



**United States
Department of
Agriculture**

**Food Safety
and Inspection
Service**

April 1997

HACCP-2

Meat and Poultry Products Hazards and Control Guide

TABLE OF CONTENTS

Preface	D-1
Section I - Overview of Biological, Chemical, and Physical Hazards	D-2
Biological Hazards	D-2
Table 1 - Characteristics of Growth for Nine Pathogens Associated with Meat and Poultry Products	D-4
Chemical Hazards	D-6
Table 2 - Types of Chemical Hazards	D-7
Physical Hazards	D-8
Table 3 - Types of Physical Hazards	D-8
Section II - Controls and Critical Limits for Biological, Chemical, and Physical Hazards	D-9
Table 4 - Examples of Preventive Measures for Biological Hazards	D-10
Table 5 - Examples of Preventive Measures for Chemical Hazards	D-11
Table 6 - Examples of Preventive Measures for Physical Hazards	D-12
Table 7 - Some Examples of Regulatory Limits	D-13
Section III - Red Meat (Beef) Slaughter Hazards and Controls	D-14
Table 8 - Red Meat Slaughter: Beef	D-15
Section IV - Red Meat (Swine) Slaughter Hazards and Controls	D-17
Table 9 - Red Meat Slaughter: Swine	D-18
Section V - Poultry Slaughter Hazards and Controls	D-20
Table 10 - Poultry Slaughter	D-21
Section VI - Ingredient Hazards and Ingredient - Related Hazards	D-29
Table 11 - Ingredient and Ingredient - Related	D-30
Section VII - Processing Hazards and Controls	D-45
Table 12 - Processing	D-46
Section VIII - References	D-58
Hazard Analysis Critical Control Point Systems	D-58
Foodborne Illnesses	D-59
Biological, Chemical, and Physical Hazards	D-59
Internet Home Pages	D-60

PREFACE

This Guide is designed to help a plant's HACCP team conduct a hazard analysis (HACCP Principle 1) by providing both general and detailed information on hazards associated with meat and poultry products and by listing some of the controls that can be used to prevent or manage those hazards. When using this Guide, it is very important to remember that it is not all-inclusive: there may be other hazards associated with ingredients or processes and there may be other control measures. The examples assembled here are to help plant HACCP teams think through all the hazards that could affect their product and know about various controls that can be used.

Section I describes some of the biological (including microbiological), chemical, and physical hazards generally recognized and associated with meat and poultry products. This section can serve as a resource when the HACCP team begins the hazard analysis. It is probably useful to read through this general information early in the process of developing the HACCP plan. This will help the team form an idea of what is meant by a given hazard.

Section II provides information on generally recognized preventive measures used in the meat and poultry industry to control biological, chemical, and physical hazards. This section also has examples of regulatory critical limits associated with some preventive measures.

Sections III, IV, and V list processing steps, hazards, and controls for beef, swine, and poultry slaughter. This section should be used with the process flow diagram developed by the HACCP team.

Section VI presents hazards and controls organized according to ingredients, including both meat and poultry ingredients and other ingredients used in meat and poultry production. This section should be used with the list of ingredients developed by the HACCP team.

Section VII contains a set of tables identifying potential hazards at various processing steps used to produce meat and poultry products. This section should be used with the process flow diagram developed by the plant's HACCP team.

Section VIII contains a list of valuable references that will help the plant's HACCP team further develop the HACCP plan.

SECTION I

OVERVIEW OF BIOLOGICAL, CHEMICAL, AND PHYSICAL HAZARDS

In a HACCP system, a hazard is defined as a biological, chemical, or physical property that may cause a food to be unsafe for human consumption. This guide is a reference for plant HACCP teams to use in their hazard identification and analysis. It is not intended to be totally inclusive; the team may have other information or may rely on additional references.

BIOLOGICAL HAZARDS

Biological hazards, mainly bacterial, can cause either foodborne infections or intoxications. A foodborne infection is caused by a person ingesting a number of pathogenic microorganisms sufficient to cause infection as a result of their multiplication, e.g., salmonellosis. A foodborne intoxication is caused by the ingestion of preformed toxins produced by some bacteria when they multiply and release toxin into the food product, e.g., staphylococcal enterotoxin.

Nine pathogenic bacteria are frequently implicated in foodborne illness and should be considered in assessing hazards to human health from the consumption of meat and poultry products. The following identifies and discusses the nine pathogenic microorganisms of concern.

Bacillus cereus

B. cereus causes foodborne illness. There are two types of toxins - diarrheal and emetic (vomiting).

Foods associated with illness include: boiled and fried rice, custards, cereal products, meats, vegetables, and fish; food mixtures such as sauces, puddings, soups, casseroles, pastries, and salads.

Campylobacter jejuni

Campylobacteriosis is the illness caused by C. jejuni. It is also often known as campylobacter enteritis or gastroenteritis.

Food associated with illness include: raw and undercooked chicken, and raw milk.

Clostridium botulinum

Foodborne botulism (as distinct from wound botulism and infant botulism) is a severe foodborne disease caused by the ingestion of foods containing the potent neurotoxin formed during growth of the organism. Botulism has a high mortality rate if not treated immediately and properly.

Foods associated with disease include: meat products, such as sausages, seafood products, improperly canned foods, and vegetable products.

Clostridium perfringens

Perfringens foodborne illness is the term used to describe the common foodborne disease caused by the release of enterotoxin during sporulation of C. perfringens in the gut.

Foods associated with illness include: meat and poultry products and gravy.

Escherichia coli O157:H7

Hemorrhagic colitis is the name of the acute disease caused by E. coli O157:H7.

Foods associated with illness include: undercooked or raw hamburger (ground beef); in sporadic cases, other meat products and raw milk.

Listeria monocytogenes

Listeriosis is the name of the general group of disorders caused by L. monocytogenes.

Foods associated with illness include: cole slaw, cooked poultry, cooked meat, and raw milk, supposedly pasteurized fluid milk, and cheeses (particularly soft-ripened varieties). Its ability to grow at temperatures as low as 3°C permits multiplication in refrigerated foods.

Salmonella spp.

S. typhi and the paratyphoid bacteria are normally septicemic and produce typhoid or typhoid-like fever in humans and are predominantly human bacteria. Other forms of salmonellosis generally produce milder symptoms. *Salmonella* spp. are found in the intestinal tracts of warm blood animals.

Foods associated with illness include: raw and cooked meats, poultry, eggs (and exterior of egg shells), raw milk and dairy products, fish, shrimp, frog legs, yeast, sauces and salad dressing, etc.

