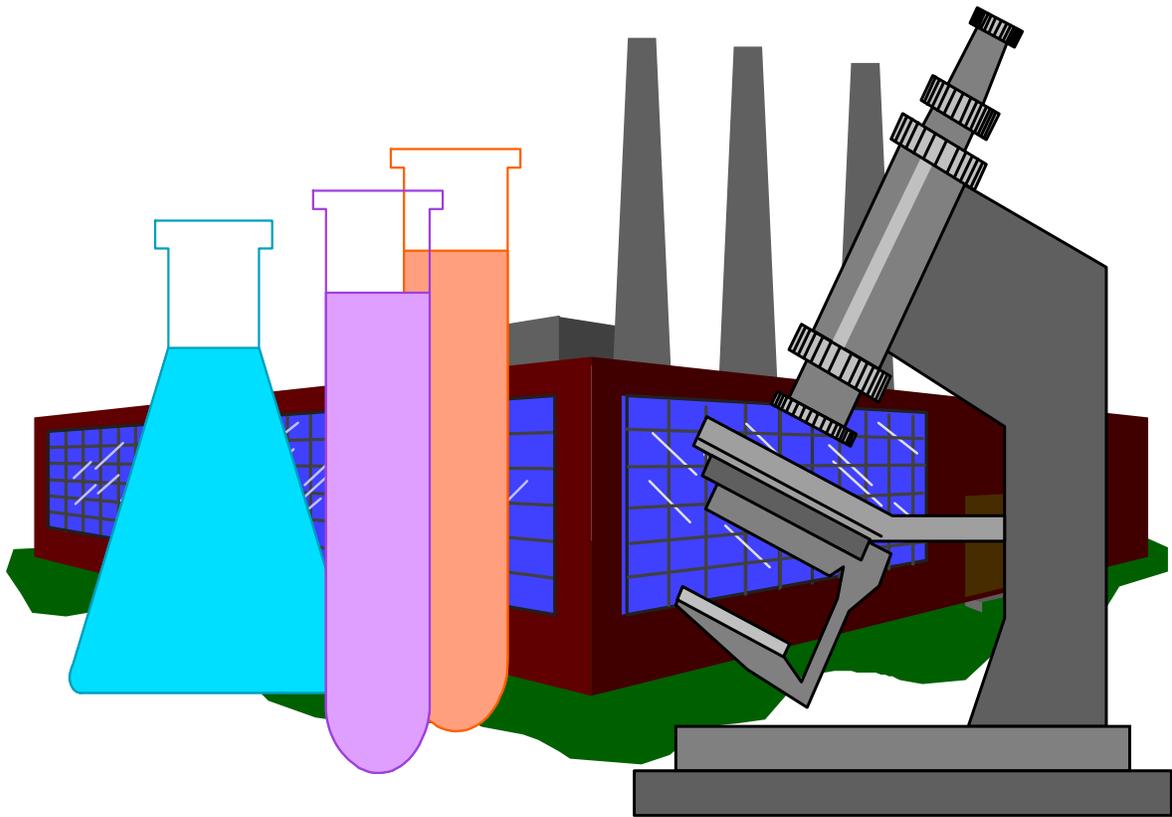


# HACCP



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# HACCP

PREPARED BY DIANE E WIGGAN

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# CHAPTER ONE:

## WHAT IS HACCP

HACCP is- an abbreviation for **Hazard Analysis Critical Control Point**.  
a systematic, multi-disciplined, task force way of working.

HACCP is based on the principle that food safety issues can be eliminated or minimised by prevention during production rather than by detection in finished product.

The concept of HACCP is to assure food safety through development, implementation, and effective management of a functional process hazard control program.

The HACCP system identifies specific hazards and preventative measures for their control.

Any HACCP system is capable of accommodating change, such as changes in equipment , processing procedures or technological developments.

HACCP can be applied throughout the food chain from the primary producer to the final consumer.

Benefits of a HACCP system include: -enhanced food safety.  
-better use of resources.  
-more timely response to problems.

Successful application of HACCP requires the full commitment and involvement of management and the workforce, as well as a team approach.

The HACCP team should include appropriate experts such as production personnel, microbiologists, chemists and engineers according to the particular study.

The application of HACCP is compatible with the implementation of quality management systems such as ISO 9000.

In brief, HACCP is applied through taking the following easy steps:

- Look at the process/product from start to finish.
- Decide where hazards could occur.
- Put controls in place and monitor them.
- Write it all down and keep records.
- Ensure that it continues to work effectively.

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## **CHAPTER TWO: HISTORY OF HACCP**

The HACCP concept was developed in the 1960's by the National Aeronautics and Space Administration[NASA] and Natick Laboratories.

HACCP was developed as an attempt to apply a zero defect program to food processing i.e. a "Right First Time" management system.

HACCP was originally developed as a microbiological safety system, as it was vital to ensure the safety of food for the astronauts, and later other issues such as metal, glass and chemical adulteration were included as potential food-borne dangers to their health.

At this time most food safety and quality systems were based on end product testing, but it was realised that this could only fully assure safe products through testing 100% of the product a method which obviously could not have worked as all product would have been used up. Instead it became clear that a preventative system was required which would give a high level of food safety assurance, and the HACCP System was born.

