

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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Abbreviations

GAP: Good Agriculture Practices

GMP: Good Manufacturing Practices

GHP: Good Hygienic practices

GSP: Good Storage Practices

GMT: Good Microbiological Technique

GLP: Good Laboratory Practices

ISO: International Standard Organization.

9000

14000

18000

17025

إدارة الجودة Quality management

- مراقبة الجودة Quality control

- توكيد الجودة Quality assurance

المواصفات القياسية

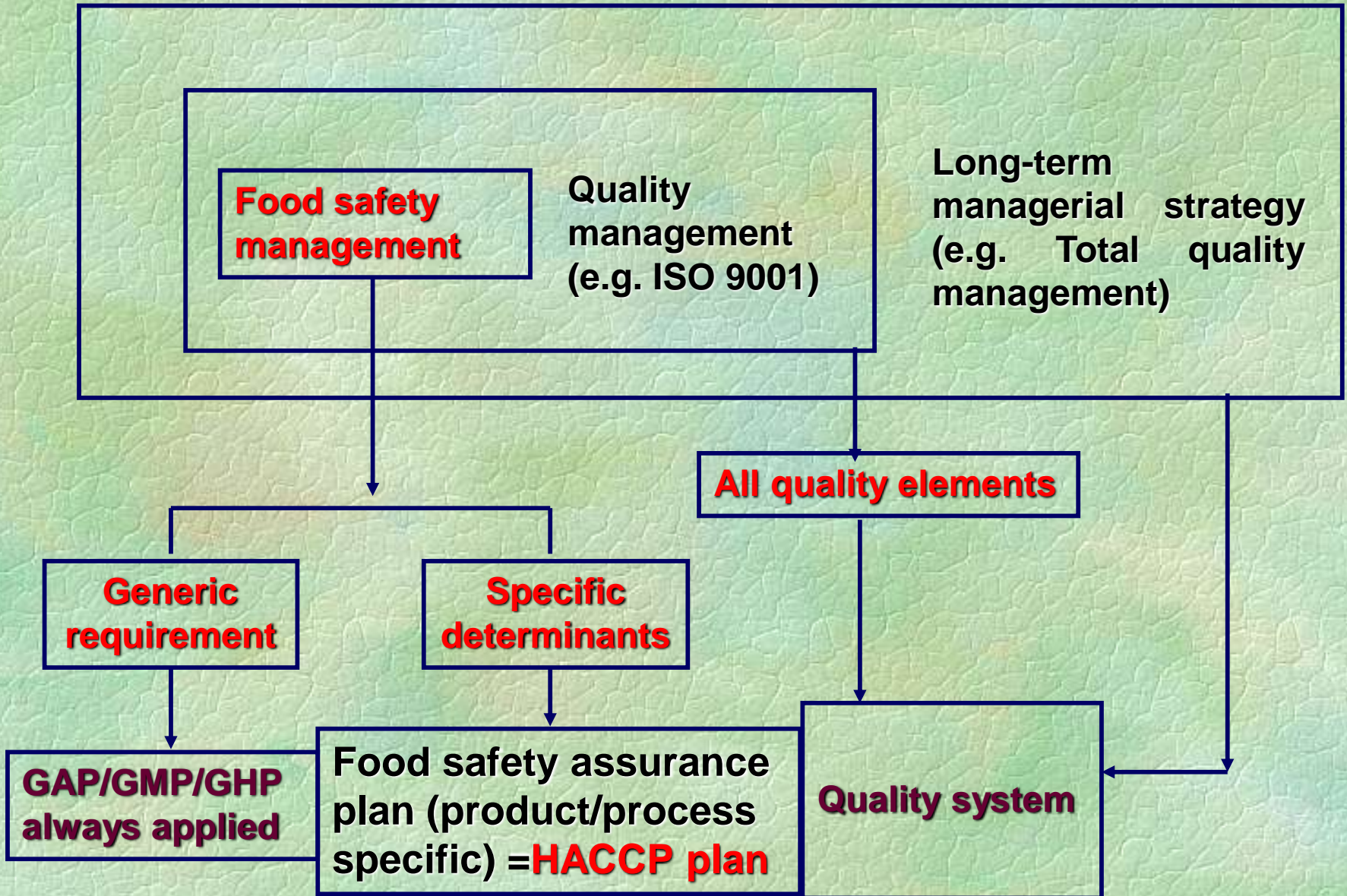
الزامية

عدم تعبئة منتج معين في عبوات
معينة مثل الأغذية الملحية أو
الحامضية في عبوات البولي
ايثيلين القائمة

ارشادية

درجات حرارة بسترة المنتجات
الغذائية (64° س/2.5ق أو ما
يكافئها) للقضاء على الميكروبات
المرضة

Food safety tools



HACCP

Hazard

Analysis

Critical

Control

Point

HACCP

Is a management tool used to protect the food supply against biological, chemical and physical hazards

Origin of HACCP

- Pioneered in the 1960s
- First used when foods were developed for the space program
- Adopted by many food processors in the U.S.

Hazard

A biological, chemical or physical property that may cause an unacceptable consumer health

Critical Control Points (CCPs)

A point at which loss of control may result in an unacceptable health risk

Critical Limit

➤ **A criterion which separates acceptability from unacceptability**

Preventative measure

An action to prevent a hazard or reduce it to an acceptable level

Corrective action

**A procedure followed
when a deviation
occurs**

Verification

**Activities that determine
the validity of the HACCP
plan**

Benefits of HACCP

- **Better understanding of the rationale for food safety**
- **Provides a systematic approach**
- **Continuous problem prevention**
- **Real-time monitoring**

Benefits of HACCP (Cont.)

- **Cost effective.**
- **More efficient and directed use of resources.**
- **Reduced need for expensive end product testing.**
- **Improved product quality.**
- **Higher customer satisfaction.**

Principles of HACCP

1. Conduct a hazard analysis.
2. Determine the critical control points (CCPs) in the process.
3. Establish critical limits.
4. Establish monitoring procedures.

Principles of HACCP (Cont.)

5. Establish corrective actions.
6. Establish verification procedures.
7. Establish keep record

HACCP Principle #1

Conduct a hazard analysis

Hazard Analysis

- Hazard identification
- Hazard evaluation

Hazard Identification

- **Biological hazards:**

Pathogenic microorganisms
(e.g., bacteria, protozoa,
viruses)

Selected biological hazards found at retail, associated foods and control measures

| HAZARD | ASSOCIATED FOODS | CONTROL MEASURES |
|--|--|--|
| <i>Bacteria</i> | | |
| <i>Bacillus cereus</i> (intoxication caused by heat stable, preformed emetic toxin and infection by heat labile, diarrheal toxin) | Meat, poultry, starchy foods (rice, potatoes), puddings, soups, cooked vegetables | Cooking, cooling, cold holding, hot holding |
| <i>Campylobacter jejuni</i> | Poultry, raw milk | Cooking, handwashing, prevention of cross-contamination |
| <i>Clostridium botulinum</i> | Vacuum-packed foods, reduced oxygen packaged foods, under-processed canned foods, garlic-in-oil mixtures, time/temperature abused baked potatoes/sautéed onions. | Thermal processing (time + pressure), cooling, cold holding, hot holding, acidification and drying, etc. |
| <i>Clostridium perfringens</i> | Cooked meat and poultry, Cooked meat and poultry products including casseroles, gravies | Cooling, cold holding, reheating, hot holding |
| <i>E. coli</i> O157:H7 (other shiga toxin-producing <i>E. coli</i>) | Raw ground beef, raw seed sprouts, raw milk, unpasteurized juice, foods contaminated by infected food workers via fecal-oral route | Cooking, no bare hand contact with RTE foods, employee health policy, handwashing, prevention of cross-contamination, pasteurization or treatment of juice |
| <i>Listeria monocytogenes</i> | Raw meat and poultry, fresh soft cheese, paté, smoked seafood, deli meats, deli salads | Cooking, date marking, cold holding, handwashing, prevention of cross-contamination |
| <i>Salmonella spp.</i> | Meat and poultry, seafood, eggs, raw seed sprouts, raw vegetables, raw milk, unpasteurized juice | Cooking, use of pasteurized eggs, employee health policy, no bare hand contact with RTE foods, handwashing, pasteurization or treatment of juice |

Selected biological hazards found at retail, associated foods and control measures

| Hazard | Associated foods | Control measures |
|---|---|---|
| <i>Shigella spp.</i> | Raw vegetables and herbs, other foods contaminated by infected workers via fecal-oral route | Cooking, no bare hand contact with RTE foods, employee health policy, handwashing |
| <i>Staphylococcus aureus</i> (performed heat stable toxin) | RTE PHF foods touched by bare hands after cooking and further time/temperature abused | Cooling, cold holding, hot holding, no bare hand contact with RTE food, handwashing |
| <i>Vibrio spp.</i> | Seafood, shellfish | Cooking, approved source, prevention of cross-contamination, cold holding |
| <i>Parasites</i> | | |
| <i>Anisakis simplex</i> | Various fish (cod, haddock, fluke, pacific salmon, herring, flounder, monkfish) | Cooking, freezing |
| <i>Taenia spp.</i> | Beef and pork | Cooking |
| <i>Trichinella spiralis</i> | Pork, bear, and seal meat | Cooking |
| <i>Viruses</i> | | |
| Hepatitis A and E | Shellfish, any food contaminated by infected worker via fecal-oral route | Approved source, no bare hand contact with RTE food, minimizing bare hand contact with foods not RTE, employee health policy, handwashing |
| Other Viruses (Rotavirus, Norovirus, Reovirus) | Any food contaminated by infected worker via fecal-oral route | No bare hand contact with RTE food, minimizing bare hand contact with foods not RTE, employee health policy, handwashing |
| RTE = ready-to-eat PHF = potentially hazardous food (time/temperature control for safety food) | | |