Staphylococcus aureus

Staphylococcal food borne illness (staphylococcal enterotoxicosis; staphylococcal enterotoxemia) is the name of the condition caused by the enterotoxins that some strains of S. aureus produce and release into the food product.

Foods associated with illness include: meat and meat products; poultry and egg products; egg, tuna, ham, chicken, potato, and macaroni salads; sandwich fillings; milk and dairy products; etc.

Yersinia enterocolitica

Yersiniosis is the name of the disease caused by pathogenic species in the genus Yersinia. The disease is a gastroenteritis with diarrhea and/or vomiting, fever, and abdominal pain.

Foods associated with illness include: meats, oysters, fish, milk, and chitterlings.

TABLE 1			
Characteristics of Growth			
for Nine Pathogens Associated with Meat and Poultry Products			
Pathogens	Temperature for Growth	pH	Minimum A_w
<u>Bacillus cereus</u>	10-48	4.9-9.3	0.95
<u>Campylobacter jejuni</u>	30-47	6.5-7.5	---
<u>Clostridium botulinum</u> Group I (Toxin types A,B,F) 10-48 Group II (Toxin types B,E,F) 3.3-45		>4.6	0.94
<u>Clostridium perfringens</u>	15-50	5.5-8.0	0.95
<u>Escherichia coli O157:H7</u>	10-42	4.5-9.0	---
<u>Listeria monocytogenes</u>	2.5-44	5.2-9.6	---
<u>Salmonella</u>	5-46		
<u>Staphylococcus aureus</u>	6.5-46	5.2-9	0.86
<u>Yersinia enterocolitica</u>	2-45	4.6-9.6	---

Zoonotic agents are biological hazards that cause disease in animals and can be transmitted and cause disease in humans. The following lists some zoonotic hazards:

Trichinella spiralis is a nematode parasite whose larval form encysts primarily in the striated muscle of pigs, horses, rats, bears, and other mammals. Infection in humans results in “flu-like symptoms” (diarrhea, fever, stiffness, muscle pain, respiratory distress, etc.). Heavy infection may lead to death.

Foods associated with illness include: raw and undercooked pork, bear, and equine meat.

Taenia saginata is a human tapeworm whose larval form (Cysticercus bovis) encysts in the tissues of cattle.

Foods associated with illness include: raw or undercooked beef.

Taenia solium is a human tapeworm whose larval form (Cysticercus cellulosae) encysts in the tissues of pigs, dogs, and humans. Cysts in humans are most common in the subcutaneous tissues, eye, and brain.

Foods associated with illness include: raw or undercooked pork.

Toxoplasma gondii is a protozoan parasite that encysts in the tissues of a variety of mammalian hosts including pigs. Human infection may result in “flu like” symptoms in adults, late term abortions in pregnant women, or serious congenial infections in children.

Foods associated with illness include: raw or undercooked pork.

Balantidium coli is a protozoal organism found primarily in swine and less commonly in other animals. Human illness in debilitated patients may cause bloody dysentery, severe dehydration and, rarely, death.

Foods associated with illness include: raw or undercooked pork (fecal contamination).

Cryptosporidium spp. is a protozoan parasite which infects epithelial cells of man and large mammals (particularly cattle and sheep). Human illness has been described as a diarrheal, cholera-like illness prolonged and often severe in immunodeficient humans.

Foods associated with the illness include: raw milk and fecally contaminated product.

CHEMICAL HAZARDS

While biological hazards are of great concern because contaminated foods can cause widespread illness outbreaks, chemical hazards may also cause foodborne illnesses, although generally affecting fewer people.

Chemical hazards can originate from four general sources:

1. Unintentionally added chemicals
 - a) Agriculture chemicals: pesticides, herbicides, animal drugs, fertilizers, etc.
 - b) Plant chemicals: cleaners, sanitizers, oils, lubricants, paints, pesticides, etc.
 - c) Environmental contaminants: lead, cadmium, mercury, arsenic, PCBs.
2. Naturally-occurring chemical hazards: products of plant, animal, or microbial metabolisms such as aflatoxins, etc.
3. Intentionally Added Chemicals: preservatives, acids, food additives, sulfiting agents, processing aids, etc.

For many years the Food Safety and Inspection Service has conducted a National Residue Program to monitor the occurrence of residues from hazardous chemicals in meat and poultry products. Under a HACCP regime, frontline responsibility for control of residues from animal drugs or environmental contaminants will move from the government to the industry, although the agency will continue to verify that these controls and preventive measures are effective. Companies that slaughter livestock and poultry will probably find the FSIS National Residue Program Plan to be a useful document. The plan contains lists of compounds that might leave residues in the tissues of animals or birds, and provides some information on their relative risk through the rankings in the Compound Evaluation System. It provides information on which compounds FSIS has included in its annual testing program. It also provides information on the methods that are used to test for the compounds. Another FSIS document, the Domestic Residue Data Book, presents the results of FSIS testing. These data can help a HACCP team understand the overall hazards presented by various residues, although each company should gather information about the residue control performance of its own suppliers.

Another useful reference about hazardous chemicals is the FSIS List of Proprietary Substances and Nonfood Compounds. This publication lists substances used in the preparation of product and nonfood compounds used in the plant environment that have been authorized by FSIS.

Table 2 identifies some additional sources of chemical hazards. References listed in Section VIII can be used by the HACCP team in evaluating the potential chemical hazards associated with their product or process.

TABLE 2 Types of Chemical Hazards	
Location	Hazard
Raw Materials	Pesticides, antibiotics, hormones, toxins, fertilizers, fungicides, heavy metals, PCBs
	Color additives, inks, indirect additives, packaging materials
Processing	Direct food additives - preservatives (e.g., nitrite), flavor enhancers, color additives
	Indirect food additives - boiler water additives, peeling aids, defoaming agents
Building and Equipment Maintenance	Lubricants, paints, coatings
Sanitation	Pesticides, cleaners, sanitizers
Storage and Shipping	All types of chemicals, cross contamination

PHYSICAL HAZARDS

Physical hazards include a variety of materials referred to as extraneous materials or foreign particles or objects. A physical hazard can be defined as any physical material not normally found in a food that can cause illness or injury to a person consuming the product.

Physical hazards in finished products can arise from several sources, such as contaminated raw materials, poorly designed or maintained facilities and equipment, faulty procedures during processing, and improper employee training and practices. Table 3 identifies some common physical hazards and their causes or sources.

