



Executive Forum



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**A STRATEGIC APPROACH TO THE
QUALITY ASSURANCE CHALLENGE**

AN INTRODUCTION TO HACCP

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An Introduction to HACCP

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1. What is HACCP?

HACCP is an abbreviation for the Hazard Analysis Critical Control Point system, which is synonymous with food safety management. It is “a system which identifies, evaluates, and controls hazards which are significant for food safety.” HACCP is a system that gives confidence that food safety is being managed effectively. The system looks for hazards, or anything that could go wrong regarding product safety, and implements controls subsequently to ensure that the product will not cause harm to the consumer.

HACCP was developed originally as a microbiological safety system in the early days (1960s) of the US manned space programme, as it was vital to ensure the safety of food for astronauts. The Pillsbury Company working alongside the National Aeronautics and Space Administration (NASA) of the United States and the US Army Laboratories developed the original system.

A “hazard” as used in the HACCP system is defined as “a biological, chemical or physical agent in, or condition of food, with the potential to cause an adverse health effect”. A “Critical Control Point” (CCP) is “a 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”.

HACCP is based on the principle that hazards affecting food safety can be either eliminated or minimized by prevention during production rather than by inspection of the finished product. Its goal is to prevent hazards at the earliest possible point in the food chain. The HACCP approach can be applied right from harvest to the point of consumption. Adding HACCP to traditional inspection and quality control activities would lead to a preventive quality assurance system in a company. Companies using the HACCP system will be able to provide greater confidence about food safety to consumers as well as to food regulatory authorities.

In many food processing industries established ways of operating, including methods of food processing and handling have become entrenched. The application of HACCP may require a fundamental change in the culture or attitudes of those involved in food processing. A good example is the need to establish a written procedural manual and for written records. In many industries there is no tradition of written procedures or records of quality or safety parameters, indeed the skill of the individual in many food processing situations is what is “in their head”. HACCP requires a fundamental change in attitudes, focused record keeping and documentation, even though many of the procedures to be documented themselves may remain unchanged. Similarly, those attempting to implement HACCP may find it difficult to grasp the concept of risk-based food safety controls, particularly if they have been accustomed to controls based on pre-specified physical parameters that may bear little resemblance to the particular characteristics of the food processing operation in which they are involved. It is very important that all the people working in the company understand the HACCP system and that they maintain it. The adoption of HACCP simply to satisfy a regulatory requirement has the potential to lead to failure in that company.

The HACCP system and guidelines for its application were developed by the Codex Committee for Food Hygiene on the Codex Alimentarius Commission, a joint Food Standards Programme of the Food and Agriculture Organization (FAO) of the United Nations, and the World Health Organization (WHO). The HACCP system and guidelines were published in 1993 and revised in 1997.

2. Principles of HACCP

The HACCP system consists of seven principles, which outline how to establish, implement and maintain a HACCP plan for the operation under study.

Principle 1

Conduct a hazard analysis. Identify potential hazards associated with all stages of the production, using a flow diagram of the steps in the process. Assess the likelihood of occurrence of the hazards, and identify preventive measures for their control.

Principle 2

Identify/Determine the CCPs. Determine the points/procedures/operational steps that can be controlled to eliminate the hazards, or minimize the likelihood of occurrence, or reduce the hazards to an acceptable level.

Principle 3

Establish Critical Limits (target levels and tolerances), which must be met to ensure the CCPs are under control. They must involve a measurable parameter and may also be known as the absolute tolerance or safety limit for the CCP.

Principle 4

Establish a system to monitor control of the CCP by scheduled testing or observation.

Principle 5

Establish the corrective action to be taken when monitoring indicates that a particular CCP is moving out of control. Corrective action procedures and responsibilities for their implementation need to be specified.

Principle 6

Establish procedures for verification to confirm that the HACCP system is working effectively. Verification procedures must be developed to maintain the HACCP system and ensure that it continues to work effectively.