Chemical hazards

- 1. Naturally-occurring chemicals.**
- 2. Intentionally-added chemicals.**
- 3. Unintentional or incidental chemical additives.**

Types of Naturally-Occurring Chemical Hazards

- **Allergens**
- **Mold toxins (mycotoxins)**
- **Toxic plant components**

Intentionally-Added Chemicals-Food Additives

Direct

- Preservatives (e.g., sodium benzoate and sulfiting agents)**
- Nutritional additives (e.g., calcium)**
- Color additives**

Indirect

- **Packaging materials**
- **Processing plant chemicals**
- **Lubricants (food grade)**
- **Sanitizers**

Unintentional or Incidental Chemical Contaminants

- **Agricultural chemicals (e.g., pesticides, fungicides, herbicides, fertilizers, and other residues)**
- **Prohibited substances**

- **Toxic elements/compounds (e.g., lead, tin, copper, zinc, arsenic, mercury, cyanide)**
- **Cross-contaminating food allergens from inadequately cleaned shared processing equipment**
- **Processing plant chemicals (e.g., lubricants, cleaners and sanitizers)**

Common chemical hazards as retail, along with their associated foods and control measures

| Chemical Hazards | Associated Foods | Control measures |
|--|--|---|
| Naturally Occurring: | | |
| Nitrites/nitrates Niacin | Cured meats, fish, any food exposed to accidental contamination, spinach Meat and other foods to which sodium nicotinate is added | Do not use more than the prescribed amount of curing compound according to labeling instructions. Sodium nicotinate (niacin) is not currently approved for use in meat or poultry with or without nitrates or nitrites. |
| Flavor enhancers Monosodium glutamate (MSG) | Asian or Latin American food | Avoid using excessive amounts |
| Chemicals used in retail establishments (e.g., lubricants, cleaners, sanitizers, cleaning compounds, and paints) | Any food could become contaminated | Address through SOPs for proper labeling, storage, handling, and use of chemicals; retain Material Safety Data Sheets for all chemicals. |
| Allergens | Foods containing or contacted by: Milk Egg Fish Crustacean shellfish Tree nuts Wheat Peanuts Soybeans | Use a rigorous sanitation regime to prevent cross contact between allergenic and non-allergenic ingredients. |

Common chemical hazards as retail, along with their associated foods and control measures

| Chemical Hazards | Associated Foods | Control measures |
|-----------------------------|---|---|
| Naturally Occurring: | | |
| Scombrototoxin | Primarily associated with tuna fish, mahi-mahi, blue fish, anchovies bonito, mackerel; Also found in cheese | Check temperatures at receiving; store at proper cold holding temperatures; buyer specifications: obtain verification from supplier that product has not been temperature abused prior to arrival in facility. |
| Ciguatoxin | Reef fin fish from extreme SE US, Hawaii, and tropical areas; barracuda, jacks, king mackerel, large groupers, and snappers | Ensure fin fish have not been caught: <ul style="list-style-type: none"> • Purchase fish from approved sources. • Fish should not be harvested from an area that is subject to an adverse advisory. |
| Tetrodotoxin | Puffer fish (Fugu; Blowfish) | Do not consume these fish. |
| Mycotoxins Aflatoxin | Corn and corn products, peanuts and peanut products, cottonseed, milk, and tree nuts such as Brazil nuts, pecans, pistachio nuts, and walnuts. Other grains and nuts are susceptible but less prone to contamination. | Check condition at receiving; do not use moldy or decomposed food. |

Common chemical hazards as retail, along with their associated foods and control measures

| Chemical Hazards | Associated Foods | Control measures |
|---|---|--|
| Naturally Occurring: | | |
| Patulin | Apple juice products | Buyer Specification: obtain verification from supplier or avoid the use of rotten apples in juice manufacturing. |
| Toxic mushroom species | Numerous varieties of wild mushrooms | Do not eat unknown varieties or mushrooms from unapproved source. |
| Shellfish toxins Paralytic shellfish poisoning (PSP) | Molluscan shellfish from NE and NW coastal regions; mackerel, viscera of lobsters and Dungeness, tanner, and red rock crabs | Ensure molluscan shellfish are: <ul style="list-style-type: none"> • from an approved source; and • properly tagged and labeled. |
| Diarrhetic shellfish poisoning (DSP) | Molluscan shellfish in Japan, western Europe, Chile, NZ, eastern Canada | |
| Neurotoxin shellfish poisoning (NSP) | Molluscan shellfish from Gulf of Mexico | |
| Amnesic shellfish poisoning (ASP) | Molluscan shellfish from NE and NW coasts of NA; viscera of Dungeness, tanner, red rock crabs and anchovies. | |

Common chemical hazards as retail, along with their associated foods and control measures

| Chemical Hazards | Associated Foods | Control measures |
|---|--|--|
| Naturally Occurring: | | |
| Pyrrolizidine alkaloids | Plants food containing these alkaloids. Most commonly found in members of the Boraginaceae, Compositae, and Leguminosae families. | Do not consume of food or medicinals contaminated with these alkaloids. |
| Phytohaemmagglutinin | Raw red kidney beans (Undercooked beans may be more toxic than raw beans) | Soak in water for at least 5 hours. Pour away the water. Boil briskly in fresh water, with occasional stirring, for at least 10 minutes. |
| Added Chemicals: | | |
| Environmental contaminants: Pesticides, fungicides, fertilizers, insecticides, antibiotics, growth hormones | Any food may become contaminated. | Follow label instructions for use of environmental chemicals. Soil or water analysis may be used to verify safety. |
| PCBs | Fish | Comply with fish advisories. |
| Prohibited substances (21 CFR 189) | Numerous substances are prohibited from use in human food; no substance may be used in human food unless it meets all applicable requirements of the FD&C Act. | Do not use chemical substances that are not approved for use in human food. |

Common chemical hazards as retail, along with their associated foods and control measures

| Chemical Hazards | Associated Foods | Control measures |
|--|--|--|
| Naturally Occurring: | | |
| Toxic elements/compounds Mercury | Fish exposed to organic mercury: shark, tilefish, king mackerel and swordfish. Grains treated with mercury based fungicides | Pregnant women/women of childbearing age/nursing mothers, and young children should not eat shark, swordfish, king mackerel or tilefish because they contain high levels of mercury. Do not use mercury containing fungicides on grains or animals. |
| Copper | High acid foods and beverages | Do not store high acid foods in copper utensils; use backflow prevention device on beverage vending machines. |
| Lead | High acid food and beverages | Do not use vessels containing lead. |
| Preservatives and Food Additives: Sulfiting agents (sulfur dioxide, sodium and potassium bisulfite, sodium and potassium metabisulfite) | Fresh fruits and Vegetables Shrimp Lobster Wine | Sulfiting agents added to a product in a processing plant must be declared on labeling. Do not use on raw produce in food establishments. |

Physical hazards

**Any potentially harmful
extraneous
matter not normally found in food**

Such as

- **Metal, glass, etc**

Main materials of concern as physical hazards and common source

| Material | Injury Potential | Sources |
|-------------------------|---|---|
| Glass fixtures | Cuts, bleeding; may require surgery to find or remove | Bottles, jars, lights, utensils, gauge covers |
| Wood | Cuts, infection, choking; may require surgery to remove | Fields, pallets, boxes, buildings |
| Stones, metal fragments | Choking, broken teeth Cuts, infection; may require surgery to remove | Fields, buildings, machinery, wire, employees |
| Insulation | Choking; long-term if asbestos | Building materials |
| Bone | Choking, trauma | Fields, improper plant processing |
| Plastic | Choking, cuts, infection; may require surgery to remove | Fields, plant packaging materials, pallets, employees |
| Personal effects | Choking, cuts, broken teeth; may require surgery to remove | Employees |

^a Adapted from Corlett (1991).

^b Used with permission, "HACCP Principles and Applications", Pierson and Corlett, Eds. 1992. Chapman & Hall, New York, NY.

Hazard Evaluation

1. Assess severity if not controlled.
2. Determine likelihood of occurrence.
3. Determine if hazard should be addressed in HACCP plan.

