GUIDELINES FOR AN ENVIRONMENTAL HEALTH OFFICER (EHO) ENGAGED IN THE EVALUATION OF FOOD PREMISES WITHIN THE HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) PRINCIPLES

DEPARTMENT OF HEALTH

DIRECTORATE: FOOD CONTROL

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1. INTRODUCTION

Food borne diseases cause considerable morbidity throughout the world even though the principles for controlling most of these diseases are well established. Traditional approaches may therefore be considered to have failed to deal with the problem.

A relatively new approach to the prevention and control of food borne diseases is the Hazard Analysis Critical Control Point (HACCP) system. This system seeks to identify the hazards associated with any stage of food production, processing or preparation, assess the related risks, and determine the operation where control procedures will be effective. Thus control procedures are directed as specific operations that are crucial in ensuring the safety of foods.

This guide is intended to assist the Environmental Health Officers (EHO's) concerned with food safety and the prevention of food borne diseases. It should also assist in the planning of food safety and health education activities that focus on the hazards and technologies associated with the type of food commonly eaten or foods that are processed and prepared by local inhabitants.
The EHO in food safety needs to understand the epidemiology of food borne disease and the microbial ecology of foods and food processing operations so that measures to prevent diseases and food spoilage can be devised, selected and given appropriate emphasis.

2. APPLICATION OF THE HACCP SYSTEM

The HACCP system is based on an understanding of the factors that contribute to outbreaks of food borne diseases and on applied research on the ecology, multiplication and inactivation of food borne pathogens. Although the initial hazard analysis will take longer than an inspection, valuable information about the food process will be obtained. In attempting to identify potential hazards it is necessary to consider three areas, namely:

- The raw materials used;
- The processing procedures; and
- The manner in which the product is used.

This means that in any particular food processing plant or establishment, the hazard will depend upon the source of ingredients, the formulation, the processing equipment, the duration of the process, the storage of food and the food handlers. Changes in the source of raw materials, product formulation, processing procedures, packaging, distribution or use of a product indicate the need for re-evaluation, because any of these changes might adversely affect food safety or product shelf-life.

3. WHERE TO CONDUCT A HACCP EVALUATION (HACCPE)

The HACCP can be conducted in homes, food-processing plants and in food service establishments. The selection of places to be studied and evaluated can be based on four factors, namely, the food property, the food operation, the volume of food prepared and the susceptibility of consumers. Whenever possible, epidemiological data should be used in making the selection. For example, if outbreaks of food borne diseases or reported cases of illness are attributed to food processed in homes, hazards analysis should be performed in those places. Where illness is common amongst visitors to the area, hazard analysis should include places frequented by tourists.

4. ANALYSING HAZARDS AND ASSESSING THEIR SEVERITY AND RISKS

The first step in the HACCP system is hazard analysis. Technical expertise is required to assess hazards and their severity and to predict risks. Incorrect predictions will not provide the security desired and will increase the costs.

A hazard can mean contamination of food by organisms that cause spoilage or can relate to survival of undesirable microorganisms or persistence of toxins after heating and the multiplication of microorganisms when food is held:

- At room temperature or warm outside temperatures for several hours;
- Warm-but not hot- in ovens or other hot-holding devices;
- In cold-storage facilities, in large quantities or sufficiently low temperatures.

Hazards may also be caused by chemical substances that reach food inadvertently through various agricultural practices or during food processing, preparation or storage. Hazards may also result from chemicals that are added to foods in excess of functional or culinary needs.

5. PREPARATION FOR ANALYSIS

- Visit several establishments of the type in which hazard analysis are planned.
- Observe the situation and talk to the people in charge, such as the manager of a food establishment, shopkeeper, street vendor, or homemaker to obtain information about the type of foods usually prepared, the way in which they are prepared, and when they are prepared.
- Explain the purpose of the study and its expected duration.
- Try to determine the degree of co-operation that can be expected and whether any special equipment will be needed.
- Choose the place where the analysis will be performed, make arrangements for the visit, and co-ordinate date and time of arrival.
- Emphasise that you are performing a scientific investigation, not an inspection, and that the data will not be used to condemn or embarrass anyone.
- Tell the people involved that their tolerance and co-operation will greatly assist the Department of Health to understand patterns of food

preparation and processing within the country and that the results of the study will be used as a basis for a health education campaign.