Principle 7

Establish documentation concerning all procedures and records relating to the application of these principles. Records must be kept to demonstrate that the HACCP system is operating under control and that appropriate corrective action has been taken for any deviations from the Critical Limits.

HACCP is not a “stand-alone” system. Good hygiene practices and other prerequisites for food processing as well as strong management commitment are also necessary; HACCP is not a substitute for these. Training is another essential requirement for a successful HACCP system. As an aid to developing specific training to support a HACCP plan, prepare working instructions and procedures that define the tasks of the operating personnel at each critical control point.

3. Implementation of HACCP

HACCP is a system that assists organizations to identify potential food safety hazards in the entire food supply chain and to take preventive measures for their control. HACCP focuses on the prevention of hazards rather than relying on end product testing. The following sequence of 12 steps, included in the guidelines developed by the Codex Committee on Food Hygiene, is the recommended approach to develop a HACCP programme.

Step 1: Assemble HACCP team

Set up a multi-disciplinary team that includes representatives from production, sanitation, quality control, food microbiology, etc. This team should be assigned specific segments of the food chain to be covered in the HACCP system, and be entrusted with developing a HACCP system as described from Step 2 onwards. Top management must give its full support to the team. If the required expertise is not available within the company, bring in help from a consultant.

Step 2: Describe product

Draw up a full description of the product for which the HACCP plan is to be prepared, including product composition, structure, processing conditions, packaging, storage and distribution conditions, required shelf life, instructions for use, etc.

Step 3: Identify intended use

Identify the intended use of the product by the end-user or consumer. You need to determine where the product will be sold as well as the target group (e.g. institutional catering, homes for senior citizens, hospitals, etc.).

Step 4: Construct flow diagram

You need to carefully examine the product/process and produce a flow diagram around which to base the HACCP study. Whatever the format you choose, study all the steps involved in the process – including delays during or between the steps from receiving the raw material to placing the end-product on the market – in sequence, and present them in a detailed flow diagram with sufficient technical data. In the diagram, you might also want to include the movements of raw materials, products, wastes, a plan of working premises, equipment layout, product storage and distribution, and of employee moves or changes.

Step 5: On-site confirmation of flow diagram

The HACCP team should confirm the processing operation against the flow diagram during all stages and hours of operation and amend the flow diagram if necessary.

Step 6: List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control hazards

Using the flow diagram, the team should list all the hazards – biological, chemical or physical – that may reasonably be expected to occur at each process step, and describe the preventive measures that can be used to control such hazards (for example, the use of air curtains, hand and feet washing at entrance to processing areas, wearing of head gear, use of good manufacturing practices [GMP]/standard operating procedures [SOP]/ sanitation standard operating procedures [SSOP], etc.).

Step 7: Determine Critical Control Points (CCPs)

You may wish to use a decision tree with “yes” or “no” answers to facilitate the determination of CCPs (See Annex A). When applying the decision tree, you need to remain flexible and use common sense to avoid, wherever possible, unnecessary control points throughout the whole manufacturing process. If you identify hazards at a step where control is necessary for safety and no preventive measures exist at that step, you need to modify the process at that step, or at an earlier or a later stage, to include a preventive measure. For example, in a slaughterhouse, covering carcasses with a sanitized cloth to prevent infection by flies is a preventive measure at the carcass stage, which substitutes for a preventive measure such as washing the prepared meat at the next stage, as it will not be possible to disinfect the meat at this stage, i.e., during cutting or mincing operations.

Step 8: Establish critical limits for each CCP

You need to establish critical limits for each CCP. They are normally derived from specifications included in the food legislation of a country or in national or international standards (e.g. moisture levels in milk powder, or pH level and chlorine limit in potable water, etc.). When limits are not taken from regulatory standards (e.g. frozen storage temperature) or from existing and validated guides of good manufacturing practices, the HACCP team should ascertain the validity of such limits relative to the control of identified hazards and critical points.