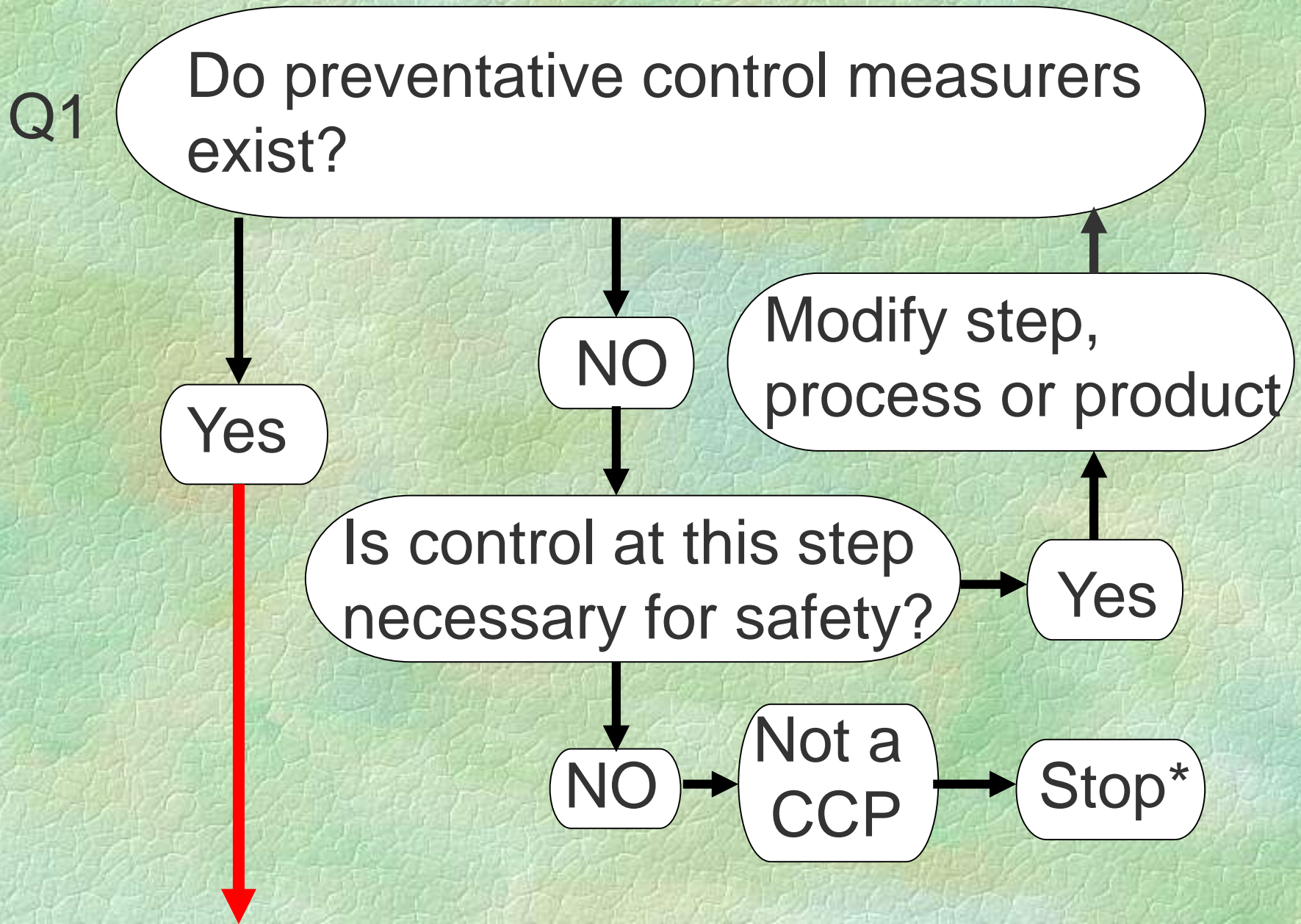
HACCP Principle #2

Determine critical control points (CCPs).

Critical Control Point

A point, step, or procedure in a food process at which a control measure can be applied and at which control is essential to reduce an identified food hazard to an acceptable level.

Example of decision tree to identify CCPs (Answer questions in sequence) (Mortimore & Wallace, 1994 and FAO/WHO, 2001).



Q2

Is the step specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level? **

NO

Yes

Critical Control CCP

Q3

Could contamination will identified hazard(s) occur in excess of acceptable level(s) or could these increase to unacceptable levels? **

Yes

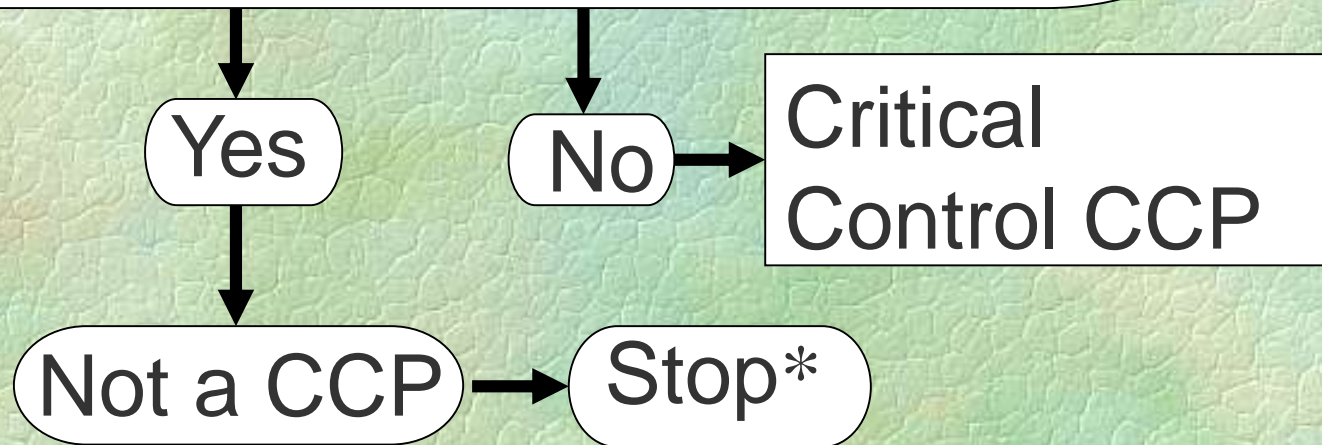
NO

Not a CCP

Stop*

Q4

Will a subsequent step eliminate identified hazard(s) or reduce likely occurrence to acceptable level(s)?**



***Proceed to the next identified hazard in the described process**

****Acceptable and unacceptable levels need to be determined within the overall objectives in identifying the CCPs of the HACCP plan**

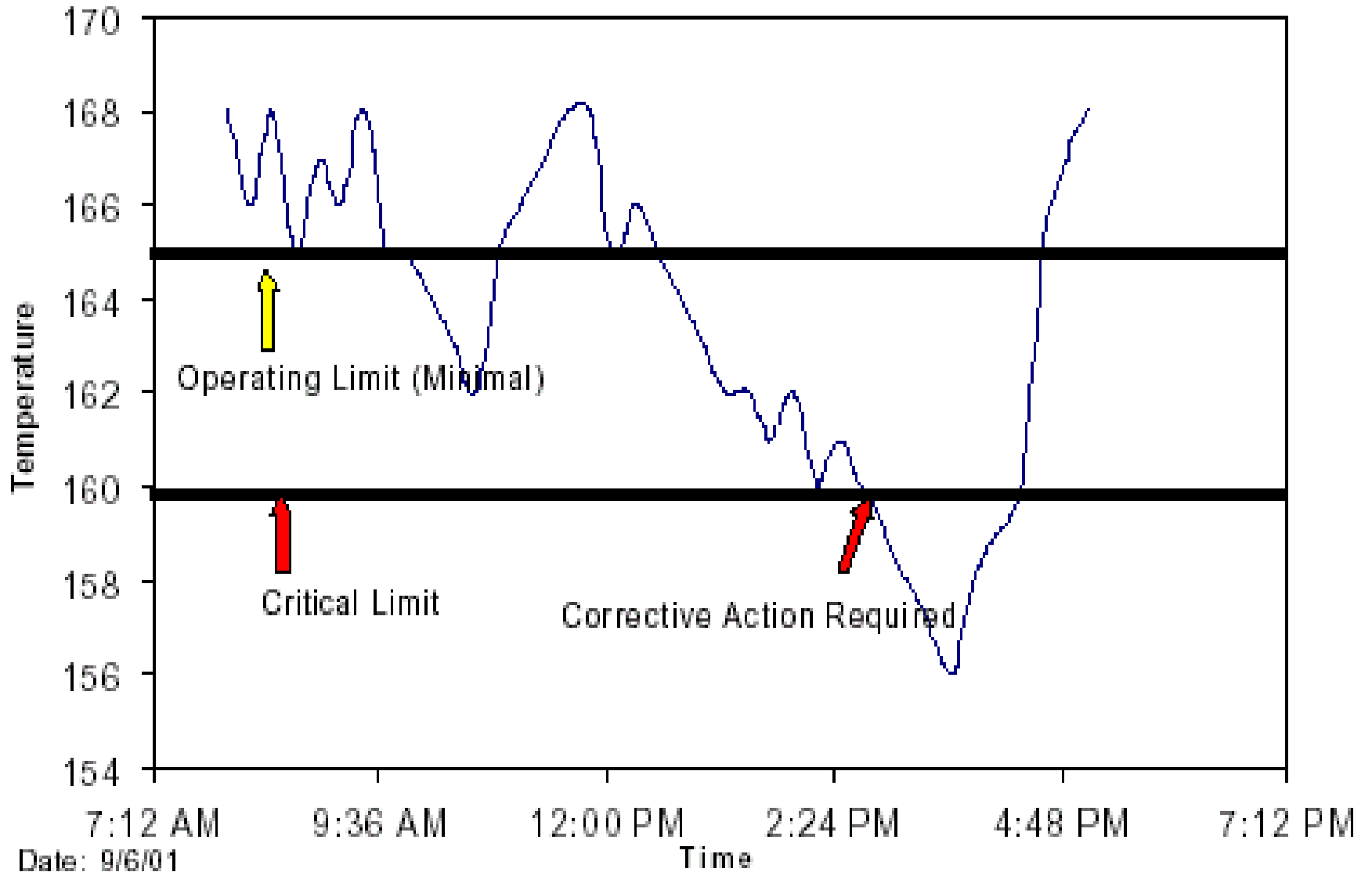
HACCP Principle #3

Establish critical limits

Critical limit

A maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of the identified food hazard

Pasteurizer temperature recorder



Date: 9/6/01

Operator: Donald Aardvark HACCP Coordinator: Dewey Care

HACCP Principle #4

Monitor each CCP

Monitor

To conduct a planned sequence of observations or measurements to assess whether a process, point, or procedure is under control and to produce an accurate record for future use in verification

The purpose of monitoring is to

- Track the operation of the process and enable the identification of trends toward a critical limit that may trigger process adjustments
- Identify when there is a loss of control (a deviation at a CCP)
- Provide written documentation

Monitoring

- *What:* usually a measurement or observation to assess if the CCP is operating within the critical limit
- *How:* usually physical or chemical measurements (for quantitative critical limits) or observations (for qualitative critical limits)

- *Frequency:* continuous or periodic (noncontinuous)
- *Who:* responsible individual trained to perform the specific monitoring activity or evaluate monitoring records

HACCP Principle #5

Establish corrective actions

Corrective action

Procedures to be followed
when a deviation occurs

Corrective Action Components

- To correct and eliminate the cause of the deviation and restore process control
- To identify the product that was produced during the process deviation and determine its disposition

HACCP Principle #6

Establish Verification Procedures

Verification

Those activities, other than monitoring, that establish the validity of the HACCP plan and that the system is operating according to the plan.