TABLE 3	
Types of Physical Hazards	
Hazard	Source or Cause
Glass	Bottles, jars, light fixtures, utensils, gauge covers, thermometers
Metal	Nuts, bolts, screws, steel wool, wire, meat hooks
Stones	Raw materials
Plastics	Packaging materials, raw materials
Bone	Raw materials, improper plant processing
Bullet/BB Shot/Needles	Animals shot in field, hypodermic needles used for injections

SECTION II

CONTROLS AND CRITICAL LIMITS FOR BIOLOGICAL, CHEMICAL, AND PHYSICAL HAZARDS

When all significant biological, chemical, and physical hazards are identified along with their points of occurrence, the next task is to identify measures to prevent the hazards from compromising the safety of the finished product.

Preventive measures or controls can be defined as physical, chemical, or other factors that can be used to remove or limit an identified hazard. When considering preventive measures or controls, a limit must be established - this is the criterion that must be met to ensure safety. For example, proper heat treatment will control some pathogenic bacteria, and it is thus crucial to know what time/temperature combinations constitute proper heat treatment for various products. These time/temperature combinations are the critical limits. Another example of a preventive measure for a biological hazard is the chlorination of poultry chiller water to prevent cross-contamination of carcasses with Salmonella.

Chemical hazards associated with raw materials may be controlled through the use of detailed product specifications set for suppliers, letters of guarantee, or purchase specifications. With identified physical hazards, the most common preventive measures may be visual examinations of product or the use of a metal detector.

Tables 4, 5, and 6 identify preventive measures that may be considered by the HACCP team. Table 7 gives some examples of regulatory limits.

TABLE 4 Examples of Preventive Measures for Biological Hazards	
Pathogen	Preventive Measure or Control
<u>Bacillus cereus</u>	Proper holding and cooling temperatures of foods; thermal processing of shelf-stable canned food
<u>Campylobacter jejuni</u>	Proper pasteurization or cooking; avoiding cross-contamination of utensils, equipment; freezing; atmospheric packaging
<u>Clostridium botulinum</u>	Thermal processing of shelf-stable canned food; addition of nitrite and salt to cured processed meats; refrigeration of perishable vacuum packaged meats; acidification below pH 4.6; reduction of moisture below water activity of 0.93
<u>Clostridium perfringens</u>	Proper holding and cooling temperatures of foods; proper cooking times and temperatures
<u>Escherichia coli O157:H7</u>	Proper holding and cooling temperatures of foods; proper cooking times and temperatures
<u>Listeria monocytogenes</u>	Proper heat treatments; rigid environmental sanitation program; separation of raw and ready-to-eat production areas and/or product. This may be included in the Sanitation SOPs
<u>Salmonella spp.</u>	Proper heat treatment; separation of raw and cooked product; fermentation controls; decreased water activity; withdrawing feed from animals before slaughter; avoiding exterior of hide from contacting carcass during skinning; antimicrobial rinses; proper scalding procedures; disinfecting knives
<u>Staphylococcus aureus</u>	Proper fermentation and pH control; proper heat treatment and post-process product handling practices; reduced water activity
<u>Yersinia enterocolitica</u>	Proper refrigeration; heat treatments; control of salt and acidity; prevention of cross-contamination

TABLE 5
Examples of Preventive Measures for Chemical Hazards

Hazard	Preventive Measure
Naturally-Occurring Chemical Substances	Supplier warranty or guarantee; verification program to test each supplier's compliance with the warranty or guarantee *
Intentionally Added Chemicals	Detailed specifications for each raw material and ingredient; warranty or letter of guarantee from the supplier; visiting suppliers; requirement that supplier operates with a HACCP plan; testing program to verify that carcasses do not have residues *
Unintentionally Added Chemicals	Identify and list all direct and indirect food additives and color additives; check that each chemical is approved; check that each chemical is properly used; record the use of any restricted ingredients *

* These may often be considered a prerequisite to HACCP and included in a plant's GMPs or general SOPs and should be verified by the plant.

Table 6
Examples of Preventive Measures for Physical Hazards

Hazard	Preventive Measure
Foreign objects in raw materials	Supplier's HACCP plan; use of specifications, letters of guarantee; vendor inspections and certification;* in-line magnets; screens, traps, and filters; in-house inspections of raw materials
Foreign objects in packaging materials, cleaning compounds, etc.	Supplier's HACCP plan; use of specifications, letters of guarantee; vendor inspections and certification;* in-house inspections of materials
Foreign objects introduced by processing operations or employee practices	In-line metal detectors; visual product examinations; proper maintenance of equipment; frequent equipment inspections

* These may often be considered a prerequisite to HACCP and included in a plant's GMPs or general SOPs, though these activities should still be verified by the plant.

Table 7
Some Examples of Regulatory Limits

Hazard	Regulatory Limit	Regulatory Citation
Biological: Microbial growth due to temperature abuse- Poultry Chilling	All poultry must be chilled immediately after processing to a temperature of 40 or less.	9 CFR 381.66
Chemical: Excess chemicals contact product	Chemicals used are approved for the intended use and at appropriate amounts	9 CFR 318.7
Chemical: Chemical hazard from packaging materials	Edible products must be packaged in container that will not adulterate product or be injurious to health; Packaging materials must be covered by a letter of guaranty	9 CFR 317.24
Biological: Trichinae in pork	Products containing pork muscle tissue must be effectively heated, refrigerated, or cured to destroy any possible live trichinae	9 CFR 318.10
Biological: Pathogens in ready to eat products	For destruction of pathogens that may survive a dry heat process. one of the time/temperature combinations for <u>cooked</u> beef, <u>roast</u> beef, and <u>cooked</u> corned beef; e.g., 143 minimum temperature at minimum time of 6 minutes	9 CFR 318.17
Physical: Metal contamination in meat/poultry products.	Metal contamination >1/32" must be removed from product	FSIS Directive 7310.4 Rev. 2

SECTION III

TABLE 8
RED MEAT (*Beef*) SLAUGHTER HAZARDS AND CONTROLS

USE OF INFORMATION

This section contains examples of common process steps in beef slaughter. With each processing step, shown in the first column, you will find an “X” in the next three columns to tell you if there is a **Biological** hazard in column 2, a **Chemical** hazard in column 3, or a **Physical** hazard in column 4. Column 5 describes the hazard(s), and the last column lists some relevant controls or preventive measures. This table should be used in conjunction with the process flow diagram developed by your HACCP team for your plant’s beef slaughter process.

