

VALIDATING THE RETAIL FOOD PROCESS



**SIXTH DUBAI INTERNATIONAL FOOD SAFETY CONFERENCE
2 MARCH 2011
8:30 AM to 12:30 PM**

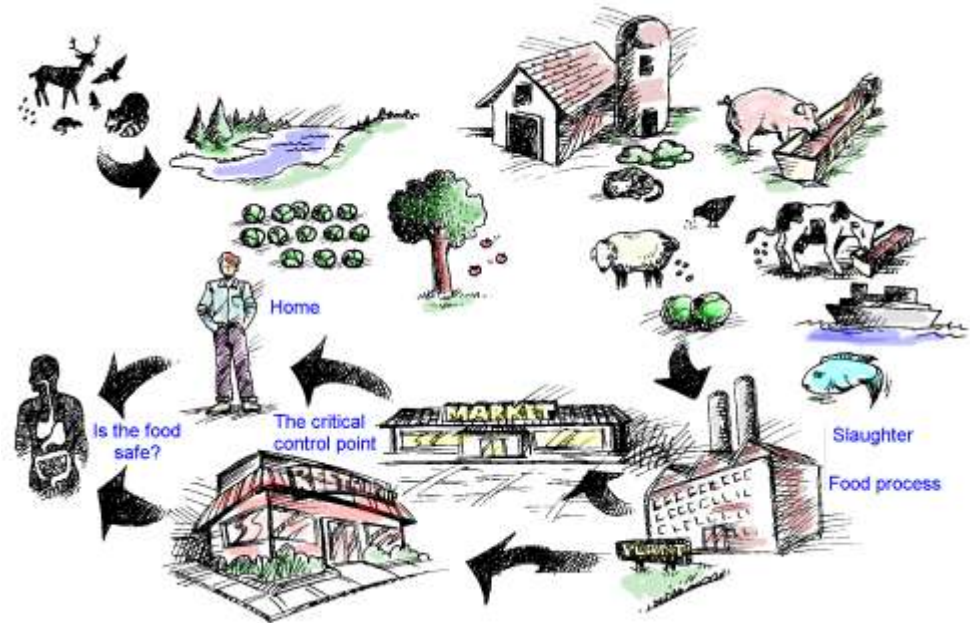
<http://www.hi-tm.com/Documents2011/Dubai-Valid-processes-Mar2-wksp.pdf>

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THE FOOD HAZARDS:

Chemical
Physical
Biological

**The farmer / supplier
and the cook
are the principal
hazard controllers.**



ACTIVE MANAGERIAL CONTROL HACCP:

There will be a Person In Charge of food safety on duty at all times, who will:

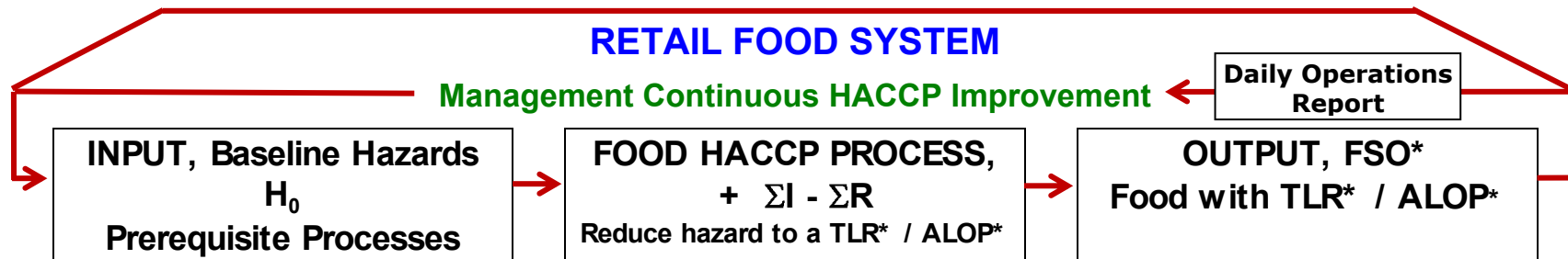
1. Identify hazards in the daily operation of the establishment.
2. Develop and implement policies, procedures, and standards to prevent foodborne illness.
3. Coordinate employee training so that they can demonstrate food safety knowledge; take corrective action as needed to protect consumer health.
4. Conduct periodic self-inspections of daily operations to ensure that food safety policies and procedures are followed.

The regulator approves the manager's HACCP plan and employee control.

HOW DO YOU EVALUATE FOOD SAFETY IN A FOOD OPERATION / SYSTEM?

1. There is a **Person In Charge (PIC)** who is certified and:
 - Has identified the hazards.
 - Has developed and implemented policies, procedures, and standards to control hazards to an Appropriate Level of Protection (ALOP) or uses "safe harbor" controls from regulations.
 - Has coordinated training of employees so that they can demonstrate hazard control.
 - Monitor daily employee performance of controls and coach them to more certain performance.
2. The **Regulatory Authority** verifies the PIC's food safety management plan (checklist) and the ability of the employee to demonstration hazard control (training).

AMC-HACCP FOOD SAFETY MANAGEMENT SYSTEM



Personnel with disease

Environment and facilities hazards

Pests, insects, birds, air
Contaminated water
Gas, solar, electric that can be interrupted

Equipment / food contact surfaces cleaning and maintenance

Supplies and material with environmental and human hazards, contamination, various levels of nutrients and spoilage, receive and store

TLR = Tolerable Level of Risk

Food processes

- I. Wash / trim, serve
 - II. Fermented, pH, a_w preserved food: cheese, yogurt, wine, sauerkraut, cider, cold smoked, dressing, salt, acid, etc.
 - III. Pasteurized, serve
Meat, fish, poultry, vegetable, starch
 - IV. Pasteurized and pH / a_w preserved: fruit / jams; BBQ; meat, poultry; salted / smoked fish, sausage; tomato, hollandaise sauce; bread, pastry
 - V. Sterilized
- Leftovers

ALOP = Appropriate Level Of Protection

Serve -- carry-out
Transport / package

Consumer

Food with a good balance among pleasure, safety, nutrition, convenience
Consumer food abuse
Consumer allergies, intolerance, etc.

Waste

Heat, contaminated air, smoke, grease
Sewage, greywater
Glass, paper, metal, plastic
Food, grease

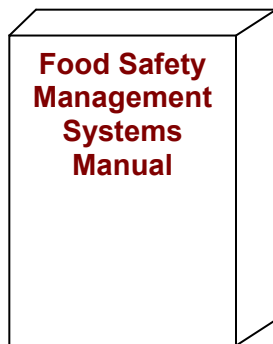
FSO = Food Safety Objective

POTENTIAL HAZARDS IN THE FOOD SYSTEM

CHEMICAL	PHYSICAL	BIOLOGICAL
<p>Poisonous Substances Toxic plant material Intentional (GRAS) food additives Chemicals created by the process Agricultural chemicals Antibiotic and other drug residues in meat, poultry, and dairy products Unintentional additives Sabotage Equipment material leaching Packaging material leaching Industrial pollutants Heavy metals Radioactive isotopes</p> <p>Adverse Food Reactions (food sensitivity) Food allergens Food intolerances Metabolic disorder-based reactions Pharmacological food reactions Idiosyncratic reactions to food Anaphylactoid reactions</p> <p>Nutrition Excessive addition of nutrients Nutritional deficiencies and/or inaccurate formulation of synthesized formulas Anti-nutritional factors Destruction and unnecessary loss of nutrients during processing and storage</p>	<p>Hard Foreign Objects Glass Wood Stones Metal Packaging materials Bones Building materials Personal effects</p> <p>Functional Hazards Particle size deviation Packaging defects Sabotage</p> <p>Choking / Food Asphyxiation Hazards Pieces of food, bone</p> <p>Thermal Hazards Food so hot that it burns tissue</p>	<p>Microorganisms and their Toxins Bacteria: vegetative cells and spores Molds [mycotoxins (e.g., aflatoxin)] Yeasts (<i>Candida albicans</i>) Viruses and rickettsia Parasites</p> <p>Fish and Shellfish as Sources of Toxic Compounds</p> <p>Pests (birds, insects and rodents) as carriers of pathogens: Filth from insects, rodents, and any other unwanted animal parts or excreta</p> <p>Humans as carries of pathogens</p>

MICROORGANISMS LINKED TO ILLNESS CAUSES

Organism	Cause
<i>Campylobacter jejuni</i>	Food contact surface cross-contamination
<i>Brucella</i> spp. <i>Escherichia coli</i> O157:H7 <i>Salmonella</i> spp. <i>Toxoplasma gondii</i> <i>Trichina</i>	Inadequate pasteurization / eating undercooked food Food contact surface cross-contamination
<i>Shigella</i> Norovirus Hepatitis A and E Rotavirus	Inadequate hand washing
<i>Cryptosporidium</i> <i>Cyclospora</i> <i>Giardia lamblia</i>	Drinking contaminated water or using contaminated water to irrigate vegetables eaten fresh
<i>Clostridium perfringens</i> (spore)	Inadequate hot holding / cooling too slowly
<i>Bacillus cereus</i> (spore) <i>Listeria monocytogenes</i>	Cold holding ready-to-eat food
<i>Clostridium botulinum</i> (spore)	Pasteurized food allowed to incubate anaerobically at 20 to 30°C (~70 to 90°F), 1 to 2 days



FOOD SAFETY MANAGEMENT SYSTEM (OPERATIONS) MANUAL

BASED ON NACMCF / ICMSF / CODEX
9CFR 416 AND 9CFR 417)

MODEL MANUAL (963 KB) AVAILABLE AT: <http://www.hi-tm.com/rfa/manu-tofc.html>

Preface

Log of changes
Reassessment

Operations Description

System description
Organization
Environment (picture)
Facilities (plan)
 Construction
Equipment (list)
Menu ingredient hazards (list)

AMC-HACCP Management

Food safety policy
Responsibility and accountability
Emergencies
Food security / sabotage / recall
HACCP team / QC
 Instrument / equipment calibration
 Self-inspection, micro sampling
 Corrective action
 Training

Prerequisite Processes

Personal hygiene

Employee illness reporting
Hand washing: after toilet; after touching raw food
Glove use
First aid

Environment

Pest control, water, storage

Facilities

Cleaning, maintenance, cross-contamination
(*Listeria*)

Equipment

Cleaning / sanitizing and maintenance of food
contact surfaces (**CIP / COP**)

Supplies

Supplier HACCP certification
 Ingredients supplier safe vs. cook safe
Receiving inspection
Storage: ambient, refrigerated, frozen
Control of physical, chemical, and biological
contamination

Food Process HACCP

Pre-preparation

Physical hazard control
Chemical hazard control
Allergen control
Thawing; bacterial control
Fruit and vegetable washing
Serving raw food

Preparation

(cook-package or package-cook)

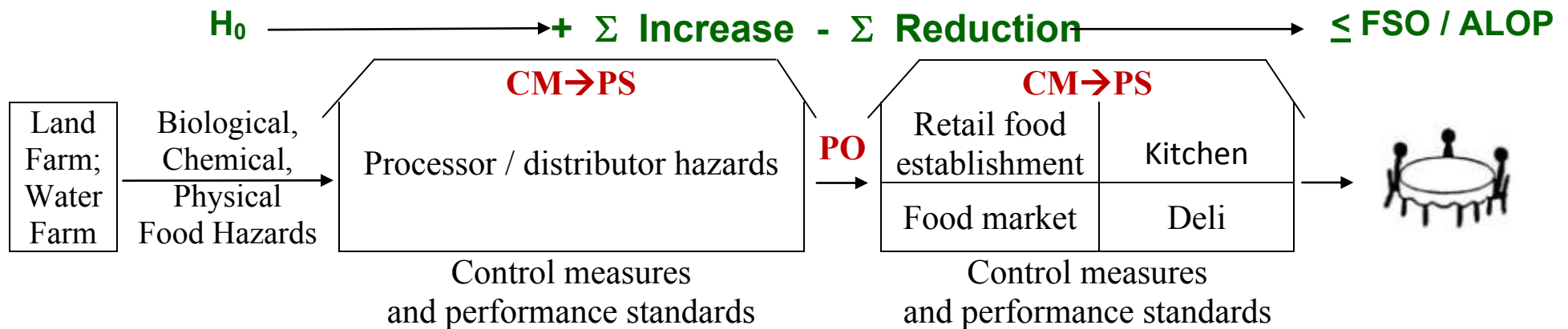
Salad and hors d'oeuvres
Pasteurization / sterilization
Ingredients to extend shelf life
Hot holding
Cooling
Cold holding
Leftovers / reprocessing

Distributing / serving food

Communicating safe handling
Catering

FARM-TO-FORK FOOD SAFETY MANAGEMENT SYSTEM (FSMS)

Science-Based Design of Hazard Control Processes



$$H_0 \text{ (Hazard input)} + \Sigma I \text{ (Hazard increase)} - \Sigma R \text{ (Hazard reduction)} \leq \text{FSO (Food Safety Objective)}$$

FSO Food Safety Objective – A level/size of hazard that gives an ALOP to the consumer
(e.g., 1 *Salmonella* / 25 g)

ALOP / TLR Appropriate Level Of Protection / Tolerable Level of Risk
(e.g., Acceptable ill / 100,000; Acceptable dead / 1,000,000)

PO Performance Objective – Level of a hazard at end of step
(e.g., " ≤ 10 *Salmonella* in prepared chicken" before cooking)

CM Control measure – Any action taken to prevent, eliminate, reduce hazard
(e.g., "Wash fingertips by _____.")

