

Chapter 8: Principle 4: Critical Control Point Monitoring

Notes:

Overhead 1

Objective:

In this module, you will learn:

- How monitoring is defined.
- Why monitoring is needed.
- How to design a monitoring system.
- What methods and equipment are used for monitoring critical limits.
- How often monitoring should be performed.
- Who should monitor.

Monitoring is important to ensure that the critical limits are consistently met.

Overhead 2

Principle 4:

Establish monitoring procedures.

Overhead 3

Definition:

Monitor: to conduct a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification.

Continued

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Notes:

• *Purpose for Monitoring*

Overhead 4

MONITORING

Purpose of Monitoring:

- To track the operation of the process and enable the identification of trends toward a critical limit that may trigger process adjustments,
- To identify when there is loss of control (a deviation occurs at a CCP).
- To provide written documentation of the process control system.

Monitoring is the process that the operator relies upon to maintain control at a CCP. Accurate monitoring indicates when there is a loss of control at a CCP and a deviation from a critical limit. When a critical limit is compromised, a corrective action is needed. The extent of the problem needing correction can be determined by reviewing the monitoring records and finding the last recorded value that meets the critical limit.

Monitoring also provides a record that products were produced in compliance with the HACCP plan. This information is useful in the verification of the HACCP plan as discussed in Principle 7.

• *Design of a Monitoring System*

The control measures discussed in Principle 1 and the critical limits discussed in Principle 3 are intended to control the hazards at each CCP. The monitoring procedures are used to determine if the control measures are being enacted and the critical limits are being met. Monitoring procedures must identify:

- What will be monitored. (Column 4)
- How the critical limits and control measures will be monitored. (Column 5)
- How frequently monitoring will be performed. (Column 6)
- Who will perform the monitoring. (Column 7)

Overhead 5

HACCP Plan Form

Monitoring:

1. CCP	2. Hazard	3. Critical Limits	4. Monitoring <small>What</small>	5. <small>How</small>	6. Frequency	7. <small>Who</small>	8. Corrective Action(s)	9. Verification	10. Records
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Specify the monitoring procedures for each CCP.

Notes:

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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). Needs to be real-time and accurate.
- **When (frequency):** can be continuous or intermittent.
- **Who:** someone trained to perform the specific monitoring activity.

Overhead 7

What will be Monitored?

• ***What will be Monitored***

Monitoring may mean measuring a characteristic of the product or of the process to determine compliance with a critical limit.

Examples include:

- Measurement of cold-storage compartment temperature when critical for temperature-sensitive ingredients.
- Measurement of the pH of an acidifying ingredient when critical for the production of an acidified food.
- Measurement of line speed when critical to adequate cooking or chilling processes.

Continued

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Monitoring may also involve observing if a control measure at a CCP is being performed.

Examples include:

- Checking that a vendor's certificate accompanies a lot of raw material.
- Checking the harvest area listed on a tag attached to a container of raw molluscan shellfish to ensure harvest from approved waters.

What will be monitored is listed in column 4 of the HACCP plan form.

Overhead 8

How Critical Limits and Control Measures will be Monitored

Explanatory Note:

The length of time between monitoring checks will directly affect the amount of rework or product loss when a critical-limit deviation is found.

• *How Critical Limits and Control Measures will be Monitored*

Monitoring must be designed to provide rapid (real-time) results. There is no time for lengthy analytical testing because critical limit failures must be detected quickly and an appropriate corrective action instituted before distribution.

Microbiological testing is seldom effective for monitoring CCPs. Very often the analytical methods are lengthy. Additionally, to do a statistically adequate job of finding pathogenic organisms at levels that may cause illness, large sample sizes are usually needed.

Physical and chemical measurements are preferred monitoring methods because testing can be done rapidly. Physical and chemical measurements (e.g., pH, time, temperature) can often be related to the microbiological control as illustrated by the fried-fish example in Principle 3. Examples of physical- and chemical-measurement monitoring at a CCP follow:

- **Time and temperature.** This combination of measurements is often used to monitor the effectiveness for destroying or controlling the growth of pathogenic bacteria. By processing a food at a set temperature for a set time, pathogenic bacteria can be destroyed. For example, pasteurized crabmeat (in a 401 x 301 can) should be heated to a container-core temperature of 185 F for one minute. This is usually assured by monitoring the temperature of a heated water bath and by monitoring the time that the product is held therein. In addition, pathogens can be controlled by minimizing exposure of a food to the critical pathogen growth temperatures between 40 F and 140 F. This can be achieved through rapid heating and/or cooling of the product through these critical temperatures and maintaining temperatures below 40 F or above 140 F during storage. For example, monitoring should be performed to determine the cumulative exposure of crabmeat to temperatures between 40 F and 140 F during the processing.

