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1 Scope

This Code of Practice covers general hygienic practices for the primary production and packing of fresh fruits and vegetables cultivated for human consumption in order to produce a safe and wholesome product: particularly for those intended to be consumed raw. Specifically, this Code is applicable to fresh fruits and vegetables grown in the field (with or without cover) or in protected facilities (hydroponic systems, greenhouses). It concentrates on microbial hazards and addresses physical and chemical hazards only in so far as these relate to GAPs and GMPs.

The *Annex for Ready –to-eat Fresh Pre-cut Fruits and Vegetables* (Annex I),*Annex for Sprout Production* (Annex II) and *Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application (Annex III)* are supplements to this Code and include additional recommendations to cover, respectively, the hygienic practices for the processing of ready-to-eat fresh pre-cut fruits and vegetables, and the hygienic practices that are specific for the primary production of seeds for sprouting and the production of sprouts for human consumption.

The Code does not provide recommendations for handling practices to maintain the safety of fresh fruits and vegetables at wholesale, retail, food services or in the home. It excludes food products for which there is a specific Codex Alimentarius Code of Hygienic Practices.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

Codex Alimentarius Commission. Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003)

Codex Alimentarius Commission. Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1-1969 Rev. 4 – 2003)

Codex Alimentarius Commission. Code of Hygienic Practice for the Transport of Food in Bulk and Semi-packed Food (CAC/RCP 47-2001)

3 Terms and Definitions

3.1
agricultural inputs
any incoming material (e.g. seeds, fertilizers, water, agricultural chemicals, plant support, etc.) used for the primary production of fresh fruits and vegetables

3.2
agricultural worker
any person who undertakes one or more of the following: cultivation, harvesting and packing of fresh fruits and vegetables

3.3
antimicrobial agents
any substance of natural, synthetic or semi-synthetic origin which at low concentrations kills or inhibits the growth of microorganisms but causes little or no host damage

3.4
biological control
use of competing biologicals (such as insects, microorganisms and/or microbial metabolites) for the control of mites, pests, plant pathogens and spoilage organisms

3.5
biosolids
sludge and other residue deposits obtained from sewage treatment plants and from treatment applied to urban and industrial wastes (food industries or other types of industry)

3.6
composting
managed process in which organic materials are digested aerobically or anaerobically by microbial action

3.7
cultivation
any agricultural action or practise used by growers to allow and improve the growing conditions of fresh fruits or vegetables grown in the field (with or without cover) or in protected facilities (hydroponic systems, greenhouses)

3.8
farm
any premise or establishment in which fresh fruits and/or vegetables are grown and harvested and the surroundings under the control of the same management

3.9
food business operator
refers to a person engaged in the food business including one's agent and is responsible for ensuring the requirements of RA 10611 (Food Safety Act) are met by the food business under one's control

3.10
grower
person responsible for the management of the primary production of fresh fruits and vegetables

3.11
harvester
person responsible for the management of the harvesting of fresh fruits and vegetables

3.12
hazard
a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect

3.13
hazardous material
any compound which, at specific levels, has the potential to cause adverse health effects (e.g., garbage, manure, etc.)

3.14
hydroponics
a general term for the production of plants without soil in a water medium

3.15
manure
animal excrement which may be mixed with litter or other material, and which may be fermented or otherwise treated

3.16
microorganisms
include yeasts, moulds, bacteria, viruses and parasites. When used as an adjective, the term "microbial" is used

3.17
packer
person responsible for the management of post-harvest processing and packing of fresh fruits and vegetables

3.18
packing
action of putting fresh fruits and vegetables in a package. This may take place in a field or in an establishment

3.19
packing establishment
any indoor establishment in which fresh fruits and vegetables receive post-harvest treatment and are packaged

3.20
primary production
those steps involved in the growing and harvesting of fresh fruits and vegetables such as planting, irrigation, application of fertilizers, application of agricultural chemicals, etc.