PS Performance Standard / Performance Criterion – hazard reduction in a step
(e.g., 5-log reduction of *Salmonella*)

International Commission of Microbiological Specifications for Foods (ICMSF). 2002. Microorganisms in Foods 7. Microbiological Testing and Food Safety Management. Kluwer Academic Plenum Publishers. New York, NY.

FOOD HAZARDS (H₀) AND FOOD SAFETY OBJECTIVES (FSO)

Hazards	Raw Product Contamination (H ₀)	Process Performance Criteria (+ I-R)	Food Safety Objective (FSO)
<u>MICROBIOLOGICAL (Reduce)</u>			
INFECTIVE			
Vegetative pathogens - infection			
<i>Salmonella</i> spp. / <i>E. coli</i> O157:H7 (food)	10 ³ cfu/g	10 ⁻⁵ cfu/g - reduce	10 ⁻² cfu/g or <1 cfu per 100 g
<i>Shigella</i> spp. (feces) (human) (fingertips)	10 ⁶ cfu/g	10 ⁻⁶ cfu/g - reduce	1-10 cfu/g or 1 cfu
Viruses			
Hepatitis A (human) (fingertips)	>10 virus / g	10 ⁻⁶ virus/g / reduce	<1/g
Norovirus (human) (fingertips)	>100 virus / g	10 ⁻⁶ virus/g / reduce	<1/g
Parasites			
<i>Cryptosporidium parvum</i> (food)	1 cyst	prevent / reduce	undetectable
<i>Toxoplasma gondii</i> (food)	1 cyst	prevent / reduce	undetectable
<i>Trichinella spiralis</i> (food)	1-500 larvae	prevent / reduce	undetectable
TOXIN PRODUCING			
<i>Staphylococcus aureus</i> (exotoxin) (human)	10 ³ cfu/g	<10 ³ cfu/g increase	<10 ⁶ cfu/g (toxin dose: <1 microgram)
SPORES			
<i>Clostridium botulinum</i> (exotoxin) (food)	1 spore / g	<10 ³ cfu/g increase	<10 ³ cfu/g (toxin dose: ≤2 nanograms)
<i>Bacillus cereus</i> (exotoxin, enterotoxin) (food)	10 ² spores / g	<10 ³ cfu/g increase	<10 ⁵ cfu/g (toxin dose: unknown)
<i>Clostridium perfringens</i> (enterotoxin) (food)	10 ² spores / g	<10 ³ cfu/g increase	<10 ⁵ cfu/g (toxin dose: unknown)
<u>CHEMICAL (Prevent / eliminate)</u>			
Sulfites	Variable	none added	<10 ppm
Nitrates	Variable	<500 ppm added	<500 ppm
Nitrites	Variable	<200 ppm added	<200 ppm
Monosodium glutamate	Variable	≤0.5 g / serving added	<3.0 g / meal
Allergens			
Aflatoxins (from mold)	<20 ppb	no increase	<20 ppb
Histamine (from fish, cheese)	<20 ppm	no increase	<20 ppm
<u>PHYSICAL (Prevent / eliminate)</u>			
Hard foreign objects (broken tooth)	>1/16 inch (1.6 mm) diameter	prevent / remove	<1/16 inch (1.6 mm) diameter
Choking	>1/4 inch (6 mm) diameter	cut ≤1/4 inch (6 mm)	<1/4 inch (6 mm)
Food burns (coffee)	>170°F (>76.7°C)	Warn	

* cfu = colony forming units

NACMCF / CODEX HACCP PROCESS ANALYSIS

HACCP, the scientific basis for a food process specification that will produce food products with an ALOP (Appropriate Level of Protection). It started with NACMCF 1992 and 1998 Hazard Analysis and Critical Control Point and Application Guidelines. It stated that a Food Safety Management System had four (4) parts:

1. System Description / Construction
2. Management of the System
3. Prerequisite Processes
4. Food HACCP Processes

HACCP is limited to food process hazards and controls, not prerequisite processes (mostly cleaning and maintenance). It states that there are three (3) groups of hazards: biological, chemical, and physical. It prescribes that hazards can be controlled by having a HACCP development team that begins by doing an accurate flow diagram of each process and then by applying the HACCP process design principles / steps:

1. Conduct / identify the hazards at each step
2. Determine which are critical control points (CCP)
3. Specify critical limits and controls to prevent, eliminate or reduce the hazard to an ALOP.
4. Establish monitoring by the cook to control the process within the critical limits. What are the failure modes, and what are the effects?
5. Establish corrective action.
6. Establish verification that the HACCP plan is functioning as intended.
7. Establish records and written documentation

**It does not use the concept of Potentially Hazardous Food or Temperature and Time Control For Safety.
It makes decisions based on RISK.**

Process Flow Steps	H ₀	+I-R			FSO / ALOP
	<u>Principles 1 & 2</u> Significant BCP Hazard Analysis (RISK)	<u>Principle 3</u> Critical Limit Control & Validation for an ALOP	<u>Principle 4</u> Cook Monitoring at the Control	<u>Principle 5</u> Corrective Action	<u>Principles 6 & 7</u> Verification with records & documentation
Management Prerequisite Food	B C P				

APPLYING RISK ASSESSMENT TO THE HACCP PLAN

The manager controls the risk

Risk is defined as *Frequency of the hazard x Severity of the illness /injury*. It is not statistically possible to produce a zero risk food.

Significant BCP hazard analysis is done using the NACMCF 1998 Principles of Risk Assessment for Illness Caused by Foodborne Biological Agents that provides the steps for doing the hazard / risk assessment and risk control.

NACMCF HACCP PLAN

Process Flow Steps	<u>Principles 1 & 2</u> Significant BCP Hazard Analysis (RISK)	<u>Principle 3</u> Critical Limit Control & Validation for an ALOP	<u>Principle 4</u> Cook Monitoring at the Control	<u>Principle 5</u> Corrective Action	<u>Principles 6 & 7</u> Verification, Records & Documentation
	B C P				

Risk Assessment		
BCP Hazard Identification	Exposure Assessment, Dose Response	Risk Characterization
Evidence of a consumer illness/injury base on epidemiological clinical research evidence	Likely intake of the hazard <ul style="list-style-type: none"> • Controls associated with the process • Frequency and level of contamination at consumption • Dose Response 	<ul style="list-style-type: none"> • Quantity of hazard to cause illness / injury • Percent of people who will get ill • Severity of illness and cost • ALOP <p style="text-align: center;">____ Number Ill 100,000 persons/yr</p>

Risk Control	
Risk Management	Risk Communication
<ul style="list-style-type: none"> • Risk evaluation • Risk management option assessment • Implementation and management of decisions • Monitoring and review 	<ul style="list-style-type: none"> • Risk is never zero • Communicate to the consumer his/her responsibility in risk control (Consumer Advisory)

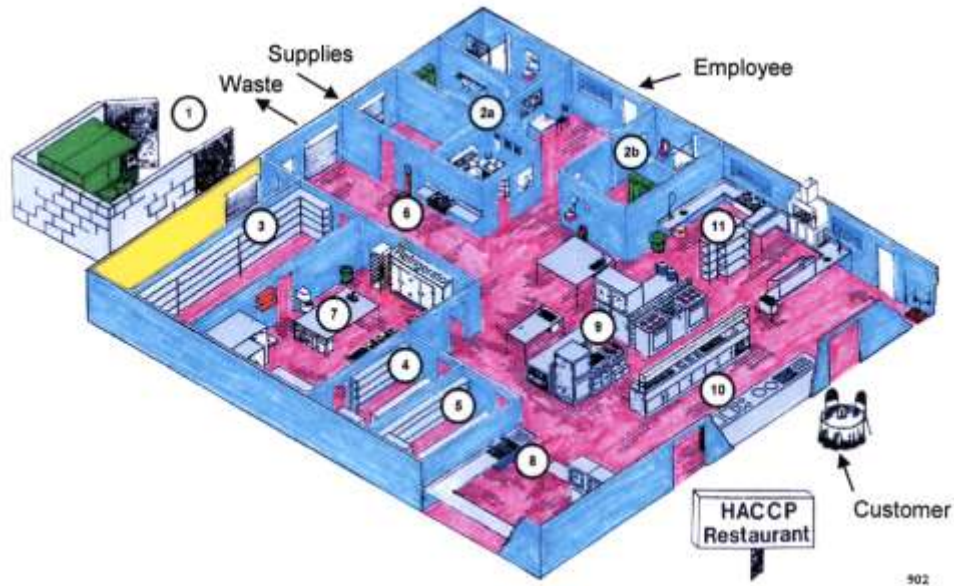
FOOD PROCESS PERFORMANCE-BASED DESIGN FOR SAFETY

MICROBIOLOGICAL

Risk Factors (hazard source)	H ₀ (incoming hazard level)	+I (increase)	-R (reduction / control)	FSO (output)
Personal hygiene				
Feces on fingers after using the toilet and toilet paper	6 log <i>Shigella</i> /g, norovirus, hepatitis A	No	Double wash of fingertips with nail brush for a 6-log reduction	1 CFU/g from fecal pathogens on fingers
Infected cuts (sores)	1,000 <i>Staphylococcus aureus</i> /g	No, in raw food	Wash cut, bandage Prevent toxin production, 3-log reduction	1 CFU/g from cuts
Bacteria on uniform, hair, fingernails, jewelry	No evidence of significant risk from pathogens	No	Exclude physical filth to a tolerable level by following GMPs	The level of filth in the food is tolerable
<i>Streptococcus</i> from throat; coughing on food	10 ³ <i>Streptococcus</i> (est.) if cough on food	Yes, if food temperature >55°F (12.8°C), >4 hours	Cough into shoulder / no droplets on food	<10 CFU on food when consumed
Environment / facilities				
Water	No significant risk if city water	No	City report of water treatment every 6 months	Water <1 coliform / 100 ml
Pests, flies, rats	Contamination of raw food killed by pasteurization; No evidence of significant risk to the contamination of ready-to-eat food in the kitchen	Unlikely	Keep kitchen clean; starve out pests	No detectable significant contamination of ready-to-eat food
Sewage back-up	No evidence of significant risk of sewage water contaminating food	Unlikely	Close kitchen if severe back-up	No measurable sewage bacteria in food
<i>Listeria</i> from environmental contamination	100 <i>Listeria</i> /g from kitchen environment	Yes, at >30°F (-1.1°C)	Store, <3-log increase [<7 days, 41°F (5°C)]	<100 CFU/g
Equipment				
Cross-contamination on food contact surfaces transferred to ready-to-eat food	1,000 <i>Campylobacter</i> spp./g on cutting board / fingers after touching raw food / poultry	No	After handling / touching raw meat, fish, and poultry, wash fingers, cutting board for a 5-log reduction of surface	<10 CFU <i>Campylobacter</i> spp. on fingers or on 8 square inches (50 square cm) cutting board
Supplies				
Receiving dented cans; broken / damaged meat, fish, poultry packages	<i>Clostridium botulinum</i> in damaged food	Possible	Reject damaged cans / food	No damaged cans / packages
Storage, raw meat, fish, poultry	Growth of <i>Salmonella</i> or <i>E. coli</i> or <i>Listeria monocytogenes</i>	Unlikely	Temperature <41°F, 0°F (<5°C, -17.8°C); pathogens will be killed with pasteurization	<1 CFU/25 g highly infective pathogen
Storage, ready-to-eat food	No risk; supplier reduces pathogens to an Appropriate Level Of Protection (ALOP) and assures Temperature Control for Safety (TCS); controls chemical and physical hazards	No	Supplier makes safe	<1/25 g highly infective pathogen

PREREQUISITE PROCESSES HAZARD IDENTIFICATION

$$H_0 + \Sigma I - \Sigma R \leq FSO / ALOP$$



Environment and facility

- Rodents, insects, birds
- Contaminated water, sewage back-up
- Cross connections, dripping pipes / roof
- Power interruption
- Waste disposal
- Lights, glass, plastic

Equipment, tools, utensils cleaning and maintenance

- Food contact surface smooth
- Safe metal or wood

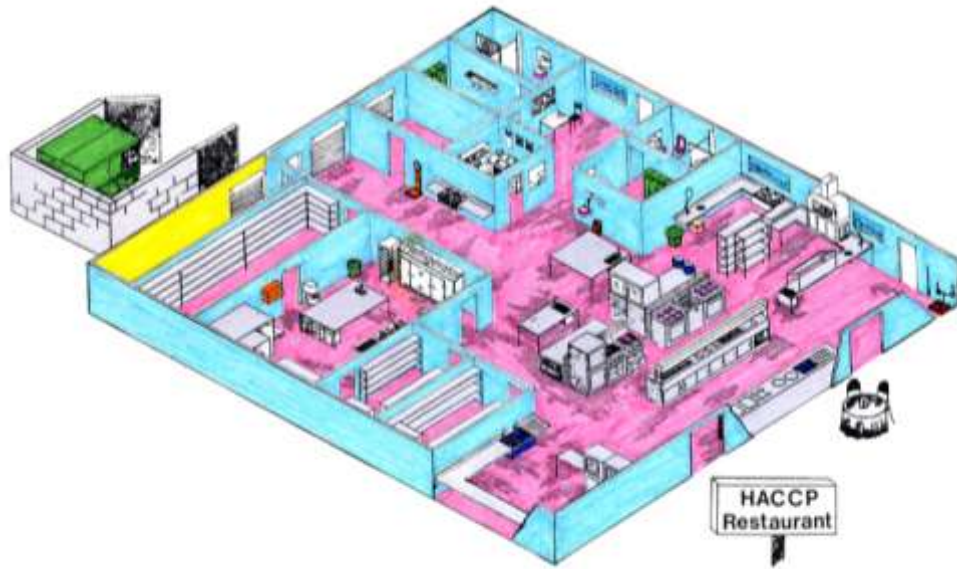
Personal Hygiene (70% symptomless shedders)

- Feces from toilet on fingers
- Strep throat
- *Staphylococcus aureus* from skin and infected cuts
- Hair, jewelry

Supplies (stock list)

- Suppliers qualified
- Ingredients, ready-to-eat, raw, chemical, physical hazards
- Ingredient separation
- Storage; Rh, temperature, time, container

KITCHEN CLEANING AND SANITATION FOR *LISTERIA* CONTROL



HAZARD

It must be assumed that the kitchen environment will be colonized with *Listeria monocytogenes* (Lm). The food contact surfaces in the cook-chill assembly and packaging departments for ready-to-eat food must be cleaned so that there is no measurable Lm (<1 CFU / 25 grams of food).