Elements of Verification

CCP verification activities:

- Calibration of monitoring devices
- Review of calibration records
- Targeted sampling and testing

Elements of Verification (cont'd)

- CCP record review
 - Monitoring records
 - Corrective action records

HACCP system verification:

- Observations and reviews
- Microbiological end-product testing

Regulatory inspections/audits

HACCP Plan Form - Verification

| 1. CCP | 2. Hazards | 3. Critical limits | Monitoring | | | | 8. Corrective actions | 9. Verification |
|-----------|---------------|--------------------------|------------|-----------|-----------------|-----------|-----------------------------|--------------------|
| | | | 4. What | 5. How | 6. Frequency | 7. Who | | |
| | | | | | | | | |

Establish verification activities and frequencies

HACCP Principle #7

Establish record-keeping and documentation procedures

Required Records

- **Records of Sanitation standard operating procedures (SSOPs).**
- **Hazard analysis/HACCP plan and supporting documentation used in developing the plan.**

Required Records (Cont.)

- **Records of CCP monitoring.**
- **Records of corrective action.**
- **Records of verification activities**

HACCP Plan Form

| 1. CCP | 2. Hazards | 3. Critical limits | Monitoring | | | | 8. Corrective actions | 9. Verification | 10. Record- keeping |
|-----------|---------------|--------------------------|------------|-----------|-----------------|-----------|-----------------------------|--------------------|---------------------------|
| | | | 4. What | 5. How | 6. Frequency | 7. Who | | | |
| | | | | | | | | | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|------------------------------|------------------------|--|----------------------------------|---|-----------|-------------------------|---|--|---------------------|
| Critical Control Point (CCP) | Significant Hazard(s) | Critical Limits for each Preventive Measure | Monitoring | | | | Corrective Action(s) | Verification | Records |
| | | | What | How | Frequency | Who | | | |
| Receiving - frozen tuna | Scombrotoxin formation | Less than 50 ppm histamine in all fish in the sample | Fish flesh for histamine content | Histamine analysis of 1 fish per ton if fish are 20 lbs. or more each and 2 fish per ton if fish are less than 20 lbs. each fish in each incoming lot | Every lot | Quality assurance staff | Subdivide lot and re-examine portions of the lot for histamine. Reject portion of the lot if any fish in the portion is 50 ppm or greater | Review monitoring, corrective action and verification records within one week of preparation | Reports of analysis |

(1)

**Critical Control Point
(CCP)**

Receiving - frozen tuna

(2)

**Significant
Hazard(s)**

**Scombrotxin
formation**

(3)

**Critical Limits for
each Preventive
Measure**

**Less than 50 ppm
histamine in all
fish in the sample**

(4)

(5)

(6)

(7)

Monitoring

What

How

Frequency

Who

Fish flesh for histamine content

Histamine analysis of 1 fish per ton if fish are 20 lbs. or more each and 2 fish per ton if fish are less than 20 lbs. each fish in each incoming lot

Every lot

Quality assurance staff

(8)

Corrective Action(s)

Subdivide lot and re-examine portions of the lot for histamine. Reject portion of the lot if any fish in the portion is 50 ppm or greater

(9)

Verification

**Review monitoring,
corrective action and
verification records
within one week of
preparation**

(10)

Records

**Reports of
analysis**

Implementation of HACCP system

- 1. Assemble HACCP team.**
- 2. Describe food and its distribution.**
- 3. Identify intended use and consumers of food.**
- 4. Develop process flow diagram.**
- 5. Verify flow diagram.**

6. Conduct a hazard analysis.
7. Determine the critical control points (CCPs) in the process.
8. Establish critical limits.
9. Establish monitoring procedures.
10. Establish corrective actions.
11. Establish verification procedures.
12. Establish record-keeping and documentation procedures.

Problems of implementation:

- **Lack of commitment by management.**
- **Lack of understanding and training.**
- **Lack of resources.**
- **Mistranslation of HACCP principles.**
- **Lack of scientifically validated risk assessment procedures**

Example: For Illustrative Purposes Only* - HACCP Plan Form

| (1) Critical Control Point (CCP) | (2) Significant Hazard(s) | (3) Critical Limits for each Preventive Measure | (4) (5) (6) (7) Monitoring | | | | (8) Corrective Action(s) | (9) Records | (10) Verification |
|-------------------------------------|------------------------------|---|--|--------------|---|------------------------|---|------------------|----------------------|
| | | | What | How | Frequency | Who | | | |
| Receiving live oysters | Pathogens | <ul style="list-style-type: none"> • Must have properly tagged containers. • Must be licensed harvester. • No oysters from closed areas. | <ul style="list-style-type: none"> • Harvester tag • Harvester license | Visual check | <ul style="list-style-type: none"> • Every container • Every delivery | Quality-control person | Reject if untagged, improperly tagged, from closed areas or from unlicensed harvester. | Receiving record | Daily record review |
| | Chemical contamination | <ul style="list-style-type: none"> • Must have properly tagged containers. • Must be licensed harvester. • No oysters from closed areas. | <ul style="list-style-type: none"> • Harvester tag • Harvester license | Visual check | Every container | Quality-control person | Reject if untagged, improperly tagged, from closed areas or from unlicensed harvester. | Receiving record | Daily record review |
| | Natural toxins | <ul style="list-style-type: none"> • Must have properly tagged containers. • Must be licensed harvester. • No oysters from closed areas. | <ul style="list-style-type: none"> • Harvester tag • Harvester license | Visual check | Every container | Quality-control person | Reject if untagged, improperly tagged, from closed areas or from unlicensed harvester. | Receiving record | Daily record review |

Firm Name: ABC Oyster Co.

Product Description: Shucked oysters in plastic one-gallon containers

Firm Address: Anywhere, USA

Method of Storage and Distribution: Shipped on ice and refrigerated; stored at retail under refrigeration.