3.21 Types of water

3.21.1
clean water
water that does not compromise food safety in the circumstances of its use

3.21.2
potable water
water which meets the quality standards of drinking water such as described in the WHO Guidelines for Drinking Water Quality

3.22
vermicompost
produced by chemical disintegration of organic matter by earthworms

3.23
hazardous waste
a waste with a chemical composition or other properties that make it capable of causing illness, death, or some other harm to humans and other life forms when mismanaged or released into the environment

4 General Principle

4.1 Objective

This Code addresses Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) that will help control microbial, chemical and physical hazards associated with all stages of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53 - 2003) production of fresh fruits and vegetables from primary production to packing. Particular attention is given to minimizing microbial hazards. The Code provides a general framework of recommendations to allow uniform adoption by this sector rather than providing detailed recommendations for specific agricultural practices, operations or commodities. The fresh fruit and vegetable industry is very complex. Fresh fruits and vegetables are produced and packed under diverse environmental conditions. It is recognized that some of the provisions in this Code may be difficult to implement in areas where primary production is conducted mostly in small holdings and also in areas where traditional farming is practiced. Therefore, the Code is, of necessity, a flexible one to allow for different systems of control and prevention of contamination for different groups of commodities.

4.2 Use

This Code follows the format of the Codex *Recommended International Code of Practice - General Principles of Food Hygiene*- CAC/RCP 1-1969, Rev 3 (1997) and should be used in conjunction with it. This Code focuses upon hygienic issues that are specific to the primary production and packing of fresh fruits and vegetables. The major issues discussed in the Code are the following: Environmental Hygiene, Hygienic Production of Food Sources, Handling, Storage and Transport, Cleaning, Maintenance and Personnel Hygiene at Primary Production (from Section 3 of Codex Recommended International Code of Practice - General Principles of Food Hygiene- CAC/RCP 1-1969, Rev 3 1997). In other sections the *General Principles of Food Hygiene* have been expanded where there are issues specific to primary production and packing. The *Annex for Ready-to-Eat Fresh Pre-Cut Fruits and Vegetables* provides additional recommendations specific for the processing of ready-to-eat fresh pre-cut fruits and vegetables and the *Annex for Sprout Production* provides additional recommendations specific for the primary production of seeds for sprouting and the production of sprouts for human consumption. The Annex for *Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application provides* general guidance

for the application of the system while recognizing that the details of application may vary depending on the circumstances of the food operation.

5 Primary Production

Fresh fruits and vegetables are grown and harvested under a wide range of climatic and diverse geographical conditions, using various agricultural inputs and technologies, and on farms of varying sizes. Microbial, chemical and physical hazards may therefore vary significantly from one type of production to another. In each primary production area, it is necessary to consider the particular agricultural practices that promote the production of safe fresh fruits and vegetables, taking into account the conditions specific to the primary production area, type of products, and methods used. Procedures associated with primary production should be conducted under good hygienic conditions and should minimize potential hazards to health due to the contamination of fresh fruits and vegetables.

5.1 Environmental Hygiene

Where possible, potential sources of contamination from the environment should be identified. In particular, primary production should not be carried out in areas where the presence of potentially harmful substances would lead to an unacceptable level of such substances in or on fresh fruits and vegetables after harvest.

Where possible, growers should evaluate the previous uses of the sites (indoor and outdoor) as well as adjoining sites in order to identify potential microbial, chemical and physical hazards. The potential for other types of contamination (e.g., from agricultural chemicals, hazardous wastes, etc.) should also be considered. The evaluation process should include the following:

a) previous and present usage of the primary production area and the adjoining sites (e.g. crop grown, feed lot, animal production, hazardous waste site, sewage treatment site, mining extraction site) to identify potential microbial hazards including faecal contamination and contamination by organic waste and potential environmental hazards that could be carried to the growing site.
b) access of farm and wild animals to the site and to water sources used in primary production to identify potential faecal contamination of the soils and water and the likelihood of contaminating crop. Existing practices should be reviewed to assess the prevalence and likelihood of uncontrolled deposits of animal faeces coming into contact with crops. Considering this potential source of contamination, efforts should be made to protect fresh produce growing areas from animals. As far as possible, domestic and wild animal should be excluded from the area.
c) potential for contaminating produce fields from leaking, leaching or overflowing manure storage sites and flooding from polluted surface waters.