CONTROL

1. Determine the niches in the equipment in the ready-to-eat assembly and packaging areas where Lm might become colonized.
2. Establish a cleaning plan for this area.
3. Chose a control alternative
 - a. Add a Lm chemical growth inhibitor such as sodium diacetate or potassium lactate and also, do a post-package heat treatment.
 - b. Just add the chemical inhibitor.
 - c. Use sanitation measures only. This is the best for retail, because it does not affect the product.

VALIDATION: Monthly, take 1 to 3 sponge samples of food contact surfaces and 1 to 3 samples of environmental surfaces (e.g., floor drains, scrubbers, floor scrubbers) and test for *Listeria innocua*. Can composite samples. Follow the action flow chart, FSIS Dir 10,240.3.

HAND WASHING HACCP



Hazard:

Toilet paper slips and tears, and a person can get 6 log fecal pathogens on fingertips.

Control (gloves or the following):

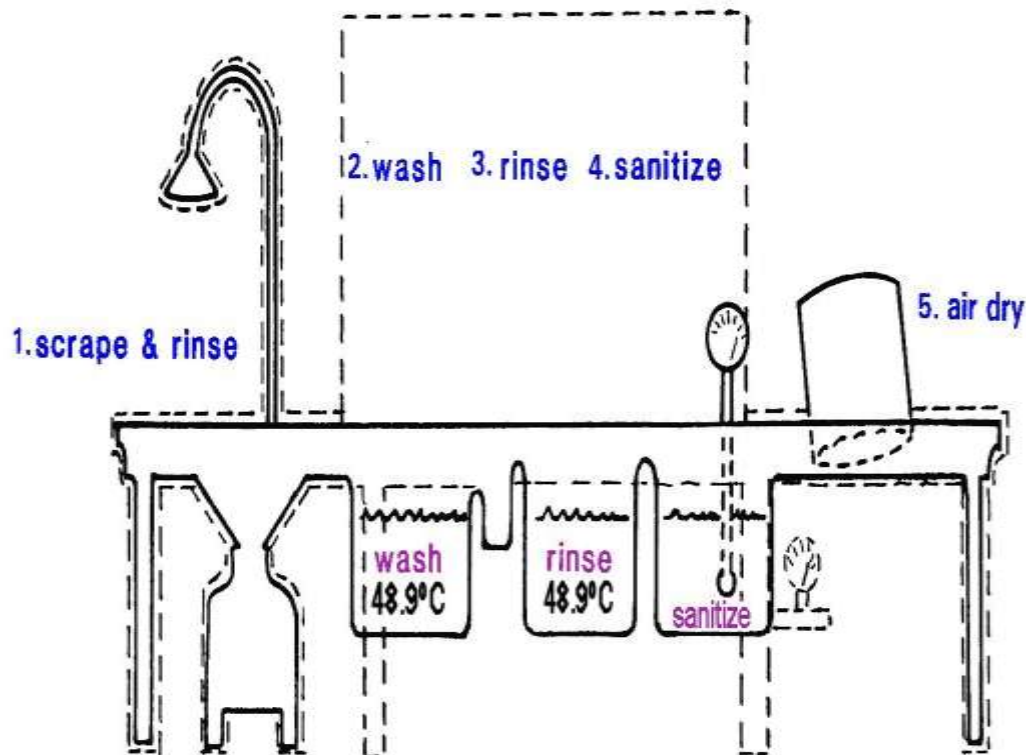
When coming from the toilet, do the double wash with a nail brush for a 6 log reduction by dilution.

1. Nail brush friction, detergent, and warm water, 3 log reduction
2. Second wash, no nail brush, 2 log reduction
3. Paper towel dry, 1 log reduction
4. Water flow, no splash, 2 gallons (7.6 liters) / minute
5. No touch controls are not necessary

Validation:

1. Contaminate fingertips 7 log with non-pathogenic *E. coli* ATCC 25922
2. Double fingertip wash, 6 log reduction
3. Petrifilm™ recovery *E. coli* <10 total

FOOD CONTACT SURFACE WASHING HACCP (cutting boards, knives)



Sanitize: **Chemical:** 23.9°C, water, 50 ppm chlorine;
12.5 ppm iodine; 150-200 ppm quat
Thermal: 77.2°C, 30 seconds

(120°F = 48.9°C 75°F = 23.9°C 171°F = 77.2°C)

Hazard:

Campylobacter jejuni from chicken
(1,000 to 10,000 on surface) and *Vibrio*
from seafood; scarred surface not a risk

Control:

1. With warm water running over the cutting board into a disposal, scrub with a brush for a few seconds; 3 log reduction by dilution
2. In the pot and pan sink, scrub again; 2 log reduction by dilution
3. Rinse to remove soap
4. Sanitize (not a CCP), air dry

Validation:

1. Put 7 log *E. coli* on the cutting board / dish
2. Wash and sanitize
3. Swab 50 sq cm (8 sq in), <100 *E. coli*, 5-log reduction

PREREQUISITE SANITATION MANAGEMENT PLAN

Significant risk, vegetative pathogens transfer to ready-to-eat food

SCHEDULE

Equipment / Area / Surface	Frequency	Chemical
Installed equipment: cleaning; calibration		
Hoods		
Sinks / faucets		
Walk-in refrigerators		
Blast chill refrigerators		
Thaw cabinets		
Walk-in freezers		
Reach-in refrigerators		
Reach-in freezers		
Display refrigerators		
Display freezers		
Lights		
Water baths		
Carts (wheels)		
Cooking equipment		
Ovens, broilers, fryers		
Hot holding cabinets		
Steam tables		
Washing machines		
Dish and pot wash machines		
Smallwares		
Small utensils		
Cutting boards		
Cooking utensils and equipment		
Hotel pans		

PROCESS

MAPLE WOOD CUTTING BOARD

<p>Get ready</p> <ul style="list-style-type: none"> • 3-compartment sink filled as follows: <ul style="list-style-type: none"> 1st sink: (dishsoap) solution 2nd sink: rinse water 3rd sink: (sanitizer) solution • Food scraper • Scrub pad and scrub brush
<p>Action</p> <ol style="list-style-type: none"> 1. Remove cutting board every 4 hours or more often, and take to 3-compartment sink to be cleaned. 2. Scrape loose food particles into disposal. 3. Using scrub brush, wash board with (dishsoap) solution in first sink. 4. Rinse in clean, warm water in second sink. 5. Sanitize in 3rd sink, 1 minute, 50 ppm chlorine. 6. Allow to air dry.
<p>Check that cutting board is clean.</p> <ul style="list-style-type: none"> • All food is removed. • Boards are free of nicks in wood.

MICROBIOLOGICAL SAMPLING



Components:

Petrifilm™ AC plates (20 sq cm / 3 sq inches) /
E. coli plates

Lethen broth tubes (sanitizer neutralizer)

Cotton swab

1-ml pipettes

Spreader plate

Uses:

Surface cleanliness sampling
(50 sq cm / 8 sq inches) (swab)

Surface sampling (direct contact)

Food: APC, *Staphylococcus aureus*,
coliform / *E. coli*, *Listeria monocytogenes*

Classroom: fingers, hair

SAMPLING THE pH OF FOOD



Method: Calibrate with pH 4.01 and pH 7.01 buffer. Put probe in stirred sample, 20°C. Wait 30 seconds for stable reading.

ACIDS THAT CAN BE USED

Acid	pK _a	Examples of usage
Acetic acid	4.75	Pickling of meat, fish, and vegetable products
Sodium diacetate	4.75	Bread and bakery products
Sodium benzoate	4.2	Pickles, acid sauces and salads, semi-preserved fish, fruit juices, soft drinks, jams, margarines
Citric acid	3.1	Soft drinks
Lactic acid	3.1	Salad creams and mayonnaise
Methyl paraben ^a	8.5	
Ethyl paraben ^a	8.5	See sodium benzoate
Propyl paraben ^a	8.5	
Sodium propionate	4.9	Breads, bakery, and cheese products
Sorbic acid (including potassium salt)	4.8	Fresh and processed cheese, dairy products, bakery products, fruit juice, acid sauces and salads, jams, jellies, soft drinks, margarines, semi-preserved fish and meat products

^a Paraben = p-hydroxybenzoic acid

Reference: ICMSF, 1980. Microbial Ecology of Foods. Vol. 1. Factors affecting growth and death in microorganisms. 128-129. Academic Press, New York, N.Y.

MENU INGREDIENT HAZARD INVENTORY

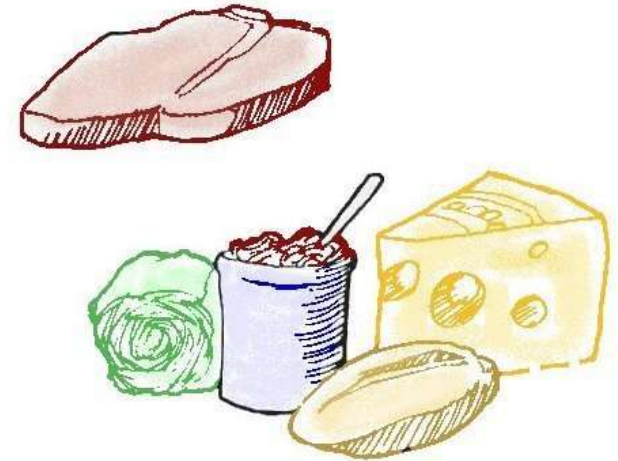
Supplier Makes Safe (ready-to-eat)		Cook Makes Safe (raw)	
Potatoes, cooked Onion Rings, cooked Corn Beef Hash, cooked Sausage Links, precooked Cheese Pizza, fully cooked Turkey Breast, fully cooked Nacho Meat Roast Beef Kraft Macaroni and Cheese French Toast Batter Gravies (pasteurized ingredients) Soups Marinara Sauce	Oatmeal Vegetables, frozen Coleslaw Mix Canned Fruits Applesauce Cheeses Pickles Cocktail Sauce Butter Honey Salad Dressings Condiments (e.g., ketchup) Coffees	Fruit Juices Soft Drinks Milk Bread Products Apple Crisp Frozen Pies Cakes Ice Cream Jams and Jellies Vinegar Sugar (brown, powdered)	Potato to be baked Chicken parts and strips Chicken Fried Steak Cod, battered Shrimp, breaded Bacon Hamburger, Junior and Regular Eggs (in-the-shell) Steak Country Fried Steak Fresh Vegetables Fresh Fruits

HOW DO YOU KNOW IF FOOD IS HAZARDOUS OR SAFE?

You control the process.

Food Spoilers

Do not cause illness.
Change the flavor, odor, and appearance of food.
Inhibit growth of pathogens.



Food Process "Spoilers"?

Used in the production of food products
(e.g., vinegar, bread, sauerkraut, cheese).
They "spoil" the food.

Food Pathogens

Cause illness.
Often do not change the flavor, odor, and appearance
of food to indicate that the food is hazardous.
If in doubt about how food was handled after cooking,
throw it out.