## CHAPTER THREE:

### WHY USE HACCP

The traditional approach to producing safe food has been quality control. This involves inspection of ingredients and processes together with a limited amount of end [finished] product testing. There are however limitations with inspection and testing. 100% inspection means that every single unit manufactured would have to be inspected. When this is applied to biological and chemical hazards, there would be no product left to sell as biological and chemical testing is almost always destructive.

More inspection and testing doesn't ensure more quality. Effective inspection relies on a good sampling plan. Sampling products to detect a hazard relies on two key factors:

1. The ability to detect the hazard reliably with an appropriate analytical technique.
2. The ability to trap the hazard in the sample chosen for analysis.

The ability to trap a hazard in a sample depends on:

1. Distribution of hazard in the batch.
2. The frequency at which the hazard occurs in the batch.

Therefore a preventative system which gives a high level of food safety assurance is needed, such as HACCP. HACCP changes retrospective quality control into preventative quality assurance. Some of the benefits of HACCP are:

- 1) A proven system- gives confidence that food safety is being effectively managed.
- 2) Helps to maintain focus on food product safety as top priority.
- 3) Allows for planning to prevent things going wrong, rather than waiting for problems to control.
- 4) Gives customers confidence in the safety of the operation.
- 5) Most effective method of maximising product safety.
- 6) A cost effective system which targets resource to critical areas of production, thereby reducing the risk of manufacturing and selling unsafe products.
- 7) Defines and conveys the company quality objectives, policies and practices.
- 8) Provides for early detection of hygiene deficiencies.
- 9) Facilitates training of new employees.
- 10) Eliminates informal instruction.
- 11) Provides a basis for system audits to be conducted.

The application of HACCP ensures that all the aspects which may affect food safety and quality, are systematically considered and the procedures required can then be specified within the quality system.

HACCP is the precursor of an effective quality system, such as Total Quality Management [TQM] in that it identifies what needs to be included in the Quality System and as importantly, it will identify what controls are not needed.

## CHAPTER FOUR:

### SETTING UP AND CONDUCTING A HACCP STUDY

The keys to success of the HACCP concept are:

1. Have in-depth knowledge of the process so that critical points necessary for producing a safe product can be identified.
2. Establish the critical points and determine the best way to control and document these points on an ongoing basis.
3. Keep the number of critical control points [CCP's] to a minimum so that the system does not become burdened with a complex, cumbersome network that can become outdated when small changes are made.
4. Review the HACCP program with key personnel semi-annually to ensure that the critical points for product safety are understood and followed.

A HACCP plan should be formulated for each specific product. The following table provides a summary of the total HACCP plan with the different principles and the stages applicable to the different principle. A detailed discussion of these individual topics then follows.

| PRINCIPLES   | STAGES  |
|--|---|
| 1. Conduct a hazard analysis.  | 0. Total management commitment.<br>1. Select HACCP team.<br>2. Define terms of reference.<br>3. Describe the product.<br>4. Identify intended use.<br>5. Construct a flow diagram.<br>6. On-site verification of flow diagram.<br>7. Identify all hazards at each stage and describe preventative measures for their control. |
| 2. Identify CCP's in the process.  | 8. Apply HACCP decision tree to each step in order to identify CCP's.   |
| 3. Establish critical limits for preventative measure associated with each identified CCP. | 9. Establish target level[s] and tolerance for each CCP.  |
| 4. Establish CCP monitoring requirements.  | 10. Establish a monitoring system for each CCP.   |
| 5. Establish corrective actions when monitoring indicates a deviation.                     | 11. Establish corrective plan of action.  |
| 6. Establish record keeping procedure.   | 12. Establish record keeping and documentation.   |
| 7. Establish procedures for verification - HACCP is working correctly.                     | 13. Verification.<br>14. Review the HACCP plan.   |

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## GUIDELINES TO ORGANISING THE HACCP PLAN:

1. Designate a person responsible for the HACCP plan , and members of the HACCP team .
2. Organise HACCP within and as part of the company quality assurance policy and program.
3. List the target food products, describe each product, list raw materials and ingredients, and prepare a preliminary flow diagram.
4. Document the hazard analysis and risk categories associated with the products, their ingredients, and the hazards in the entire product food chain [Principle 1 ].
5. Develop individual flow diagrams for each product that document the location and type of CCP's for identified hazards [Principle 2 ].
6. Document description of each CCP, including the type of hazard, procedures or processes to control the hazard, and definition of the critical limits or tolerances that apply to each CCP [Principles 2 & 3].
7. Document monitoring procedures for the CCP's and critical limits, monitoring frequency, and person(s) responsible for specific monitoring activities [Principle 4].
8. Document deviation procedures for each CCP that specify action to be taken if monitoring determines that a CCP is out of control. Action must include safe disposition of affected food and correction of procedures or conditions that caused the out-of-control situation [Principle 5].
9. Develop and document record-keeping systems for the HACCP system using Principle 6. All records are to be signed off by a responsible official of the company.
10. Develop and document verification procedures based on Principle 7. Designate responsible personnel to conduct verification of compliance with the HACCP plan and system on a scheduled basis. Designate those who are not generally involved in the line HACCP functions (such as QA).
11. Document procedures for revision and updating of the HACCP plan any time there is a change of products, manufacturing conditions, evidence of new potential or actual hazard risks, or any other reason that may influence the safety of the product(s).

