HACCP for Food Safety:

Asia-Pacific Economic Cooperation
Partnership Training Institute Network

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Grocery Manufacturers Association
Washington, DC

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Workshop Objectives

• Introduce HACCP as a food safety management tool
  – Codex requirements for HACCP.

• Working Group Exercises

• Present an example for HACCP application in seafood production
Hard
Agonizing
Complicated
Confusing
Paperwork
Have A Cup of Coffee and Pray
Hazard Analysis and Critical Control Points
HACCP Concept

♦ Preventive system for assuring safe production of foods
♦ A management tool
HACCP - A Management System

• Focuses on the prevention of problems that could lead to foodborne illness or injury.
• Can be applied throughout the food chain (from harvest to table).
• Commonly applied in manufacturing settings.
Mandatory HACCP by Worldwide Regulatory Agencies

**EU:**
All food business operators (852/2004/EC)

**US:**
Seafood, juice (FDA), meat & poultry (USDA)

**Canada:**
Mandatory: Meat & poultry
Recognition process: Dairy, processed fruits and vegetables, shell eggs, processed eggs, honey, maple, and hatcheries.
Key Points

• Food Safety Only…Not Quality
• HACCP does not stand alone
  – Management commitments
  – GMPs
  – Sanitation Programs
  – Prerequisite Programs
Prerequisites Are the Building Blocks of a HACCP System

- HACCP
- Codex
- ISO 22000
- GMP
- SSOPs
- TRAINING
Foodborne Illnesses Associated with Seafood

- A total of 1194 outbreaks in the home, restaurants and delis have been associated with seafood in the US since 1997 (Center for Science in the Public Interest, 2010).
- Over 50,000 cases of ciguatera poisoning occur internationally every year (CDC, 2009).
- 425 cases of scombroid poisoning in the US since 1997 (Center for Science in the Public Interest, 2010).
Comprehensive System for Product Control

- **HACCP** (CCPs)
- **Regulatory Requirements** (RCPs)
- **Quality Factors** (QCPs)

**Safety**

**Hygiene** (GMP) Standards (Codex)

**Plant Specific**
Codex International Code of Practice (Standards)

- General Principles of Food Hygiene (1)
- Lobsters (24)
- Smoked Fish (25)
- Crabs (28)
- Frog Legs (29)
- Fish and Fishery Products (52)
Origin of HACCP

Pillsbury - NASA “space foods”
Origin of HACCP

• The Pillsbury Company, U.S. Army Natick Laboratories and NASA developed HACCP in response to the food safety requirements for production of foods for the space program.
End-product testing ineffective

- 1/1000 units contaminated with *Salmonella*
- 60 samples tested
- >94% probability of acceptance (all negative)
Original 3 HACCP Principles (1971)

• Identify/Assess hazards
• Determine critical control points
• Establish systems to monitor CCPs
Codex Alimentarius Commission

“Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application.”

Codex 22nd session, 1997
Updated in 2003
“Hazard Analysis and Critical Control Point Principles and Application Guidelines”

National Advisory Committee on Microbiological Criteria for Foods

J. Food Protection 61(9) 1998 pp. 1246-1259
Food Safety Hazard

A **biological, chemical or physical** agent that is **reasonably likely** to cause illness or injury in the absence of its control.
Classes of Food Safety Hazards

Biological:

- Bacterial Pathogens
- Parasites
- Viruses
<table>
<thead>
<tr>
<th>Food*</th>
<th>Some Pathogens of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Seafood</td>
<td><em>Salmonella, C. botulinum, parasites, viruses</em></td>
</tr>
<tr>
<td>Molluscan Shellfish</td>
<td><em>Vibrio</em> spp., Hepatitis A virus, Norwalk virus*</td>
</tr>
</tbody>
</table>

*Likelihood of occurrence is often product specific*
Classes of Food Safety Hazards

Chemical:

- Natural Toxins
  (Scombrototoxin/Histamine)
- Allergens
- Mercury
- Drugs (Aquaculture)
Common Food Allergens

- Peanuts
- Milk
- Eggs
- Fish
- Celery

- Crustaceans
- Soy
- Tree nuts
- Wheat
- Sesame
- Mustard
Classes of Food Safety Hazards

Physical:

- Metal
- Glass
- Hard or sharp foreign objects
Physical Hazards Are (Only) Those Capable of Causing Injuries

- Examples of what are physical hazards?