Step 9: Establish a system of monitoring each CCP

Monitoring is the scheduled measurement or observation of a CCP to determine conformance to its critical limits. The monitoring procedures must be able to determine loss of control, if any, at the CCP (e.g. improper control of the temperature that may lead to faults in the functioning of a pasteurization unit in a dairy plant). Monitoring for CCPs needs to be done rapidly, as they later relate to on-line processes, and there is usually no time for lengthy analytical testing. Physical and chemical measurements are often preferred as these can be done rapidly and can frequently indicate microbiological control of the product.

The programme of observations or measurements should properly identify for each critical point:

- Who is to perform monitoring and checking;
- When monitoring and checking are performed; and
- How monitoring and checking are performed.

All records and documents associated with monitoring CCPs must be signed by the person(s) doing the monitoring.

Step 10: Establish corrective actions

The HACCP team should develop specific corrective actions and document them in the HACCP plan for each CCP in the HACCP system so that they can deal with deviations when they occur. Such corrective action should include:

- Proper identification of the person(s) responsible for implementation of a corrective action;
- Actions required to correct the observed deviation;
- Action to be taken with regard to products manufactured during the period when the process was out of control; and

- Written records of measures taken.

The actions must ensure, for example, that the CCP has been brought under control, that procedures or conditions that created the out-of-control situation have been corrected, and the food affected, disposed off safely, etc.

Step 11: Establish verification procedure

Develop a verification procedure to ensure that the HACCP system is working correctly. The procedure should include the frequency of verification, which should be conducted by a responsible and independent person. Examples of verification include auditing methods, random sampling and analysis, etc.

Step 12: Establish documentation and record keeping

The HACCP system requires efficient documentation and accurate record keeping. For example, hazard analysis, identified CCPs and their limits (including revisions, if any) should be documented. Examples of records are CCP monitoring records, records of deviation found and corrective action taken on them, etc.

Common implementation costs

The type and magnitude of costs involved in the implementation of HACCP varies widely according to the type of product and processing operation, existing conditions and the manner in which HACCP is implemented. It is not uncommon for companies to have to carry out modifications in areas such as material flow, waste flow, water supply system, insect proofing, restricting the entrances to processing areas, installation of air curtains, temperature control of processing areas, etc., if such preventive measures are found necessary during hazard analysis. The total cost of implementing HACCP depends on the general sanitary and hygiene conditions prevalent in the company before initiating HACCP. It should be emphasized that the implementation of HACCP does not necessarily require investment in sophisticated equipment and procedures. All that is required is that Critical Control Points are established and these can be monitored in an effective manner. There are countless cases of food processors being reluctant to implement HACCP because they over-estimate the costs and/or fail to appreciate the potential benefits from improvements in product quality or shelf-life, reduced wastage, etc.

In companies where preventive measures identified during hazard analysis do not require additional equipment or alteration in the plant layout, the cost of implementing HACCP will only relate to costs of training and development of HACCP plans/manuals and to the hiring of consultants (if required). The HACCP system will require initial and continued investment in human resources and the development of training programs for employees.

If the company decides to obtain third-party certification of HACCP then this additional cost should be taken into account.

Studies of the costs of implementing HACCP indicate that the major cost of both implementing and operating HACCP is associated with documentation and record-keeping, particularly staff time. If there is a lack of expertise internally, consultancy fees can also be significant, although there are countless cases of consultants being used when a simple group training course may suffice.

Cost-saving measures

To implement HACCP in a cost-effective manner, it is advisable for small and medium-sized enterprises to develop competence among their own personnel for preparing HACCP plans and other system procedures. Competence can be built through sponsoring some staff for training. If required, the services of a food specialist with Good Manufacturing Practices (GMP) and HACCP system experience can be hired for a short period. The specialist can also train company staff. To save costs, you may incorporate a HACCP system into other quality management systems, such as ISO 9001, which may already be in place (see Section 4). By integrating the systems, the cost of periodic internal audits and third-party certification can be reduced.