If previous uses cannot be identified, or the examination of the growing or adjoining sites leads to the conclusion that potential hazards exist, the sites should be analysed for contaminants of concern. If the contaminants are at excessive levels and corrective or preventative actions have not been taken to minimize potential hazards, the sites should not be used until correction/control measures are applied.

5.2 Hygienic Primary Production of Fresh Fruits and Vegetables

5.2.1 Agricultural input requirements

Agricultural inputs should not contain microbial or chemical contaminants (as defined under the *Recommended International Code of Practice – General Principles of Food Hygiene* (CAC/RCP 1-1969, Rev 3 (1997) at levels that may adversely affect the safety of fresh fruits and vegetables and taking into consideration the WHO guidelines on the safe use of wastewater and excreta in agriculture and aquaculture as appropriate.

5.2.1.1 Water for primary production

5.2.1.1.1 General

Growers should identify the sources of water used on the farm (municipality, re-used irrigation water, well, open canal, reservoir, rivers, lakes, farm ponds etc.). They should assess its microbial and chemical quality, and its suitability for intended use, and identify corrective actions to prevent or minimize contamination (e.g. from livestock, sewage treatment, human habitation).

Where necessary, growers should have the water they use tested for microbial and chemical contaminants. The frequency of testing will depend on the water source and the risks of environmental contamination including intermittent or temporary contamination (e.g. heavy rain, flooding, etc.). If the water source is found to be contaminated corrective actions should be taken to ensure that the water is suitable for its intended use.

5.2.1.1.2 Water for irrigation and harvesting

Water used for agricultural purposes should be of suitable quality for its intended use. Special attention to water quality should be considered for the following situations:

a) irrigation by water delivery techniques that expose the edible portion of fresh fruits and vegetables directly to water (e.g. sprayers) especially close to harvest time
b) irrigation of fruits and vegetables that have physical characteristics such as leaves and rough surfaces which can trap water
c) irrigation of fruits and vegetables that will receive little or no post-harvest wash treatments prior to packing, such as field-packed produce

5.2.1.1.3 Water for fertilizers, pest control and other agricultural chemicals

Clean water should be used for the application of water-soluble fertilizers and agricultural chemicals in the field and indoors. Special attention to the water quality should be considered when using fertilizer and agricultural chemical delivery techniques (e.g. sprayers) that expose the edible portion of fresh fruits and vegetables directly to water especially close to harvest time.

5.2.1.1.4 Hydroponic water

Plants grown in hydroponic systems absorb nutrients and water at varying rates, constantly changing the composition of the re-circulated nutrient solution. Because of this:

a) water used in hydroponic culture should be changed frequently, or if recycled, should be treated to minimize microbial and chemical contamination
b) water delivery systems should be maintained and cleaned, as appropriate, to prevent microbial contamination of water