## ***PRINCIPLE 1: CONDUCT A HAZARD ANALYSIS***

### *STAGE 0: OBTAIN MANAGEMENT COMMITMENT*

### *STAGE 1: SELECT THE HACCP TEAM*

It is important to remember that HACCP is not carried out by one person alone but is the result of a multi-disciplinary team effort - the HACCP team. Always make management part of the team if they are close enough to the operation. It is recommended that as a minimum the core HACCP team consists of the experts (expert meaning knowledge and experience) from the following areas:

- |                        |  |
|------------------------|--|
| QA/QC Specialist:      | An individual who understands the microbiological, chemical and physical hazards and associated risks for the products. This can be a QA/QC manager, microbiologist or chemist as appropriate.                                       |
| Production Specialist: | An individual who has responsibility for, or is closely involved with the process under study. It is essential that this individual is able to contribute details of what actually happens on the production line during all shifts. |
| Engineer:              | An individual who has a working knowledge of the hygienic design and engineering operation of the equipment under study.   |
| Others:                | Other relevant specialists e.g. buyers, operators may be co-opted onto the team as necessary.  |

In terms of team size, between 4- 6 people is a good number.

There may be more than one HACCP team if desired e.g. one for each different department.

Personnel attributes of team members should include:

- Being able to evaluate data in a logical manner.
- Being able to analyse problems effectively and solving them permanently, treating the cause not the symptom of the problem.
- Being creative - looking outside the team and the company for ideas.
- Being able to get things done - make recommendations happen.
- Communication skills - the HACCP team must be able to effectively communicate both within the team and without, across all levels of the company.
- Leadership abilities.

### *STAGE TWO : DEFINE TERMS OF REFERENCE*

A HACCP study should be carried out on a specific product/process line and in order for the study to proceed quickly, it is essential that the terms of reference be outlined clearly at the outset, i.e. define whether the HACCP study should consider microbiological, chemical or physical hazards, or any combination of these. The terms of reference must also clearly state

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whether the product is to be judged safe at the point of consumption, or at the point of manufacture, with clear storage and use instructions.

It is recommended when introducing HACCP for the first time to keep the terms of reference simple, i.e. restricted to one or two types of hazards and product safety issues only.

The following questions may help with describing the terms of reference:

- Should all types of hazards be covered initially or just one type?
- Should the study cover the whole process or one specific part?
- Should the HACCP study stop at the end of the production line or continue through distribution, retail and consumer handling?

### *STAGE THREE : DESCRIBE THE PRODUCT*

A full description of the product or intermediate product should be drawn up and should be defined in terms of:

- Composition.
- Structure.
- Processing.
- Packaging system.
- Storage and distribution conditions.
- Required shelf life.
- Instructions for use.

### *STAGE FOUR : IDENTIFY INTENDED USE*

The intended use of the product by the consumer and the consumer target groups should be defined. It's function is to focus attention on the likely uses or abuses of the product after it leaves the control of the food producer.

Decide whether product is a high risk product i.e. no further processing or re-heating will take place.

Decide whether product will be consumed by high risk groups i.e. infants, elderly, immunocompromised.

### *STAGE FIVE : CONSTRUCT A FLOW DIAGRAM*

Prior to the hazard analysis, it is necessary to carefully examine the product/process under study and produce a flow diagram around which the study can be based.

### *STAGE SIX . ON-SITE VERIFICATION OF FLOW DIAGRAM*

This involves checking the flow diagram against what actually happens in the factory. This includes verification during the night shift and weekend running of the operation.

**STAGE SEVEN : IDENTIFY HAZARDS AT EACH STAGE AND DESCRIBE PREVENTATIVE MEASURES FOR THEIR CONTROL**

Hazard : A biological, chemical or physical property which may cause food to be unsafe for human consumption.

Hazards can be divided into the following categories :

PHYSICAL: glass , stones , plastic , metal , wood , pests.

CHEMICAL: cleaning chemicals , pesticides.

BIOLOGICAL: bacteria.

*Hazard analysis and assignment of risk categories:*

1. Food should be ranked according to hazard characteristics A through F, using a plus (+) to indicate a potential hazard. The number of plusses determine the risk category. If a product falls under hazard class A it should automatically be considered risk category VI.

Hazard A      This hazard applies to a special class of non-sterile products designated and intended for consumption by at -risk populations, e.g. infants, the aged or immuno-compromised individuals.

Hazard B      Products that fit this hazard contain “sensitive ingredients” in terms of microbial hazards.

Hazard C      Foods in this hazard group are manufactured by a process that does not contain a controlled processing step that effectively destroys harmful bacteria.

Hazard D      Foods that fit this hazard are subject to recontamination after processing and before packaging.

Hazard E      With this hazard there is substantial potential for abusive handling in distribution or in consumer handling that could render the product harmful when consumed.

Hazard F      Foods in this group have not been subjected to a terminal heat process after packaging or when cooked in the home.

2. The following risk categories are based on ranking by hazard characteristics:

Category 0      No hazard.

Category I      Food products subject to one of the general hazard characteristics.

Category II      Food products subject to two of the general hazard characteristics.

Category III      Food products subject to three of the general hazard characteristics.

Category IV      Food products subject to four of the general hazard characteristics.

Category V      Food products subject to all five general hazard characteristics: Hazard classes B , C , D , E and F.

Category VI      A special category that applies to non-sterile products designated and intended for consumption by at-risk groups.