4. HACCP and ISO 9000

The food industry is highly regulated by local, national and international laws relating to food safety. More so, consumers are very careful in their buying decisions relating to raw or processed foods. Consumers usually feel more confident when they have evidence of quality management during the manufacturing of food and drink products, in addition to supervision by food regulators.

The ISO 9000 family of standards is generic in nature and has been developed to assist organizations of all types and sizes that wish to implement and operate a quality management system (QMS). There are no restrictions on its implementation by any sector of industry, including the food and drink industry. Large and small companies that process and/or package food products worldwide have implemented ISO 9000 and obtained third-party certification. These companies may also use HACCP or similar systems as part of their quality assurance system. Some companies are using both ISO 9000 and HACCP as an integrated food safety and quality management system.

ISO 9000 focuses on customer needs and expectations, and one of the most important customer expectations is to have safe food products. Applying HACCP within an ISO 9000 QMS can result in a food safety system that is more effective than applying ISO 9001 or HACCP separately. The emphasis of both systems is prevention rather than correction of problems or deficiencies after they occur. A company implementing a HACCP system does not have to comply with ISO 9001 but it is desirable.

The seven principles of HACCP can be integrated with ISO 9001:2000 requirements, as explained below:

QMS documentation

When developing documentation for ISO 9001 (such as a Quality Manual, quality system procedures, work instructions, quality plans, etc.), also take into account HACCP Principle 7, which requires you to establish documentation on all procedures and records, to ensure that requirements concerning food safety aspects are integrated at the documentation stage.

Management responsibility

When defining the requirements concerning management responsibility (e.g. quality policy, quality objectives, planning, customer focus, communication, responsibility and authority), you can incorporate the requirements of Principle 1 (conducting a hazard analysis), Principle 2 (determining critical control points [CCPs]) and Principle 4 (establishing a system to monitor CCPs).

For example:

- In the quality policy, stress that the organization is fully aware of its problems within the food chain, by referring to food production, hygiene and safety;
- Consider the HACCP plan while carrying out QMS planning; and
- Make all personnel aware of the role they play in achieving stated policies and objectives and in meeting customer requirements for both food safety and quality.

Resource management

When managing resources for ISO 9000 (e.g. human resources, infrastructure, work environment, and other services), ensure that you have provided resources for preventing hazards (HACCP Principle 1) and resources to monitor the control of CCPs (Principle 4). For example:

- The design and maintenance of the work area has a major effect on food safety;
- Appropriate maintenance of equipment can also ensure that hazards do not affect the food production process;
- Effective sanitary and hygiene conditions in the processing area, including drainage, pest control, segregation of wastes, health screening of employees, provision of appropriate work wear (coats, boots, head gears, etc.) are essential for food products.

Product realization processes

In your product realization processes (e.g. planning, identification and review of customer requirements, design and development, purchasing and operational controls), you can integrate several HACCP principles, e.g. Principle 1 (identifying hazards), Principle 2 (determining CCPs), Principle 4 (establishing a system to monitor control of CCPs), etc. For example:

- Incorporate the HACCP study and CCPs into the product realization planning process.
- Identify potential users and consumers for each product. Give careful consideration to the special requirements of groups of consumers such as babies, children, patients, elderly people, etc.
- Determine specific customer and regulatory requirements such as control limits of pesticides, residues, and heavy metals; test methods, etc.
- Make food safety paramount when developing new products. Consult regulatory requirements relating to the product during product development.

- In purchasing processes, check suppliers' capability to adhere to critical limits at critical control points for raw materials, equipment, cleaning chemicals, transport services, laboratory testing services, warehousing, distribution, etc.
- In your HACCP plan, include the identification of product and its traceability at each stage of processing to ensure compliance with legal requirements for batch/lot traceability control on raw materials and packaging materials.
- Include controls identified in your HACCP plan for storage handling, delivery conditions of the product including temperature/humidity control, shelf life, hygiene, and infestation controls.
- Processes such as pasteurization and sterilization, require well-defined process conditions, trained personnel, adequate machinery and equipment to reduce reliance on end-product testing.
- The verification of measuring and monitoring devices in the food industry is crucial, and may require data from inter-laboratory studies.

