Chapter 11

Preparation of HACCP plan

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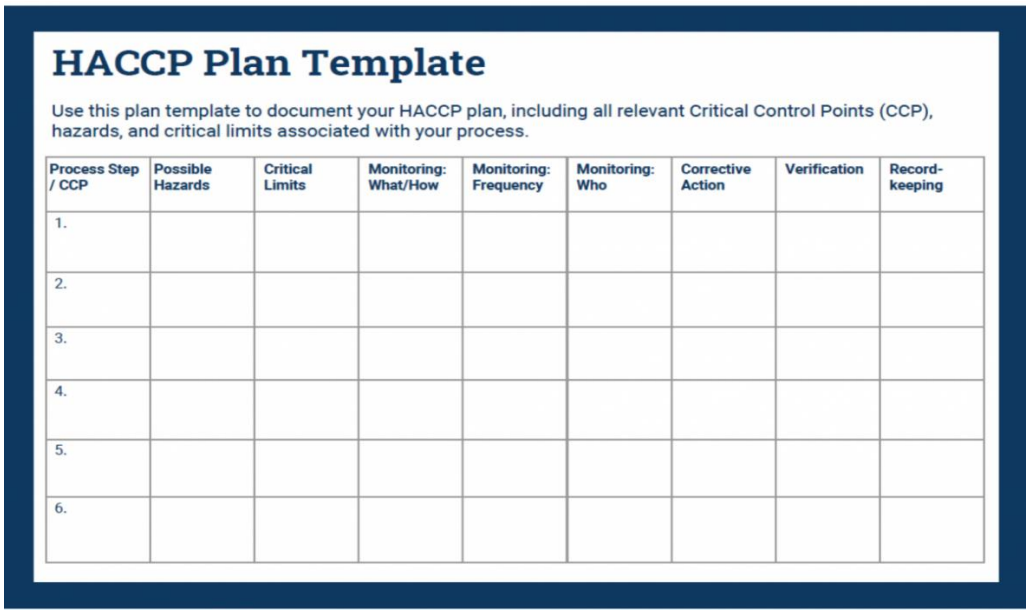
HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. **A different HACCP plan will be needed for each food product**, each processing method and each facility if the processing raises unique or individualized risks.*Writing a HACCP plan is a very crucial step in keeping control of food safety in the food industry.*

Creating a HACCP plan needs preparation and the correct mindset. A HACCP is a written plan that properly addresses the food safety risks of your food business, which requires focus and adequate knowledge about food safety and related manufacturing operations.

Making your own HACCP plan in-house promotes a sense of ownership and a general understanding of your food operations. In case of problems, you can resolve unexplained system failures if you know your plan in-depth. While making a HACCP plan from scratch can be tedious, some food companies seek the advice of independent experts such as food safety consultants from regulatory agencies in the food industry.

HACCP PLAN FORM

HACCP plan form is tool which helps to manage each CCPs. The planform will address the last five principals of HACCP. A typical planform is given in figure.



HACCP Plan Template

Use this plan template to document your HACCP plan, including all relevant Critical Control Points (CCP), hazards, and critical limits associated with your process.

Process Step / CCP	Possible Hazards	Critical Limits	Monitoring: What/How	Monitoring: Frequency	Monitoring: Who	Corrective Action	Verification	Record-keeping
1.								
2.								
3.								
4.								
5.								
6.								

Like in the worksheet, each planform should near the name and address of the production unit, name of the product, intended use of the product and target consumers and method of storage and distribution.

The plan form will help you to 1) set critical limits 2) establish monitoring procedures 3) determine corrective actions and 4) design records (to positively document that the process is in control) for identified hazards in each CCP.

The plan form has ten columns, the Column 1 in the HACCP Plan form contains the CCP's, which are identified using HACCP worksheet. Column 2 lists the hazards and critical limits are listed in column 3. Columns 4 to 7 are meant for entering monitoring procedures, in and the persons responsible for monitoring are entered. Column 8 details the corrective actions to be taken in case of any deviation. Column 9 lists the various verification procedures required to validate our HACCP plan and column 10details the relevant records which are to be maintained.

Critical Limit

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

A critical limit represents the boundaries that are used to ensure that an operation produces safe products. Each CCP must have one or more critical limits for each food-safety hazard. When the process deviates from the critical limit, a corrective action must be taken to ensure food safety.

How to establish Critical Limits:

Critical limit for the operation may not be available readymade. They have to be fixed by conducting tests and validating them with competent laboratories. These tests may be designed and conducted in association with reputed laboratories or by consulting scientific publication, regulatory guidelines, in house experiments etc.