## QUESTIONS TO BE CONSIDERED IN A HAZARD ANALYSIS

### Ingredients / Raw materials

- Does the food contain any sensitive ingredients that may present microbiological hazards e.g. Salmonella; chemical hazards e.g. antibiotic residues, pesticide residues or physical hazards e.g. stones, glass, metal?
- Is potable water used in formulating or in handling the food?
- What hazards are likely to be present in each raw material and are these likely to be of concern to the process and/or product?
- Are any of the raw materials themselves hazardous if excess amounts are added?

Intrinsic factors [physical characteristics and composition of the food during and after processing e.g. pH, water activity, preservatives].

- Which intrinsic factors of the food must be controlled to assure food safety?
- Does the food permit the survival or multiplication of pathogens and/or toxin formation in the food during processing?
- Will the food permit survival or multiplication of pathogens and/or toxin formation, during subsequent steps in the production chain?

Procedures used for processing.

- Does the process include a controllable processing step that destroys pathogens? Consider both vegetative cells and spores.
- Is the product subject to recontamination between processing steps e.g. after pasteurising, packaging?

Microbial content of the food.

- Is the food commercially sterile e.g. low acid canned food?
- Is it likely that the food will contain viable spore-forming or non-spore-forming pathogens?
- What is the normal microbial content of the food?
- Does the microbial population change during the normal time the food is stored, prior to consumption?
- Does the subsequent change in microbial population alter the safety of the food?

Facility design.

- Does the layout of the facility provide an adequate separation of raw materials from finished product, if this is important to food safety?
- Is positive air pressure maintained in product packaging area?
- Is the traffic pattern for people and moving equipment, a significant source of contamination?

#### Equipment design.

- Will the equipment provide the time/temperature control that is necessary for safe food?
- Is the equipment properly sized for the volume of food that will be processed?
- Can the equipment be sufficiently controlled so that the variation in performance will be within the tolerances required to produce a safe product?
- Is the equipment reliable or is it prone to frequent breakdowns?
- Is the equipment designed so that it can be cleaned and sanitised effectively?
- Is there a chance for product contamination with hazardous substances e.g. glass, detergents, lubricant?
- What product safety devices are used to increase consumer safety and where are they placed? e.g. metal detectors, filters, screens, thermometers.

#### Packaging.

- Does the method of packaging affect the multiplication of microbial pathogens?
- Does the package include instructions for the safe handling and preparation of the food by the end user?
- Is the packaging material resistant to damage, preventing the entrance of microbial contamination?

#### Sanitation.

- Can sanitation impact on the safety of food that is being processed?
- Can the facility and the equipment be cleaned and sanitised to permit the safe handling of food?
- Is it possible to provide sanitary conditions consistently and adequately to assure safe foods?

#### Employee health, hygiene, and education.

- Can employee health or personal hygiene practises impact upon the safety of the food being processed?
- Do the employees understand the process, and the factors they must control, to assure the production of safe food? What hygiene training do they have?
- Will the employees inform management of a problem which could impact on the safety of the food being processed?

#### Conditions of storage between packaging and the end user.

- What is the likelihood that the food will be improperly stored at the wrong temperature?
- Would an error in storage lead to a microbiologically unsafe food?

#### Intended use.

- How will the food be prepared and consumed?
- Are their likely to be leftovers?

#### Intended consumer.

- Is the food intended for the general public?

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#### HANDLING HAZARD INFORMATION:

- Using the flow diagram as a guide the HACCP team should list all the biological, chemical and physical hazards that may be reasonably expected to occur at each step and describe the preventative measures that can be used to control these hazards. The hazards must be of such a nature that their elimination or reduction to acceptable levels is essential for the production of safe food.
- No attempt is made at this stage to determine CCP's.
- Hazards and their causes should be brainstormed by the HACCP team.

#### THE HAZARD ANALYSIS CHART:

- All the information obtained for hazards at each stage, must be recorded on a hazard analysis chart. Refer to chart 1.

#### DESCRIBING PREVENTATIVE MEASURES FOR CONTROLLING HAZARDS:

- Preventative measures are those actions and activities that are required to eliminate hazards or reduce their occurrence to acceptable levels. More than one preventative measure may be required to control a specific hazard.
- Control measures need to be underpinned by detailed specifications and procedures to ensure their effective implementation [e.g. detailed cleaning schedules, personnel hygiene policy, ingredient specifications].
- When evaluating preventative measures it is necessary to consider what you already have in place.

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## **PRINCIPLE 2: IDENTIFY CCP's IN THE PROCESS**

### *STAGE 8: APPLY HACCP DECISION TREE TO EACH STEP IN ORDER TO IDENTIFY CCP's*

A critical control point is a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels.

To assist in finding where the correct CCP's should be, a tool is available known as the CCP decision tree.

The CCP decision tree is a logical sequence of questions to be asked for each hazard at each process step. The answers to the questions lead the HACCP team to decisions determining which process steps are CCP's.

(See page 16 for the decision tree.)

#### *Question 1. Is there a hazard at this process step?*

This question helps to focus the HACCP teams minds on the specific process step in question. Sometimes a hazard identified during brainstorming turns out not to be a real hazard when challenged here. If there is a real hazard move on to question 2.