- Ask them to prepare or process foods in their usual way, telling them that you will be watching, taking certain measurements, and possibly collecting samples

6. INTERVIEWING RESPONSIBLE PERSONS

- Ask the managers and the people who prepare foods each step of the operation.
- Take as complete a history of the processing or preparation of the foods under investigation as possible. This history should include the sources of foods and ingredients, the people who handled the items, the procedures and equipment used, all potential sources of contamination during handling, and the time and temperature conditions to which foods were exposed.
- Talk to the people responsible for each operation.
- Obtain recipes or product formulae of composition, if possible.
- Note the sequence of operations, from arrival of the ingredients until their distribution, sale or consumption.
- Note all temperature settings and the duration of each step.
- At processing establishments, for example, the investigation may cover the conditions under which animals are held prior to slaughter, the slaughter itself, dehairing, defeathering, washing, evisceration, heat processing, cooling, freezing, drying, fermentation, acidification, smoking, packaging and storage.
- At food service operations and in homes, the investigation will probably study receipt of food, storage, preparation, cooking, handling after cooking, hot holding, reheating and serving of foods.
- Study also the operations in establishments where the ingredients were previously stored or processed, and the storage method and preparation practices used after the products left those establishments.

7. OBSERVING OPERATIONS

During a hazard analysis, specific evaluations of products and operations are necessary. Concerns about products include formulation, processing, and conditions of intended distribution and use. Answers to the following questions should be obtained:

Reading formulation or recipe

a) What raw materials or ingredients are used?
b) Are microorganisms of concern likely to be present on or in these materials, and if so what are they?
c) Do any of the ingredients have toxic properties or contain toxic substances?
d) If preservatives are used, are they at concentrations able to prevent the growth of microbes of concern?
e) Are any of the ingredients used in quantities too high or too low for culinary needs?
f) Will the pH of the product prevent microbial growth or inactivate particular pathogens?

Regarding food processing and preparation:

a) Can a contaminant reach the product during preparation, processing or storage?
b) Will microorganisms or toxic substances of concern be inactivated during cooking, reheating or other processes?
c) Could any microorganism or toxic substance of concern contaminate the food after it has been heated?
d) Could any microorganism of concern multiply during preparation or storage?
e) How does the package or container affect survival and/or growth of microorganisms?
f) What is the time taken for each step of processing, preparation, storage and display?

Regarding the expected use of prepared foods:

a) Is the food expected to be held hot, chilled, frozen or at ambient temperature after it leaves the plant or store?

b) Will the time – temperature exposure during reheating inactivate microorganisms and toxins of concern?

c) If the food is held after reheating, will it be held hot or at ambient temperature?

d) Will the food be handled or otherwise exposed to potential contamination?

Answers to these questions may indicate possible hazards and provide information on severity and risks.

Evaluate the effectiveness of cleaning of utensils and equipment by:

- Observing the cleaning procedures;
- Measuring the temperature and/or concentration of detergent and disinfectant solutions, and the contact time;
- Examining the appearance of equipment after cleaning, and under some circumstances;
- Swabbing or taking contact samples from surface.

8. FOOD PROCESSING IN FOOD INDUSTRIES

The hazards associated with food processing in food industries will vary with the type of food and the process used; however, some general principles can be described:

* **INGREDIENT:** Certain ingredients, especially those of animal origin, are likely to contain pathogens; for example, raw meat, poultry and fish frequently harbour a variety of enteric pathogens; spices, sugar and starch may contain bacterial spores; water may be contaminated by enteric pathogens, etc.

* **PROCESS FAILURE:** processes that fail can create hazards. For example, pasteurisation, retorting, and sometimes preheating are intended to kill particular groups of microorganisms, but inadequate heating times or too-low temperatures can permit their survival.

* **MISHANDLING OF THE PRODUCT:** The possibility of mishandling of the product by food handlers or preparers of food in homes is another concern of food processors. When assessing product stability, the potential consequences of such abuse should be borne in mind.

9. FOOD SERVICE ESTABLISHMENTS, FOOD STALLS AND OTHER RETAILS OUTLETS

In establishments where foods are prepared, displayed, served or sold the sources of the food, and the likelihood of being contaminated on arrival at the establishment or during handling, should be evaluated. Recipes of formulated (composite) foods should be assessed for the types and amount of ingredients that are likely to contain pathogens, as well as for other substances (e.g. acid, salt, sugar, garlic) that act as stabilizers. Cooking and reheating practices should be evaluated to determine whether they are sufficient to inactivate pathogens and denature any toxins. For this purpose, some or all of the following actions will be necessary at the various steps of the operation:

- Receiving: Assess incoming foods for appearance, quality, temperature, pH and type of packaging. Note any damage to packaging and estimate the possible types and quantities of contaminants. Note the source of food and, if possible, the processing history.
- Storage: Appraise methods of storing raw, frozen, chilled and dry foods, to identify any situation that could permit contamination or promote microbial growth.
- Handling of raw products: Assess the handling of raw products, reconstitution of dehydrated foods, thawing of frozen foods, and

preparation of foods to be served without subsequent heating, to identify operations during which contamination could occur.