General source	Examples
Scientific publications	Journal articles, food science texts, microbiology texts etc.
Regulatory guidelines	National/ International guidelines, BIS, EIA/MPEDA publications, tolerance and action levels, FDA or EU guidelines, tolerance and action levels
Subject experts	CIFT, CIBA, CMFRI, thermal process authorities, consultants, food scientists, microbiologists, universities etc.
Experimental studies with validated data	In house experiments, Accredited laboratories

A few examples of critical limits are given below

Hazard	CCP	Critical Limit
Microbial Pathogens	Cooking	85oC for 3 minutes for elimination if pathogens from shrimp
Microbial Pathogens	Drying	a_w<0.7
Microbial Pathogens	Acidification	Batch schedule- pH<2, time 28 h

We should understand that a variety of options are available for managing and controlling a hazard. Only experience and practicality will help you to select the best control measure that has to be adopted.

Monitoring:

Monitoring is the process by which hazard control is effected by ensuring the operations is well under critical limit. It is a planned sequence of observations or measurements to assess whether a CCP is under control. Monitoring also helps to produce an accurate record of operation, which will be useful verification.

Monitoring procedures can either be qualitative or quantitative, Sensory observation for decomposition is an example of a qualitative observation, whereas a temperature reading form a thermometer is a quantitative observation. Monitoring can be performed either in a continuous or in a periodic (non-continuous) basis. It is always desirable to have a continuous monitoring procedure, however, if it is non continuous, procedures should be reliably indicate that the hazard is under control. The means by which the observation is done should be given in the HACCP plan. Monitoring should be done on a real time basis, so that corrective actions can be taken in time, whenever deviations are observed.

Monitoring a CCP can be categorised into five viz. visual observations, sensory evaluation, physical measurement, chemical testing and microbiological examination. Visual monitoring needs no expensive equipment and may not even require highly specialized staff. Sensory evaluation can sometimes provide a quick indication of loss of control. If can be used to check the quality of incoming raw materials. Bad odours van also provide a quick indication of loss of control Physical measurements, such a temperature, pH, water activity, humidity can means to control a particular CCP. Rapid chemical tests (eg. Chlorine level in water) are useful as means of monitoring CCPs. Microbiological testing and detailed chemical analysis are of limited use in monitoring CCPs. It can be employed for the testing of raw materials before starting processing, and for testing critical finished products (eg. Ready to eat fish curry) before release. 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.

Components of Monitoring System

The monitoring procedure ensures that the required control measures are effective and hazards are kept below critical limits. This is done in the plan form by identifying following parameters:

- What will be monitored (Direct/Indirect). (Column4)
- 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)

What will be monitored

It can be a measurement of a product characteristic or a processing

- Measurement of boiler compartment temperature
- Measurement of the pH of pickle
- Measurement of conveyor belt speed

It can also a subjective measurement which involves observation of a control measure to manage hazard.

Examples

- Checking that a supplier's certificate accompanies a lot of raw material.
- Auditing the farm premises to check whether the fish farmer is using the permitted antibiotic and whether he applies it as per guidelines.

How Critical Limit and Control Measures will be monitored?

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

Examples

- Time and temperature using a calibrated thermometer and stopwatch.
- Water Activity (a_w) using a calibrated RH meter
- Acidity (pH) using a calibrated pH meter
- Visual observation for subjective evidences like supplier's guarantee, freshness using sensory evaluation *etc.*

Frequency of monitoring

As mentioned above, monitoring can be continuous or non-continuous. Where possible, continuous monitoring should be used. Continuous monitoring is possible for many type of physical and chemical parameters.

Examples of continuous monitoring include:

- The time and temperature of a batch cooker process for IQF shrimps may be continuously monitored and recorded on a temperature-recording chart.
- Checking for presence of metals in frozen shrimp blocks using a metal detector.

Examples of non-continuous monitoring include:

- Routine. Daily checks for temperature of stored fish waiting for processing.
- Periodic sensory examination for decomposition in histamine forming seafood

Who will do the Monitoring?

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,
- Technologist

Corrective Actions

Corrective actions are predetermined procedures to be adopted when critical limits at a CCP is compromised. These procedures should restore process control and state clearly the method of disposing the product produced during the deviation.

An effective corrective action plans must:

- Correct and eliminate the cause of the noncompliance to assure that the CCP is brought back under control.
- Segregate, assess and determine the disposition of the noncompliant product.

All corrective actions taken must be documented. Documentation will assist the firm in identifying recurring problems so that the HACCP plan can be modified. Additionally, corrective action records provide proof of product disposition.

