

## INTRODUCTION

HACCP describes a system of control for assuring food safety and provides a more structured and critical approach to the control of identified hazards than that achievable, by traditional inspection and quality procedures. It has the potential to identify areas of concern where failure has not yet been experienced, making it particularly useful for new operations. The approach described here consists of:

- ✓ Description of assessment of hazards associated with all stages of food manufacturing, from raw material acquisition to product sale and consumption.
- ✓ Identification of critical control points at which it is necessary to control the hazards that have been identified.
- ✓ Establishment of procedures through which critical control points can be effectively monitored.

The HACCP approach to safety assurance shifts the emphasis from final product testing to process and raw material control. The food industry has tended to operate, by sample analyses, but by using a HACCP system control is taken out of the analytical laboratory and included into the manufacturing environment.

The HACCP concept is an effective and rational approach to the assurance of safety and to the prevention or delay of spoilage in foods. In the application of HACCP, the use of microbiological criteria is sometimes the most effective means of monitoring critical control points, although microbiological methods are often slow and difficult to interpret. In other instances, monitoring of critical control points may best be accomplished through the use of physical and chemical test, visual observations and sensory evaluations. A broad base of information is required to establish a HACCP system and will therefore require specialist knowledge from many disciplines, since safety assurance cannot be categorized by a single discipline. Although the technique was initially developed for microbiological control, it has been extended to apply to other categories of hazard, e.g. chemicals and foreign bodies.

Consideration of individual products and their associated hazards will allow different control approaches. Since HACCP is an ongoing dynamic process, analyses will need to be reviewed in the light of new pathogens and changes in the process parameters. By using HACCP in every one's situation, it will lead to better safety assurance and good manufacturing practices.

## METHODOLOGY

To carry out HACCP analysis, a formalized and structured approach is needed towards the two elements of the procedure: Hazard Analysis and identification of Critical Control Points.

### Terminology

Certain terminology is used, and where used it has very specific meanings. The principal terms requiring definition are:

**CRITICAL CONTROL POINT (CCP):** a location, stage, operation or raw material which, if not controlled, provides a threat to product acceptability or consumer safety

**CONCERN:** an expression of the seriousness of a failure to control a critical point, derived from knowledge of a hazard and the risk of it occurring. Only four levels of concern are used in this document, high, medium, low and none.

- a) High Concern: An expert judgment that without control is a life threatening risk.
- b) Medium Concern: An expert judgment that is a threat to the consumer or to the product which must be controlled.
- c) Low Concern: An expert judgment that is little threat to the consumer or the product. It still may however be advantageous to control it.
- d) No Concern: An expert judgment that is no threat to the consumer.

**GOOD MANUFACTURING PRACTICE (GMP):** a specified and recorded method of operation designed to minimize hazards and capable to be controlled and monitored.

**HAZARD:** A potential harm to the consumer (safety) or the product (spoilage). This may be described as a specific threat or as an operational malpractice.

**HAZARD ANALYSIS:** any system which analyses the significance of a hazard to consumer safety or product acceptability.

**RISK** is the chance (probability) that a hazard will be realized.

SAMPLES of possible hazards:

- Microbiological: this can be divided in pathogenic and indicator organisms.

**Severe hazards:**

The severity can vary depending on type and target consumer group:

- a) Bacteria
- b) Toxin
- c) Virus

**Moderate hazard with potentially extensive spread:**

The severity can vary depending on type and target consumer group.

Pathogenic: E. Coli

**Moderate hazards with limited or no spread:**

- a) Bacteria
- b) Parasite

- Non Microbiological:

Expert opinion should be sought before making decisions on the relevance of these hazards to particular circumstances.

Raw materials

In the process

Adventitious contaminants

From packing material

Foreign bodies

**HACCP GROUP COMPOSITION**

It is indicated that a broad discipline base is preferred to carry out a HACCP analysis. This requires that a group of individuals, with the necessary knowledge and expertise, needs to be

brought together. These can be identified by reference to their function.

**CHAIRMAN:** someone must convene the group and ensure that the technique is properly applied. Not only must this individual know about the technique, but must also be able to direct the group, be sympathetic to their ideas, allow everyone to participate and maintain enthusiasm throughout the analysis.

**PRODUCTION SPECIALIST:** It is imperative that an accurate and good quality flow diagram is prepared initially. Ideally, the person preparing this should have detailed knowledge of the production, and should be part of the HACCP group.

**TECHNICAL SPECIALIST:** An individual able to understand the hazards and associated risks is essential to the group. This can be a QA/QC manager, microbiologist or chemist as appropriate. More than one individual may be needed.

**PROCESS ENGINEER:** In many cases, it is necessary to consider the mechanical operation / performance of the processing lines, in which case an engineer is a valuable HACCP team member.

**OTHER SPECIALISTS:** Other specialists such as raw material buyers, packaging specialists, distribution and sales personnel may be needed. Such individuals may not be permanent team members during an analysis.

**SECRETARY:** A technical secretary may be used to record the progress and results of the analysis, if it is judged inappropriate for one of the other team members to carry out this role.

In total a team between 4 to 7 people is required for the analysis, which can take several meetings to complete.

## THE ANALYSIS

### Stage 1

The first activity of an analysis is to obtain a detailed flow diagram for the process. When dealing with a specific process, many of the considerations will be influenced by issues specific to the factory which depend upon detailed knowledge of the process.