#### *Question 2. Do preventative measures exist for the identified hazard?*

If the answer is NO (i.e. control measures are not in place for the hazard) the team must ask a supplementary question to determine if control is necessary at this step for product safety. If control is not necessary then the step is not a CCP and the team should apply the decision tree to the next identified hazard. If the answer to the supplementary question is YES then it is necessary to modify the step or process or product so that control is obtained over the specified hazard. During the analysis, the team may recommend a number of changes to the step, process or product that would allow control to be achieved and the analysis to proceed.

If the answer is YES the team should proceed to question 3.

#### *Question 3. Is the step specifically designed to eliminate or reduce the likely occurrence of the hazard to an acceptable level?*

The team should use the flow diagram data to answer this question for each process step. The question will identify those processing steps that are designed to eliminate or reduce the hazard to an acceptable level.

When considering this question for microbiological hazards, the team should take account of the appropriate product technical data (e.g. pH, type of preservative, particle size etc.) as well as the physical process being applied. Pasteurisation, cooking and aseptic packaging are some examples of process steps that could be microbiological CCP's in the right context.

If the team consider the answer to question 3 to be YES then the process step is a CCP. The team must identify precisely what is critical (is it the ingredient, process step, the location or practise/procedure associated with the process step), before applying the decision tree to the next process step.

If the answer to question 3 is NO then question 4 must be considered for the same process step.

**Question 4. Could contamination occur at or increase to unacceptable levels?**

The team should consider the following:

Are the ingredients used likely to be a source of the hazard under study?

Is the process step carried out in an environment which is likely to be a source of the hazard?

Is cross contamination from personnel or another product/ingredient possible?

Are there areas in equipment, in which product can stagnate and allow increase of the hazard to unacceptable levels?

Are the cumulative time/temperature conditions such that the hazard will increase in the product to unacceptable levels?

If after taking account of all the factors, the team are confident that the answer to question 4 is NO, then this step is not a CCP and the team should apply the decision tree to the next process step. If the answer is YES, then question 5 should be considered for the same process step.

**Question 5. Will a subsequent step or action eliminate or reduce the hazard to an acceptable level?**

The team must proceed sequentially through the remaining process steps of the flow diagram and determine if any subsequent steps will eliminate the hazard or reduce it to an acceptable level. Correct consumer use must be included here if the product is being judged "safe at the point of consumption".

Question 5 plays an important role, because if it is not done properly, every process step in an operation might be regarded as critical leading to too many CCP's for an effective, practical control system.

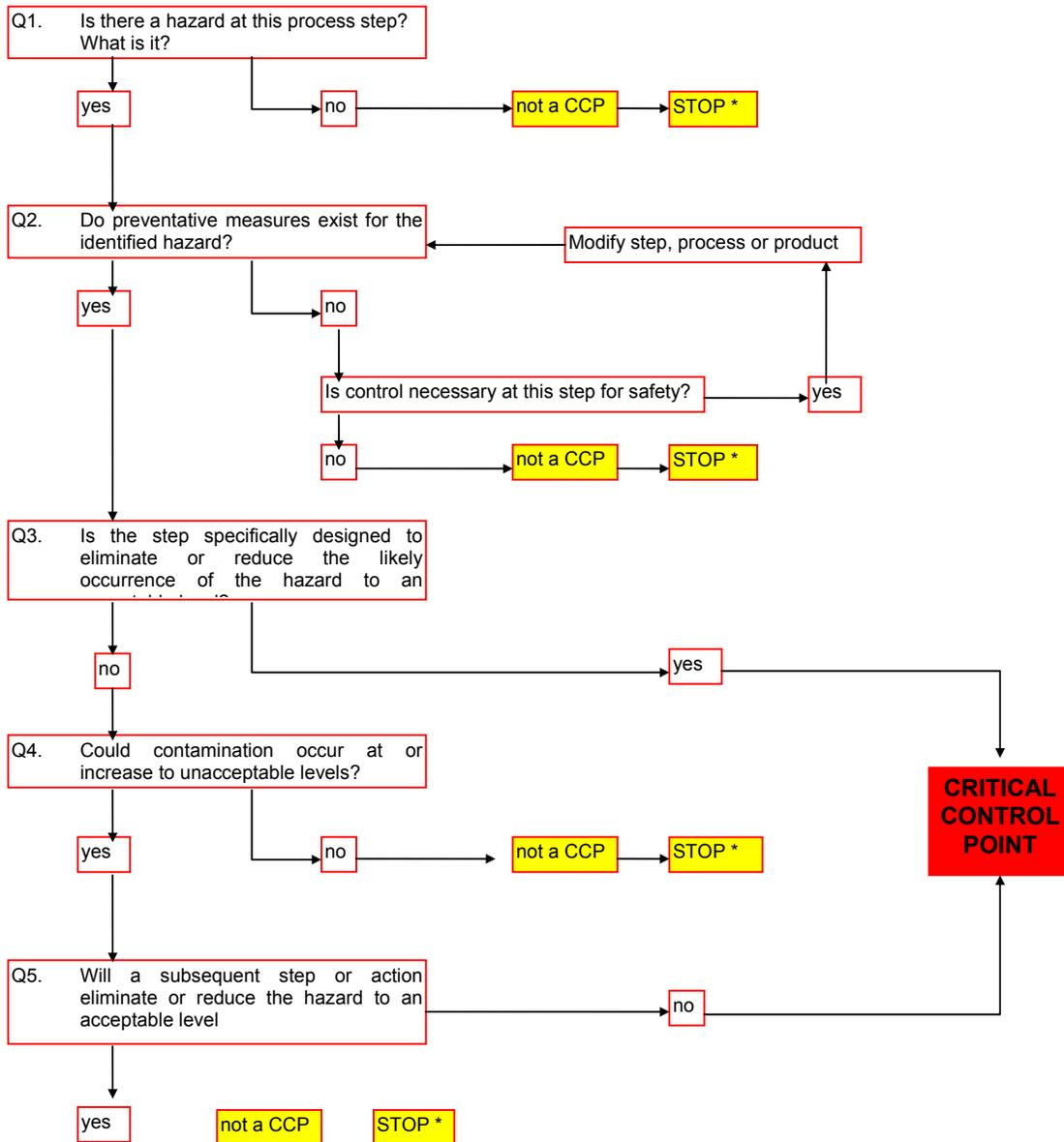
If the team judge the answer to question 5 is YES, they should then apply the decision tree to the next hazard, or to the next process step.