TABLE 8: RED MEAT SLAUGHTER: BEEF

RED MEAT SLAUGHTER- BEEF: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Receiving & Holding		X		-residues present in edible tissues above tolerances	-Residue certification presented for live animal(s)
Skinning	X			-micro contamination of carcass surface due to contaminated outside hide surface -contamination of carcass from floor -cross-contamination by equipment/utensils -contamination by employee handling	-Skinning procedures are accomplished without hair or visible fecal contamination of the carcass -Careful employee practices -Udder and pizzle removal are accomplished without contamination of edible product
Evisceration	X			-cross-contamination from broken viscera	-Esophagus is tied to prevent escape of stomach contents -Bung is dropped with sanitized knife and bagged to prevent escape of feces -Viscera are removed intact
Cleaning Systems Implemented Prior to Carcass Wash	X			potential for residual contamination	-Cleaning System contamination removed as soon as possible after occurrence to control microbial attachment

RED MEAT SLAUGHTER- BEEF: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Final Wash	X			-growth of pathogens through insufficient wash	-Final wash: Temperature: 90 - 100 2070 kpa (50 - 300 psi) -Steam Pasteurization: Temperature: 195 or greater at surface Dwell time: 5 - 15 seconds in cabinet
Chilling	X			-growth of pathogens	-Surface temperature possible -Carcasses spaced a minimum of 1 inch apart
Packaging of Primals		X		-contamination from deleterious chemicals present in the packaging materials	-Letters of guarantee on file for all packaging materials/non-meat supplies used by the establishment -Vendor certification -Use of approved materials
Storage-Non-Beef Supplies			X	-contamination of stored packing materials/supplies from foreign material	-Examine to ensure no visible foreign material on/in non-meat supplies or packaging materials

SECTION IV

TABLE 9 RED MEAT (*Swine*) SLAUGHTER HAZARDS AND CONTROLS

USE OF INFORMATION

This section contains examples of common process steps in swine slaughter. With each processing step, shown in the first column, you will find an “X” in the next three columns to tell you if there is a **Biological** hazard in column 2, a **Chemical** hazard in column 3, or a **Physical** hazard in column 4. Column 5 describes the hazard(s) and the last column lists some relevant controls or preventive measures. This table should be used in conjunction with the process flow diagram developed by your HACCP team for your plant’s swine slaughter process.

TABLE 9 RED MEAT SLAUGHTER: SWINE

RED MEAT SLAUGHTER-SWINE: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Animal Receiving	X	X	X	-pathogens-parasites; sanitation of receiving holding areas. -residues-antibiotics -foreign material-needles, buckshot, etc.	-This could be covered as part of a plant's GMPs
Scalding	X		X	-contamination from scalding medium	-Plant time/temperature limits for scalding (e.g., although it may vary with facilities, a temperature of 138 to 140 satisfactory) -Equipment design and proper adjustment
		X		-contamination with chemicals via stick wound	-USDA/FDA approved chemical concentration not to exceed manufacturer's recommendations
Dehairing	X			-contamination and growth of microorganisms due to breaking of the skin from overexposure to the dehairer	-Time/temperature determined by plant-specific testing results to remove visible hair to an acceptable level without breaking skin -Equipment design and proper adjustment
Pre-evisceration Wash and Antibacterial Intervention	X			-high bacterial loads on the surface of the carcass due to dehairing & polishing	-Hot water and/or organic rinse, steam, or other approved antibacterial intervention

				STEPS	
Evisceration	X			-cross-contamination from equipment/utensils -contamination from stomach, intestines, and/or bladder contents -contamination from employee handling	-Remove all viscera intact -Contaminated equipment will be clean and sanitized before being used again * -Training program for all employees, to include personal hygiene, product handling procedures, and sanitary dressing procedures *
Trimming	X			-stick wound has not been removed	-Remove all visible stick-wound related defects
Chilling	X			- growth of pathogens	-Cool surface temperature to 40 soon as possible
Receiving-Packaging Materials and Non-Swine Supplies		X		-contamination from deleterious chemicals present in the packaging materials	-Letters of guarantee are on file for all packaging materials/non-poultry supplies used by the establishment
Storage-Non-Swine Supplies			X	-contamination of stored packing materials/supplies from foreign material	-Examine to ensure no visible foreign material on/in non-poultry supplies or packaging materials

* Some of these activities are more appropriately covered in the Sanitation SOPs or plant GMPs.

SECTION V

**TABLE 10
POULTRY SLAUGHTER HAZARDS AND CONTROLS**

USE OF INFORMATION

This section contains examples of common process steps in poultry slaughter. With each processing step, shown in the first column, you will find an “X” in the next three columns to tell you if there is a **Biological** hazard in column 2, a **Chemical** hazard in column 3, or a **Physical** hazard in column 4. Column 5 describes the hazard(s) and the last column lists some relevant controls or preventive measures. This table should be used in conjunction with the process flow

diagram developed by your HACCP team for your plant's poultry slaughter process.

TABLE 10 POULTRY SLAUGHTER

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Scalding	X			-contamination from scalding medium -cross-contamination from pathogens	-Fresh water input to achieve a minimum of 1 quart per bird. -Temperature of the scald water maintained at appropriate levels (e.g., $\geq 126^{\circ}\text{F}$) -Maintain counterflow scalding unit function -Post scald wash has sufficient pressure and volume to cover carcass with fresh (potable) water spray -Overflow volumes are at required amounts

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Transfer/Rehang	X			-cross-contamination from intestinal contents/exudate -bird to bird contamination	-Follow approved offline plant procedures for handling airsacculitis salvage and reprocessing for contamination (e.g., an air sac salvage program that transfers the carcasses to another station where the thigh, drumstick, wing tip, and first wing section are salvaged and washed with chlorinated water). Minimize product accumulation
Venting/Opening/Evisceration	X			-pathogenic cross- contamination due to gut breakage	-Proper equipment adjustment. Proper training and execution by employees (turkey)
POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES

Final Wash	X			-growth of pathogens	<p>-A final water wash with appropriate levels of chlorinated water (e.g. 20-50 ppm residual chlorine in the water)</p> <p>-Sufficient water volume and pressure for equipment operation and sufficient dwell time in the final washer to remove visible contamination on internal and external surfaces of the carcass</p>
------------	---	--	--	----------------------	---

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Chilling-Carcass	X			<ul style="list-style-type: none"> -growth of pathogens -cross contamination 	<ul style="list-style-type: none"> -Deep breast muscle temperature of carcass $\leq 40^{\circ}\text{F}$ within the specified time from slaughter for the class of poultry -maintain an adequate chlorine level in the overflow water of in-line immersion chillers (e.g., 20-50 ppm residual chlorine in the incoming water) -Maintain proper water flow rates (input/overflow) for continuous chillers per USDA requirements (not less than $\frac{1}{2}$ gallon of fresh water per frying chicken with continuous overflow) -No visible fecal contamination -Approved antimicrobial interventions