MENU ITEM HAZARD CONTROL PLAN

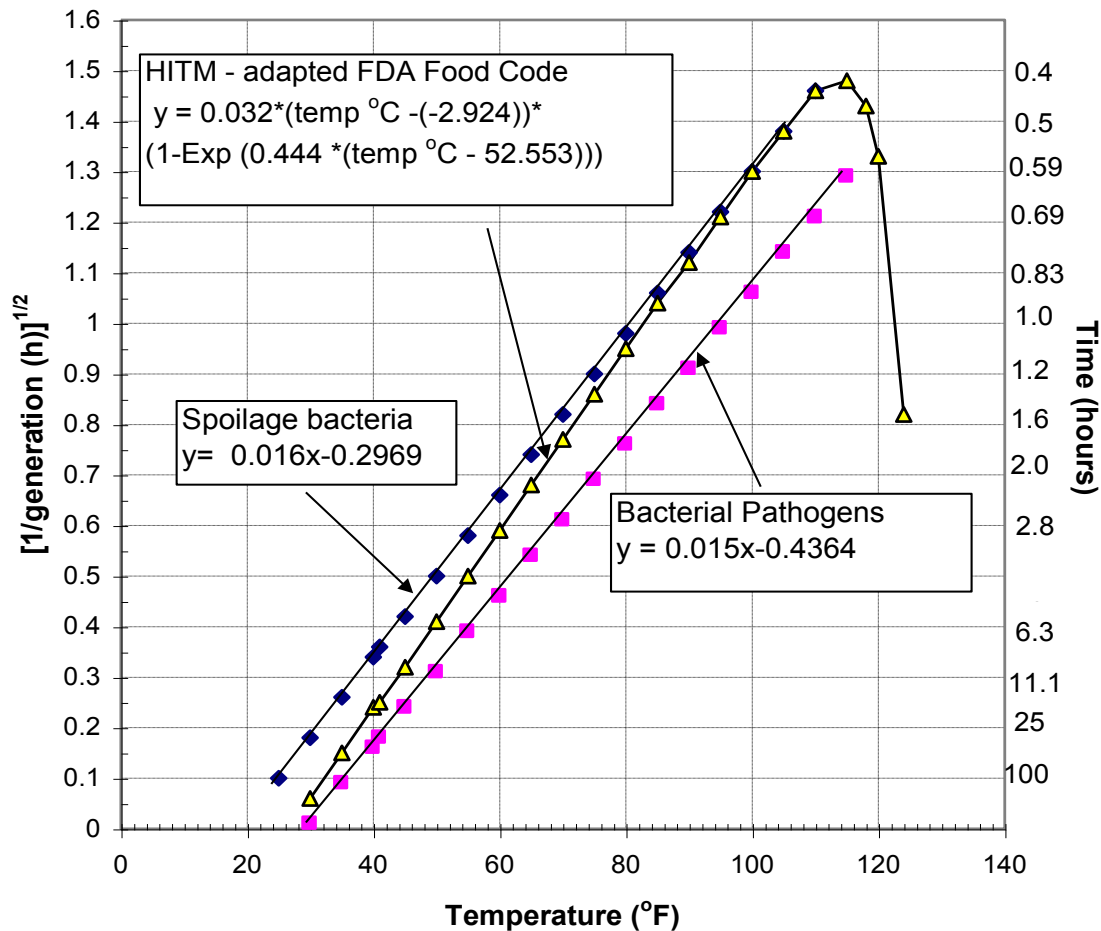
Menu Item	Storage	Preparation	Hold / Serve	Leftovers
Steak, sirloin / steak T-bone, raw	Frozen / thaw 24 hrs. refrig. Hold 48 hrs. / RD <40°F (<4.4°C) (clock date).	Cook to order >145°F (>62.8°C), CCP unless customer requests otherwise.	Serve immediately.	None
Eggs, pasteurized liquid, supplier pasteurized	After opening 24 hrs. / WR <40°F (<4.4°C) (clock date).	Cook to order (scrambled eggs, omelets) to >150°F (>65.6°C), 15 sec.	Serve immediately.	None
Eggs, fried, raw	Refrigerated shell eggs [<40°F (<4.4°C)].	Cook to 145°F (62.8°C), 15 sec., unless customer requests otherwise. CCP .	Serve immediately.	None
Eggs, hard boiled, raw	Refrigerated shell eggs [<40°F (<4.4°C)].	Cook for 10 minutes, >150°F (>65.6°C), 15 sec. Pour ice over eggs to cool. CCP .	24 hrs. refrig. <40°F (4.4°C).	Discard
Oatmeal, a _w control, supplier pasteurized	RT storage	Mix pack with hot water [>190°F (87.8°C)] or: Kettle, add oatmeal to boiling water, simmer 8-10 minutes <160°F (71.1°C), 15 sec.	Service immediately. ST = 4 hrs., >160°F (71.1°C)	Discard
Mashed potatoes, a _w control, supplier pasteurized	RT storage	Mix 2 qts. (1.8 liters) boiling water [212°F (100°C)], 2 oz. (60 ml) Liquid Margarine and 1 bag potato mix >160°F (71.1°C), 15 sec.	Service immediately. ST = 4 hrs., >160°F (71.1°C)	Discard
Celery, raw	5 days refrig. <40°F (4.4°C) (cover label, clock date).	Clean and trim. Double wash. CCP . Cut or dice <40°F (4.4°C).	<40°F (4.4°C), 24 hrs.	Discard
Lettuce, iceberg, raw	5 days refrig. <40°F (4.4°C) (cover label, clock date).	Clean, core, remove brown leaves. Double wash. CCP . Quarter. Separate leaves. Remove excess water. Store in plastic container <40°F (4.4°C).	<40°F (4.4°C), 24 hrs.	Discard

RD = refrigerated drawer WR = walk-in refrigerator RT = room temperature FD = freezer drawer

FOOD PROCESS PERFORMANCE-BASED DESIGN FOR SAFETY (cont'd)

Risk Factors (hazard source)	H₀ (incoming hazard level)	+I (increase)	-R (reduction / control)	FSO (output)
Food Production				
Thaw	No significant <i>Salmonella</i> / <i>E. coli</i> growth during thaw	Not significant, <1 log	5-log pasteurization No toxin production	Pasteurization reduces vegetative pathogens to <1 CFU/25 g
Pre-preparation (<i>Staphylococcus aureus</i> not a problem, because spoilage organisms out-compete microorganisms and prevent growth)	<u>Vegetative pathogens:</u> 1,000 <i>Salmonella</i> / <i>E. coli</i> /g	<1-log multiplication	Wash for a 2-log reduction; 5-log reduction cannot be achieved	FSO of 1 CFU/100 g is desired
Preparation	1,000 <i>Salmonella</i> / <i>E. coli</i> /g	No	5-log pasteurization	≤1/25 g highly infective
Hot hold	<u>Spores:</u> 100 <i>Clostridium perfringens</i> /g survive pasteurization	<1-log increase vegetative <i>Clostridium perfringens</i>	Temperature >130°F (54.4°C) prevents germination	<10/g increase FSO <5 log/g
Cool	100 <i>Clostridium perfringens</i> spores/g	<1,000 CFU / gram increase	Cool to prevent >3-log increase in <i>Clostridium perfringens</i> vegetative cells	<5 log <i>Clostridium perfringens</i> vegetative cells/g
Cold hold	100 <i>Bacillus cereus</i> spores/g	<1,000 <i>Bacillus cereus</i> increase during cold hold	Hold at a time and temperature to prevent >3-log increase of <i>Bacillus cereus</i>	<5 log/g No detectable toxin
Reheat (not necessary if control steps have been followed)	<5 log <i>Bacillus cereus</i> and <i>Clostridium perfringens</i> /g; no significant risk; prevent cross-contamination to ready-to-eat food (hands are washed) Prevent toxin by <i>Staphylococcus aureus</i>	No	Reheating to 165°F (73.9°C), 15 seconds will reduce vegetative pathogens to safe level (toxin prevented)	FSO <10/g No detectable toxin

GROWTH OF BACTERIA IN FOOD BASED ON FDA FOOD CODE HOLDING / STORAGE RECOMMENDATIONS



Temp. °C (°F)	1 Generation	10 Generations / 3-log increase
-1.1 (30)	297.14 hr.	123.8 days
1.7 (35)	46.34 hr.	19.3 days
4.4 (40)	17.99 hr.	7.5 days
5.0 (41)	15.55 hr.	6.5 days
7.2 (45)	9.49 hr.	4.0 days
10.0 (50)	5.85 hr.	2.4 days
12.8 (55)	3.96 hr.	1.7 days
15.6 (60)	2.86 hr.	1.2 days
21.1 (70)	1.69 hr.	16.9 hr.
26.7 (80)	1.12 hr.	11.1 hr.
32.2 (90)	0.79 hr.	7.9 hr.
37.8 (100)	0.59 hr.	5.9 hr.
43.3 (110)	0.47 hr.	4.7 hr.
46.1 (115)	0.46 hr.	4.6 hr.
48.9 (120)	0.56 hr.	5.6 hr.
41.7 (125)	3.10 hr.	31.0 hr.

spoilbac/Chart9

FOOD RECEIVING AND STORAGE HACCP



Hazard:

Pathogens from raw food can cross-contaminate ready-to-eat food.

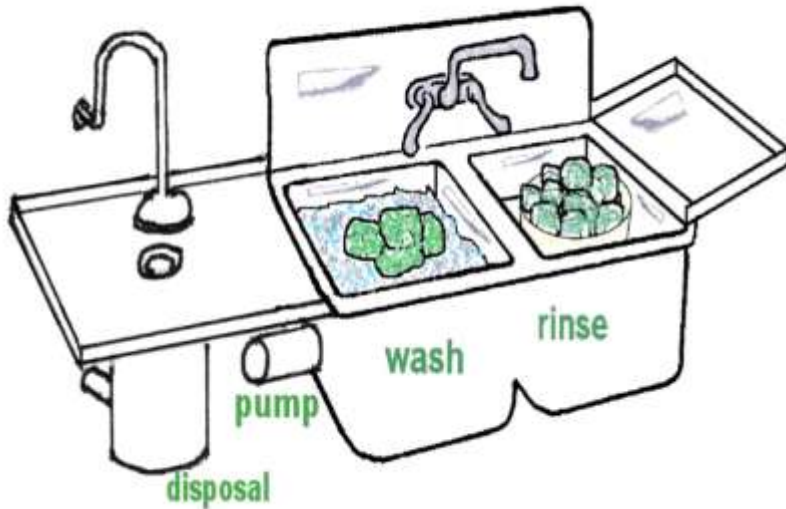
Control:

- Raw food: time and temperature not CCP; washing or cooking makes food safe
- Ready-to-eat food on top, raw on bottom
- Air flow: 5 feet (15 meters) per minute holding; 1,000 feet per minute cooling;
41°F (5°C), 7 days; 45°F (7.2°C), 4 days; 50°F (10°C), 2.5 days; 70°F (21.1°C), 18 hours; 110°F (43.3°C), 4 hours
- Humidity 70% to prevent mold growth; 95% to prevent drying of fruits and vegetables

Validation of temperature:

- Cup of salt in refrigerator and freezer

WASHING AND BLANCHING FRUITS AND VEGETABLES (VEGETATIVE BACTERIA) HACCP



71°C = 160°F

Hazard:

Raw fruits and vegetables are contaminated in the pores of the surface. Chemicals do not affect pathogens in the surface.

Control:

The bacteria must be removed by brush friction or water turbulence. The following reduces bacteria, parasites, and viruses about 2 log by dilution.

1. Trim.
2. Wash in turbulent water. Transfer to 2nd sink.
3. Rinse in turbulent water, 2nd sink.
4. Spin dry.

Chemicals can be used in a 3rd sink, but have a limited effect, 1 log.

Blanch fruit or vegetable in 160°F (71°C) water, 1 minute, for a 5-log reduction.

Electrolized water is good.

Validation:

Put *E. coli* on food and measure before and after treatment, using *E. coli* Petrifilm™.

THAWING

Flowing water

<70°F (<21.1°C)

Refrigerator

<41°F (<5°C)

Below cooked food, uncovered

Microwave

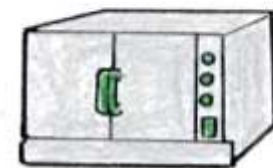
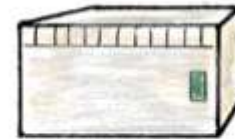
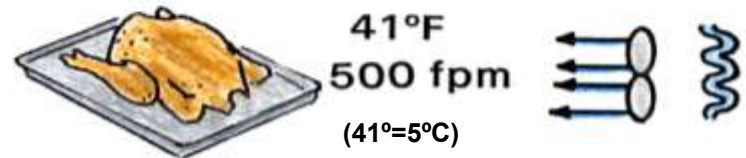
When followed by immediate cooking

