and experience to develop a good system. If your company has only a few people in it, they may all need to be on the HACCP team, because they all probably have multiple roles and responsibilities in the company's operations.

You should also consider including people from outside the company on your HACCP team. You may be able to get help from a trade association or from a local college, university or extension office which has people in it who know about HACCP. Individuals from outside trained in HACCP do not need to be company employees, but they do need to be available to you for plan development and for certain other functions, such as reassessing your HACCP plan.

#### **Describe the food and who it is intended for**

The next step is for the HACCP team to describe the product(s) and their methods of production and distribution. If your team includes the people who know how things work in your operations, they should be able

Keywords: biological hazards, chemical hazards, critical control points, HACCP, meat processing, meat products, physical hazards

to do this quite easily. The important thing for them to keep in mind is that they must include every step of the process. The following questions should be answered when you describe the product:

- What is the common name of the product?
- How is the product to be used?
- What type of packaging encloses the product?
- What is the length of shelf life of the product, at what temperature?
- Where will the product be sold? Who is the intended consumer and what is the intended use?
- What labeling instructions are needed?
- Are special distribution controls needed?

### **Develop a process flow diagram**

A flow diagram is a simple chart of the process you use in your plant to produce the product. It needs to be an accurate, clear sketch of the process used in your plant to make the product. The best way to make sure your flow diagram is accurate is to have the HACCP team verify it by walking through the plant, and making sure all the steps in the process you carry out are included in the flow diagram.

Verifying the flow diagram is a step your team should be sure to do carefully. It is a common way in which auditors or inspectors verify that a particular flow diagram is correct and complete. When you are certain that you have an accurate flow diagram and your team has verified it, it is time to move to the final step.

### **Decide whether products can be grouped**

This part of the regulations lists nine process categories into which meat and poultry production can be grouped. The nine categories are listed below, together with some examples.

- Slaughter, all species: Beef, swine, and poultry
- Raw product, ground: Ground beef, ground pork, ground turkey
- Raw product, not ground: Boneless cuts, steaks
- Thermally processed, commercially sterile:

Canned beef stew, pasta with meat

- Not heat treated, shelf stable: Dried salami
- Heat treated, shelf stable: Beef jerky
- Fully cooked, not shelf stable: Hot dogs, wieners, roast beef, ham
- Heat treated but not fully cooked, not shelf stable: Partially cooked patties, bacon
- Product with secondary inhibitors, not shelf stable: Corned beef, cured beef tongue

After you have completed the preliminary steps, it is time for you to apply the seven principles of HACCP and develop your HACCP plan.

### **SEVEN PRINCIPLES APPROACH FOR HACCP SYSTEM**

HACCP is usually defined as a preventive, seven-principle approach to food safety. The steps include:

1. Conducting a hazard analysis and assessment;
2. Determining critical control points (CCPs);
3. Establishing critical limits for CCPs;
4. Monitoring critical limits;
5. Correcting deviations from critical limits;
6. Establishing an effective record keeping system *and*;
7. Verifying that the HACCP program is working correctly.

### **HOW TO CONDUCT A HAZARD ANALYSIS**

The first principle of HACCP is to conduct a hazard analysis. Before beginning the process, you should review the definitions of food safety hazards and preventive measures.

Conducting a hazard analysis is generally considered to be a two-step process. The first step is to identify the threats to human health which might be introduced into meat and poultry products during processing. These hazards are usually grouped into three categories: Biological, chemical, and physical.

#### **Biological hazards**

Biological hazards are living organisms that can make food unsafe to eat. Biological hazards may be bacteria, parasites, or viruses. Biological hazards are frequently associated

with the raw materials from which meat and poultry products are made, including living animals and birds.

Biological hazards may be also introduced during processing; by people involved in the processing; from the environment in which foods are processed; from other ingredients in the products; or from the processes themselves.

Currently, there is a great deal of emphasis on microbial hazards associated with meat and poultry products. Some of the major pathogens that may be associated with meat and poultry products are: *Salmonella*, *Campylobacter jejuni*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Clostridium botulinum*, *Staphylococcus aureus* and *Yersinia enterocolitica*.

## Chemical Hazards

Chemical hazards may be something which occurs naturally in foods, or something added during processing. Harmful chemicals have been associated with both acute illness and chronic illness. Naturally occurring chemical hazards are those that are natural constituents of foods and not the result of other environmental contamination. They include aflatoxins, mycotoxins and shellfish toxins.