Signature: _____

Intended Use and Consumer: Raw consumption

Date: _____

Product flow diagram: Hamburger patties

Receiving



Cold Storage



Patty Preparation

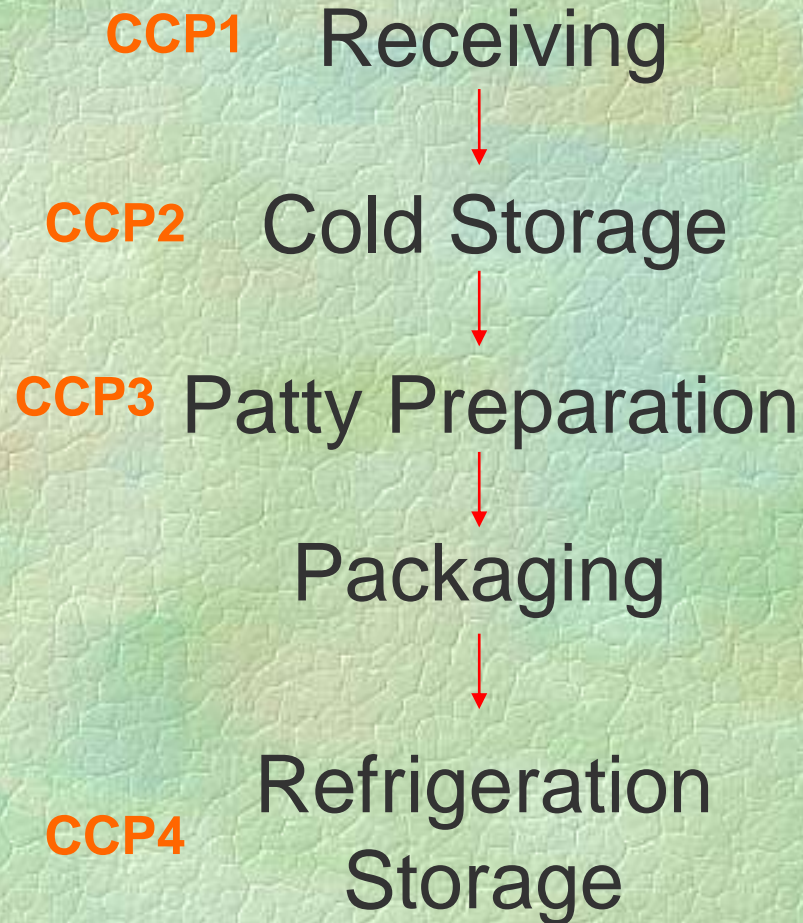


Packaging

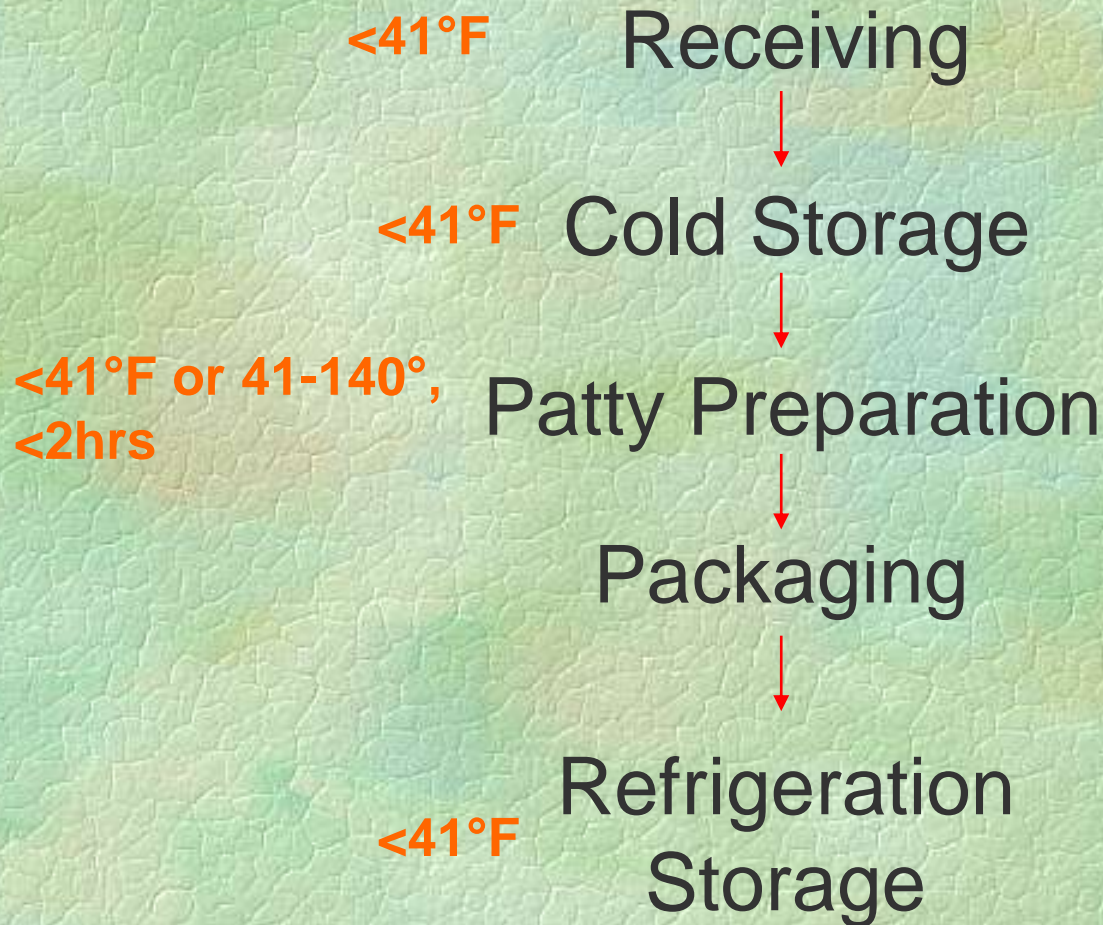


Refrigeration
Storage

Critical control point: Hamburger patties



Critical control point limits: Hamburger patties

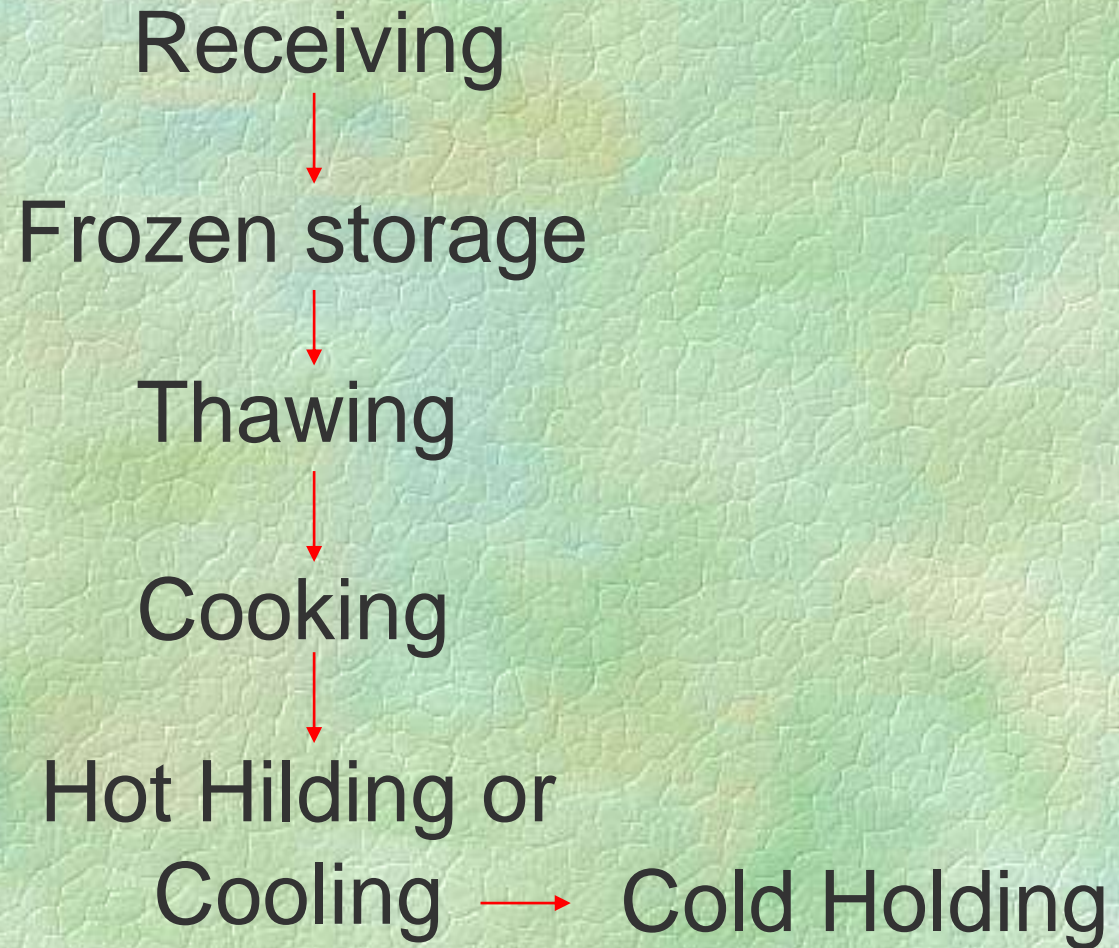


Record keeping: Hamburger patties

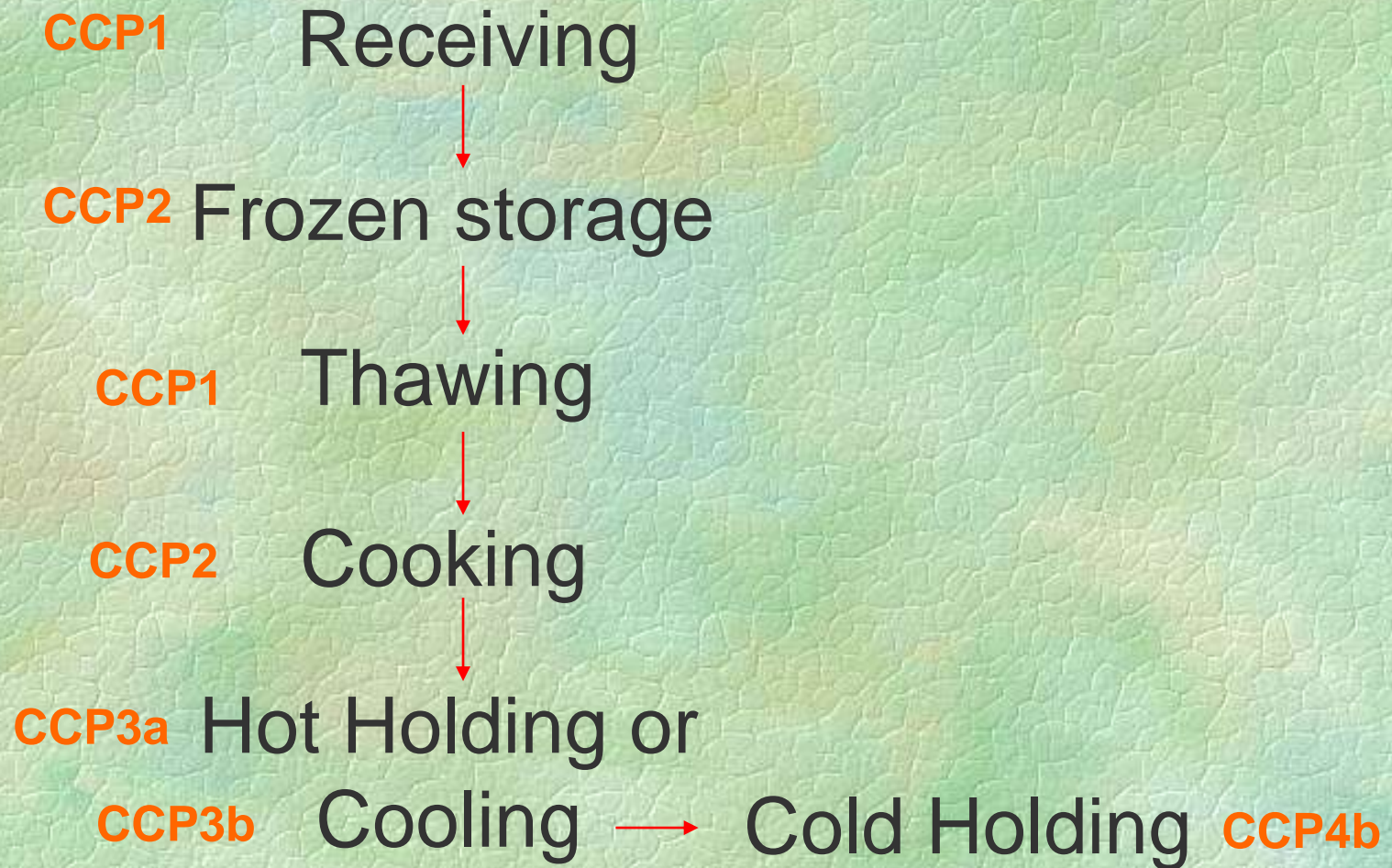
| Date | Time of Day | CCP# | CCP limit(s) | Temp. (°F) | Time | Action Yes/No | Initials |
|--------|-------------|-----------|---------------------------|------------|------------------|------------------------------|-----------|
| 1/5/93 | 11:21 am | 1 (Rec.) | <41°F | 38°F | — | No | <i>UJ</i> |
| 1/6/93 | 1:45 pm | 2 (Stor.) | <41°F | 37°F | — | No | <i>UJ</i> |
| 1/6/93 | 6:15 pm | 3 (Prep.) | <41°F or 41-140°, <2hr | — | 4.5 hr 41-140 | Yes, product discarded | <i>UJ</i> |
| 1/6/93 | NA* | 4 (Stor.) | <41°F | NA* | NA* | NA* | <i>UJ</i> |

*NA - Data not available since product was discarded at CCP 3 (patty preparation time exceeded limit of 2 hrs).