5.2.1.2 Manure, biosolids and other natural fertilizers

The use of manure, biosolids and other natural fertilizers in the production of fresh fruits and vegetables should be managed to limit the potential for microbial, chemical and physical contamination. Manure, biosolids and other natural fertilizers contaminated with heavy metals or other chemicals at levels that may affect the safety of fresh fruits and vegetables should not be used. Where necessary, in order to minimize microbial contamination the following practices should be considered:

a) Adopt proper treatment procedures (e.g. composting, vermicomposting, pasteurization, heat drying, UV irradiation, alkali digestion, sun drying or combinations of these) that are designed to reduce or eliminate pathogens in manure, biosolids and other natural fertilizers. The level of pathogen reduction achieved by different treatments should be taken into account when considering suitability for different applications;
b) Manure, biosolids and other natural fertilizers which are untreated or partially treated may be used only if appropriate corrective actions are being adopted to reduce microbial contaminants such as maximizing the time between application and harvest of fresh fruits and vegetables;
c) Growers who are purchasing manure, biosolids and other natural fertilizers that have been treated to reduce microbial or chemical contaminants, should, where possible, obtain documentation from the supplier that identifies the origin, treatment used, tests performed and the results thereof;
d) Minimize direct or indirect contact between manure, biosolids and other natural fertilizers, and fresh fruits and vegetables, especially close to harvest;

e) Minimize contamination by manure, biosolids and other natural fertilizers from adjoining fields. If the potential for contamination from the adjoining fields is identified, preventative actions (e.g. care during application and run-off controls) should be implemented to minimize the risk; and

f) Avoid locating treatment or storage sites in proximity to fresh fruit and vegetable production areas. Prevent cross-contamination from runoff or leaching by securing areas where manure, biosolids and other natural fertilizers are treated and stored.

5.2.1.3 Soil

Soils should be evaluated for hazards. If the evaluation concludes that such hazards are at levels that may compromise the safety of crops, control measures should be implemented to reduce hazards to acceptable levels. If this cannot be achieved by available control measures, growers should not use these soils for primary production.

5.2.1.4 Agricultural chemicals

Growers should use only agricultural chemicals which are authorized for the cultivation of the specific fruit or vegetable and should use them according to the manufacturer's instructions for the intended purpose. Residues should not exceed levels as established by the Codex Alimentarius Commission. In order to minimize and contain the emergence of microbial resistance:

a) use of antimicrobial agents significant to human and animal therapy should be avoided;

b) antimicrobial agents not significant to human and animal therapy should be used only when unavoidable and in accordance with good agricultural practices and in a manner that achieves this objective;

c) agricultural workers who apply agricultural chemicals should be trained in proper application procedures;

d) growers should keep records of agricultural chemical applications. Records should include information on the date of application, the chemical used, the crop sprayed, the pest or disease against which it was used, the concentration, method and frequency of application, and records on harvesting to verify that the time between application and harvesting is appropriate;

e) agricultural chemical sprayers should be calibrated, as necessary, to control the accuracy of the rate of application;

f) mixing of agricultural chemicals should be carried out in such a way as to avoid contamination of water and land in the surrounding areas and to protect employees involved in this activity from potential hazards;

g) sprayers and mixing containers should be thoroughly washed after use, especially when used with different agricultural chemicals on different crops, to avoid contaminating fruits and vegetables;

h) agricultural chemicals should be kept in their original containers, labelled with the name of the chemical and the instructions for application. Agricultural chemicals should be stored in a safe, well ventilated place, away from production areas, living areas and harvested fruits or vegetables, and disposed of in a manner that does not pose a risk of contaminating crops, the inhabitants of the area, or the environment of the primary production; and

i) empty containers should be disposed of as indicated by the manufacturer. They should not be used for other food-related purposes

5.2.1.5 Biological control

Environmental and consumer safety should be considered when using competing biological organisms and/or their metabolites applied for the control of pests, mites, plant pathogens and spoilage organisms in fresh fruits and vegetables.

Growers should use only biological controls which are authorized for the cultivation of the specific fruit or vegetable and should use them according to the manufacturer's instructions for the intended purpose.

5.2.2 Indoor facilities associated with growing and harvesting

For operations where fresh fruits and vegetables are grown indoors (greenhouses, hydroponic culture, etc.) suitable premises should be used.

5.2.2.1 Location, design and layout

Premises and structures should be located, designed and constructed to avoid contaminating fresh fruits and vegetables and harboring pests such as insects, rodents and birds.