Cook from the frozen

1/3 more time

Roast beef, turkey, steak, hamburger,
prepared food

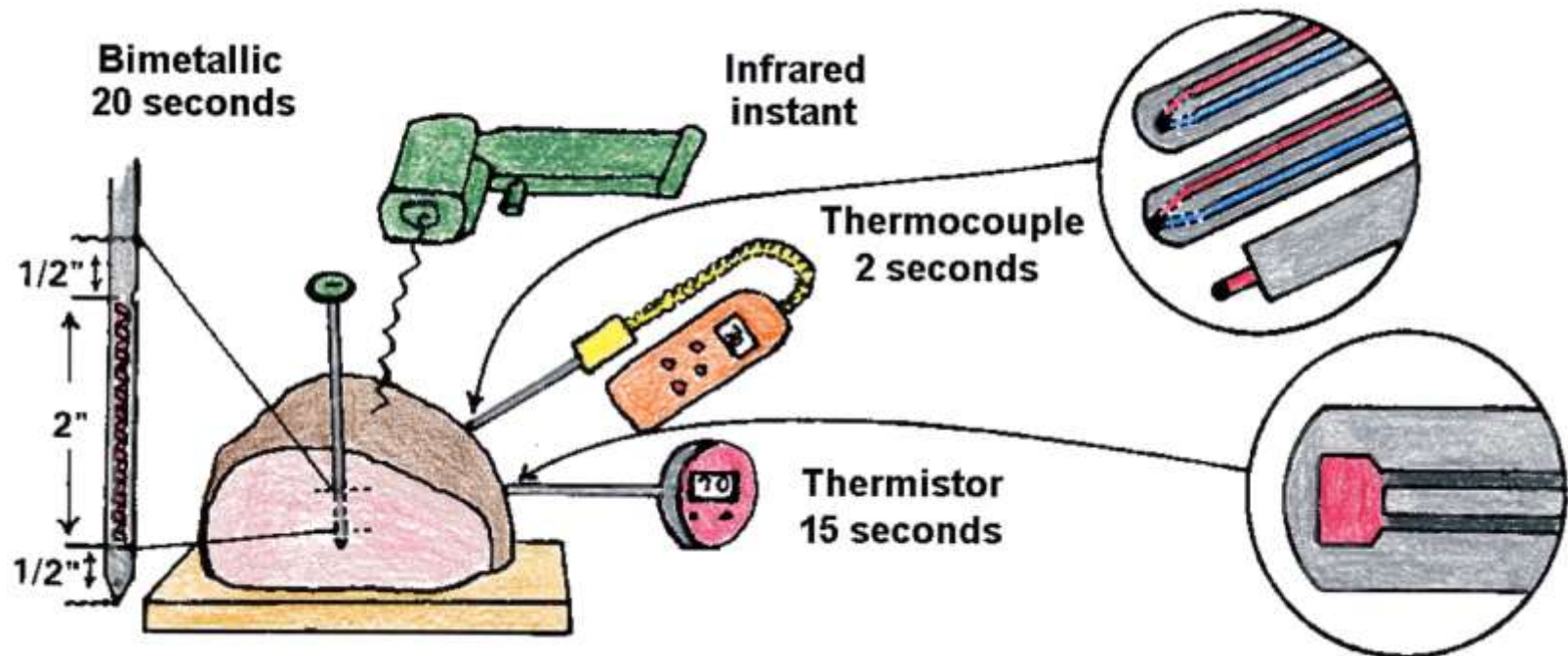
HACCP validates thawing on the counter as safe. At 70°F (21.1°C), air thawing takes about 11 to 12 hours for a 25-lb (11.34 kg) turkey. The surface gets to about 55 to 60°F (13 to 16°C), and there is approximately 1 multiplication of *Salmonella*.



1228

Klose, A.A., Lineweaver, H., and Palmer, H.H. 1968. Thawing turkeys at ambient air temperatures. Food Technol. 22: 1310-1314.

TEMPERATURE MONITORING that the process is in control



Bimetallic Coil Thermometer = Average temperature over 7.6 cm (3 inches) (from tip to dimple)

Thermocouple [1 mm (0.040-inch) diameter or less] = Temperature at tip

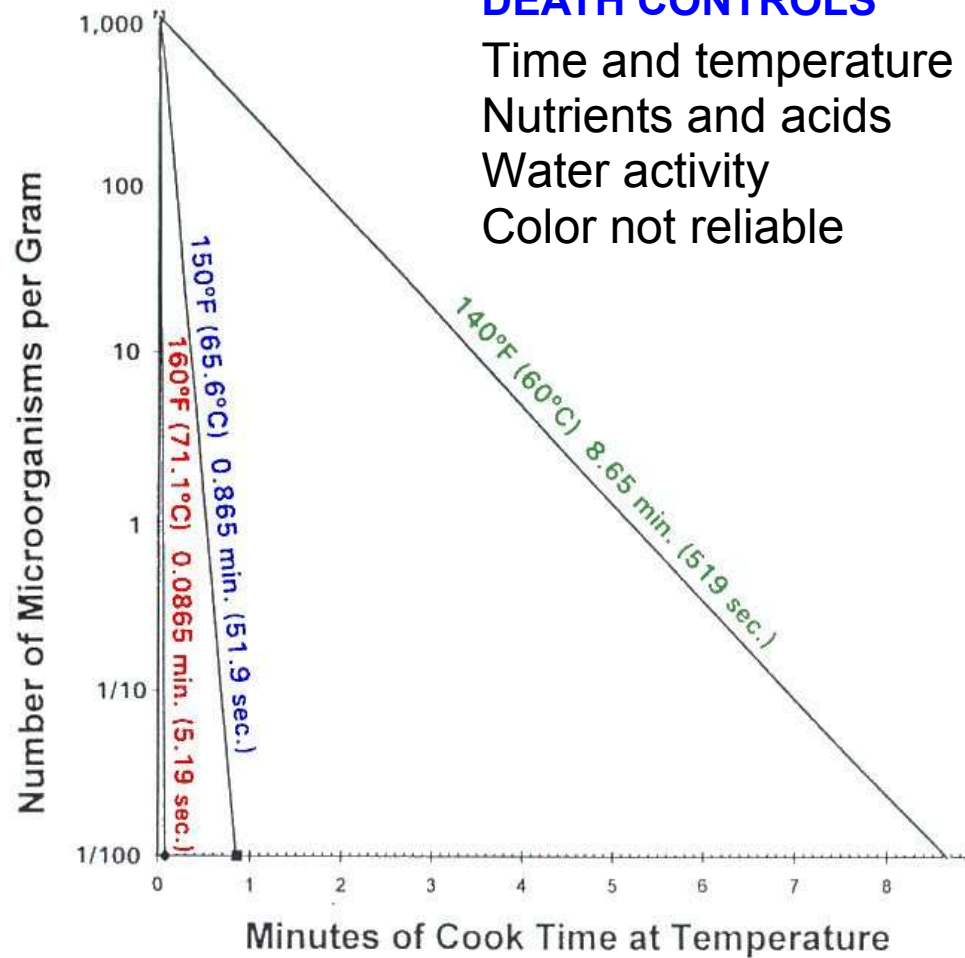
Thermistor [1.6 mm (0.0625-inch) diameter] = Average temperature from tip up 0.6 cm (0.25 inch)

Infrared Heat Detector = Surface measurement

DESTRUCTION OF SALMONELLA IN FOOD

DEATH CONTROLS

Time and temperature
 Nutrients and acids
 Water activity
 Color not reliable



DESTRUCTION OF SALMONELLA SPP. IN FOOD

Temp. °F (°C)	5D FDA Hamburger (100,000:1)	6.5D USDA Roast beef (3,160,000:1)	7D USDA Poultry with 12% fat
130 (54.4)	86 min.	112 min	---
135 (57.2)	27 min.	35 min.	---
140 (60.0)	8.7 min.	11.2 min.	35 min.
145 (62.8)	2.7 min.	3.5 min.	13.8 min.
150 (65.6)	52 sec.	67 sec.	4.9 min.
155 (68.3)	16 sec.	21 sec.	1.3 min.
160 (71.1)	5.2 sec.	6.7 sec.	26.9 sec.
165 (73.8)	Instant	Instant	<10 sec.

1326

FOOD PASTEURIZATION HACCP (VEGETATIVE BACTERIA)



Hazard:

Pathogens contaminate raw meat, fish, and poultry.

Control:

Salmonella is the target pathogen.

Reduce *Salmonella* 5 log / 7 log.

(Assumes the food is contaminated with about 1,000 / gram, and must be reduced to 1 per 100 grams.) Color not reliable.

Do not need 165°F (73.9°C)

150°F (65.6°C), 1 minute.

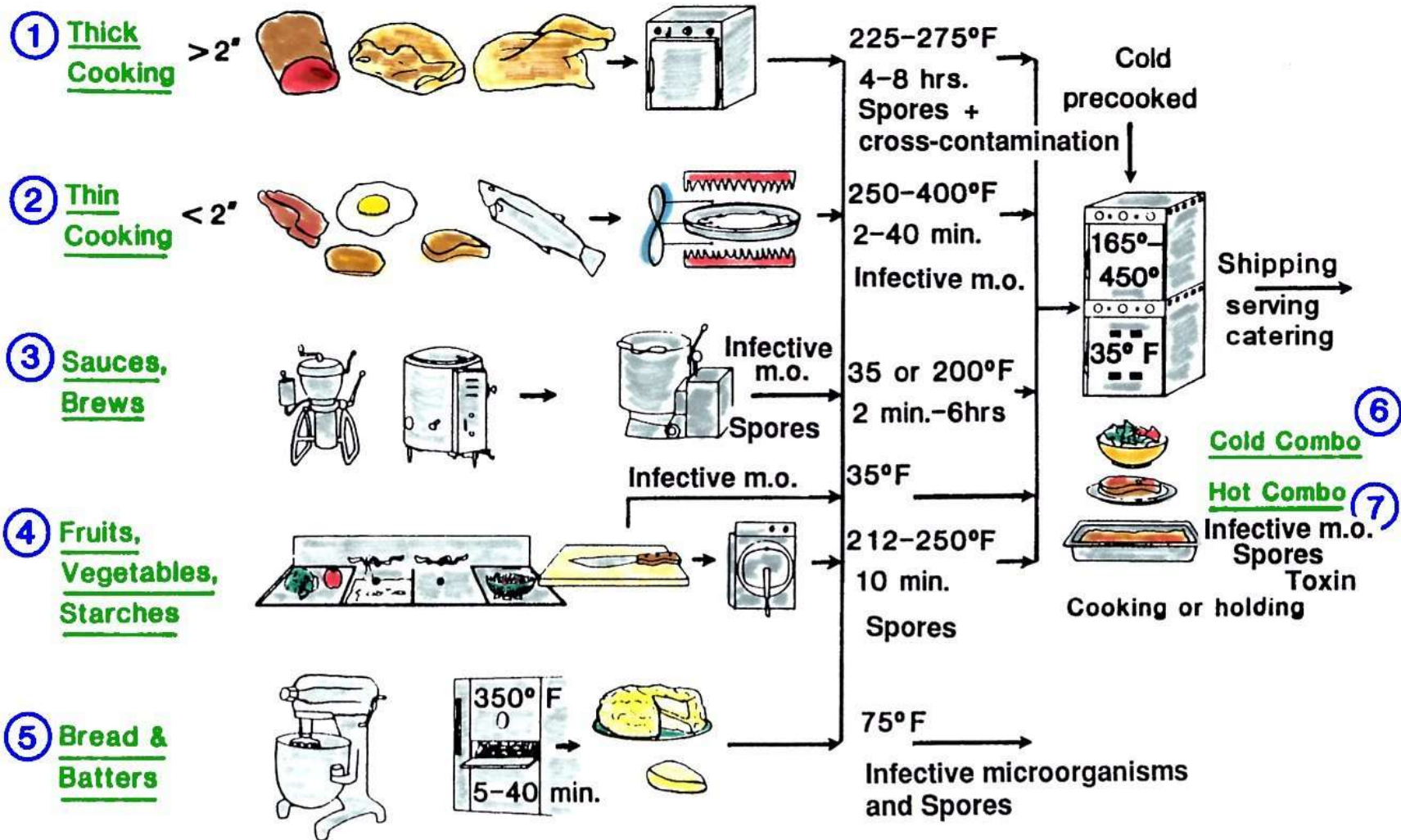
Validation:

- Contaminate with non-pathogenic *E. coli*.
Take sample before heating, <68°F (<20°C).
- Take samples about 130°F, 140°F, and 150°F (55°C, 60°C, and 65°C) and count survivors. By 150°F (65°C), there should be >5-log reduction.



THE SEVEN COOK-THEN-PACKAGE / SERVE RECIPE PROCESSES

Kill the *Salmonella* and do not let the spores multiply.



350°F = 177°C 225-275°F = 107-135°C 250-400°F = 121-204°C
 35°F = 1.7°C 200°F = 104°F 212°F-250°F = 100-121°F 75°F = 24°C

1284

FOOD GROUPS HACCP PROCESS ANALYSIS

HACCP Process Groups (USDA HACCP, 9 CFR 417) Prerequisite / GMPs working	Control	Shelf life
I Raw, not heat treated. Not TCS / no RPG: sprouts; raw meat, fish; sushi, sashimi; eggs, raw fruits and vegetables, flour, salt, sugar, spices, oil	Grown safe, with H_0 that meets FSO. May require Temperature Control for Quality.	<14 days or longer (bact. spoilage)
II Not fully cooked, with inhibitors to make shelf stable. <u>Water activity:</u> nuts, sugar icing, butter honey, dried fish, fresh pasta, peanut butter <u>Fermentation:</u> pepperoni, salami; olives; dairy (cheese, yogurt, sour cream / milk / crème fraîche); bread; sauerkraut; kimchee; beer, wine <u>Acidified:</u> salad dressing; cole slaw; salsa; condiments	With H_0 that, with $+\Sigma I - \Sigma R$ (5-log <i>Salmonella</i> reduction), meets FSO. Does not require TCS because of product a_w , pH, or additives. $A_w < 0.86$ (<i>Staphylococcus</i>) $pH < 4.2$ (<i>Salmonella</i>) (or fermentation)	>2 years, 68°F (20°C) (chem. spoilage)
III Fully cooked, not shelf stable. hot or cooled, refrigerated ready-to-eat food; meat, fish, poultry; fruits, vegetables, dairy, pastry filling, pudding	Pasteurized (5-log to 7-log <i>Salmonella</i>) so that $+\Sigma I - \Sigma R$ meets FSO. Requires TCS.	41 to 135°F (5.0 to 57.2°C), ≤4 hours or Cold 41°F (5.0°C), 7 days / unlimited
IV Fully cooked, with inhibitors to make shelf stable. marinara sauce; fruit pie fillings; cake icing, bread and pastry, dry cereals, dry pasta, smoked fish; packaged, low-pH fruits and vegetables	Pasteurized (5-log to 7-log <i>Salmonella</i>) so that $+\Sigma I - \Sigma R$ meets FSO. $A_w < 0.92$; $pH < 4.6$ Does not require TCS because of product a_w , pH, or additives.	>5 years
V Commercially sterile, shelf stable. "packaged" meat, fish, poultry, fruits, vegetables, dairy / UHT milk	Sterilized, <i>Clostridium botulinum</i> spores reduced 9 log to 12 log. Does not require TCS.	>5 years