- Examples of what are not physical hazards?
Questions?
HACCP - Getting Started

Assemble the HACCP Team

Describe the Food and its Distribution

Describe the Intended Use and Consumers of the Food

Develop a Flow Diagram Which Describes the Process

Verify the Flow Diagram
Example: Apple Juice in Glass Bottle, Shelf Stable

- Receive Apple Juice Concentrate
- Blend Tank
- Hold Tank
- Pasteurize
- Hot Fill
- Close
- Invert
- Cool
- Code/Label
- Palletize

- Receive and Store Packaging Materials
- Bottle Inversion/Air Cleaning
- Caps
- Storage/Ship
7 HACCP Principles

1. Conduct a hazard analysis
2. Determine the CCPs
3. Establish critical limits
4. Establish monitoring procedures
5. Establish corrective actions
6. Establish verification procedures
7. Establish record keeping and documentation
HACCP Principle 1

Conduct a Hazard Analysis
Hazard Analysis

The process of collecting and evaluating information on hazards associated with the food under consideration to decide which are significant and must be addressed in the HACCP plan.
Evaluation for Hazards to Include:

1. Microbiological contamination
2. Parasites
3. Chemical contamination
4. Unlawful pesticide residues
5. Decomposition (if a food hazard exists)
6. Natural Toxins
7. Unapproved use of food or color additives
8. Presence of undeclared ingredients that may be allergens
9. Physical hazards
Hazard Analysis

Two Stages:

1. Hazard identification
   - list of potential hazards

2. Hazard evaluation
   - select based on severity and likelihood of occurrence
Is It Significant?

Severity
The seriousness of the effect(s) of a hazard and...

Likelihood of Occurrence
Example - evaluation for refrigerated raw shellfish

Stage 1: hazard identification
Determine potential hazards associated with product

\textit{Vibrio} spp. in incoming raw shellfish
Stage 2: Hazard evaluation

Step (1): Assess severity of health consequences if potential hazard is not properly controlled

*Vibrio* spp. in raw shellfish may result in an infection with moderate to severe consequences.
Stage 2: Hazard evaluation

Step (2): Determine likely occurrence of potential hazard.

Raw shellfish have been known to contain *Vibrio* spp.
Stage 2: Hazard evaluation

Step (3): Decide if this potential hazard is to be addressed in the HACCP plan.

Yes;
If *Vibrio* spp from raw shellfish is not properly controlled, consuming this product presents a significant risk.
Working Group Exercise

Given a product and process, determine potential hazards and their sources.
HACCP Principle 2

Determine the Critical Control Points (CCPs)
Definitions

CCP

A point or step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Definitions

Control Measure

Any action or activity that can be used to *prevent, eliminate or reduce* a significant hazard.
### Examples:

<table>
<thead>
<tr>
<th>Point of Occurrence</th>
<th>Hazard</th>
<th>CCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw fish</td>
<td><em>Salmonella</em></td>
<td>Heat Treatment</td>
</tr>
<tr>
<td>Ingredients</td>
<td><em>Sulfites</em></td>
<td>Labeling</td>
</tr>
<tr>
<td>Equipment</td>
<td><em>Metal</em></td>
<td>Metal detectors</td>
</tr>
</tbody>
</table>
HACCP Principle 3

Establish Critical Limits
Critical Limit

Codex Definition

“A criterion which separates acceptability from unacceptability.”
Basis for Critical Limits

- Biological hazards
  - Inactivation of microbes, toxins prevention/destruction, growth prevention
- Chemical hazards
  - Toxicity, allergen, safety limits
- Physical hazards
  - Criteria related to potential for injury (object size)
Examples of parameters that may be CLs

- “on and functioning”
- “in place and intact”
- “presence of supplier guarantee”
Critical limit is a maximum or minimum value, not an average value.
Not Meeting CL Indicates