Where appropriate, the internal design and layout should permit compliance with good hygienic practices for the primary production of fresh fruits and vegetables indoors, including protection against cross-contamination between and during operations. Each establishment should be evaluated individually in order to identify specific hygienic requirements for each product.

5.2.2.2 Water supply

Where appropriate an adequate supply of potable or clean water with appropriate facilities for its storage and distribution should be available in indoor primary production facilities. Non-potable water should have a separate system. Non-potable water systems should be

identified and should not connect with, or allow reflux into, potable water systems. In order to ensure the quality of water supply:

a) avoid contaminating potable and clean water supplies by exposure to agricultural inputs used for growing fresh produce;
b) clean and disinfect potable and clean water storage facilities on a regular basis; and
c) control the quality of the water supply

5.2.2.3 Drainage and waste disposal

Adequate drainage and waste disposal systems and facilities should be provided. These systems should be designed and constructed so that the potential for contamination of fresh fruits and vegetables, agricultural inputs or the potable water supply is avoided.

5.2.3 Personnel health, hygiene and sanitary facilities

Hygiene and health requirements should be followed to ensure that personnel who come directly into contact with fresh fruits and vegetables during or after harvesting are not likely to contaminate them. Visitors should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

5.2.3.1 Personnel hygiene and sanitary facilities

Hygienic and sanitary facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained. As far as possible, such facilities should:

a) be located in close proximity to the fields and indoor premises, and in sufficient number to accommodate personnel;
b) be of appropriate design to ensure hygienic removal of wastes and avoid contamination of growing sites, fresh fruits and vegetables or agricultural inputs;
c) have adequate means of hygienically washing and drying hands; and
d) be maintained under sanitary conditions and good repair

5.2.3.2 Health status

People known, or suspected, to be suffering from, or to be a carrier of a disease or illness likely to be transmitted through fresh fruits and vegetables, should not be allowed to enter any food handling area if there is a likelihood of their contaminating fresh fruits and vegetables. Any person so affected should immediately report illness or symptoms of illness to the management.

5.2.3.3 Personal cleanliness

Agricultural workers who have direct contact with fresh fruits and vegetables should maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing and footwear. Cuts and wounds should be covered by suitable waterproof dressings when personnel are permitted to continue working.

Personnel should wash their hands when handling fresh fruits and vegetables or other material that comes in contact with them. Personnel should wash their hands before starting work involving the handling of fruits and vegetables, each time they return to handling areas after a break, immediately after using the toilet or after handling any contaminated material where this could result in contamination of fresh fruits and vegetables.

5.2.3.4 Personal behaviour

Agricultural workers should refrain from behaviour which could result in the contamination of food, for example: smoking, spitting, chewing gum or eating, or sneezing or coughing over unprotected fresh fruits and vegetables.

Personal effects such as jewelry, watches, or other items should not be worn or brought into fresh fruit and vegetable production areas if they pose a threat to the safety and suitability of the food.

5.2.4 Equipment associated with growing and harvesting

As required, growers and harvesters should follow the technical specifications recommended by the equipment manufacturers for their proper usage and maintenance. Growers and harvesters should adopt the following sanitary practices:

a) equipment and containers coming into contact with fresh fruits and vegetables should be made of materials that are non-toxic. They should be designed and constructed to ensure that, when necessary, they can be cleaned, disinfected and maintained to avoid the contamination of fresh fruit and vegetables. Specific hygienic and maintenance requirements should be identified for each piece of equipment that is used and the type of fruit or vegetable associated with it;

b) containers for waste, by-products and inedible or dangerous substances, should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Where appropriate, such containers should be lockable to prevent malicious or accidental contamination of fresh fruits and vegetables or agricultural inputs. Such containers should be segregated or otherwise identified to prevent their use as harvesting containers;

c) containers that can no longer be kept in a hygienic condition should be discarded; and

d) equipment and tools should function according to the use for which they are designed without damaging the produce. Such equipment should be maintained in good order