PHF=Potentially Hazardous Food; RPG-Rapid and Progressive Growth; UHT=Ultra High Temperature; H_0 =Starting Hazard; FSO=Food Safety Objective; Σ =summary; I=Increase; R=Reduction; TCS=Temperature Control for Safety; a_w =water activity

RETAIL PROCESS HACCP BASED ON FIVE USDA HACCP PROCESSES

Process	Purchase	Receive / Store	Pre-Prep	Preparation	Transport, Hold, Serve	Cool	Customer Consumption
I. Not heat treated, not shelf stable♦♦ Raw mushrooms, green onions, salad greens, fruit, fruit juice, fresh fruit and vegetable salads, fish, beef, pork, shellfish, eggs	CCP. Farmer has HACCP and guarantees safe levels of hazards on food.	No B,C,P* cross-contamination	Remove hard foreign objects. Wash fruits and vegetables, 2 log. No cross-contamination.	No B,C,P cross-contamination.	No B,C,P cross-contamination.	N/A	Raw food spoils safe. No B,C,P cross-contamination.
II. Not heat treated, with inhibitors to make shelf stable Combine flour, nuts, salt, sugar, vinegar, eggs, milk, etc. to make foods such as butter with honey, herbs, acid, salad dressing, pickles, olives, kimchee, wine.	CCP. Farmer / supplier has HACCP and guarantees safe levels of hazards on food.	No B,C,P cross-contamination	Remove hard foreign objects. Wash fruits and vegetables, 2 log. No cross-contamination.	CCP. 5-log <i>Salmonella</i> kill with acid if eggs added or pH <4.1 or a _w <0.92 or combination.	No hazard.	No hazard.	No hazard.
III. Fully cooked*, not shelf stable Ready-to-eat meat, fish, poultry, butter, cheese, ice cream, salads with cooked safe ingredients	<10 ³ <i>Salmonella</i> . Chemicals at tolerable levels.	No C,P cross-contamination.	Remove hard foreign objects.	CCP. Cooking gives a 5-log to 7-log <i>Salmonella</i> kill; spores survive. No inhibitors.	CCP. >130°F (54.4°C).	CCP. <14 hours, 120 to 55°F (48.9 to 12.8°C).	CCP. <40°F (4.4°C) or <3 log growth of vegetative pathogens before consumption.
IV. Fully cooked*, with inhibitors to make shelf stable Smoked, salted, canned meat, fish, poultry; canned fruit; jam, jelly, syrup, processed cheese, acidic sauces (BBQ sauce, catsup), acidic beverages, bread, bagels, cake, cookies, dry cereals, taco shells)	<10 ³ <i>Salmonella</i> . Chemicals at tolerable levels.	No C,P cross-contamination.	Remove hard foreign objects.	CCP. Cooking gives a 5-log to 7-log <i>Salmonella</i> kill. pH, a _w , and chemical inhibitors prevent spore outgrowth.	No hazard.	No hazard.	No hazard.
V. Commercially sterile**, shelf stable Hermetically / anaerobically packaged food (vegetables, beans, meat, poultry, fish, soup, dairy products)	<1 <i>Clostridium botulinum</i> / gram Chemicals at tolerable levels.	No C,P cross-contamination.	Remove hard foreign objects.	CCP. Product receives a 9-log to 12-log <i>Clostridium botulinum</i> reduction.	No hazard.	No hazard.	No hazard.

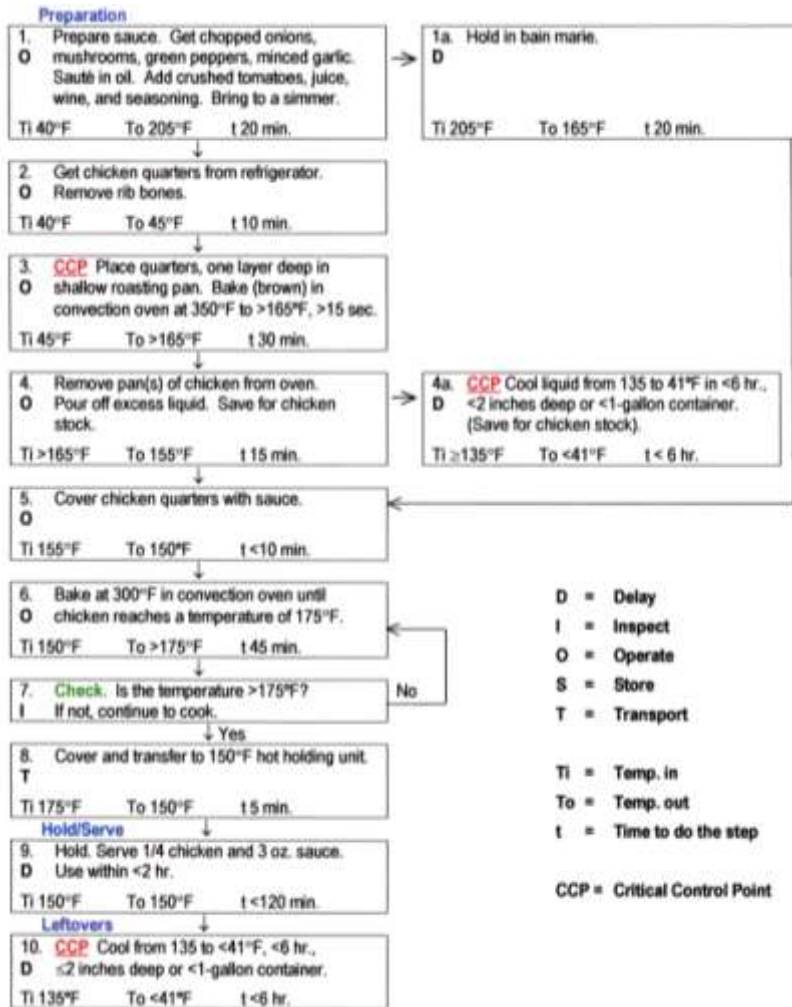
♦B,C,P = biological, chemical, and physical

♦♦Not shelf stable = pathogenic vegetative cells can grow, and spores can outgrow

*Fully cooked = 5-log to 7-log *Salmonella* treatment or Food Safety Objective (FSO) of <1 *Salmonella* / 25 grams

**Commercially sterile = 9-log to 12-log *Clostridium botulinum* treatment

CHICKEN CACCIATORE QA RECIPE FLOW AND QUALITY-ASSURED HACCP RECIPE PROCEDURES



Recipe Name: **Chicken Cacciatore** Portion size (vol./wt.): 1/4 (6 oz.) chicken + 3 oz. sauce
 Production style: **Combination** Number of portions: 100 Prepared by: **S. P.**
 Written by: **O. P. S.** Date: 10/95 Final yield (AS): 100 Supervisor:
 SA/QA by: **J. Bell** Date: 12/95 Final yield:

Gp. #	Ingrd. #	Ingredients and Specifications	Edible Portion (EP) (weight or volume)		EP Weight %	As served (weight)
I	1	Onions, chopped (1/2" x 1")	3.0 lb	1,360.00 g	13.26	
	2	Mushrooms, cut (1/2", caps & stems)	3.0 lb	1,360.00 g	13.26	
	3	Peppers, green, cut (1/2" x 1")	2.0 lb	907.2 g	8.84	
	4	Garlic, chopped	6 Tbsp.	86.05 g	0.53	
	5	Tomatoes, canned, crushed (2 - #10 cans)	13.25 lb	6,010.00 g	58.58	
	6	Oil, vegetable	1/4 cup	54.00 g	0.53	
	7	Wine, Marsala or Madeira	2 cups	472.00 g	4.60	
	8	Oregano, crushed	2 tsp.	3.00 g	0.03	
	9	Salt	1 tsp.	5.50 g	0.05	
	10	Pepper	1 tsp.	2.10 g	0.02	
Total			22.6 lb	10,268.85 g	100.00	22.0 lb
Approx. gallons			2.5 gal.			
II	11	Chickens, whole (25 - 2 3/4 to 2 3/4 lb.)	62 lb			40.0 lb

- Preparation**
- Prepare sauce. Get chopped onions, mushrooms, green peppers and garlic (40°F) from refrigerator. Sauté the vegetables in vegetable oil for about 10 minutes. Add crushed tomatoes with juice, wine, and seasonings (72°F). Bring sauce to a simmering temperature (205°F, 10 min.).
 1a. Hold sauce in bain marie. (165°F, 20 min.)
 - Prepare chicken. Get chicken quarters (40°F) from meat and poultry refrigerated storage area. Remove rib bones. (45°F, 10 min.)
 - CCP Place quarters, one layer deep in shallow roasting pans. Brown chicken by baking it in a convection oven at 350°F for 30 min. (>165°F, >15 sec.)
 - Remove pans of chicken from oven. (165°F, 15 min.) Pour off excess liquid. Save for chicken stock.
 4a. CCP Cool liquid from 135 to <41°F, <6 hours, <2 inches deep or <1-gallon container.
 - Cover the chicken quarters with sauce, 155°F, <10 min. (Final temperature 150°F.)
 - Return the pans of chicken and sauce to convection oven at 300°F and continue baking until all parts of the chicken reach a temperature of 175°F (about 45 minutes).
 - Check temperature of chicken. If temperature is not 175°F, continue baking.
 - Cover chicken, 175°F, transfer to 150°F hot holding unit and serve within <2 hours.
- Hold / Serve**
- Hold / serve chicken >150°F, <2 hours. For each portion, use either 1/4 quarter white or dark meat. Chicken should be accompanied by 3 ounces of sauce (165°F) (about 3 tablespoons).
- Leftovers**
- CCP Cool from 135 to <41°F in <6 hours, <2 inches deep or <1-gallon container.
- Ingredients that could produce possible allergic reactions: Tomatoes, wine

Process step #	Start food ctr. temp., °F	Thickest food dimension (in.)	Container size (HxWxL, (in.))	Cover Yes/No	Temp. on/ around food	End food ctr. temp., °F	Process step time, hr./min.
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FOOD HOT HOLD HACCP (SPORE CONTROL)



Hazard:

- The surface of food with a center temperature of 140°F (60°C) in a steam table exposed to air with a relative humidity of 50% will be about 117°F (47.2°C) because of evaporative surface cooling.
- *Clostridium perfringens* will grow <125°F (<51.7°C). Hot hold >125°F (>51.7°C).
- Heat lamps dry food, reduce quality.

Control:

Keep food covered; keep high humidity, >90%, above food; or cover food with something like a butter sauce or cheese.

Validation:

- Make a pan of instant mashed potatoes with cooked ground beef and *C. perfringens* on the surface.
- Measure temperature. Hold in a steam table for 4 hours. Measure *C. perfringens* growth on the surface.

FOOD COOLING HACCP (SPORE CONTROL)



Hazard:

Clostridium botulinum, *Bacillus cereus*, and *Clostridium perfringens* spores survive pasteurization and will germinate and multiply if cooling is too slow between 125 and 80°F (51.7 and 26.7°C).

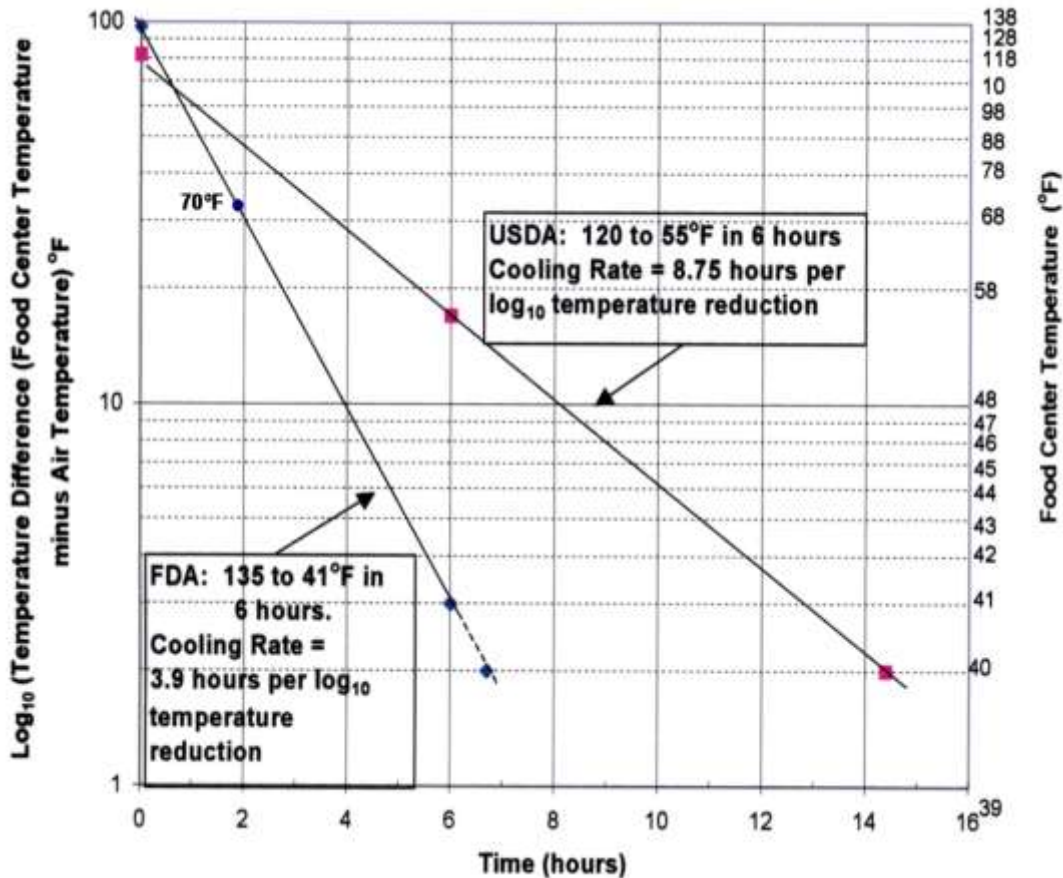
Control:

- Cool fast enough between 120 and 80°F (48.9 and 26.7°C) to prevent outgrowth of spores <1 log.
- Pre-cool to 120°F (48.9°C) at room temperature.
- Blast cooler 300 meters per minute air, 38°F (3.3°C), 2-inch (5-cm) pan, 6 hours.
- Ordinary reach-in refrigerator 50 feet (15 meters) per minute air, 2-inch (5-cm) pan, covered. Takes 15 hours to cool in the center.