If the answer to question 5 is NO then a CCP has been identified. In this case the team must identify precisely what is critical, i.e. is it a raw material, a process step, the location or a practise/procedure associated with the process step. When identified, the decision is made as to whether the existing control measure is enough.

When working through the different hazards by means of the decision tree, it is important to record the results of the different questions. This is done by means of a "process step decision matrix".

| <b>Process step and hazard</b>               | <b>Q1</b> | <b>Q2</b> | <b>Q3</b> | <b>Q4</b> | <b>Q5</b> | <b>CCP</b> | <b>HACCP team notes</b> |
|--|-----------|-----------|-----------|-----------|-----------|------------|-------------------------|
| Pasteurisation<br><i>Correct temperature</i> | Y         | Y         | Y         | -         | -         | Y          | Temp/Time Control       |

## THE CCP DECISION TREE



\* Stop and proceed with the next hazard at the current step or the next step in the described process.

## **PRINCIPLE THREE: ESTABLISH CRITICAL LIMITS FOR PREVENTATIVE MEASURE ASSOCIATED WITH EACH IDENTIFIED CCP.**

### *STAGE 9: ESTABLISH TARGET LEVEL(S) AND TOLERANCE FOR EACH CCP.*

**CRITICAL LIMIT:** An absolute tolerance value which must be met for each control measure at a CCP. Values outside the critical limits indicate a deviation and potentially unsafe product.

**TARGET LEVEL:** A value within the critical limits which can be used to take action and prevent the occurrence of a deviation.

Since the critical limits define the boundaries between safe and unsafe product, it is vital that they are set at the correct level for each criteria. Critical limits will not necessarily be the same as your existing processing parameters.

In order to monitor the CCP, target levels and tolerances must be specified for each preventative measure. In some cases more than one target level and tolerance will be elaborated at a particular step.

The specific target level(s) and tolerances set for each CCP/control measure must represent some measurable parameter related to the CCP. Those that can be measured relatively easily and quickly are preferred. Examples of these include assessing temperature, time, moisture level, pH, water activity, chemical analyses, visual assessments of products and management/operational practises.

Types of critical limits:

*Chemical limits-* related to chemical hazards e.g. pH.

*Physical limits-* related to physical hazards e.g. temperature, time, intact sieves for retention of foreign bodies.

*Microbiological limits:-* these should be avoided as part of a HACCP system apart from the control of non-perishable raw materials. The reasons are:

- Time consuming analysis- does not allow instant action when deviation occurs.
- Micro-organisms are unevenly distributed in the product.

After determining the actual limits for each of the CCP's it is added to the HACCP control chart. Refer to chart 2.

The hazard analysis will identify one or more parameters that need to be controlled at the critical point. There may not always be suitable methods for measuring these parameters in a control situation. If a sampling method is used many samples may need to be taken for analysis and rapid response is needed. Ideally, this extends to continuous monitoring by an in-line instrument that may then be coupled back with control gear to provide continuous control.

The number of parameters that can be measured in-line in food systems is relatively limited - temperature, moisture, flow rate, mass flow, density, colour. The number of parameters that can be measured off-line with a response time of 15 min or less is larger, but still limited.

It is, therefore, required to demonstrate that the parameter to be controlled correlates with another parameter or group of parameters that can be measured. This is most likely to occur when all the other variables in the system are under control.

Commonly there is a need to correlate survival, death or growth of micro-organisms with parameters such as time/temperature and pH.

## **PRINCIPLE 4: ESTABLISH CCP MONITORING REQUIREMENTS.**

### *STAGE 10: ESTABLISH A MONITORING SYSTEM FOR EACH CCP.*

**MONITORING** - A planned sequence of observations or measurements to assess whether a CCP is under control. Records of monitoring are kept for future use in verification.

Monitoring is one of the most important parts of the HACCP system, ensuring that the product is manufactured safely from day to day.

There are two basic types of monitoring procedures:

On-line systems, where the critical factors are measured during the process. These may be continuous systems where critical data are continuously recorded, or discontinuous systems where observations are made at specified time intervals during the process.

Off-line systems, where samples are taken for measurement of the critical factors elsewhere. Off-line monitoring is normally discontinuous and has the disadvantage that the sample taken may not be fully representative of the whole batch.