An example of disposition procedure for an affected product is given below:

- Isolating and holding product for safety evaluation. If the product was found to be safe, release the product.
- Diverting the affected product or ingredients to another line where deviation would not be considered critical.
- Reprocessing.
- Destroying product.
- It may be necessary to determine the cause of the deviation to prevent future recurrence. A critical limit failure that was not anticipated or reoccurs should result in an adjustment to the product or process or a re-evaluation of the HACCP plan.

Verification Procedures

Verification are those activities, other than monitoring, that determine the validity of the HACCP plan and that verify the system is operating according to the plan. The purpose of the HACCP plan is to prevent food-safety hazards, and the purpose of verification is to provide a level of confidence that the plan is based on solid scientific principles, is adequate to control the hazards associated with the product and process, and is being followed.

Parts of Verification:

- Validation
- CCP verification activities
  - Calibration of monitoring devices
  - Calibration record review
  - Targeted sampling and testing
  - CCP record review
- HACCP system verification
  - Observations and reviews
  - Microbiological end-product testing
- Regulatory agencies

Validation:

The element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP plan, when properly implemented, will effectively control the hazards. Validation can be performed by the HACCP team or by an individual qualified by training or experience. Validation involves a scientific and technical review of the rationale behind each part of the HACCP plan from hazard analysis through each CCP verification strategy.

Verification of CCPs Verification activities developed for CCPs are essential to ensure that the control procedures used are properly functioning and that they are operating.

- **Calibration**

Verification activities at CCPs include calibration of monitoring devices

To ensure the accuracy of the measurements taken with traceability. Calibration is conducted

To verify that monitoring results are accurate.

Calibration of CCP monitoring equipment is fundamental to the successful implantation and operation of the HACCP plan. If the equipment is out of calibration, then monitoring results will be unreliable, Frequency of calibration should also be influenced by equipment sensitivity

- **Calibration Record Review**

  Reviewing the equipment calibration records involves checking the dates and methods of calibration and the test results

- **Targeted Sampling and Testing**

  Verification may also include targeted sampling, testing and other periodic activities, Vendor compliance may be checked by targeted sampling when receipt of material is a CCP and purchase specifications are relied on as critical limits. Typically, when a monitoring procedure is not as stringent as desire, it should be coupled with a strong verification strategy.

- **CCP Record Review**

At least two types of records are generated at each CCP: monitoring and corrective action. These records are valuable management tools, providing documentation that CCPs are operating within established safety parameters and that deviations are handled in a safe and appropriate manner. However, records alone are meaningless unless someone in a supervisory capacity reviews then on a periodic basis to "verify" that the HACCP plan is being followed.

HACCP System Verification

In addition to the verification activities for CCPs, strategies should be developed for scheduled verification of the complete HACCP system. The frequency of the system wide verification should be yearly (at a minimum) or whenever there is a system failure or a significant change in the product or process. The HACCP team is responsible for ensuring that this verification function is performed. Often, the HACCP team will contract an independent third party to conduct the system-wide verification.

Activities

- **System Verification Activities**

Systematic verification activities include on-site observations and record reviews. Reviews are usually performed by an unbiased person who is not responsible for performing the monitoring activities. System verification should occur at a frequency that ensures the HACCP plan is being followed continuously. This frequency depends on a number of conditions, such as the variability of the process and product.

- **End-product Microbiological Testing in HACCP Verification**

  As explained in Chapter2, microbiological testing is ineffective for routine monitoring by can be used as a verification tool. Microbiological testing can be used to determine (e.g., during verification audits or on periodic basis that the overall operation is under control)

  Record-keeping procedures

  Accurate record keeping is an essential part of a successful HACCP program. Records provide documentation that the critical limits have been met or that appropriate corrective actions were taken when the limits were exceeded. Likewise, they provide a means of monitoring so that process adjustments can be made to prevent a loss of control.

  Four kinds of categories are kept as part of the HACCP system.

  1. HACCP plan and support documentation used in developing the plan
  2. Records of CCP monitoring
  3. Records of corrective action
  4. Records of verification activities

Conclusion

HACCP was designed to prevent hazardous products from leaving the manufacturing or processing facility. The key to the success of HACCP is employee training, behaviour and attitude. Some companies are under the misconception that they already have al HACCP plan because they are adequately controlling all areas where safety could be compromised. The difference is that, rather than monitoring isolated processing steps, an HACCP approach controls the entire production process as an integrated system.

Although HACCP provides insurance that fish is safe, there is no way to completely eliminate all hazards. HACCP is most effective when used with other control systems. Total Quality Management programs and Standard Operating Procedures should be used along with HACCP to improve product safety, product quality, and plant productivity by providing intimate knowledge of the production process, production environment and processing equipment.