Measurement, analysis and improvement

In measuring, analyzing and improving the processes of ISO 9000, you can address HACCP Principle 3 (establishing critical limits), Principle 4 (establishing a system to monitor control of CCPs), Principle 5 (establishing corrective action) and Principle 6 (establishing a verification procedure to check effective operations).

- A *monitoring plan* is the output of a HACCP plan. It should include monitoring of product, process, services, environmental aspects concerning food safety, etc. Measurement and monitoring records are the backbone of a documented HACCP system, as the records provide evidence that a product is within defined acceptance limits.
- The overriding principle behind the establishment of a HACCP system is to ensure that products are produced safely. It is argued that “after-the-fact inspection” will not contribute to this principle, and therefore gathering information as to whether the controls identified and executed have been successful or not is extremely important. The results of the monitoring exercises will show whether the control steps have been effective.

General

The QMS requirements of training, internal audit and management review ensure the effective operation and measurement of the HACCP system through internal audit; periodic review of audit results and other data by top management ensures that the HACCP system will continue to provide the desired results, i.e. the provision of safe food to its consumers.

The HACCP approach and the ISO 9000 QMS are complementary. For companies that have not yet settled on setting up a QMS but have decided to adopt HACCP for controlling food safety requirements, it is advisable to first develop a HACCP system and then integrate it into a QMS, when the company decides to adopt ISO 9000. Those companies that have

already set up a QMS conforming to ISO 9001 may use the HACCP approach to upgrade their quality planning to include food safety issues, if this has not already been done.

National HACCP system standards

National HACCP system standards have been developed in many countries. Certification bodies provide third-party certification to companies that implement such standards. For example, Det Norske Veritas (DNV), an international certification body, provides an accredited Food Safety Management System certification to Danish Standard DS 3027, *Requirements of Food Safety according to HACCP*.

The Bureau of Indian Standards (BIS) provides two certification schemes to the food industry, the first for a HACCP system alone, and the second for a combined HACCP and ISO 9000 system:

- Food Safety Certification against Indian Standard IS 15000:1998, *Food Hygiene - Hazard Analysis and Critical Control Point (HACCP) - System and Guidelines for its Application*.
- The HACCP-based Quality Management System Certification provides for two certifications through one audit; certification of the quality system to Indian Standard IS/ISO 9000, and certification of HACCP to IS 15000:1998.

5. HACCP in international trade

It is important for SMEs in the food processing business to use HACCP: firstly because of internal benefits like reducing the risk of manufacturing and selling unsafe products and thus providing better confidence to consumers; and secondly, because food regulatory authorities in many countries are adopting or likely to adopt HACCP as a part of their food regulations. By implementing HACCP, you will have opportunities to export to such markets. Some examples are given below:

- In the United Kingdom, the Food Safety Act, 1990, and the Food Hygiene Inspection Codes of Practice both include HACCP.
- Canada has developed a Food Safety Enhancement Programme (FSEP) to encourage the establishment of HACCP-based procedures in all registered establishments in the agricultural and food processing sectors.
- The Australian Quarantine and Inspection Service (AQIS) has developed a new inspection system known as Food Hazard Control System (FHCS).
- In the USA, the Food Adviser to the Center for Food Safety and Applied Nutrition has recommended that the US Food and Drug Administration (FDA) encourage and eventually require HACCP for the entire food industry. The FDA revised the Food Code in 1993, making it compatible with HACCP concepts. From December 1997, all fish and fishery products produced and marketed in the USA have had to comply with HACCP requirements. FDA verifies HACCP plans prepared by producers. This also applies to imports of fish and fishery products into the USA. Importers are required to obtain HACCP plans from the concerned producers (exporters) in the exporting country and submit them to FDA for verification. In addition, many HACCP principles are already in place in the FDA-regulated

low-acid canned food industry. The juice industry is subject to HACCP regulation according to a staggered schedule since January 2002. The US Department of Agriculture has required the use of HACCP in meat and poultry processing plants since January 1999. FDA published the *Fish and Fishery Products Hazards and Controls Guide* in September 1996 to assist processors in the development of their HACCP plans, identify hazards and formulate control strategies for those hazards. FDA is now considering development of regulations that would establish HACCP as the food safety guideline throughout other areas of the food industry.