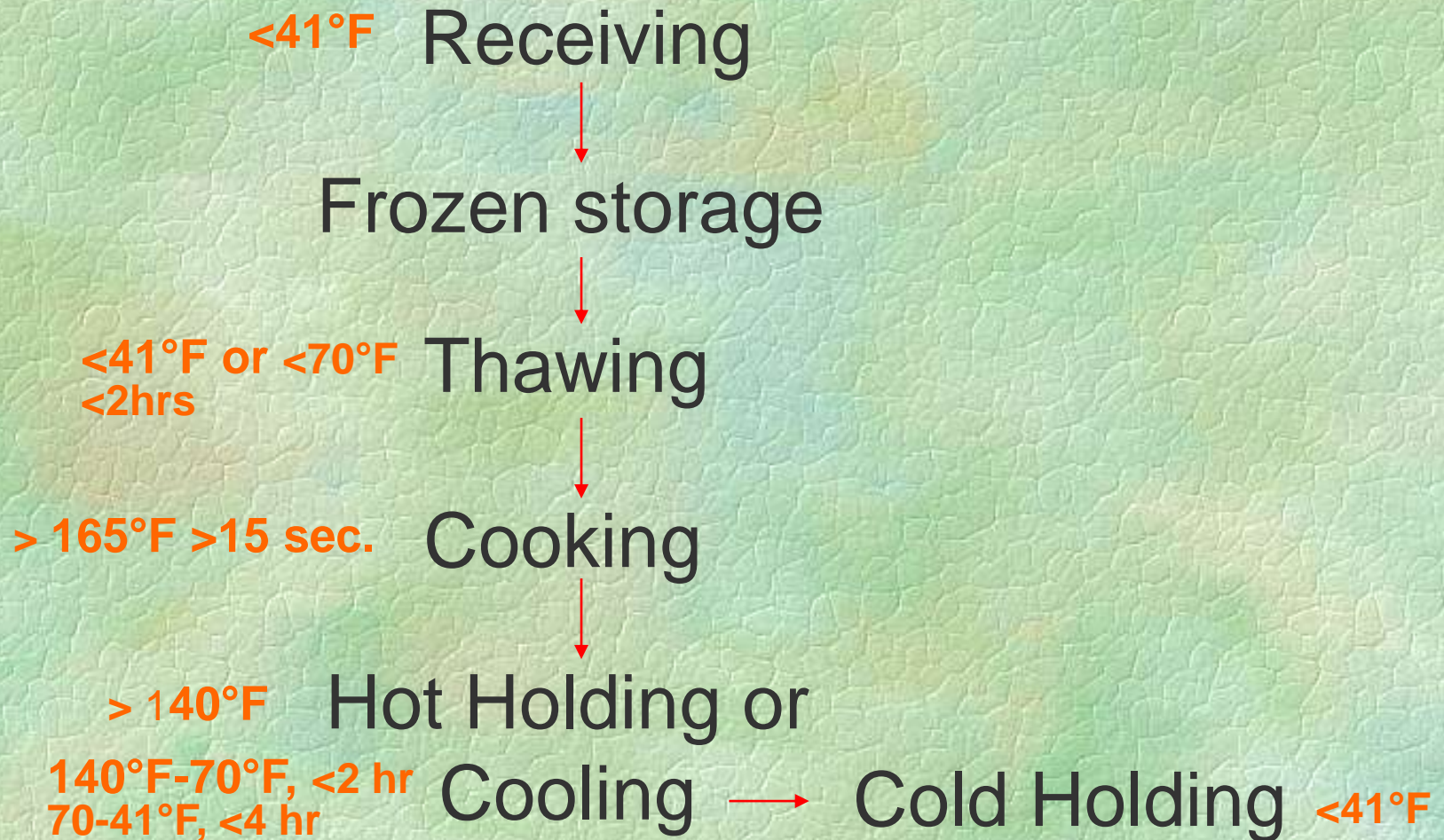
Product flow diagram: Turkey roast



Critical Control Points: Turkey roast



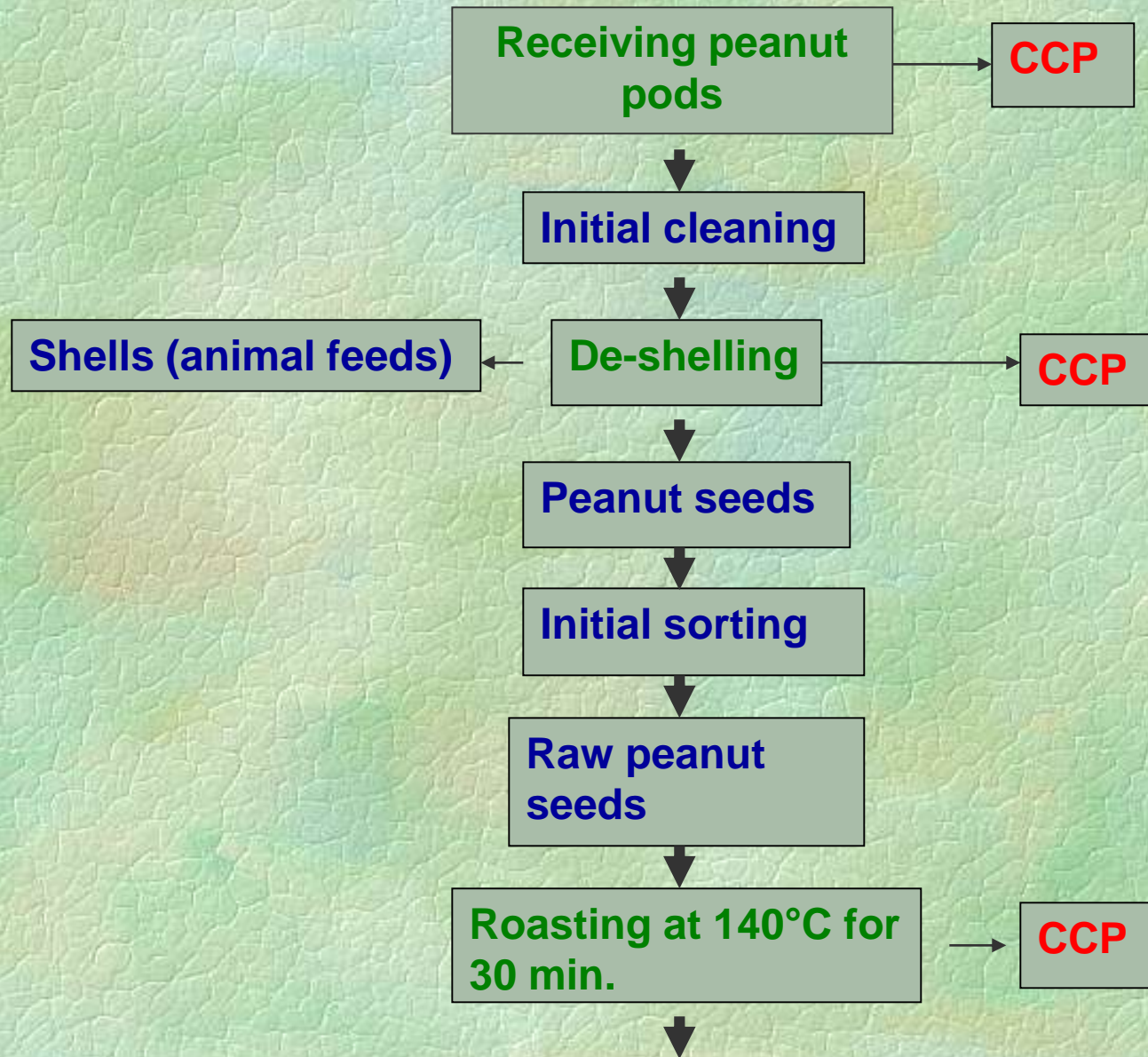
Critical control point limits: Turkey roast