- **Water Activity (a_w).** Pathogen growth can be controlled by limiting water activity — the amount of water available for microbial growth. For example, drying products to a water activity below 0.85 stops pathogen growth. In this case, samples may be collected during the drying process and tested for water activity. The process is completed when a_w falls below 0.85. Processors may monitor temperature, time and flow if the rate of drying under these conditions is known to achieve an 0.85 a_w at the end of the process.
- **Acidity (pH).** Pathogen growth can be controlled by limiting the pH of the product to a level that does not allow growth. For instance, the growth of *Clostridium botulinum*, which leads to botulism, is controlled in acidified products by adding acid to lower the pH to 4.6 or below. In this case, the pH of an acidifying agent may be monitored before it is added to a batch. Recording the pH of the finished product is not a good monitoring tool because a few days must pass before the finished product's pH reaches equilibrium.
- **Sensory examination.** This is a means of testing for decomposition that may result in food-safety hazards such as histamine development. The type and intensity of the odor gives the examiner an indication of the time/temperature abuse that could result in histamine development.

The selection of the monitoring equipment is a major consideration during development of a HACCP plan. Equipment used for monitoring CCPs varies with the attribute being monitored. Examples of monitoring equipment include:

- thermometers,
- clocks,
- scales,
- pH meters,
- water activity meters and
- chemical analytical equipment.

The equipment chosen for monitoring at the CCP must be accurate to ensure control of the hazard. The variability of the monitoring equipment should be considered when setting the critical limit. For example, if a minimum internal temperature of 145 F is necessary to kill pathogens in a product and the thermometer has an accuracy of ± 2 F, then the critical limit should be set no lower than 147 F. Periodic calibration or standardization is necessary to ensure accuracy. This is further discussed in Chapter 11.

How monitoring will be performed is recorded in column 5 of the HACCP plan form.

Notes:

Continued

Notes:

Overhead 9

Monitoring Frequency

• *Monitoring Frequency*

Monitoring can be continuous or noncontinuous. Where possible, continuous monitoring should be used. Continuous monitoring is possible for many types of physical and chemical parameters. Examples of continuous monitoring include:

- The time and temperature of a batch pasteurization process for crabmeat may be continuously monitored and recorded on a temperature-recording chart.
- Each package of frozen, mechanically-cut fish blocks may be passed under a metal detector.

A monitoring instrument that produces a continuous record of the measured value will not control the hazard on its own. The continuous record needs to be observed periodically and action taken when needed. This too is a component of monitoring. The length of time between checks will directly affect the amount of rework or product loss when a critical-limit deviation is found. In all cases, the checks must be performed in time to ensure that irregular product is isolated before shipment.

When it is not possible to monitor a CCP on a continuous basis, it is necessary for the monitoring interval to be short to detect possible deviations from critical limits or operating limits.

The frequency of noncontinuous monitoring should be partially determined from historical knowledge of the product and process. Questions that will help determine the correct frequency include:

- How much does the process normally vary (i.e., how consistent is the data)? If the data varies considerably, the time between monitoring checks should be short.
- How close are the normal values to the critical limit? If the normal values are close to the critical limit, the time between monitoring checks should be short.
- How much product is the processor prepared to risk if the critical limit is exceeded?

Examples of potential noncontinuous monitoring include:

- Temperature checks of batter on a breading line at specified time intervals.
- Routine, daily checks for properly iced fish.
- Periodic sensory examination for decomposition in histamine-forming seafood.

Overhead 10

Notes:

Who will Monitor?

• *Who will Monitor?*

Assignment of the responsibility for monitoring is an important consideration when developing a HACCP plan.