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Chilling-Carcass (continued)			X	-contamination from foreign material	-Product entering (prechill) and exiting (postchill) the chiller system meets the criteria for public health- related contamination per USDA requirements (e.g. the limits are not exceeded for the number and size of extraneous materials found during the postchill examination - 9 CFR 381.76

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Chilling-Giblet/Neck	X			-growth of pathogens -cross contamination	-Temperature and fresh water input sufficient to meet USDA requirements for giblets and necks -Chlorination of giblet chiller water at appropriate levels for giblets and necks (e.g., giblets must be chilled to 40°F within 2 hours from removal from other viscera/fresh water intake not less than 1 gallon per 40 frying chickens processed - 9 CFR 381.66(c)(5) -Other approved antimicrobial interventions

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Chilling-Giblet/Neck (cont.)			X	-contamination from foreign material	-Visually free of hazardous foreign material -Public health related defects on poultry giblet and necks meet USDA requirements (e.g., each carcass must be observed for conformance against pre and post chill criteria, including unidentified foreign materials - 9 CFR 381.76

POULTRY SLAUGHTER: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Cut-Up/Boning/Packaging/ Labeling	X			-growth of pathogens	-Temperature of product does not exceed 55° F during further or second processing -Movement of product through these areas and into the cooler is timely and efficient -A mid-shift cleanup of the area(s) is performed if the room temperature is not maintained at or below 50°F -Packaging/labeling materials that come into direct contact with product are intact
Receiving-Packaging Materials and Non-Poultry Supplies		X		-contamination from deleterious chemicals present in the packaging materials	-Letters of guarantee are on file for all packaging materials/non-poultry supplies used by the establishment
Storage-Non-Poultry Supplies		X		-contamination by chemicals stored or being used of product or product contact surface	-Proper use and rinsing of chemicals -Employee training -Control with GMP

SECTION VI

TABLE 11 INGREDIENT AND INGREDIENT-RELATED HAZARDS

USE OF INFORMATION

This section contains an alphabetical list of ingredients commonly used in making meat and poultry products. For each entry, you will find the name of the ingredient in the first column, and an “X” in the next three columns to tell you if there is a **Biological hazard** in column 2, **Chemical hazard** in column 3, or **Physical hazard** in column 4. Column 5 describes the hazard(s) and the last column lists some relevant controls or preventive measures. This table should be used in conjunction with the list of ingredients developed by your HACCP team for the products produced in the process under consideration.

The HACCP team may find that a particular ingredient does not present the hazard identified in these tables. This can be based on a number of factors. The presence or absence of a hazard can be influenced by the ingredient source and/or supplier. Also, *Ingredient Specifications*, provided by the supplier to the establishment, may give details on the material/ingredient being sold, including statements that the materials/ingredients are food grade and are free of harmful components. For example, the ingredient specifications for dried legumes might state that there will be fewer than 5 small rocks or stones per 10 pound bag and that no harmful pesticides were used in the growing process.

The determination as to whether a hazard will exist that is significant and/or likely to occur will also be based on the amount and type of ingredient, chemical, and/or packaging material used and the conditions that they are used under. The following tables are examples, and are not meant to imply the specific amount or condition that will result in a significant hazard in a particular product, process, or operation. The toxicological results referred to as hazards, if limits are exceeded, should be part of the determination performed during the hazard analysis. This will aid in selecting appropriate hazards and neither under nor over estimate the significance of the hazard.

TABLE 11 INGREDIENTS AND INGREDIENT-RELATED

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Acidifiers		X		-toxicological effects if limits are exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications
Anticoagulants		X		-toxicological effect if limits are exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications
Antifoaming Agents		X		-toxicological effect if limits are exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications
Antioxidants		X		-toxicological effect if limits are exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Batter/Breading	X		X	<ul style="list-style-type: none"> -growth of mold due to improper storage and handling -hazardous foreign material 	<ul style="list-style-type: none"> -Temperature controls for storage -Ingredient specification sheet identifying the required parameters the ingredient must meet -Where applicable, ingredients must be pathogen-free
Beef (fresh, frozen)	X			<ul style="list-style-type: none"> -growth of pathogens due to improper storage, handling, and/or transport 	<ul style="list-style-type: none"> -Product temperature must be sufficient to preclude excess microbial growth -Product must meet establishment purchase specifications. This may be included as part of a plant's GMPs -Product must be produced under a HACCP plan
Binders/Extenders		X	X	<ul style="list-style-type: none"> -hazardous foreign material 	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee. This may be included as part of a plant's GMPs -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Bleaching Agents		X		-toxicological effect if limits exceeded	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee. This may be included as part of a plant's GMPs -Ingredients purchased based on producer/provider ingredient specifications
Blood	X			-growth of pathogens from improper handling and storage, and/or transport	<ul style="list-style-type: none"> -Ingredient specification sheet identifying the required parameters the ingredient must meet - Where applicable, ingredients must be pathogen-free -Meet appropriate temp.

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Boneless Beef	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling storage, and/or transport -foreign particle contamination, e.g., metal fragments or bone 	<ul style="list-style-type: none"> -Product temperature must be at a level sufficient to preclude excess bacterial growth at receiving -Product must meet establishment purchase specifications -Product must be produced under a HACCP plan -Visual examination of product for foreign materials
Cooked Beef	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage, and/or transport -foreign particle contamination, e.g., metal fragments or bone particles in boneless beef 	<ul style="list-style-type: none"> -Frozen or refrigerated receiving temperature of product must be at a level sufficient to preclude excess bacterial growth - Product must be received from an approved supplier who produces the product under a HACCP plan -Visual examination of product for foreign materials