Added chemical hazards are those which are intentionally (or sometimes unintentionally) added to food during growth, harvesting, storage, processing, packaging or distribution. This group of chemical hazards is very broad. It might include components of animal feed or drinking water, animal drugs, pesticides, food ingredients themselves, or chemicals used in the processing plant such as lubricants, cleaners, paints and coatings.

## Physical hazards

A physical hazard is a component of a food that is unexpected and may cause illness or injury to the person consuming the food. Foreign materials such as glass, metal or plastic are familiar physical hazards in meat and poultry products. They usually occur because a piece of equipment has not been properly looked after while the food was being produced. There are a number of situations that can contribute to physical

hazards in foods. They include:

- Contaminated raw materials;
- Poorly designed or poorly maintained facilities and equipment;
- Contaminated packaging materials; and,
- Inattention to details by employees with key responsibilities.

The first step in identifying hazards should be to use the flow diagram and product description which you created in your preliminary steps. You should systematically think about what could occur at each step in the process.

The second step in performing a hazard analysis is to identify the preventive measures that could be used to prevent each hazard. These are the physical, chemical, or other means that can be used to control a food safety hazard.

More than one preventive measure may be needed to control a food safety hazard, while more than one hazard may be controlled by a preventive measure.

It is helpful to list the actual hazards or organisms of concern. For example, you might list metal contamination from equipment, *Salmonella*, *Escherichia coli* O157:H7, *Campylobacter jejuni*, *Listeria monocytogenes* or other specific pathogenic hazards, or a specific residue that is known to occur in your product.

We cannot overemphasize how important it is to do a good job on your hazard analysis. This is often a difficult and time-consuming step. It is one that requires all the technical and scientific resources you can get. You cannot expect to develop a good HACCP system if you have not been careful and thorough in your hazard analysis.

## HOW TO IDENTIFY CRITICAL CONTROL POINTS

The second HACCP principle is to identify the critical control points (CCPs) in the processing. A CCP is a point, step, or procedure in a food process at which control can be applied. As a result, a food safety hazard can be eliminated, or reduced to acceptable levels. For each food safety hazard reasonably likely to occur, you have identified a preventive measure.

Your next step is to find the point or points in the process where these preventive

measures should be applied. Some common points where control can be applied in your process include:

- Chilling to temperatures that minimize microbial growth;
- Cooking at a specific temperature for an exact period of time in order to destroy microbial pathogens;
- Product formulations, such as the addition of cultures or adjustment of pH or water activity;
- Processing procedures, such as filling and sealing cans; *and*,
- Slaughter procedures such as evisceration or anti-microbial interventions.

## HOW TO ESTABLISH CRITICAL LIMITS

A critical limit is the maximum or minimum value to which a physical, biological or chemical hazard must be controlled at a critical control point. This criterion must be met in order to prevent, eliminate, or reduce to an acceptable level an identified food safety hazard.

A critical limit will usually be a reading or observation such as a temperature, a time, a product property such as water activity, or a chemical property such as available chlorine, salt concentration, or pH.

Critical limits need to be exact and specific. HACCP plans should use a measurement, not a range of measurements, as critical limits.

There are two types of critical limits. A critical limit can be an upper limit which cannot be exceeded. A critical limit can also be a lower limit, where a minimum amount is required to keep the food safe. A temperature in a grinding room of 15°C to help control pathogen growth is an example of an upper critical limit. An example of a lower critical limit would be the addition of an acidifier to inhibit bacterial growth.

## HOW TO ESTABLISH MONITORING PROCEDURES

Monitoring procedures are carried out routinely, either by employees or by mechanical means, to measure the process at a given CCP, and create a record for future use. Monitoring procedures include observations by employees, and checks such as checking the

documentation accompanying incoming materials. Other monitoring procedures are records from instruments such as recording thermometers.

Continuous monitoring is always preferred if it is possible. If it is not possible, your HACCP team will need to decide what will be their non-continuous monitoring procedures, and how frequently they will be performed.

There are several issues to consider when deciding the frequency of non-continuous monitoring checks. The most important is that the procedures must be performed sufficiently often to accurately measure any variations in the process. When monitoring procedures show that there has been a deviation from a critical limit, corrective action needs to be applied.

Generally, physical and chemical procedures are preferred over microbial approaches for monitoring, because they provide more rapid feedback. Employees monitoring CCPs should be trained in the technique they will use. They should fully understand the purpose and importance of monitoring, and accurately report monitoring activities and results.

The persons performing monitoring must record exact values where exact values are indicated, not "yes/no" or "OK". This means that if the critical limit is a minimum internal temperature of 72°C, the observations on the monitoring record would be recorded as 71°C or 73°C, rather than as "yes" or "no".