Individuals assigned to CCP monitoring can be:

- Line personnel,
- Equipment operators,
- Supervisors,
- Maintenance personnel or
- Quality-assurance personnel.

Monitoring by line personnel and equipment operators can be advantageous since they are continuously viewing the product and/or equipment and can readily observe changes from the norm. Also, including line personnel in HACCP activities has the advantage of building a broad base of understanding and commitment to the HACCP program.

Those responsible for monitoring a CCP should:

- Be trained in the CCP monitoring techniques.
- Fully understand the importance of CCP monitoring.
- Have ready access to the monitoring activity.
- Accurately report each monitoring activity.
- Immediately report critical-limit infractions so that immediate corrective actions (Principal 5) can be taken.

The monitor's duties should require that all unusual occurrences and deviations from critical limits be reported immediately to make sure adjustments and corrective actions are made in a timely manner. All records and documents associated with CCP monitoring must be signed or initialed by the person doing the monitoring.

The monitoring procedures for each of the critical limits identified in Principle 3 for the IQF cooked-shrimp are contained in the attached HACCP plan.

Who will perform the monitoring will be recorded in column 7 of the HACCP plan form.

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EXAMPLE: For Illustrative Purposes Only* - HACCP Plan Form
ABC Shrimp Co.
Cooked Shrimp

(1) Critical Control Point (CCP)	(2) Significant Hazards	(3) Critical Limits for each Control Measure	(4)			(5) Monitoring		(7) Who	(8) Corrective Action(s)	(9) Verification	(10) Records
			What	How	Frequency	How					
Cooker	Survival of bacterial pathogens	Cook at 212 F for three minutes (to achieve minimum internal temperature of 145 F for 15 seconds)	Cook temperature Cook time	<ul style="list-style-type: none"> Monitor temperature with a continuous temperature recorder Monitor cook time by timing the movement of a block placed on belt through cooker. 	<ul style="list-style-type: none"> Temperature monitored continuously with hourly visual checks. Cook time monitored hourly. 	<ul style="list-style-type: none"> Quality-control supervisor will program the continuous-recording thermometer. Cook will perform the hourly checks. 					
Firm Name: <u>ABC Shrimp Co.</u>			Product Description: <u>Cooked and frozen, headless, peeled and deveined shrimp</u>								
Firm Address: <u>Anywhere, USA</u>			Method of Storage and Distribution: <u>Frozen</u>								
Signature: _____			Intended Use and Consumer: <u>Thaw and serve, general public</u>								
Date: _____											

*Models may not be fully consistent with guidance contained in FDA's Fish and Fishery Products Hazards and Control Guide.

EXAMPLE: For Illustrative Purposes Only* - HACCP Plan Form
ABC Shrimp Co.
Cooked Shrimp

(1) Critical Control Point (CCP)	(2) Significant Hazards	(3) Critical Limits for each Control Measure	(4)			(6) Monitoring	(7) Who	(8) Corrective Action(s)	(9) Verification	(10) Records
			What	How	Frequency					
Weigh/Pack Label	Allergic-type reaction from undeclared sulfiting agent	All product containing residual sulfiting agent must declare presence	<ul style="list-style-type: none"> At weigh/pack/label stage, check for "contains sulfite" declaration. 	<ul style="list-style-type: none"> Examine all labels issued at packing line and match declaration with product identity. 	<ul style="list-style-type: none"> One label each time a label roll is replaced 	<ul style="list-style-type: none"> Packing supervisor 	<ul style="list-style-type: none"> Dock master 			
			<ul style="list-style-type: none"> At receiving, sample each vessel of fresh shrimp to test for presence of sulfites. 	<ul style="list-style-type: none"> Rapid sulfite test 	<ul style="list-style-type: none"> Fresh shrimp, three-grab samples per vessel 	<ul style="list-style-type: none"> Dock master 				
			<ul style="list-style-type: none"> At receiving, supplier declaration for absence of sulfites for frozen shrimp. 	<ul style="list-style-type: none"> Observation of supplier declaration 	<ul style="list-style-type: none"> Frozen shrimp, check every shipment 	<ul style="list-style-type: none"> Dock master 				
<p><i>Note: In this example, results from product screening at the receiving step are a portion of the monitoring necessary to assure compliance with weigh/pack/label critical limits.</i></p>										

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