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Cooked Poultry	X		X	-growth of pathogens due to improper handling storage, and/or transport -foreign particle contamination, e.g., bone particles in boneless poultry	-Frozen or refrigerated receiving temperature of product must be at a level sufficient to preclude bacterial growth -Product must be received from an approved supplier who produces the product under a HACCP plan. -Visual examination of product for hazardous foreign materials
Cooked Pork	X		X	-growth of pathogens due to improper handling and storage, and/or transport -foreign particle contamination, e.g., bone particles in boneless pork	-Frozen or refrigerated receiving temperature of product must be at a level sufficient to preclude bacterial growth -Product must be received from an approved supplier who produces the product under a HACCP plan
Coloring Agents (natural)		X		-toxicological effect possible if limits exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Coloring Agents (artificial)		X		-toxicological effect if limits exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs
Curing Agents		X		-toxicological effect if limits exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs
Curing Accelerators		X		-toxicological effect if limits are exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Dairy Products	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage, and/or transport -hazardous foreign material 	<ul style="list-style-type: none"> -Temperature control -Ingredient specification sheet identifying the required parameters the ingredient must meet -Where applicable, ingredients must be pathogen-free
Eggs or Egg Products	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage, and/or transport -foreign particle contamination, e.g., shell particles in broken eggs 	<ul style="list-style-type: none"> -Temperature control -Ingredient specification sheet identifying the required parameters the ingredient must meet - Where applicable, ingredients must be pasteurized or treated in order to assure pathogen control
Emulsifying Agents		X		<ul style="list-style-type: none"> -toxicological effects if limits exceeded 	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Flavoring Agents		X		-toxicological effects if limits exceeded	-Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs
Fruits		X	X	-contamination from agricultural chemicals -foreign material	-Ingredient specification sheet identifying the required food safety parameters the ingredient must meet
Honey	X		X	-contamination from inherent microorganisms - foreign particle contamination, e.g., dirt, insect parts	-Ingredient specification sheet identifying the required food safety parameters the ingredient must meet
Legumes (dry)			X	-foreign particle contamination, e.g., rocks	-Ingredient specification sheet identifying the required parameters the ingredient must meet

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Mechanically Deboned Product	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage -foreign particle contamination, e.g., bone particles 	<ul style="list-style-type: none"> -Product temperature must be at a level sufficient to preclude excess microbial growth -Product must meet establishment purchase specifications -Product must be produced under a HACCP plan
Mold Inhibitors		X		-toxicological effect if improper amounts used	-Ingredient specification sheet identifying the required parameters the ingredient must meet
Mushrooms	X	X	X	<ul style="list-style-type: none"> -contamination from inherent microorganisms -contamination from agricultural chemicals -foreign material 	<ul style="list-style-type: none"> -Ingredient specification sheet identifying the required parameters the ingredient must meet. This may be included as part of a plant's GMPs -Where applicable, ingredients must be treated to control pathogens

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Nuts	X	X	X	<ul style="list-style-type: none"> -contamination from inherent microorganisms -contamination from agricultural chemicals -foreign particle contamination, e.g., broken shells 	<ul style="list-style-type: none"> -Ingredient specification sheet identifying the required parameters the ingredient must meet. This may be included as part of an establishment's GMPs
Packaging Materials		X	X	-toxicological effects	<ul style="list-style-type: none"> -Use only FDA approved packaging materials -Each lot of packaging material must be accompanied by a Letter of Guarantee in which the manufacturer attests to compliance with FDA requirements. This may be included as part of an establishment's GMPs
Phosphates		X		-toxicological effect if limits are exceeded	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee. This may be included as part of an establishment's GMPs -Ingredients purchased based on producer/provider ingredient specifications

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Poultry (fresh, frozen)	X			-growth of pathogens due to improper handling and storage	<ul style="list-style-type: none"> -Product temperature must preclude microbial growth -Product must meet establishment purchase specifications. This may be included as part of an establishment's GMPs -Product must be produced under a HACCP plan
Pork (fresh, frozen)	X			-growth of pathogens due to improper handling and storage	<ul style="list-style-type: none"> - Product temperature must preclude microbial growth -Product must meet establishment purchase specifications -Product must be produced under a HACCP plan
Proteolytic enzymes <i>Aspergillus oryzae</i> <i>Aspergillus flavus</i> <i>oryzze</i> group Bromelin Ficin Papain		X		-toxicological effects possible if limits exceeded	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications. This may be included in a plant's GMPs

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Partially Defatted Products	X		X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage -foreign particle contamination, e.g., metal, plastic 	<ul style="list-style-type: none"> -Product temperature must preclude microbial growth -Product must meet establishment purchase specifications -Product must be produced under a HACCP plan
Seafood (fresh, frozen)	X	X	X	<ul style="list-style-type: none"> -growth of pathogens due to improper handling and storage -environmental contamination 	<ul style="list-style-type: none"> -Product temperature must preclude microbial growth -Product must meet establishment purchase specifications. This may be included in a plant's GMPs -Product must be produced under a HACCP plan
Spices/Herbs Sterilized Unsterilized	X	X	X	<ul style="list-style-type: none"> -contamination from microorganisms inherent to the ingredient -contamination from agricultural chemicals -foreign material 	<ul style="list-style-type: none"> -Ingredient specification sheet identifying the required parameters the ingredient must meet
Sweeteners Saccharin Citric acid Malic acid Monoisopropyl citrate Phosphoric acid Monoglyceride citrate		X		<ul style="list-style-type: none"> -toxicological effects possible if limits exceeded 	<ul style="list-style-type: none"> -Ingredients purchased under a Letter of Guarantee -Ingredients purchased based on producer/provider ingredient specifications

EXAMPLES OF INGREDIENTS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARD FOR THE INGREDIENT	CONTROLS OR PREVENTIVE MEASURES
Tenderizing Agents		X		-toxicological effects possible if limits exceeded	-Ingredients purchased under a Letter of Guarantee. This may be included as part of a plant's GMPs -Ingredients purchased based on producer/provider ingredient specifications. This may be included as part of a plant's GMPs
Variety Meats	X			-growth of pathogens due to improper handling, storage, or cleaning	-Product temperature must preclude microbial growth -Product must meet establishment purchase specifications -Product must be produced under a HACCP plan
Vegetables	X	X	X	-growth of pathogens due to improper handling and storage -contamination from agricultural chemicals -foreign material	-Ingredient specification sheet identifying the required parameters the ingredient must meet -Control storage temperatures to preclude microbial growth

SECTION VII

TABLE 12 PROCESSING HAZARDS AND CONTROLS

USE OF INFORMATION

This section contains a list of processing hazards and controls commonly used in making meat and poultry products. They are listed in alphabetical order. For each processing step, shown in the 1st column, you will find an “X” in the next three columns to tell you if there is a **Biological hazard** in column 2, **Chemical hazard** in column 3, or **Physical hazard** in column 4. Column 5 describes the hazard(s) and the last column lists some relevant controls or preventive measures. This table should be used in conjunction with the process flow diagram developed for your plant processes and considered when conducting a hazard analysis.