Monitoring is the measurement or observation at a CCP of the target levels and tolerances set down for each preventative measure. The monitoring system describes the methods by which management are able to confirm that all CCP's are operating within specification (i.e. they are in "control") and it also produces an accurate record of performance for future reference in verification. Ideally, CCP's are monitored on a continuous basis. However, when this is not feasible, a technically sound schedule of periodic measurements or evaluations is appropriate.

In an ideal situation, a monitoring system should be chosen that gives an on-line continuous monitor of performance and responds dynamically to correct changes exceeding the specified tolerance, but in the practical situation the choice of monitoring systems available for a particular CCP may often be quite limited. Whichever monitoring system is chosen, the team must ensure that the results obtained are directly relevant to the CCP and that any limitations are fully understood.

In addition to identifying the most appropriate monitoring system, the team should address the following issues:

#### *Who should act?*

The job title of the operator(s) who will carry out the monitoring should be specified. This person must have the knowledge and authority to take corrective action if the specified tolerance is not achieved. All records and documentation associated with monitoring should be signed by the person doing the monitoring and checked by a designated manager.

#### *When should they act?*

If monitoring is not continuous then the frequency of monitoring must be specified and must be sufficient to ensure that control is being exercised at the CCP.

The frequency of monitoring will depend on the nature of the CCP and the type of monitoring procedure. It is imperative that the HACCP team determines the appropriate frequency for each monitoring procedure.

#### *How should they act?*

This requires a detailed description of precisely how the monitoring should be carried out. The details should be relevant to the type of monitoring being carried

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out, e.g. temperature measurements for a heating process should be made at the coldest point of the product and vice-versa. This requirement means that the designated operators must be trained to understand their monitoring functions and how to carry them out correctly.

Laboratory methods are an important part of the whole scenario. Because these methods play an important role, they should be:

- accurate.
- reproducible.
- clearly described.
- safe.
- easy to conduct.
- rapid (in turnaround time).
- efficient.
- officially recognised

We can now fill in the monitoring procedures and frequencies in our HACCP control chart. Refer to chart 2.

## **PRINCIPLE 5: ESTABLISH CORRECTIVE ACTIONS WHEN MONITORING INDICATES A DEVIATION.**

### *STAGE 11: ESTABLISH CORRECTIVE PLAN OF ACTION*

When following a deviation it is important to act quickly! A deviation means that monitoring results show that a CCP has deviated from specified tolerances or target levels.

Two types of actions are important:

- Adjust the process to bring it back under control.
- Deal with disposition of the material which was produced during the time that the CCP was out of control.

In order to effectively handle non-complying materials you will need to implement a series of further corrective actions:

- Place all suspect product on hold.
- Seek advice from the HACCP team, facility management and other relevant experts. Here it is important to consider the risk of the hazard occurring in the product.
- Conduct further tests, where appropriate, to assess safety.

When you have obtained sufficient information the decision about what should happen to the product can be taken. This would probably be to:

- Destroy the non-complying product;
- Rework into new products;
- Direct non-complying product into less sensitive products such as animal feed;
- Release product following sampling and testing;

### **RESPONSIBILITY FOR MONITORING AND CORRECTIVE ACTION:**

The most important issue with responsibility is that you ensure that it is properly defined. It is important that people understand their responsibilities and authority.

Responsibility and authority are described by means of:

#### *Organigram*

The Management Organisation of a company should be presented in such a manner that the delegation of responsibility and authority for the functions affecting hygiene is clearly understood. A convenient method is by using an organisational chart (family tree) which should indicate positions held, lines of reporting, accountability for decision etc.

#### *Job descriptions*

Job descriptions for all personnel involved in the management of food safety must be defined.

The reason for this requirement is to ensure that the responsibilities for particular activities are allocated to specific members of the personnel. Job descriptions are necessary for those personnel who are responsible for key activities while work instructions may suffice at a lower level.

At this stage the HACCP control chart should be completed to include corrective action and responsibility. Refer to chart 2

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**PRINCIPLE 6: ESTABLISH RECORD KEEPING PROCEDURES AND DOCUMENTATION.**

*STAGE 12: ESTABLISH RECORD KEEPING.*

To demonstrate and verify that the HACCP plan is working effectively records need to be maintained either in the departments concerned or in one central department. These records should be available for purposes such as to assess supplier performance and quality trends, identifying process trends, checking for nonconformances.

Food safety records should be retained, for a specified period, in such a manner as to be easily retrievable for analysis. While in storage these records should be protected from damage loss and deterioration due to environmental conditions.

Examples of records are:

- The HACCP plan - flow diagram, HACCP control chart, hazard analysis, HACCP team, etc.
- History of amendments.
- CCP monitoring.
- Hold/Trace/Recall.
- Training.
- Audit.
- Meetings - decisions related to product safety.
- Calibration.
- Cleaning and disinfection.
- Deviations.
- Corrective action/Disposition action.
- Modification file.
- Verification data.
- Review data.

## **PRINCIPLE 7: ESTABLISH PROCEDURES FOR VERIFICATION.**

### *STAGE 13: VERIFICATION.*

These are procedures (other than those used for monitoring) which ensure that the HACCP study has been carried out correctly and that the HACCP plan continues to be effective.