- Formulation: Review the formulation of foods and if appropriate measure pH and water activity.
- Cooking: Measure the highest temperature attained at the geometric centre of foods after cooking, or record the time-temperature exposure of foods during cooking, to determine whether pathogens of concern could survive cooking.
- Handling of cooked foods: Appraise the handling of cooked foods to identify potential modes of contamination.
- Hot holding of cooked foods: Measure the time for which foods are held hot and their temperature to determine whether pathogens could survive and multiply. Holding of cooked foods at room temperature: Observe whether cooked foods are kept at room temperature and if so, measure the temperature and the duration whether pathogenic bacteria could multiply or generate toxins.
- Cooling: Measure the depth of food being cooled, or the temperature of food at intervals during cooling, to determine whether pathogenic bacteria could multiply.
- Reheating: Measure the highest temperature attained at the geometric centre of foods after reheating, or record the time-temperature exposure of foods during reheating to determine whether pathogens could survive reheating.
- Cleaning of equipment and utensils: Determine whether cleaning and disinfection procedures are adequate to remove pathogens from equipment and utensils or to inactivate them.
- Storage of final product: Determine the characteristics of prepared food and microbiological quality to assess the type of storage needed.
- Personnel: Assess the knowledge of personnel regarding the safe handling of foods.

10. SPECIFYING CRITERIA

Once the critical control points have been identified, applicable control measures should be implemented. These measures must be practicable and economically feasible, and must ensure food safety. Examples of criteria are:

- End-point temperatures attained after heat processing.
- Time-temperature exposure adequate to inactivate microorganisms of concern.
- The pH or water activity of the final product.
- Temperatures during cooling or hot holding.
- The concentration of chlorine in water used.

Each criterion must be expressed in a clear and unambiguous statement, with specification of acceptable tolerances.

11. MONITORING CRITICAL CONTROL POINTS

Monitoring of critical control points is essential to ensure that the specified criteria are being met. Foods can be monitored in many ways depending on the type of control point and the instruments and equipment available. Monitoring should aim to detect any deviation from the established criteria. It usually depends on observation, or physical or chemical measurements (e.g. temperature, pH, concentration of salt, etc.) Results should be obtainable immediately so that the process can be quickly adjusted, if necessary.

12. TAKING CORRECTIVE ACTION

If monitoring indicates that a process is out of control or that established criteria are not being met, immediate action must be taken. The specific action will depend on the process being monitored and may include reheating or reprocessing, increasing temperature, decreasing water activity, decreasing pH, extending the processing time, adjusting the concentration of certain ingredients, adjusting the processing at a later stage, rejecting incoming lots,

diverting the product to use as animal feed, or discarding the product. The decision will be based on the hazards, their severity, and the risks involved and on the expected use of the product.

Routine monitoring of the critical control points of a food operation is the responsibility of the manager of the establishment, but food safety programme supervisors will need to verify the appropriateness of control criteria and critical control points, and the EHO will need to verify the extent and effectiveness of the monitoring. Verification may include:

- Checking records of time-temperature readings;
- Observing operations at critical control points;
- Making measurements to confirm the accuracy of the monitoring;
- Collecting samples;
- Conducting special studies, e.g. inoculating pack or challenge tests, with regard to the safety of products; and
- Interviewing staff about the way they monitor critical points.
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Furthermore, the composition of food products and operational procedures should be reviewed to determine whether any changes have been made since the HACCP system was established. If so, it may be necessary to select different critical control points or modify the monitoring procedures.

13. USING HACCP TO IMPROVE FOOD SAFETY

The EHO who conducts HACCP evaluations can make significant contributions to improve health and welfare and economic development, by providing leadership to the food industry and the public. The EHO is also ideally placed to guide the development of educational programmes so that the food industry and the public are informed of significant risks associated with food processing and food preparation practices, and of practical and economical ways to prevent of eliminate hazards.

14. CONCLUSION

Inspections for food safety should focus on the processes that the foods undergo, with particular attention to:

- Possible sources of contamination to which foods are exposed;
- Modes of contamination;
- Effects of the process on the level of contamination;
- Probability of microorganisms surviving processing; and
- Chances that bacteria or moulds will multiply during processing or storage.