Existence of a direct health hazard.
A direct health hazard could develop.
Product was not produced under conditions assuring safety.
Now that you have determined the hazards, select the **control measures** that can be used to control the hazard and the **critical limits** for those control measures.
HACCP Principle 4

Establish Monitoring Procedures
Monitoring is:

“The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control.”
Monitoring Provides:

- Data to track control (Trend)
- Used to make adjustments and detect deviations
- Written documentation for use in verification
Types of Monitoring

- Observations
- Measurements
- Continuous or Discontinuous
Monitoring activities

- Identify **who** (job position)
- **What** is to be monitored
- **How** it is to be monitored
- **When**, how often (frequency)
- Documents that CLs are met
Now that you have determined the control measures and critical limits, choose the **monitoring procedures** for you critical limits.
HACCP Principle 5

Establish Corrective Actions
Corrective Action

“Any action to be taken when the results of monitoring at the CCP indicate a loss of control”

Codex
Corrective actions must be developed for possible deviations at each CCP.
Corrective Actions

Should include the following:

• Ensure the CCP is under control
• Determine and correct the deviation cause
• Determine disposition of non-compliant product
• Record the corrective actions taken
HACCP Principle 6

Establish Verification Procedures
VERIFICATION

“The application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan.”
Types of Verification

1. Validation that the HACCP plan (and its components) are adequate to control hazards.
2. “Routine” verification that the CCPs are in control and effective.
3. Verification that the HACCP system is operating according to the HACCP plan.
4. Regulatory verification.
Validation of HACCP Plan

Right CCPs?

Control Hazards?

Valid!
HACCP Principle 7

Establish Record-Keeping and Documentation Procedures
Records established for the HACCP system

- Summary of Hazard Analysis
- Team members, Product Information, and Flow Diagrams
- The HACCP Plan
- Training Records
- May include Pre-requisite Program Details (if mentioned in HACCP plan)
- SSOP implementation records
Records maintained for the HACCP system

For steps in process that are CCPs:
Controlling hazards of concern within critical limits

Types of Records:
• Monitoring
• Verification procedures, schedules & records
• Corrective actions
Questions?
This generic HACCP plan was developed for training purposes only and is not intended to replace any processor’s hazard analysis and HACCP plan development. This model may not reflect all concerns outlined in Codex guidelines.
Frozen, breaded fish sticks are prepared from blocks of frozen minced fish; batter and breading prepared from mixes of wheat and corn flour, modified corn starch, spices, seasonings, egg whites, and vegetable oil. The packaging materials used are PET trays, plastic shrink-wrap film, and corrugated shipping cartons for consumer packages; polyethylene film liners and corrugated cartons for foodservice packages; and package labels. The fish sticks are not fully cooked and require cooking prior to consumption. The fish sticks are distributed for retail sales or foodservice use. Each package is labeled with a “use by” date, cooking instructions and the phrase “keep frozen.”
Frozen Breaded Fish Sticks

Receive frozen fish blocks

Frozen storage

Unwrap

Cut/Saw

Cull

Batter

Batter

Dry cold storage

Mix batter

Cull

Batter

Bread

CCP 1 (P)

CCP 2 (B)

CCP 3 (P)