This covers such things as:

- ✓ Management routine (shift patterns, skill levels, working practices);
- ✓ Process details (hygiene and design of equipment, plant lay-out, line efficiency, maintenance and cleaning routines);
- ✓ Factory operations ( design, storage areas, related processes, security);

The detailed process flow diagram must be supported during the analysis by a competent member of the production management team, who is able to provide the necessary detailed information.

### Stage 2

The second phase of the analysis identifies those essential characteristics of the product and its use, which enable definitive conclusions to be drawn about the hazards which will threaten the consumer or product. This analysis must consider food production storage conditions, formulation and preservation systems, packaging used, expected customer handling practices for the food and target consumer group.

There is a need to define the food product and its relationship to the consumer groups, storage conditions and processing.

The following categories are used:

a) Storage

All food products are handled and stored by the customer (caterer, retailer, distributor or consumer). In all cases there is an opportunity for storage abuse and this can seriously compromise the safety of the food product.

b) Formulation / Preservation

The shelf life and safety of many foods rely upon the use of specific preservation systems. Traditional preservation systems are being constantly modified to meet marketing needs and it is critical to understand the implications of these changes to the stability of the product.

c) Packaging

Packaging has to fulfill several functions, one of which is maintenance of an acceptable microbiological quality for the food. For microbiological considerations, packaging always acts as a physical barrier but may also provide structural protection to some preserved products.

d) Consumer practices

There is a lack of detailed information about current consumer practices and it is an area where little control can be exercised by the food processor. However, the food processor should attempt to give adequate information and advice to the consumer.

e) Target Groups

The source of any food poisoning outbreak from catering services is likely to be easily identified because of the number of individuals involved; however the source would not be so easily recognizable if the same number of cases were associated over a long period of the time within a large population of consumers. Not all consumer groups have the same sensitivity to the microbiological challenge, and this should be borne in mind in any risk assessment

### **Stage 3**

Both detailed process information and hazards of concern are known at this stage. The detailed process information will also include methods of production, preparation and transport of raw materials as far as these are known. If these are not known, then the most unfavorable assumptions must be made unless there is a long, proven history of the raw materials presenting no hazard to the process or product.

Every stage of the process must be considered in turn. At each stage or operation, the relevance of any hazard identified is considered. The types of considerations are whether it is possible for contamination to occur at this stage, whether the hazard (microbiological) might grow (or toxin be produced), or whether the hazard (microbiological, toxin, or chemical) might be destroyed. In practice it should be expected that most product safety failures are associated with abnormal deviations i.e. the operation was not carried out according to design or specification. However, the consideration of hazards with respect to each stage of the process should also take into account realistic process deviations at this stage. In this way, stages which are critical can be identified. These points need to be controlled adequately to assure safety and therefore Critical Control Points (CCP).

Identifying the CCP is not the final stage of the analysis. Judgment of risk must be made, so that the level of concern for the CCP can be made. This is important in order to apportion control effort in a TOTAL QUALITY ASSURANCE SYSTEM. As with hazard identification, risk assessment often needs expert judgment.

There are three basic methods by which risk may be assessed.

a) Probabilistic:

This approach requires an assessment of probability, describing the chance that a particular

failure mode will occur. This approach can be effective if the "Chance" can be accurately defined. Special care must be taken if very low probability calculations are made as extrapolation of data is often used and predictions are unlikely to be either accurate or precise. If cumulative probabilities are used, requiring multiplication of "Chances", it is important to remember that errors are also multiplied. Probabilities of failure of normal operations can be used to predict the "chance" of an unacceptable condition. Monitoring the temperature of a cold store will establish the normal temperature variation and enable the chance of the temperature exceeding the critical level to be predicted. However, there must be an awareness that problems can arise from catastrophic failures, malfunction of the chilling unit in the cold store, and statistics relating normal variability are then of no advantage for risk assessment.

b) Comparative (comparison with other products):

In many cases detailed, quantified information risks is not available. It is often possible to compare the product with other related products which have proven to be acceptable in the market place and for which there is quantified risk information. This comparison then allows consideration of the differences only and the affect on product safety and shelf life.

c) Pragmatic (expert judgment):

Where no information exists to guide the decision, there is no option but to make a judgment. Basically the judgment will be that:

- ✓ The risk is acceptable
- ✓ There are reservations, which might be resolved by testing
- ✓ The risk is unacceptable

Making such judgments requires a high degree of expertise and experience and should only be made by suitably qualified people. Ideally, the opinion of more than one expert should be sought. The choice of an appropriate method depends upon circumstances, so it is important to record the basis for any judgment.

#### **Stage 4**

At this stage detailed information has been obtained describing Critical Control Points, the hazards associated with them, their relative importance to safety, and the conditions which would lead to failure resulting in realization of the hazards and subsequent food poisoning. The final step is to devise effective control options. Apart from the expert microbiologist (and Chemist) and the process manager, an appropriate quality assurance manager and production engineer are needed to consider control options.

In any HACCP system it is wise to recognize that no system can give 100 % security. Ultimately, it may be necessary to recall food products from distribution centers, trade or, in extreme cases, consumers. While all systems are designed to minimize the risk of this happening, an accepted, workable recall procedure should exist as part of responsible management. Ideally, this plan should be tested to ensure its efficiency and effectiveness.