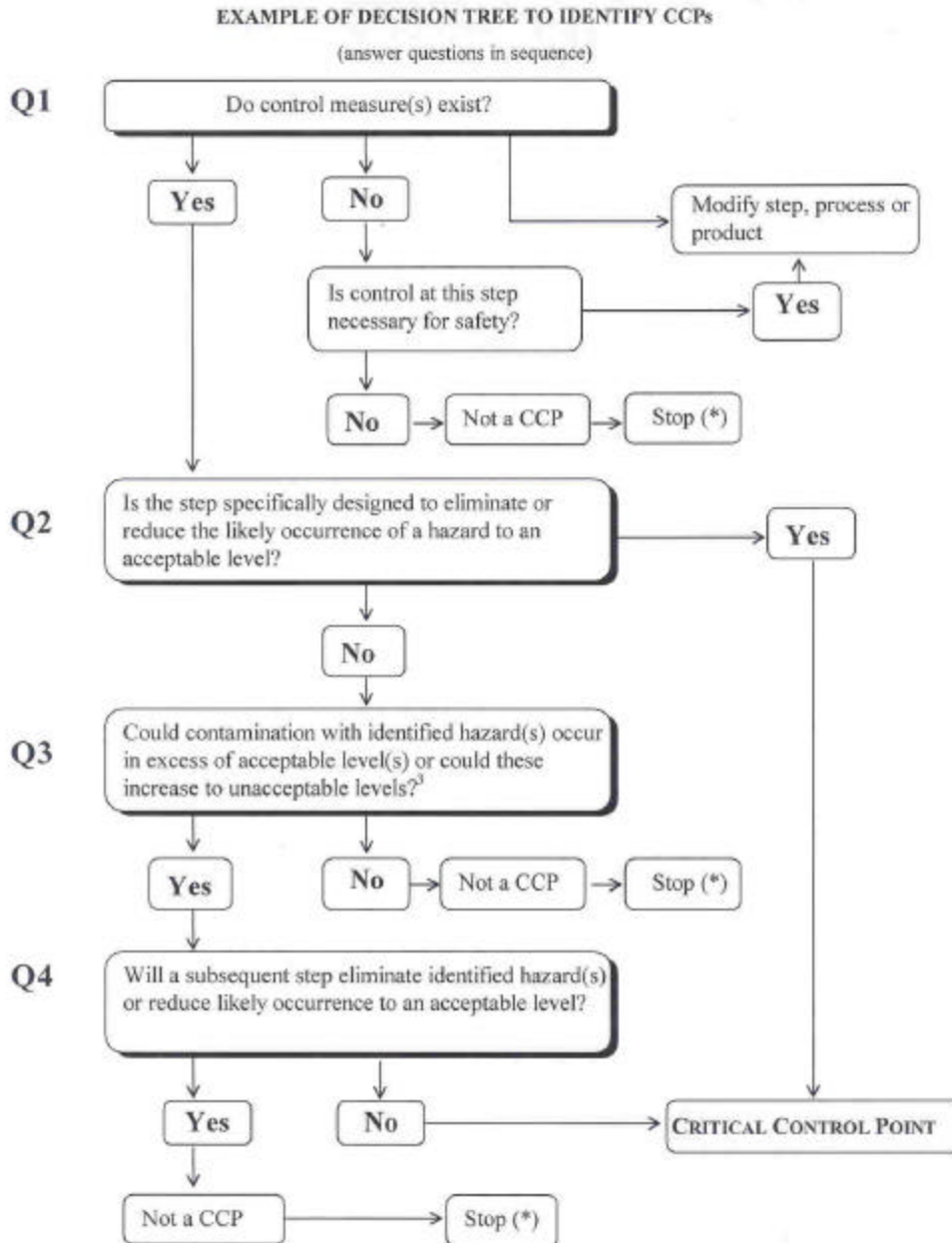
- In the European Union (EU), EU Council Directive No. 93/43/EEC of 14 June 1993 on Hygiene of Foodstuffs requires that food business operators should develop HACCP-based systems for ensuring food safety. This Directive further suggests that member states may develop codes of practice for specific food industries and adopt EN 29000 (the European equivalent of the ISO 9000 series) to implement the general rules of hygiene and guides to good hygiene practices. The European Commission Decision of 20 May 1994 (94/356/EC) requires a system of “own checks” for the production and sale of fishery products in EU countries. This decision also applies to imports. “Own check” means all those actions aimed at ensuring and demonstrating that a fishery product satisfies the requirements of the above decision. The “own check” included in this decision contains HACCP requirements. The EU has also decided that HACCP plans prepared by producers/exporters are verified by an authority nominated by the European Union. For example, in India, EU authorities have nominated the Export Inspection Council, a statutory body under the Ministry of Commerce, to verify exporters’ HACCP plans.