Periodic review should be conducted to ensure that the HACCP program is working correctly. Verification should cover two aspects:

- Is the HACCP procedure, as originally applied still appropriate to the product/process hazards?
- Are the specified monitoring procedures and corrective actions still being properly applied?

Verification is accomplished through methods, procedures, and tests to determine that the HACCP system is in compliance with the HACCP plan. Verification confirms that all hazards were identified in the HACCP plan when it was developed. Verification may be accomplished through chemical and sensory methods and testing for conformance with microbial criteria when established. Verification activities may include, but are not limited to:

- scientific or technical process to verify that critical limits at CCP's are satisfactory,
- establishment of appropriate verification inspection schedules, sample collection and analysis,
- documented periodic re-validation's independent of audits or other verification procedures that must be performed to ensure accuracy of the HACCP plan. Revalidation includes a documented on-site review and verification of all flow diagrams and CCP's in the HACCP plan.

All elements, aspects and components pertaining to the HACCP plan should be audited and evaluated on a regular basis. These audits are carried out in order to determine whether various elements within the HACCP plan are effective in achieving stated hygiene objectives. For this purpose an appropriate audit schedule should be formulated and established by the company's management.

The audits must be conducted by persons independent of the specific activities according to the planned arrangement. The policy statement should reference that the audits and follow-up actions to be carried out, use documented procedures and that results are documented so that timely corrective action can be taken on deficiencies found by the audits.

The main reasons and benefits of auditing a HACCP system are:

1. Providing documented evidence of due diligence in managing food safety.
2. Independent and objective review of effectiveness.
3. Maintain confidence in HACCP system.
4. Identify areas for improvement.
5. Continually reinforcing awareness of food safety.
6. Removing obsolete control.

The HACCP compliance audit should assess two areas:

1. Compliance with the requirements of the HACCP principles.
2. Compliance with the documented HACCP plan.

#### *STAGE 14: REVIEW OF HACCP PLAN.*

In addition to the verification principle outlined above, it is necessary to have a system in place that will automatically trigger a review of a HACCP plan prior to any changes to raw material/product/process, consumer use etc.

Below is a list of potential operations which should automatically act as a trigger for a HACCP review:

- Change in raw material/product formulation.
- Change in processing system.
- Change in factory layout and environment.
- Modification to process equipment.
- Change in cleaning and disinfection programme.
- Change in packaging, storage and distribution system.
- Change in staff levels and/or responsibilities.
- Anticipated change in consumer use.
- Report from the market place indicating a health or spoilage risk associated with the product.

Data arising from HACCP reviews must be documented and form part of the HACCP record keeping system. Any changes arising from the review must be incorporated into the HACCP plan. This is because these changes may mean that certain CCP control measures of specified tolerances have been changed and/or additional CCP's or control measures have been put in place. It is essential for a user to be sure that accurate up-to-date information is available from the records. A system of management for the maintenance of the HACCP record keeping system is therefore required and its proper operation is essential.

#### *Why analyse data?*

- To verify that the HACCP plan continues to be effective.
- To enable trends to be recognised and corrective action teams to be set up to deal with the cause, e.g. customer complaints and recurring CCP deviations.
- To launch investigatory audits of problem areas.
- To ensure that timely corrective actions are being taken through trace audits of meeting minutes.

#### *What data do you have available?*

- CCP log sheets.
- Process Control Charts.
- Audit Reports - Non-compliance Notes.
- Corrective Action reports.
- Minutes of food safety-related meetings, e.g. HACCP meetings, hygiene meetings.
- Pest control records
- Customer complaint data

*How often should you review data?*

- Daily
  - i CCP log sheets
  - ii Process Control Charts
- Monthly
  - i Customer complaints reports
  - ii Hygiene meetings
- Three-monthly
  - i CCP deviation summaries As appropriate
  - ii Corrective Action reports
  - iii Audit Reports
  - iv HACCP and quality meetings
  - v Pest control records
- Annual
  - i Audit reports
  - ii Minutes of food safety meetings

*Who should review it?*

- HACCP team
- Quality Manager
- Operations Manager As appropriate
- R&D Personnel
- Sales/Marketing personnel

*Updating and amending the HACCP plan*

The HACCP plan will need to be updated and amended periodically to ensure that it remains current. A HACCP plan which was drawn up a year ago is unlikely to accurately reflect current activities.

It is recommended that periodic revalidation of the plan is also carried out. Revalidation can be considered as a complete review of the HACCP plan in order to confirm its accuracy. This is done by the HACCP team and should be done at least annually.

Remember! Any changes made to the HACCP plan will need to be recorded and approved. A useful method of recording is to draw up a history of amendments sheet.

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**CHART 1: HAZARD ANALYSIS CHART**

| <b>PROCESS STEP</b> | <b>HAZARD</b> | <b>PREVENTATIVE MEASURES</b> |
|---------------------|---------------|------------------------------|
|                     |               |                              |

**CHART 2: HACCP CONTROL CHART**

| PROCESS STEP | CCP No. | HAZARD | PREVENTATIVE MEASURE | CRITICAL LIMITS | MONITORING |           | CORRECTIVE ACTION | RESPONSIBILITY |
|--------------|---------|--------|----------------------|-----------------|------------|-----------|-------------------|----------------|
|              |         |        |                      |                 | PROCEDURE  | FREQUENCY |                   |                |
|              |         |        |                      |                 |            |           |                   |                |