TABLE 12 PROCESSING

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Acidifying (also see Pickling, Brining)	X			-survival of pathogens due to final pH > 4.6	-Shelf-stable, non-heat treated acidified product must obtain a pH of 4.6 or lower
Aging (Meats)	X			-growth/survival of pathogens from inappropriate storage temperatures and humidity (inadequate product water activity (a_w)) -growth of pathogens due to rise in the pH due to development of surface molds	-Temperature of the aging room must preclude growth of pathogenic microorganisms -Product temperature must preclude microbial growth throughout the aging process -The aging process will not exceed seven days

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Boning	X			<ul style="list-style-type: none"> -contamination by pathogens in product accumulations (e.g., cutting boards, conveyor belts, utensils and other equipment) -cross-contamination of product by equipment/utensils contaminated with pathogens when cutting through a non-apparent lesion (e.g., abscesses) 	<ul style="list-style-type: none"> -Careful employee practices to make sure that there is no contamination of the product * -Equipment and utensils are washed and sanitized immediately, when contaminated, and each time the employee leaves the working station * -All hot water sanitizers are maintained at 180 degrees Fahrenheit -Processing room temperature is maintained at 50 degrees Fahrenheit or a midshift cleanup is performed within five hours after operations begin *
			X	-contamination from bones, cartilage/extraneous material	-A boneless beef re-inspection procedure established by the plant

* This may be included as part of a plant's SSOPs.

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Cooling	X			-growth of pathogens due to improper temperatures -germination of spore-forming pathogens due to slow chilling (e.g., <u>C. perfringens</u>)	-Cooked product will be cooled according to established procedures by a processing authority, scientific studies, and/or regulatory requirements
Cooking	X			-survival of pathogens due to improper procedures	-Time/Temperature combinations are adequate to destroy the pathogens of concern

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Drying (Meat)	X			-bacterial growth due to inadequate control over time, temperature and humidity	-A water activity will be specified that in conjunction with other barriers will inhibit growth of pathogenic microorganisms e.g., for shelf stable sausage A_w of 0.91 and a pH of 4.6
Filling	X			-recontamination by pathogens in product accumulations -growth of pathogens due to temperature abuse	-Product will be protected from contamination during the filling process, and product temperature/ time will be maintained at or below the maximum determined to inhibit growth of pathogenic microorganisms
		X		-contamination from lubricants	-No lubricants or other chemical contaminants will be allowed in or on the product *

* This may be included as part of a plant's GMPs.

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Formulation	X			<ul style="list-style-type: none"> -contamination by employee handling -incorrect formulation -contamination through damaged packages 	<ul style="list-style-type: none"> -Careful employee practices used at all times to make sure that there is no contamination of product. This may be included as part of a plant's SSOPs or GMPs -Ingredient packages will be clean and intact -Ingredients will be added to product according to requirements outlined 9 CFR 318.7
		X		<ul style="list-style-type: none"> -excessive addition of restricted ingredients/ additives could be toxic to the consumer 	<ul style="list-style-type: none"> -Restricted ingredients will be added to product according to requirements outlined in the 9 CFR 317.8
Freezing (Meats)	X			<ul style="list-style-type: none"> -survival of parasites due to improper time/temperature application -growth of pathogens due to temperature abuse 	<ul style="list-style-type: none"> -Rapid cooling and freezing

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Grinding	X			<ul style="list-style-type: none"> -contamination by employee handling -recontamination by pathogens in product accumulations 	<ul style="list-style-type: none"> -Careful employee practices to make sure that there is no contamination of product. This may be included as part of a plant's SSOPs or GMPs -Product will not be allowed to accumulate at the end of the grinder -The temperature of the grinding room will be maintained at 50 degrees Fahrenheit
Grinding		X		-contamination from lubricants	-Food grade lubricants will be used on areas of the machinery where a potential for product contamination exists. This may be included as part of a plant's GMPs
			X	-contamination from extraneous material	-All boneless product will be re-inspected before being loaded into the grinder

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Handling and Inspecting of Empty Containers and Packaging Materials	X	X	X	-recontamination through damaged or soiled containers/packaging material	-Packaging materials and empty containers will be protected from contamination during their storage and handling -No materials or containers that appear to be contaminated with foreign material will be used
Mechanical Separating	X			-growth of pathogens	-Product holding and cooling requirements outlined in 9 CFR 318.18 will be followed
			X	-contamination from bone, cartilage fragments -contamination from extraneous material	-The finished product will meet the standards outlined in 9 CFR 319.5 for bone particles
Packaging (also see Modified Atmospheric Packaging, Vacuum Packaging Seaming, Sealing)	X	X		-contamination from packaging material -contamination through damaged containers	-Closure and/or machine specifications sufficient to ensure adequate barrier formation

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Packaging cont.			X	-contamination from metal clips or other foreign material resulting from the packaging process or equipment operation	-No detectable foreign material will be allowed in or on the product or immediate product containers

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Peeling	X			-contamination by pathogens in product accumulations -contamination from employee handling	-Careful employee practices to make sure that there is no contamination of product * -Product will not be allowed to accumulate in/on peeling equipment
			X	-contamination from extraneous material	-Peeling equipment will be maintained in a proper operating condition ** -No foreign material in the finished product

* This may be included as part of a plant's SSOPs.

** This may be included as part of a plant's GMPs.

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Receiving	X			-contamination through damaged containers -growth of pathogens due to inappropriate storage conditions (temperature, humidity) -growth of pathogens due to temperature abuse -contamination from receiving equipment (pumps, hoses)	-Product must be received in sound containers and at temperatures appropriate for the type of product
		X		-cross-contamination from non-food chemicals	-Product must be received in sound containers and be accompanied by a letter of guarantee from the supplier if such letter is not on file. This may be included in the plant's GMPs
			X	-contamination from extraneous material (wood, nails from pallets, plastic pieces)	-Product must be received in sound containers. This may be included in the plant's GMPs
Retorting	X			-inadequate application of scheduled process	-A thermal process specific to the product, container type and size, and retorting system must be in use. The initial product temperature and any critical factors specified for the thermal process must also be controlled. Specified retort come up procedures will be followed

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Reworking	X			-contamination by employee handling -contamination from pathogen accumulations in product improperly stored, rework product, or emulsion	-Careful employee practices to make sure that there is no contamination of product * -Temperature of storage coolers will preclude microbial growth in and/or on product
			X	-contamination from foreign material	-Careful employee practices to make sure that there is no contamination of product *

* This may be included in a plant's SSOPs.