- HACCP third-party certification on a voluntary basis exists in Australia, New Zealand, some countries of Europe, India, Brazil, etc. It has also started in some countries in the Middle East, South Asia and Latin America.

As shown above there are many different ways in which HACCP as a concept is implemented into regulatory food safety requirements. In some cases, for example the United States, detailed HACCP plans may be specified, the basic elements of which food processors must translate and implement in their own operations. In other cases there may be a general requirement to implement HACCP-based food safety controls, for example for certain products in the European Union. In such cases, food processors must demonstrate that they have an effective HACCP system in place, although the specific way in which the system is implemented and operated is flexible. Further, in some cases a full seven-point HACCP system may be required, including verification, whilst in others a six-point system, without a specific requirement for verification, may be required. It should be emphasized, however, that a properly implemented HACCP system, which will continue to operate effectively over time, requires the full seven steps.

ANNEXES

A. Example of decision tree to identify CCPs



⁽¹⁾ Proceed to the next identified hazard in the described process.

³ Acceptable and unacceptable levels need to be defined within the overall objectives in identifying the CCPs of the HACCP plan.

B. List of selected websites where information about HACCP can be obtained

- **Codex Alimentarius Commission** of the Food and Agricultural Organisation (FAO) of the United Nations. <http://www.codexalimentarius.net>. This site contains information on Codex Standards as well as other standards including HACCP.
- **U.S. Food and Drug Administration** web site available from <http://vm.cfsan.fda.gov/~lrd/haccp.html>. This site gives useful information on HACCP principles and application guidelines.
- **National Center for Food Safety and Technology (NCFST)** - Consortium of academia, industry, and government working together in Illinois, USA, to ensure the safety and quality of the nation's food supply. <http://www.iit.edu/~ncfs/>
- **The Society for Food Hygiene Technology in the United Kingdom.** A group of professional people who recognised the need for an organisation to cover the interests and views of everyone involved in food hygiene in its widest application throughout the food chain. <http://www.sofht.co.uk>
- **The Seafood Network Information Centre** web site providing information including generic HACCP plans and current progress in the area of seafood HACCP. <http://seafood.ucdavis.edu/pubs/99resources.htm>

C. List of selected documents on HACCP

a. Documents downloadable free from the Internet

Strategies for Implementing HACCP in Small and/or Less Developed Businesses (1999), World Health Organization (WHO), Avenue Appia 20, 1211 Geneva 27, Switzerland, Tel: +41 22 791 21 11, Fax: +41 22 791 3111, E-mail: info@who.int Internet: <http://www.who.int> Available to download for free from the WHO web site at <http://www.who.int/fsf/smallHACCPconsulreport.pdf>. This report presents the benefits of and barriers to implementing HACCP, gives advice on development of sector-specific industry guides and provides guidelines for the application of the HACCP System to Small and/or Less Developed Businesses.