Validation:

- Cook hamburger to 150°F (65.6°C), 1 minute, to pasteurize the food and activate the spore. Put in a test container.
- Cool. Take a center sample before and after cooling. Determine if there is growth.

COOLING FOOD FROM 48.9 TO 12.8°C (120 TO 55°F) IN 6 HOURS (USDA GUIDELINES) COMPARED TO FDA 6-HOUR COOLING RECOMMENDATION



pictures:cooling-USDA-FDA-addedpoint-2-15-11

COOLING TIMES AND TEMPERATURES

FDA 6-Hour Cooling 57.2 to 5.0 °C (135 to 41°F) [3.3°C (38°F) Environment]		USDA Cooling 48.9 to 12.8°C (120 to 55°F) in 6 hours, followed by cooling to 4.4°C (40°F) [3.3°C (38°F) Environment]	
Hr.	°C (°F)	Hr.	°C (°F)
0	57.2 (135)	0	48.9 (120)
1	34.4 (94)	1	38.3 (101)
2	21.1 (70)	2	30.0 (86)
3	13.2 (55.8)	3	23.9 (75)
4	8.9 (48)	4	18.9 (66)
5	6.39 (43.5)	5	15.6 (60)
6	5.0 (41)	6	12.8 (55)
		7	10.6 (51)
		8	8.9 (48)
		9	7.5 (45.5)
		10	6.61 (43.9)
		11	5.83 (42.5)
		12.6	5.0 (41)
		14.16	4.4 (40)

RAPID COOLING METHODS

6 HR. TO 5°C (41°F) (FDA) 48.9 TO 12.8°C (120 TO 55°F), 6 HR. (USDA)

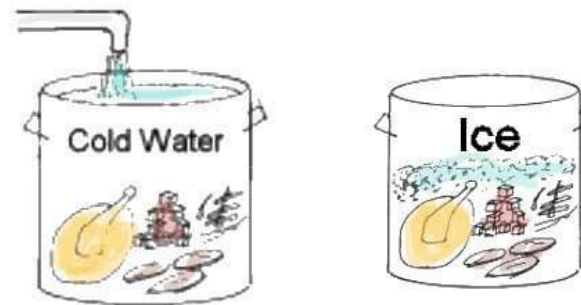
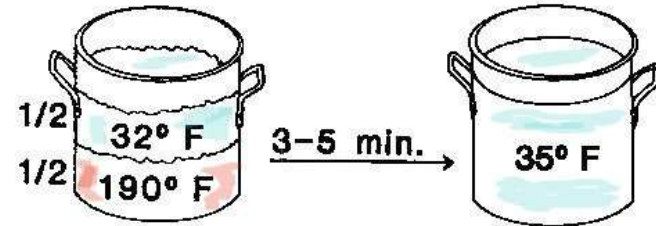
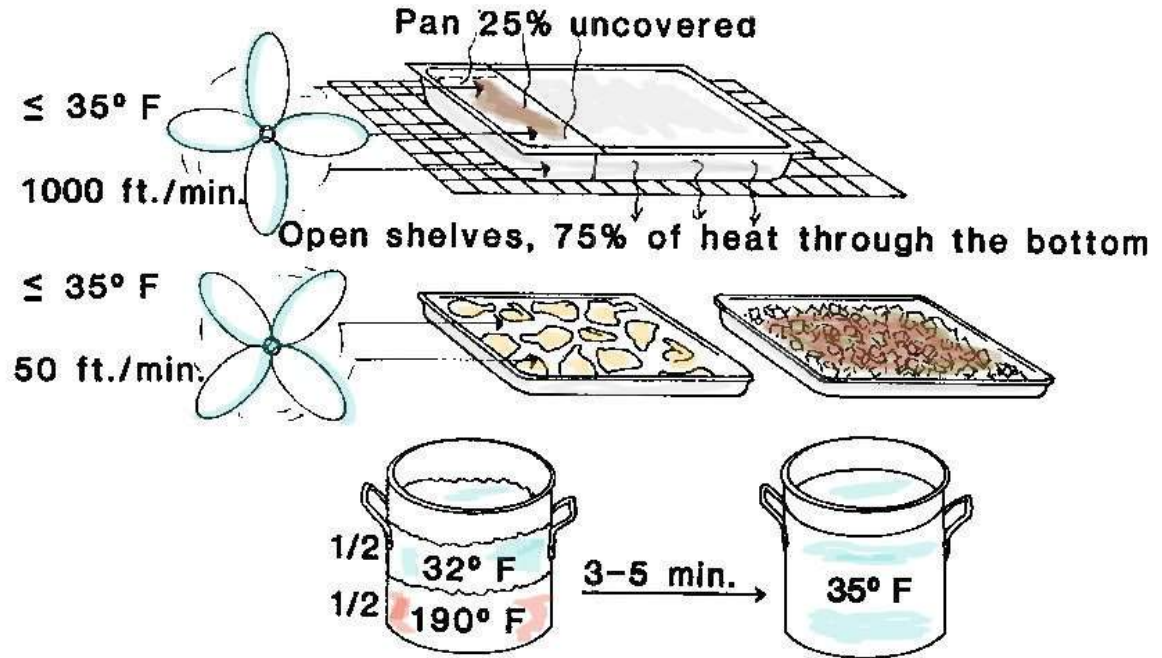
Blast chilling
2" thick

Thin layers
3/4" and less

Frozen
Water
Stock
CO₂

Water and ice

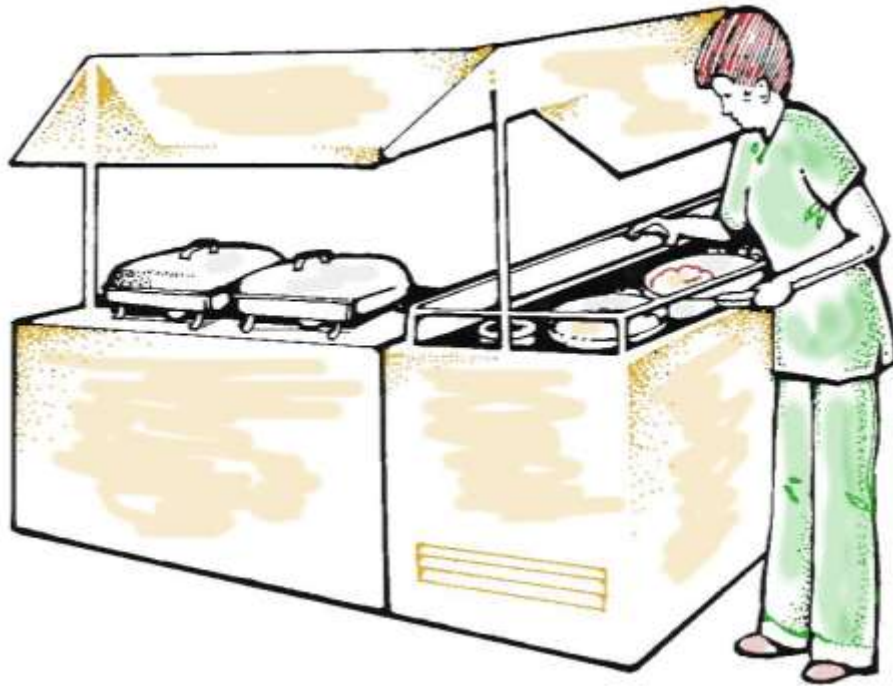
Cubed potatoes
Pasta, Rice
Chicken, Turkey
Roast beef



32°F = 0°C
35°F = 1.7°C
190°F = 87.8°C
1,000 ft = 300 meters
50 ft = 15.25 meters

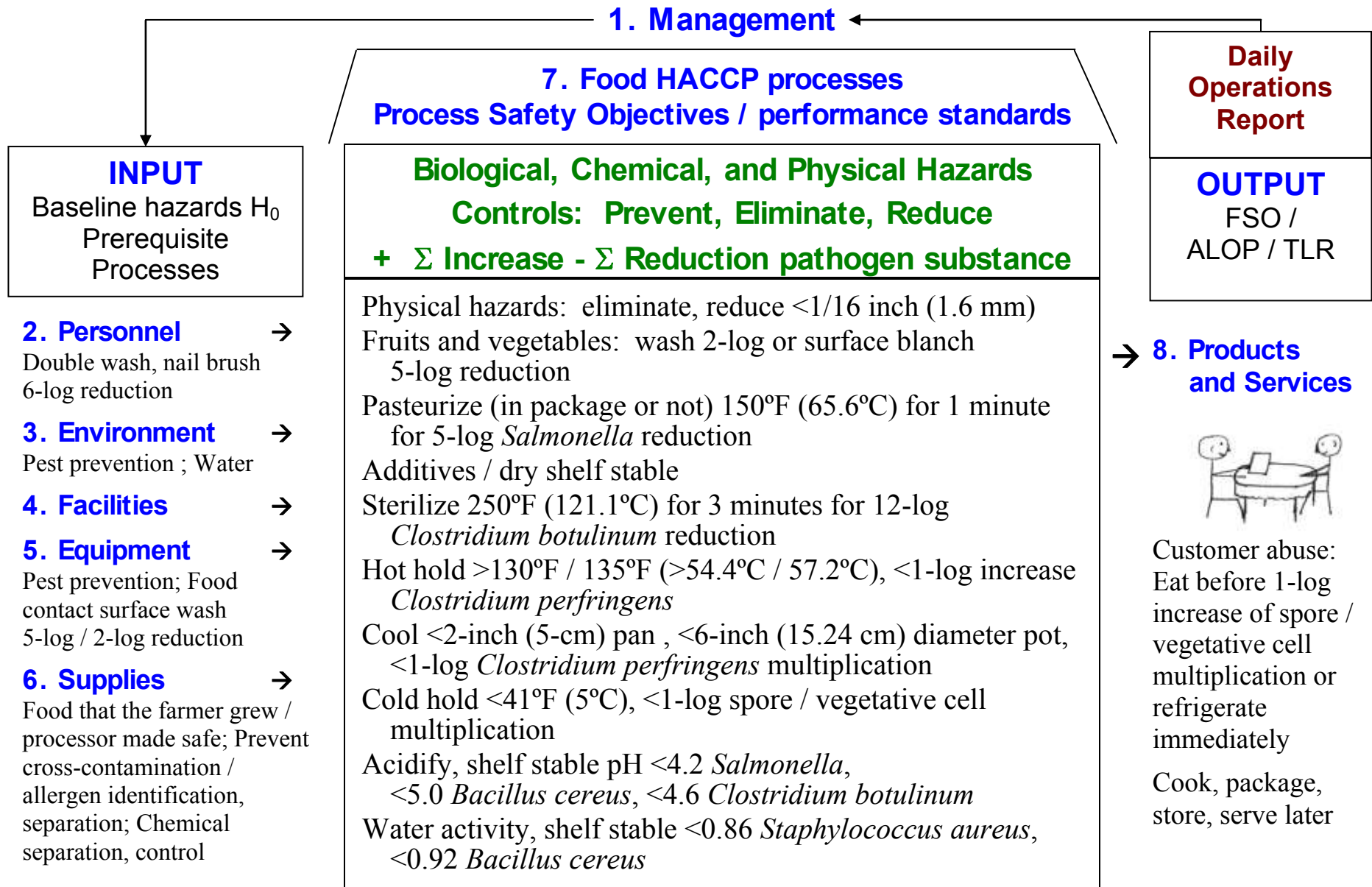
BUFFETS – BANQUETS

Hazard Analysis



- Customer sneezing *Staphylococcus* or *Streptococcus* on food.
Not a significant risk, because bacteria must multiply to an infectious dose, and the food is old, spoiled, and thrown out first.
- Customer getting fingers in food.
Not significant. No evidence of an outbreak.
- Customer cross-contaminating allergens.
This is possible, but highly unlikely.
- Customer cross-contamination if customer does not use clean plate and utensils.
Not a significant risk, because there are too few pathogens to be an infective dose, and mouth bacteria are not a significant risk.