## HOW TO ESTABLISH CORRECTIVE ACTION

HACCP is a preventive system to correct problems before they affect the safety of food products. Deviations from critical limits will occur, so you need to have a plan to make sure those deviations do not lead to unsafe products. For each CCP, you need to devise a standardized set of actions that company employees will follow when there is a deviation from a critical limit.

These are some questions which should be considered when you are developing corrective action.

- How will people be informed when the deviation occurs?
- If the person doing the monitoring procedure is the one to first notice the

deviation, who will that person contact?

- Who will be responsible for controlling any product that may have been affected by the deviation?
- How should that person decide how much of the product needs to be controlled?
- Who will be involved in deciding what to do about any of the product which may have been affected by the deviation?
- How will you decide what was the cause of the deviation?
- If you need technical experts from outside the company, where do you get them from?
- Once you have figured out what was the cause of the deviation, who will be involved in deciding how to get the process back under control, and how will you prevent recurrence of the deviation?
- If the staff trained in HACCP are not immediately available in the plant when the deviation occurs, whom can you get with the necessary HACCP expertise to advise if your plan needs to be modified?
- Who in the company needs to approve any modifications to the plan?
- Who will be responsible for keeping the records of everything you do in response to a deviation from a critical limit at this particular control point?
- If any person who has a responsibility in the corrective action plan is not available, who will be the back-up?
- Is this set of corrective actions feasible at all times?

### **HOW TO ESTABLISH A RECORD-KEEPING SYSTEM**

The practice of HACCP requires that a full set of records be kept about both plan development and the operation of the system. Clearly, more sophisticated records are required for more complex operations. One way to approach the record-keeping requirements of your HACCP system is to review the records you already keep, and see if they are suitable. Perhaps they may need minor modifications for the HACCP system. The best record-keeping system is usually a simple one that can be

easily integrated into your existing operation.

When you are setting up your record-keeping system, think about who will be in the best position to make the record entry, and who will need to review the records before the product is shipped. You also need to consider where will be the best place to keep the records. You should try to develop simple forms that are easily understood. Make sure your employees know exactly what is expected if they are responsible for making a record entry. It is extremely important that they sign and date the record at the time when a specific event occurs.

### **HOW TO VALIDATE A HACCP SYSTEM**

The final principle of HACCP is to establish verification procedures, to make sure the plan is working correctly. You need to decide the procedures your plant needs to carry out in order to do this, and how often they should be performed.

Verification makes use of procedures and tests in addition to those used in monitoring, to see whether the HACCP system is in compliance with the HACCP plan or whether it needs modification. Ongoing verification ensures that the HACCP plan is working effectively on a day-to-day basis. This type of verification includes such tasks as calibrating monitoring instruments, observing monitoring activities and corrective actions, and reviewing HACCP records to see that they are being kept according to the plan.

Reassessment is an overall review of the plan that must be performed at least annually, or whenever any changes occur that could affect the hazard analysis. Reassessment is similar to validation, in that it considers whether the plan is adequate in general terms rather than focusing on the plan's daily operations.

### **REFERENCES**

- NACMCF. 1992. *Hazard Analysis and Critical Control Point System*. National Advisory Committee on Microbiological Criteria for Foods, Washington, D.C., United States.
- Pearson, A.M. and Dutson, T.R. 1995. *HACCP in Meat, Poultry and Fish Processing*. Blackie Academic &

- Professional, Bishopbriggs, United Kingdom.
- Pierson, Merle D. and Corlett, D.A., Jr. (Eds.). 1992. *HACCP: Principles and Applications*. Van Nostrand Reinhold, New York, United States.
- Snyder, O.P., Jr. 1990. Applying HACCP for Food Safety Assurance in the 21st Century. *Dairy, Food and Environmental Sanitation* 10,4: 197-204.
- USDA. 1999. *Generic HACCP Model for Heat Treated but Not Fully Cooked, Not Shelf Stable Meat and Poultry Products. HACCP-II*. US Department of Agriculture, Food Safety and Inspection Service, Washington, D.C., United States.
- USDA. 1999. *Guidebook for the Preparation of HACCP Plans. HACCP-I*. US Department of Agriculture, Food Safety and Inspection Service, Washington, D.C., United States.
- U.S. Dept. of Health, Education and Welfare. 1972. *Proceedings of the 1971 Conference on Food Protection*. U.S. Government Printing Office, Washington, D.C., United States.