Fry

IQF freeze

Cull

Pack/weigh/label

Case

Frozen storage
# Hazard Analysis Worksheet

## Frozen Breaded Fish Sticks

<table>
<thead>
<tr>
<th>Ingredient or Processing Step</th>
<th>Potential hazards introduced, controlled or enhanced at this step</th>
<th>Does this potential hazard need to be addressed in HACCP plan? (Yes/No)</th>
<th>WHY? (Justification for decision made in previous column)</th>
<th>What measures can be applied to prevent, eliminate or reduce the hazards being addressed in your HACCP plan?</th>
<th>Is this step a critical control point (CCP)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive frozen fish blocks</td>
<td>BIOLOGICAL Pathogens such as <em>Vibrio</em> spp., Parasites such as nematodes</td>
<td>No</td>
<td>Product is not ready to eat. Product is intended to be fully cooked prior to consumption; freezing will kill the parasites.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEMICAL None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYSICAL Bones</td>
<td>No</td>
<td>This inherent defect is not reasonably likely to result in the food being unsafe for consumption.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frozen Storage</td>
<td>BIOLOGICAL Pathogens such as <em>Vibrio</em> spp.</td>
<td>No</td>
<td>Product is frozen so opportunity for pathogen growth or contamination is not reasonably likely to occur.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEMICAL None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYSICAL None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut/Saw</td>
<td>BIOLOGICAL Growth of pathogens such as <em>Vibrio</em> spp.</td>
<td>No</td>
<td>Period of time at this step is short; product remains frozen; opportunity for pathogen growth not reasonably likely to occur.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEMICAL None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYSICAL Metal fragments</td>
<td>Yes</td>
<td>Potential for saw blade to break and contaminate product is reasonably likely to occur. Metal fragments can cause moderate injury.</td>
<td>Periodic inspection of equipment</td>
<td>Yes CCP1(P)</td>
</tr>
<tr>
<td>Product</td>
<td>Biological</td>
<td>Chemical</td>
<td>Physical</td>
<td>Risk</td>
<td>Control Measures</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>----------</td>
<td>----------</td>
<td>------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Mix batter</td>
<td>Growth of pathogens such as <em>Vibrio</em> spp.; contamination with pathogens such as <em>Cryptosporidium</em></td>
<td>No</td>
<td></td>
<td>Risk is low due to short mixing time; potable water is used.</td>
<td></td>
</tr>
<tr>
<td>Batter</td>
<td>BIOLOGICAL Growth of <em>Staphylococcus aureus</em> with toxin formation</td>
<td>Yes</td>
<td></td>
<td>Potential for <em>S. aureus</em> growth if batter held too long at elevated temperature. Staph enterotoxin can cause moderate illness.</td>
<td>Keep temperature low.</td>
</tr>
<tr>
<td></td>
<td>CHEMICAL</td>
<td>None</td>
<td></td>
<td></td>
<td>Yes CCP2(B)</td>
</tr>
<tr>
<td></td>
<td>PHYSICAL Metal fragments</td>
<td>Yes</td>
<td></td>
<td>Potential for metal fragments from wire-mesh conveyor contaminating product. Metal fragments can cause moderate injury.</td>
<td>Periodic inspection of equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes CCP3(P)</td>
</tr>
<tr>
<td>Bread</td>
<td>BIOLOGICAL Growth of pathogens such as <em>Vibrio</em> spp.</td>
<td>No</td>
<td></td>
<td>Application of dry breading does not promote pathogen growth due to short time period.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEMICAL</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYSICAL Metal fragments</td>
<td>Yes</td>
<td></td>
<td>Potential for metal fragments from wire-mesh conveyor contaminating product.</td>
<td>Periodic inspection of equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes CCP3(P)</td>
</tr>
<tr>
<td>Fry</td>
<td>BIOLOGICAL</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEMICAL Rancid cooking oil</td>
<td>No</td>
<td></td>
<td>Potential for toxic compounds from cooking oil is not reasonably likely to occur.</td>
<td></td>
</tr>
</tbody>
</table>
Example: For Training Purposes Only