PROCESSING: EXAMPLES OF PROCESSING STEPS	B	C	P	DESCRIPTION OF BIOLOGICAL, CHEMICAL, OR PHYSICAL HAZARDS FOR THE PROCESS STEPS	CONTROLS OR PREVENTIVE MEASURES
Shipping	X			-growth due to shipping temperatures inadequate to prevent excess microbial growth	-Product will not be shipped unless it is at a temperature that precludes microbial growth -Product will not be loaded into transport vehicles if the vehicles' temperature does not preclude microbial growth
			X	-contamination from extraneous material introduced through damaged packages	-All product packages will be intact before shipping -All transport vehicles will be cleaned after each use and before loading of product
Thawing	X			-growth of pathogens due to improper temperatures	-Thawing Room temperature will not exceed 50 degrees Fahrenheit

SECTION VIII

REFERENCES

HAZARD ANALYSIS CRITICAL CONTROL POINT SYSTEMS

Agriculture Canada. 19--. Food Safety Enhancement Program - Implementation Manual. Nepean, Ontario, Canada.

HACCP: The Hazard Analysis and Critical Control Point System in the Meat and Poultry Industry. 1994. American Meat Institute Foundation. Washington, D.C.

International Commission on Microbiological Specification for Foods. 1989. "Microorganisms in Foods 4. Application of hazard analysis and critical control point (HACCP) system to ensure microbiological safety and quality." Blackwell Scientific Publications, Boston.

National Advisory Committee on Microbiological Criteria for Foods (NACMCF).
March 20, 1992 - Hazard Analysis and Critical Control Point System. *Int. J. Food Micr.* 16: 1-23.

National Advisory Committee on Microbiological Criteria for Foods NACMCF). June 1993 - Report on Generic HACCP for Raw Beef. *Food Micr.* 10: 449-488.

Pierson, M.D. and Corlett, D A., Jr. ed. 1992. "HACCP/Principles and Applications." Van Nostrand Reinhold.

Stevenson, K.E. ed. 1993. "HACCP-Establishing Hazard Analysis Critical Control Point Programs." A Workshop Manual. The Food Processors Institute. Washington, D.C.

Tompkin, R.B. 1990. The Use of HACCP in the Production of Meat and Poultry Products. *J. of Food Protect.* 53(9): 795-803.

Tompkin, R.B. 1995. The use of HACCP for producing and distributing processed meat and poultry products. In *Advances in Meat Research*. Volume 10. Hazard Analysis Critical Control Point (HACCP) in Meat, Poultry and Seafoods. Chapman & Hall (In Press).

FOODBORNE ILLNESSES

Bean, N.H. and Griffin, P.M. 1990. Foodborne disease outbreaks in the United States, 1973-1987: Pathogens, vehicles, and trends. *J. Food Protect.* 53: 804-817.

Bean, N.H. and Griffin, P.M. 1990. Foodborne disease outbreaks, 5-year summary, 1983- 1987. *J. Food Protect.* 53: 711.

Council for Agricultural Science and Technology. February, 1993. "Risks Associated with Foodborne Pathogens."

Oblinger, J.L., ed. 1988. Bacteria Associated with Foodborne Illnesses, A Scientific Status Summary by the Institute of Food Technologists Expert Panel on Food Safety and Nutrition. *Food Technol.* 42(4).

Padhye, N.V.; Doyle, M.P. 1992. *E. Coli* O157:H7 Epidemiology, pathogenesis, and methods for detection in food. *J. Food Prot.* 55:55-565.

Schuchat, A., Swaminathan, B. and Broome, C.V. 1991. Epidemiology of human listeriosis. *Clin. Microbiol. Rev.* 4: 169-183.

Tauxe, R.V., "Epidemiology of *Campylobacter jejuni* infections in the United States and other Industrialized Nations," In Nachamkin, Blaser, Tompkins, ed. *Campylobacter jejuni: Current Status and Future Trends*, 1994, chapter 2, pages 9-19.

Tauxe, R.V., Hargett-Bean, N., Patton, C.M. and Wachsmuth, I.K. 1988. *Campylobacter* isolates in the United States, 1982-1986. In, CDC Surveillance Summaries, June 1988. *MMWR* 37 (No. SS-2) : 1-13.

Todd, E. 1990. Epidemiology of Foodborne Illness: North America. *The Lancet* 336:788.

BIOLOGICAL, CHEMICAL, AND PHYSICAL HAZARDS

Corlett, D.A., Jr. and R.F. Steir. 1991. Risk assessment within the HACCP system. *Food Control* 2:71-72.

Environmental Protection Agency. Tolerances for Pesticides in Foods. Title 40, Code of Federal Regulations, Part 185. U.S. Government Printing Office, Washington, DC.

FDA. 1989. The Food Defect Action Levels. FDA/CFSAN. Washington, DC.

FDA. 1994. Fish and Fishery Products Hazards and Control Guide - Get Hooked on Seafood Safety. Office of Seafood, Washington, DC.

HACCP: The Hazard Analysis and Critical Control Point System in the Meat and Poultry Industry. 1994. American Meat Institute Foundation. Washington, D.C.

International Commission on Microbiological Specification for Foods. 1989. "Microorganisms in Foods 4. Application of hazard analysis and critical control point (HACCP) system to ensure microbiological safety and quality." Blackwell Scientific Publications, Boston.

Pierson, M.D. and Corlett, D A., Jr. ed. 1992. "HACCP/ Principles and Applications." Van Nostrand Reinhold.

Stevenson, K.E. ed. 1993. "HACCP-Establishing Hazard Analysis Critical Control Point Programs." A Workshop Manual. The Food Processors Institute. Washington, D.C.

USDA, Domestic Residue Data Book. USDA, FSIS, Washington, D.C.

USDA, Miscellaneous Publication #1419: "List of Propriety Substances and Nonfood Compounds Authorized for Use under USDA Inspection and Grading Programs". USDA, FSIS, Washington, D.C.

USDA, National Residue Program Plan. USDA, FSIS, Washington, D.C.

INTERNET HOME PAGES

Agriculture Canada/<http://aceis.agr.ca>

Food Law Sites/<http://www.fsci.umn.edu/FoodLaw/foodlaw.html>

HACCP95/<http://www.cvm.uiuc.edu/announcements/haccp95/haccp95.html>

Center for Disease Control/<http://fftp.cdc.gov/pub/mmwr/MMWRweekly>

Material Safety Data Sheets/<http://listeria.nwfsc.noaa.gov/msds.html>

U.S. Food and Drug Administration/<http://vm.cfsan.fda.gov/list.html>
Bad Bug Book

U.S. Department of Agriculture/<http://www.usda.gov>