Hazard Analysis and Critical Control Point (HACCP) Principles and Application Guidelines, available from the Internet: <http://www.fst.vt.edu/haccp97/> Adopted by the National Advisory Committee, USA, on Microbiological Criteria for Foods, this document is a review of the HACCP principles and application guidelines.

Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application, Alinorm 97/13A Appendix II, Codex Committee on Food Hygiene, Codex Alimentarius Commission, <http://www.codexalimentarius.net>. The Codex defines terms used in HACCP and the seven HACCP principles; provides twelve steps for the application of HACCP; and a decision tree to identify critical control points.

b. Books

Quality Management Systems for the Food Industry, A Guide to ISO 9001/2, Andrew Bolton, Editor, GBP 66. Hardcover, 208 pages, latest edition October 1996, Aspen Publishers; ISBN: 07 5140 30 32. This volume deals with the ISO 9000:1994 series of standards, providing guidance on what is required to achieve certification, and making reference to sources of further information, training and guidance. Describes what the standards are, what they mean and how to implement them. Guidance is given on the basic format for a suitable quality management system for the food industry.

ISO 15161:2001, Guidelines on the application of ISO 9001:2000 for the food and drink industry. International Organization for Standardization. CHF 116. ISO, Case postale 56, CH 1211, Geneva 20, Switzerland, Tel: +41 22 749 0111, Fax: +41 22 733 34 30, E-mail: sales@iso.ch Internet: <http://www.iso.org> The standard is also obtainable from national standards bodies in ISO member countries. This document contains guidelines on applying ISO 9001:2000 to the food and drink industry, explaining how to integrate HACCP within an ISO 9001 QMS.

The economics of HACCP – costs and benefits.

Unnevehr L J (Dr.), Editor; Department of Agricultural and Consumer Economics, University of Illinois, USA. 2000, 412 pages. Eagan Press, St. Paul, Minnesota, USA. This new book contains the papers presented at a conference held in June 1998 on “The economics of HACCP. Over 130 participants attended the conference which covered several emerging issues for economics and agro-business research related to the use of HACCP in the food industry.

HACCP: A Practical Approach.

Mortimore S and Wallace C. 2nd edition 1998. 403 pages. Gaithersburg, Maryland: Aspen, Aspen Publishers, Inc. 200 Orchard Ridge Drive, 20878 Gaithersburg, MD USA. Study providing a step-by-step approach for developing a Hazard Analysis and Critical Control Point (HACCP) System - explains each of HACCP techniques and gives examples; includes case studies illustrating various HACCP application aspects in food management systems.

How to HACCP: an illustrated guide

Dillon M and Griffith C., 1995. 83 pages. M.D. Associates, Cleethorpes Enterprise Centre, Unit 43, Jackson Place, Humberston, Grimsby, South Humberside DN 36 4AS UK. Handbook on Hazard Analysis and Critical Control Point (HACCP) system development designed to assist small businesses and students gain an insight into practical aspects of food production and management systems – explains HACCP methodology – reviews risk assessment and analysis methods – includes illustrations and diagrams; appendices with practical information and reference sources to assist the HACCP team.

Food Quality and Safety Systems – A training manual on food hygiene and the Hazard Analysis and Critical Control Point (HACCP) system. Food and Agriculture Organization (FAO) of the United Nations, 1998, 243 pages, Publishing Management Group, FAO Information Division, ISBN: 92-5-104115-6. The book is intended for trainers in food quality and safety assurance at the government and industry levels. The manual consists of three sections: Principles and methods of training; Recommended International Code of Practice – General Principles of Food Hygiene; and The Hazard Analysis and Critical Control Point (HACCP) system.