Record keeping: Turkey roast

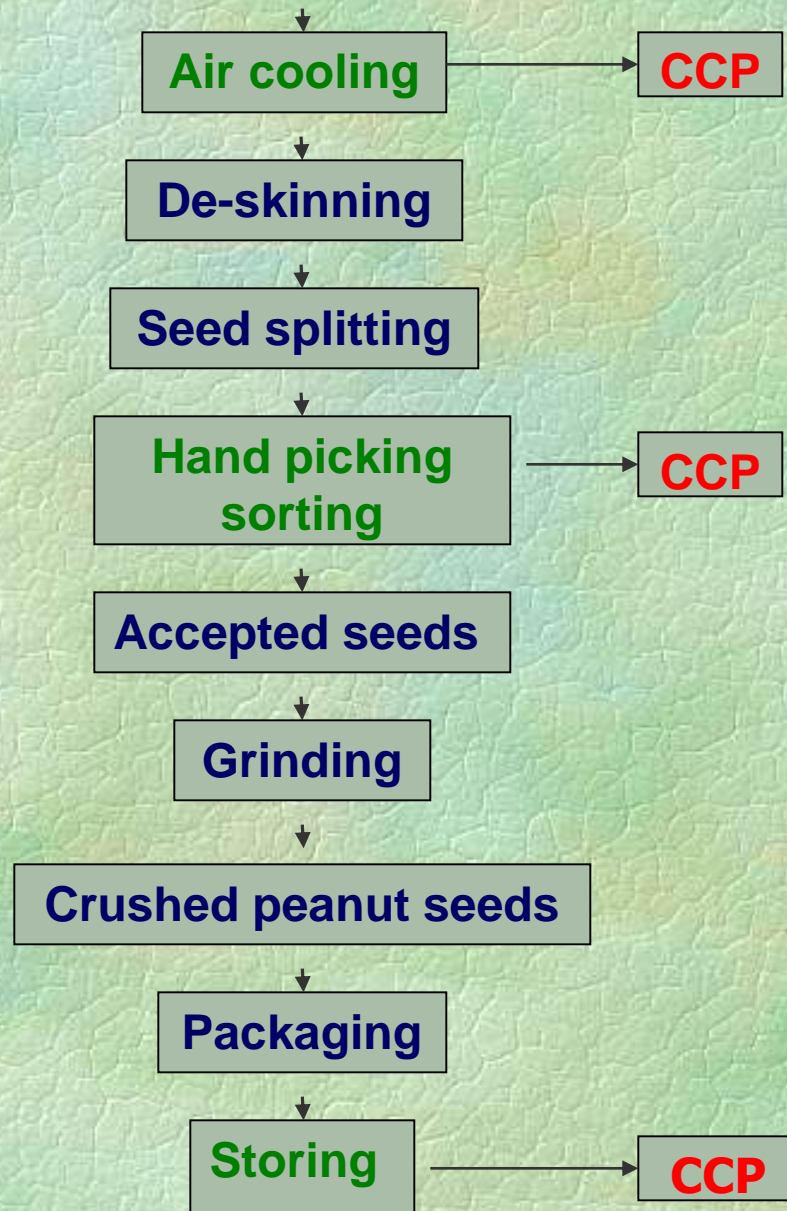
| Date | Time of Day | CCP# | CCP limit(s) | Temp. (F) | Time | Action Yes/No | Initials |
|--------|-------------|----------------|------------------------------|------------------|--------------------------|-------------------------------|-----------|
| 1/4/93 | 7:30 pm | 1 (Thaw) | <41F, or <2hrs, <70F | 37F cold room | --- | No | <i>NJ</i> |
| 1/5/93 | 10:00 am | 2 (Cook) | >165F, 15sec. | 180F | 15 sec. | No | <i>NJ</i> |
| 1/5/93 | 1:25 pm | 3a (Hot Hold) | >140F | 98F | --- | Yes - product discarded | <i>NJ</i> |
| 1/5/93 | 1:30 pm | 3b (Cool) | 140-70F, <2hr 70-41, <4hr | 38F | at 2:00 pm (<2hrs) | No | <i>NJ</i> |
| 1/5/93 | 2:30 pm | 4b (Cold Hold) | <41F | 39F | --- | No | <i>NJ</i> |

Flow chart of peanut commercial processing line



Flow chart of peanut commercial processing line

Cont.



HACCP plan worksheet of peanut processing

| Processing step | Hazard | CC P | Critical limit | Preventative measures | Monitoring | Corrective action (s) | Record |
|-------------------------------|--|-------|----------------|--|---|---|---|
| Receiving shelled peanut pods | - Aflatoxin formation - Growth of fungi | - Yes | - <10 ppb | - Control the source supply - Have the supplier to apply GAP* | - Visual inspection - Aflatoxin testing by Ridascreen® Fast aflatoxins or AflaTest kits | -Records subdivide lot and re-examine portion of the lot for aflatoxins by Ridascreen® Fast aflatoxins kit - Using cleaned container - Reject portion aflatoxin≥10ppb | - Report of visual inspection and aflatoxins analysis |
| Initial cleaning | -Physical hazards (stone, clay and other foreign bodies), and fungal contaminated pods | - No | - | - Precision of removal contaminated pods and other foreign bodies. - GMP* | - | - | - |
| De-shelling | - Aflatoxins formation in shells | - Yes | - <20 ppb | -Control of temperature and humidity | - Measure temperature and humidity. - Aflatoxin testing by Ridascreen® Aflatoxin Express kit | - Reject shells over 20 ppb and moderates the temperature and humidity. | - Record Temperature, humidity and Aflatoxin level |
| Initial sorting | - Damaged, immature and mold infested kernels. | -No | - | - Avoid fungal re-contamination by fungal spores - GMP* | - | - | - |

| Processing step | Hazard | CCP | Critical limit | Preventative measures | Monitoring | Corrective action (s) | Record |
|-------------------------------|--|-------|--|---|---|---|--|
| Roasting | - Aflatoxins level - Over roasted seeds | - Yes | - 140 °C for 30 min. | - Control time and temperature of roasting process. | - Measure temperature and time of roasting. - Aflatoxin test by Ridascreen® Fast Aflatoxin | - Reject over roasted seeds or over aflatoxin level | - Time and temperature - Aflatoxin level |
| Air-cooling | - Contamination with fungal spores | - Yes | - Non-contaminated air (filtered or sterilized air) | - Using air filter to avoid fungal spores. - Ultraviolet light exposure. | -- Visual inspection of the filters. -- Continuous cleaning of filters | - Changing the air filter | - Date of filter usage |
| Hand picking sorting | - Discolored seeds | - Yes | - Non-contaminated area | - Avoid fungal recontamination - GMP* | - Visual inspection of discolored seeds | - Removing the discolored seeds | - % discolored seeds |
| Grinding and packaging | - Recontamination with aflatoxin forming fungi | - No | - | - Avoid fungal recontamination - GMP* | - | - | - |
| Storing | - Temperature and relative humidity | - Yes | - Low temperature, low relative humidity and aflatoxins level less than 10 ppb | - Control temperature and relative humidity (GSP*) | - Measure, temperature, relative humidity and aflatoxins level by Ridascreen® Fast Aflatoxins or AflaTip kits | - Avoid the use of rejected stored ground peanut in animal feeds or other usage | - Temperature and relative humidity report - Aflatoxin report |

**GMP: Good Manufacturing Practices GSP: Good Storage Practices
Agricultural Practices**

GAP: Good

Main Topic of HACCP plan worksheet

- 1. Processing step**
- 2. Hazard**
- 3. CCP**
- 4. Critical limit**
- 5. Preventative measures**
- 6. Monitoring**
- 7. Corrective action (s)**
- 8. Record**