Hence, food safety rests on controlling food operations from receipt of ingredients until the processed or prepared foods are distributed, sold or eaten. Surveillance should emphasize operations rather than physical facilities.

Reference: Frank L Bryan (1992): A guide to identifying hazards and assessing risks associated with food preparation and storage.

ANNEXURE A

THE HACCP SYSTEM

1. DEFINITION

The hazard Analysis Critical Control Point (HACCP) concept is a systematic approached to the identification, assessment and control of hazards. The system offers a rational approach to the control of microbiological hazards in food, avoids the many weaknesses inherent in the inspectional approach and circumvents the shortcomings of reliance on microbiological testing.

2. COMPONENTS OF THE SYSTEM AND DEFINITIONS OF TERMS

The HACCP system comprises the following sequential steps:

Identification of hazards and assessment of the severity of these hazards and their risks (hazard analysis) associated with growth, harvesting, processing, manufacturing, distribution, marketing, preparation and/or use of a raw material of food products.

- **HAZARD** means the unacceptable contamination, growth or survival in food of microorganisms that may affect food safety or lead to spoilage, and/or the unacceptable production or persistence in foods of products of microbial metabolism, e.g. toxins and enzymes.

- **SEVERITY** is the magnitude of the hazard, or the seriousness of the possible consequences.

- **RISK** is an estimate of the probability of a hazard occurring.

Hazard analysis consists of an evaluation of all procedures concerned with the production, distribution and use of raw materials and food products to:

a. Identify potentially hazardous raw materials and food that may contain poisonous substances, pathogens or large numbers of food spoilage microorganisms, and/or that can support microbial growth;
b. Identify the potential sources and specific points of contamination;
c. Determine the probability that microorganisms will survive or multiply during production, processing, distribution, storage and preparation for consumption; and
d. Assess the risks and severity of the hazards identified.

3. DETERMINATION OF CRITICAL CONTROL POINTS (CCP's) AT WHICH THE IDENTIFIED HAZARDS CAN BE CONTROLLED

* A CCP is an operation (practice, procedure, location or process) at which control can be exercised over one or more factors to eliminate, prevent of minimize a hazard.

In some food processes, control of a single operation (CCP) can completely eliminate one or more microbial hazards, e.g. pasteurisation. It is also possible to identify control points at which a hazard can be minimized, but not completely eliminated. Both types of CCP's are important and must be controlled.

4. SPECIFICATION OF CRITERIA THAT INDICATE WHETHER AN OPERATION IS UNDER CONTROL AT A PARTICULAR CRITICAL CONTROL POINT

- Criteria are limits of characteristic of a physical (e.g. time or temperature), chemical (e.g. concentration of salt or acetic acid) biological or sensorial nature.

  It is important to select appropriate means to check that the hazard has been controlled at the CCP. Factors to be monitored may include:

  - time and temperature for thermally processed foods;
  - water activity of certain foods;
  - pH of fermented foods;
  - chlorine levels in can cooling water;
  - humidity in storage areas for dry products;
  - temperature during distribution of chilled foods;
  - depth of product in trays to be chilled;
  - instructions on labels of finished products describing recommended procedures for preparation and use by the consumer.

5. ESTABLISHMENT AND IMPLEMENTATION OF PROCEDURES TO MONITOR EACH CRITICAL CONTROL POINT TO CHECK THAT IT IS UNDER CONTROL

* **MONITORING:** involves the systematic observation, measurement and/or recording of the significant factors for control of the hazard. The monitoring procedures chose must enable action to be taken to rectify an out-of control situation, either before or during an operation.

The monitoring must detect any deviation from the specification (loss of control) in time for corrective action to be taken before the product is sold or distributed.

Five main types of monitoring are employed: observation, sensory evaluation, measurement of physical properties, chemical testing and microbiological examination.

6. **IMPLEMENTATION OF APPROPRIATE CORRECTIVE ACTION WHEN MONITORING INDICATES THAT CRITERIA SPECIFIED FOR SAFETY AND QUALITY AT A PARTICULAR CRITICAL CONTROL POINT ARE NOT MET**

7. **VERIFICATION**, i.e., the use of supplementary information and tests to ensure that the HACCP system is functioning as planned. Verification includes a review of the HACCP plan to determine whether all hazards have been detected, all critical control points identified, criteria are appropriate and monitoring procedures are effective in evaluating operations.