HACCP Plan Form

FROZEN BREADED FISH STICKS

<table>
<thead>
<tr>
<th>Critical Control Point (CCP)</th>
<th>Hazard(s) to be Addressed in HACCP Plan</th>
<th>Critical Limits for Each Control Measure</th>
<th>Monitoring</th>
<th>Corrective Action</th>
<th>Verification Activities</th>
<th>Record-keeping Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCP1(F) Cut/Saw</td>
<td>Metal fragments</td>
<td>Presence of broken or missing metal parts from sawblade</td>
<td>Visualize check sawblade for broken or missing parts</td>
<td>Stop production</td>
<td>QA to inspect sawblade once per personnel shift</td>
<td>Sawblade inspection log</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prior to start-up</td>
<td>Adjust or modify equipment to reduce risk of recurrence</td>
<td>QA supervisor or designated employee to review monitoring and corrective action records daily</td>
<td>Corrective Action log</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End of operations</td>
<td>Hold product from last acceptable check</td>
<td>QA verification log</td>
<td>QA verification log</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After sawblade malfunction</td>
<td>Run product through calibrated operable metal detector</td>
<td>Metal detector calibration log</td>
<td>Metal detector calibration log</td>
</tr>
<tr>
<td>Critical Control Point (CCP)</td>
<td>Hazard(s) to be Addressed in HACCP Plan</td>
<td>Critical Limits for Each Control Measure</td>
<td>Monitoring</td>
<td>Corrective Action</td>
<td>Verification Activities</td>
<td>Record-keeping Procedures</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>-----------------------------------------</td>
<td>------------</td>
<td>------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>CCP2(B) Batter</td>
<td>Staphylococcus aureus toxin formation</td>
<td>Hydrated batter temperature should not exceed 50°F for more than 12 hours and should not exceed 70°F for more than 3 hours¹</td>
<td>Temperature of hydrated batter (exposure time will be monitored by frequency of checks)</td>
<td>Manually check temperature in hold tank with digital indicating thermometer</td>
<td>Approximately every hour</td>
<td>Batter operator</td>
</tr>
<tr>
<td>CCP3(F) Batter/Bread</td>
<td>Metal fragments</td>
<td>No broken or missing metallic parts from mesh conveyor belt</td>
<td>Presence of broken or missing metallic parts from conveyor belt</td>
<td>Visually check conveyor belt for broken or missing parts</td>
<td>Prior to start-up, End of operations, After conveyor belt malfunction</td>
<td>Batter/breading operator</td>
</tr>
</tbody>
</table>

¹Note: The SOP requires operator to cool batter if temperature exceeds 50°F and determine exposure time should better temperature exceed 70°F.
## GMA HACCP Courses

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HACCP Online course</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td>This online workshop provides flexible, affordable and effective training for food safety personnel who need to learn and apply the principles of HACCP in plan development and implementation.</td>
</tr>
<tr>
<td><strong>GMA Online HACCP Follow-up Workshop</strong></td>
<td>This course complements the online HACCP training by providing hands-on experience with the development of a &quot;mock&quot; HACCP plan to facilitate understanding of the online material. Completion of the online course is prerequisite to this 1-day certificate workshop. The online course plus this 1-day follow-up workshop meet the educational requirements cited in the FDA &amp; USDA HACCP regulations.</td>
</tr>
<tr>
<td><strong>Advanced HACCP, Verification &amp; Validation</strong></td>
<td>This workshop, accredited by the International HACCP Alliance, concentrates on verification activities included in the sixth principle of HACCP. It explores activities in-depth and how to implement them in a successful HACCP system.</td>
</tr>
<tr>
<td><strong>HACCP Train the trainer</strong></td>
<td>The HACCP Train the Trainer workshop is designed to prepare and qualify candidates as International HACCP Alliance Lead Instructors. In addition to providing a greater understanding of the 7 HACCP principles, the workshop covers adult learning styles and delivery techniques to more effectively present HACCP course material. Hands-on working group exercises facilitate the learning process.</td>
</tr>
<tr>
<td><strong>Basic HACCP</strong>&lt;br&gt;(Meat, Poultry, Juice, Seafood and Other Products as needed)</td>
<td>This introductory workshop, accredited by the International HACCP Alliance, is composed of lectures and group exercises. Each of the seven HACCP principles is discussed. The workshop focuses on strategies for HACCP plan development and implementation. GMA instructors can accommodate and provide lectures for specific areas of interest based upon the participants’ needs.</td>
</tr>
</tbody>
</table>

*http://www.gmatraining.com/HACCP_Purchase_Info.html*
GMA HACCP Resources

HACCP Materials:
• PowerPoint slide sets to accompany the above HACCP manuals:
  o English: http://www.fpa-food.org/store_product.asp?inve_id=64
• HACCP Verification and Validation: An Advanced HACCP Workshop
  o English: http://www.fpa-food.org/store_product.asp?inve_id=118
Other Courses Offered by GMA

• Thermal Process Development
• Thermal Process Deviations
• Better Process Control School
• Aseptic Better Process Control School
• Food Labeling

• Contact Sherri Frye at: sfrye@gmaonline.org
Questions?