THE RETAIL FOOD SAFETY MANAGEMENT SYSTEM WITH PROCESS PERFORMANCE STANDARDS



pictures&00lh2: retail fd sys house-4-10

EMPLOYEE FOOD HACCP TRAINING CHECKLIST

PREREQUISITES

Personal hygiene

If I have vomiting or diarrhea, I will tell the PIC.

I will double wash my fingertips when coming from an "unknown location" such as the toilet.

When handling raw meat / fish / poultry, I will clean my hands and food contact surface before touching RTE food.

I do not touch my skin when working with food.

Immediately after glove use, I remove the gloves and wash my hands

Receiving

When receiving food / opening food, any food that is damaged or spoiled will be returned to the supplier / discarded. Refrigerate food 41°F (5°C).

Storage

I store raw food on the bottom shelves in the refrigerator and RTE food above the raw food.

I store chemicals completely separate from food.

Equipment

I assure that my equipment is clean before I use it.

I assure that my equipment is working correctly and calibrated before I begin preparation.

FOOD PROCESS HAZARD CONTROLS

I double wash raw fruits and vegetables before using in menu items.

During pre-preparation, I remove physical hazards from food. I know if any ingredient in a recipe is an allergen so that I can accurately answer customer questions. If in doubt, I refer allergen questions to the kitchen manager.

After handling raw meat / fish / poultry, I decontaminate my hands, equipment, and work area before touching ready-to-eat food.

I know how to use a thermometer or thermocouple properly.

I cook foods to the following center temperatures:

a. Solid steaks, chops, fish: 145°F (62.8°C), 15 seconds

b. Ground meat, fish: 155°F (68.3°C), 15 seconds

c. Poultry: 165°F (73.9°C), 15 seconds

OR: as ordered by the individual customer.

I hold hot food 135°F (57.2°C) or hotter, or for less than 4 hours if time is used as a control.

When cooling, I place no more than 2 inches (5 cm) of solid food in a pan, no more than 1 gallon (4 liters) of liquid in a container.

When making a cold combination such as salads, I pre-cool ingredients to 50°F (10°C) or colder. When mixing, I wear gloves or use a utensil.

I hold cold ready-to-eat food at 41°F (5°C) or colder for no more than 7 days. It is labeled.

I do not add leftovers to a fresh food.

WEEKLY HACCP CHECKLIST

Evaluator _____ Date _____ Time _____

PREREQUISITE HACCP REQUIREMENTS	PERSON / ITEM :	OBSERVATION	CORR. ACT #
1. Personal Hygiene (Person: Health, cleanliness, double hand washing when coming from toilet, single hand washing for raw food / RTE food control, gloves control)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
2. Environment / facilities (Item: Cleaned, maintained, pests, trash, chemicals, water, plumbing controlled)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
3. Equipment (Item: Cleanliness, temperature, maintenance, sanitizer concentration, thermometers / instrument calibration)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
4. Supplies (Food: temperature, use by; inventory rotation; approved supplier, protected, RTE on top)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
FOOD HACCP PROCESSES	FOOD :	OBSERVATION	CR ACT#
1. Physical hazards (Food: hard foreign objects, choking, thermal)	1. _____ : _____ 2. _____ : _____		
2. Chemical hazards (Item: separate from food, used at correct level)	1. _____ : _____ 2. _____ : _____		
3. Allergen control (Food: allergen control; do not add fresh to old; do not combine different leftovers)	1. _____ : _____ 2. _____ : _____		
4. Double wash fruits and vegetables (Food: adequate physical wash)	1. _____ : _____ 2. _____ : _____		
5. Cooking pasteurization (Food: temperature and time, pH, water activity)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
6. Hot hold, transport, serve / catering (Food: temperature 135°F / 57.2°C hold time, surface humidity)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
7. Cooling (<2 inches thick, <1 gallon / <5 cm thick, 4 liters) (Food: container, date)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
8. Cold hold, transport, serve / catering (Food: temperature, protection)	1. _____ : _____ 2. _____ : _____ 3. _____ : _____		
9. Salads mixed with cold ingredients (Food: temperature)	1. _____ : _____ 2. _____ : _____		
10. Leftovers (Food: temperature, age, refrigeration, freezing)	1. _____ : _____ 2. _____ : _____		

PROCESS VALIDATION / VERIFICATION SUMMARY

Validation / Verification Procedure

1. Recipe
2. Flow the process
3. Get process performance values and critical limits
4. Do challenge tests to validate that performance standards can be met

Validation Standards

- To validate refrigerated holding processes, use non-pathogenic *Listeria innocua* and control to <3-log increase.
- To validate washing food contact surfaces and pasteurization, use non-pathogenic *E. coli* ATCC 25922 and measure reduction.
 - Reduction on fingertips after using the toilet, 6 log.
 - Reduction on fingertips after touching raw meat, fish, and poultry, 2 log.
 - Reduction on raw food contact surfaces, 5 log.
- To validate cold holding of ready-to-eat food, use a non-pathogenic *Bacillus cereus* and control to <3-log increase.
- To validate cooling, use non-pathogenic *Clostridium perfringens* and limit to ≤ 1 -log increase.

Once you have a validated process, you do not have to log it all of the time.

You just have to verify that you are doing the process according to the validated process.

- Washing for a 5-log surface reduction of *Salmonella*
- Washing fingers for a ≥ 5 -log *Salmonella* reduction
- Washing ready-to-eat vegetables for a ≥ 5 -log *E. coli* reduction
- Pasteurizing for a ≥ 5 -log *Salmonella* reduction
- Hot hold for a <1-log *Clostridium perfringens* increase
- Cooling for a <1-log (3-log) increase of *Clostridium perfringens*
- Cold holding for a <3-log increase of *Listeria monocytogenes*

RETAIL FOOD PROCESS GOVERNMENT SAFE HARBORS VS. HACCP

Process step: FDA safe harbors control	HACCP analysis
Receiving	
Raw, aerobic fruits and vegetables: No pathogen growth control	None necessary; spoil safe
Shelf-stable canned food: None; canning makes safe	None necessary; canning makes safe
Frozen meat, fish & poultry: Frozen; no specified temperature, <-1.1°C (30°F)	<-1.1°C (30°F) is safe; no growth
Raw meat, fish & poultry: ≤5.0°C (41°F); no time limit	Cooking gives adequate reduction
RTE refrigerated meat, fish and poultry from vendor: ≤5.0°C (41°F); no time limit (supplier use-by-date)	Supplier reduces vegetative pathogens to a safe level
RTE bagged vegetables from vendor: ≤5.0°C (41°F); no time limit <i>Clostridium botulinum</i> control	Spoilage bacteria grow fastest and spoil food
Pre-preparation	
Cut-up fruits and vegetables, raw meat, fish, poultry, RTE food: None	Cooking gives adequate reduction
Wash fruits and vegetables: None	Desired 5 log <i>E. coli</i> reduction
Freeze fish, <i>Anisakis</i> control: -20°C (-4°F), 7 days	3-log parasite reduction
Cooking	
Time to heat food from cold to ≥54.4°C (≥130°F): None	<2 hr. <i>Clostridium perfringens</i> or 12 hr. and pasteurize

RETAIL FOOD PROCESS GOVERNMENT SAFE HARBORS VS. HACCP (cont'd)

Process step: FDA safe harbors control	HACCP analysis
Pasteurization	
Whole roasts (beef, corned beef, lamb, veal, pork): 55°C (130°F), 112min. 60°C (140°F), 11.2 min. 65°C (150°F), 1.12 min. (67 sec.) 70°C (157°F), instantaneous	6.5 log <i>Salmonella</i> spp. kill
Solid chops, steaks, fish, farm-raised game animals: 63°C (145°F), 15 sec., and surface browning	Parasite reduction to safe level in center of food
Ground meat and fish: 63°C (145°F), 3 min. 65°C (150°F), 1 min. 68°C (155°F), 15 sec. 70°C (157°F), Instantaneous	5 log <i>Salmonella</i> spp. kill
Poultry, wild game animals, stuffed meat, fish, poultry, pasta and stuffings containing fish, meat or poultry: 74°C (165°F), 15 sec.	7 log <i>Salmonella</i> spp. kill
Any meat, fish, or poultry cooked in a microwave oven: 74°C (165°F) Stir and hold 2 min.	7 log <i>Salmonella</i> spp. kill
Hot Hold	
Hot hold: Whole roasts (beef, pork, corned beef, lamb, veal): 55°C (130°F) No time limit	<1 log growth, <i>C. perfringens</i>
Hot hold: All other food: 57°C (135°F) No time limit	<1 log growth, <i>C. perfringens</i>
Cool	
Cool food [(<5 cm (<2 inches) deep, <4 -liter (<1 -gallon) container]: 57 to 20°C (135 to 70°F), 2 hr., followed by 20 to 5°C (70 to 41°F) in 4 hr.	<1 log increase of <i>C. perfringens</i>

RETAIL FOOD PROCESS GOVERNMENT SAFE HARBORS VS. HACCP (cont'd)

Process step: FDA safe harbors control	HACCP analysis
Time as a public health control	
Display in the range of 57 to 5°C (135 to 41°F) without temperature control: ≤4 hours, no leftovers	<1 log increase of <i>C. perfringens</i>
Display in the range of 5 to 20°C (41 to 70°F) without temperature control: ≤6 hours, no leftovers	<1 log increase of <i>B. cereus</i>
Cold hold	
Holding cold food that requires TCS: 5°C (41°F), <7 days	<1 log increase of <i>B. cereus</i> or <3 log increase <i>L. monocytogenes</i>
Reheating	
Reheat food: <2 hours from cold to ≥74°C (165°F) for 15 sec.	No limit on number of times reheated; not a CCP; toxin not destroyed

RTE = Ready-to-Eat TCS = Temperature Control for Safety

RETAIL FOOD SAFETY MANAGEMENT: EVIDENCE OF ACTIVE MANAGERIAL CONTROL

Description of Food Safety Operating Procedures for System Operation

Please provide, after each requirement listed below, a brief explanation of your standard operating policies, procedures, and standards to ensure that the following are done adequately to protect your customers' health.

MANAGEMENT AND CONTROL OF THE SYSTEM

Do you budget money for the training of your employees and managers? If yes, how much?

How will you ensure that employees in food preparation and service are following your food safety rules?

What is your plan if power or water is interrupted; if there is a terrorist threat; if there is a recall?

What is your plan if a customer complains that your food made him/her sick?

What is your plan to ensure that thermometers are used correctly and calibrated?

PREREQUISITE PROGRAMS

Personal hygiene

How will you check to make sure that no sick employee is working ?

What are your rules to ensure that employees wash hands at correct times?

How do you ensure that hand washing facilities are maintained and always stocked?

Environment and facilities

How do you ensure that there is adequate, safe hot and cold water?

How do you provide for proper and timely disposal of garbage, food waste, and recyclables?

What is your plan to ensure that the facility and environment, to include the dumpster area, are kept clean and maintained and pests are controlled?

Equipment

Who cleans equipment, when and how?

How do you verify that tableware and food preparation equipment are adequately clean and sanitized?

How do you ensure that the wet wiping cloth sanitizer solution is adequate?

What process do you use for hand dish washing?

What process do you use for mechanical dish washing with a dish machine?

Supplies

How do you ensure that all supplies come from approved suppliers?

EVIDENCE OF AMC (cont'd)

Supplies (cont'd)

How do you ensure that supplies are stored correctly [e.g., 6 inches (15 cm) above the floor] and chemicals are separated from food?

How do you ensure that allergenic ingredients are identified and separated? How do you ensure that food in refrigerators is at less than 41°F (5°C), and ready-to-eat food is covered, dated, and separate from raw food, ready-to-eat food is on top, and inventory is rotated using FIFO (first in first out)?

How do you ensure that dry goods are stored correctly?

How do you ensure that you do not over- or under-order food?

FOOD HACCP PROCESSES

What categories of Potentially Hazardous Foods / food that require Temperature Control for Safety are prepared and served (e.g., meat, fish / seafood, poultry, raw eggs, etc.)?

How are the foods in each PHF / TCS category, above, thawed?

Thawing process	Category			
	Meat	Fish / Seafood	Poultry	Other
Refrigeration				
Running water less than 70°F (21.1°C)				
Cooked frozen				
Microwave				

How do you ensure that raw fruits and vegetables eaten uncooked are adequately disinfected?

If foods other than produce (i.e., meat, fish and seafood, poultry, eggs) are washed or otherwise handled prior to use, how will they be washed or handled?

How do you ensure that the cook adequately pasteurizes the food?

How do you ensure that hot food is held, transported, and served above 135°F (57.2°C)? What equipment is used?

How do you ensure that cold food is held below 41°F (5°C) during service? What equipment is used?

How do you ensure that hot food is cooled in 6 hours to 41°F (5°C) [i.e., food less than 2 inches (5 cm) deep in pan; or less than 1 gallon (4 liters); ice bath; rapid chill]?

How do you ensure that cold, ready-to-eat food is kept cold, transported cold, catered cold, less than 41°F (5°C), and used within 7 days?

How do you ensure that cold menu items are made with cold ingredients and held at a temperature of less than 41°F (5°C)?

How do you ensure that ready-to-eat food between 135 and 41°F (57.2 and 5°C) is used within 4 hours, or food between 41 and 70°F (5 and 21.1°C) is used in 6 hours?

What do you do with leftovers?

What do you do with take-out / donated food?