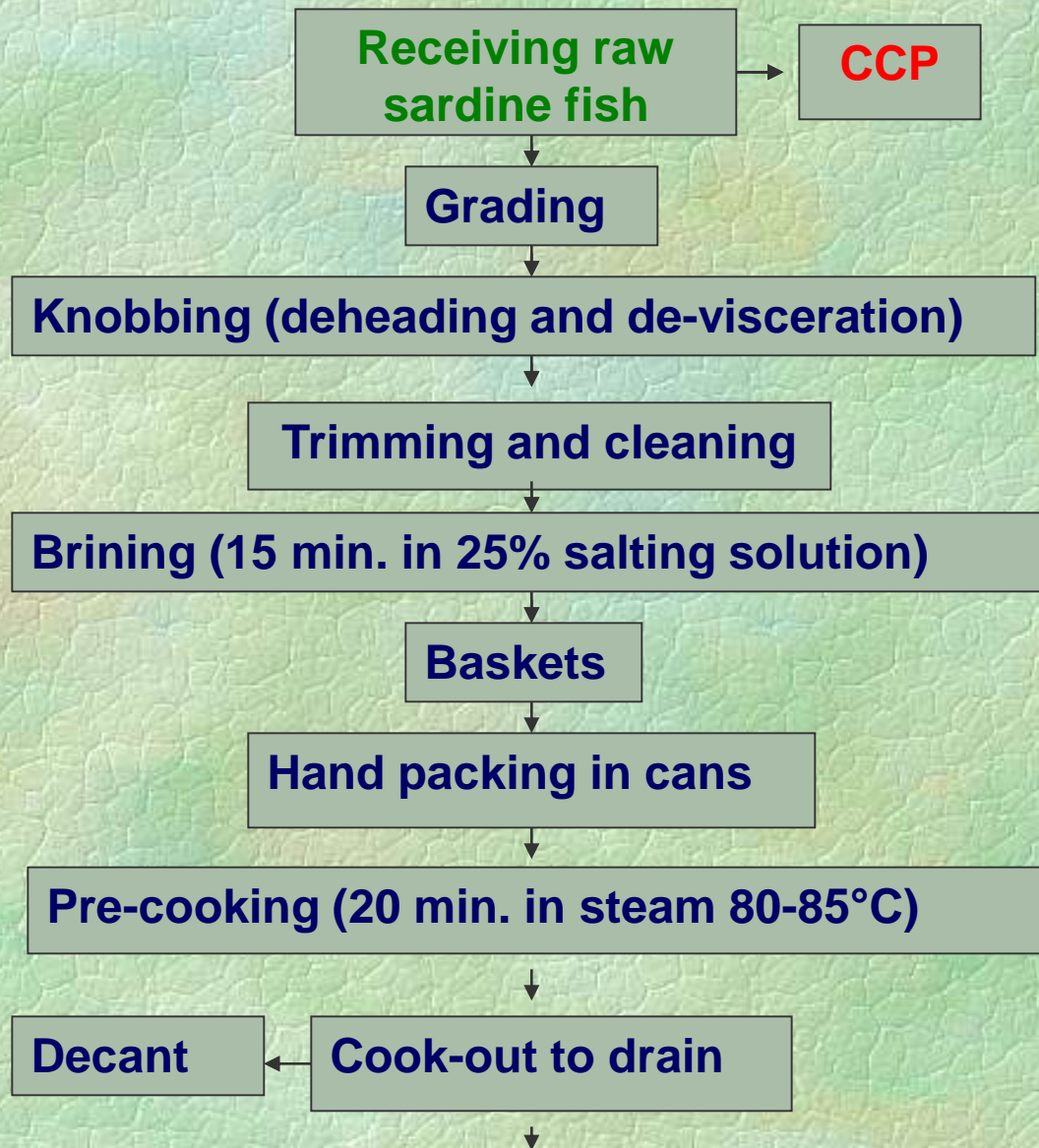
Receiving step

| Processing step | Hazard | CCP | Critical limit | Preventative measures |
|-------------------------------|---|---|--|---|
| Receiving shelled peanut pods | <ul style="list-style-type: none">- Aflatoxin formation- Growth of fungi | <ul style="list-style-type: none">- Yes | <ul style="list-style-type: none">- <10 ppb | <ul style="list-style-type: none">- Control the source supply- Have the supplier to apply GAP* |

Cont.

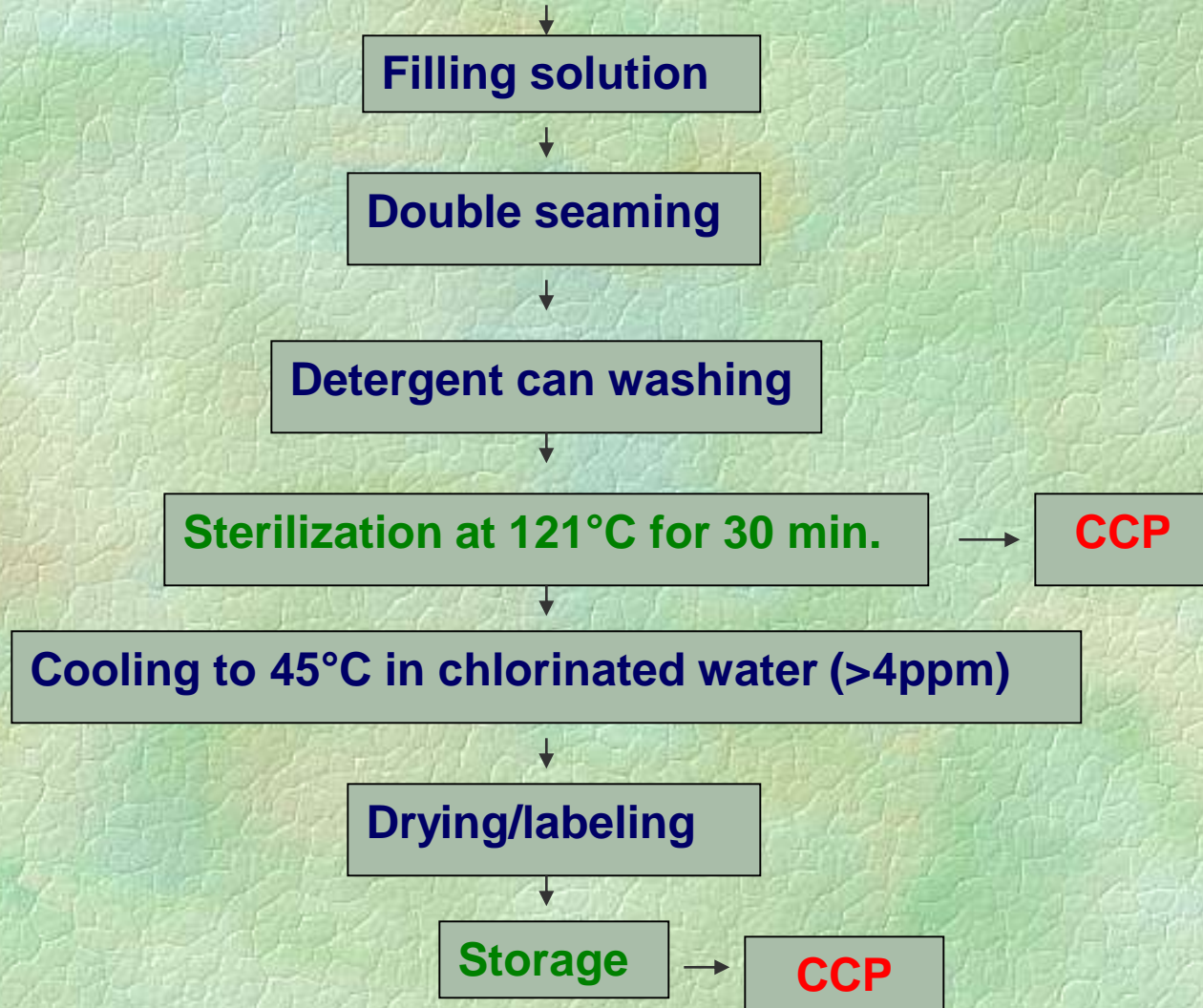
| Monitoring | Corrective action (s) | Record |
|--|--|---|
| <ul style="list-style-type: none">- Visual inspection- Aflatoxin testing by Ridascreen[®] Fast aflatoxins or AflaTest kits | <ul style="list-style-type: none">-Records subdivide lot and re-examine portion of the lot for aflatoxins by Ridascreen[®] Fast aflatoxins kit- Using cleaned container- Reject portion aflatoxin\geq10ppb | <ul style="list-style-type: none">- Report of visual inspection and aflatoxins analysis |

Flow chart for the production of canned sardine



Flow chart for the production of canned sardine

Cont.



HACCP plan worksheet of sardine canning process

| Processing step | Hazard | CCP | Critical limit | Preventative measures | Monitoring | Corrective action | Record |
|-----------------------------------|--|-----|-------------------|--|--|--|---|
| Receiving | - Histamine -Decomposed fish | Yes | Histamine <50 ppm | - Control supply source - Have the supplier provide a product temperature history | -Measure temperature upon receipt -Visual inspection -Histamine testing by QE or TLC methods | -Subdivide lot, re-examine portions for histamine by QE or TLC method and reject portions of ≥50 ppm histamine | Report of visual inspection, temperature and histamine analysis |
| Knobbing and de-viseration | - Histamine - Discolored Flesh | No | - | - Control time of fish cleaning and hygienic practices - GMP | - | - | - |
| Brining | - Temperature - Salt conc. - Salt purity | No | - | - Control temperature and salt concentration | - | - | - |
| Packing | - Defected empty cans - Over filled cans | No | - | - Select can supplier - Set up empty can sampling plan and specification required and train workers on container integrity -Calibrate the used balance | - | - | - |
| Precooking | - Under cooking - Over cooking | No | - | - Control time and temperature of precooking | - | - | - |

| Processing step | Hazard | CCP | Critical limit | Preventative measures | Monitoring | Corrective action | Record |
|-------------------------------------|---|------------|--|---|--|--|---|
| Filling solution and seaming | <ul style="list-style-type: none"> - Over filling - Defect double seam | No | - | <ul style="list-style-type: none"> - Calibrate balance used - Adjustment of seamer - Test run before use - Train QC/seam mechanic | - | - | - |
| Sterilization | <ul style="list-style-type: none"> - Improper processing resulting in outgrowth of microbes and toxins - Histamine increasing - Improper pressure, resulting in physical defects in cans | Yes | <ul style="list-style-type: none"> - Sterilization temperature, pressure and time | <ul style="list-style-type: none"> - Train retort operators - Establish process schedule - Calibration of the retort - Close surveillance of operation (by QC/QA) | <ul style="list-style-type: none"> -Time, pressure and temperature -Histamine testing by IE method | <ul style="list-style-type: none"> - Reprocess the under processed cans | <ul style="list-style-type: none"> -Time and temperature - Histamine report |
| Cooling | <ul style="list-style-type: none"> - Post process contamination | No | - | <ul style="list-style-type: none"> - Restrict area - Traffic control - GHP (use of chlorinated cooling water) | - | - | - |
| Incubation period | <ul style="list-style-type: none"> - Cans swelling | Yes | <ul style="list-style-type: none"> - Abnormal appearance | <ul style="list-style-type: none"> - GMP and GHP | <ul style="list-style-type: none"> - Visual inspection of cans | <ul style="list-style-type: none"> - Reject the defected cans | <ul style="list-style-type: none"> - Percent age of defect cans |

IE: Ion Exchange (Rida®quick histamine)

(Ridascreen®histamine)

QC: Quality Control

QA: Quality Assurance

QE: Quantitative ELISA

GHP: Good Hygienic Practices

Cont.

| Monitoring | Corrective action | Record |
|--|---|---|
| <ul style="list-style-type: none">-Measure temperature upon receipt-Visual inspection-Histamine testing by QE or TLC methods | <ul style="list-style-type: none">-Subdivide lot, re-examine portions for histamine by QE or TLC method and reject portions of ≥ 50 ppm histamine | Report of visual inspection, temperature and histamine analysis |

Thank you