5.3 Handling, Storage and Transport

5.3.1 Prevention of cross-contamination

During the primary production and post-harvest activities, effective measures should be taken to prevent cross-contamination of fresh fruits and vegetables from agricultural inputs or personnel who come directly or indirectly into contact with fresh fruits and vegetables. To prevent the potential of cross-contaminating fresh fruits and vegetables, growers, harvesters and their employees should adhere to the recommendations presented elsewhere in Section 5: Primary Production of this Code and the following:

a) at the time of harvest, consideration should be given to the need for additional management action where any local factor, for example adverse weather conditions, may increase the opportunity for contamination of the crops ;

b) fresh fruits and vegetables unfit for human consumption should be segregated during harvesting. Those which cannot be made safe by further processing should be disposed of properly to avoid contamination of fresh fruits and vegetables or agricultural inputs;

c) agricultural workers should not use harvesting containers for carrying materials (e.g. food, tools, fuel, etc.) other than harvested fruits and vegetables;

d) equipment and containers previously used for potentially hazardous materials (e.g. garbage, manure, etc.) should not be used for holding fresh fruits or vegetables or have contact with packaging material that is used for fresh fruits and vegetables without adequate cleaning and disinfecting; and

e) care must be taken when packing fresh fruits and vegetables in the field to avoid contaminating containers or bins by exposure to manure or animal/human faeces

5.3.2 Storage and transport from the field to the packing facility

Fresh fruits and vegetables should be stored and transported under conditions which will minimize the potential for microbial, chemical or physical contamination. The following practices should be adopted:

a) storage facilities and vehicles for transporting the harvested crops should be built in a manner to minimize damage to fresh fruits and vegetables and to avoid

access by pests. They should be made of non-toxic materials that permit easy and thorough cleaning. They should be constructed in a manner to reduce the opportunity for potential contamination from physical objects such as glass, wood, plastic, etc.;

b) fresh fruits and vegetables unfit for human consumption should be segregated before storage or transport. Those which cannot be made safe by further processing should be disposed of properly to avoid contamination of fresh fruits and vegetables or agricultural inputs;

c) agricultural workers should remove as much soil as possible from fresh fruits and vegetables before they are stored or transported. Care should be taken to minimize physical damage to crop during this process; and

d) transport vehicles should not be used for the transport of hazardous substances unless they are adequately cleaned, and where necessary disinfected, to avoid cross-contamination

5.4 Cleaning, Maintenance and Sanitation

Premises and harvesting equipment should be kept in an appropriate state of repair and condition to facilitate cleaning and disinfection. Equipment should function as intended to prevent contamination of fresh fruits and vegetables. Cleaning materials and hazardous substances such as agricultural chemicals should be specifically identifiable and kept or stored separately in secure storage facilities. Cleaning materials and agricultural chemicals should be used according to manufacturer's instructions for their intended purpose.

5.4.1 Cleaning programs

Cleaning and disinfection programs should be in place to ensure that any necessary cleaning and maintenance is carried out effectively and appropriately. Cleaning and disinfection systems should be monitored for effectiveness and should be regularly reviewed and adapted to reflect changing circumstances. Specific recommendations are as follows:

a) harvesting equipment and re-usable containers that come in contact with fresh fruits and vegetables should be cleaned, and, where appropriate, disinfected on a regular basis

b) harvesting equipment and re-usable containers used for fresh fruits and vegetables that are not washed prior to packing should be cleaned and disinfected as necessary

5.4.2 Cleaning procedures and methods

The appropriate cleaning methods and materials will depend on the type of equipment and the nature of the fruit or vegetable. Cleaning procedures should include the removal of debris from equipment surfaces, application of a detergent solution, rinsing with water, and, where appropriate, disinfection.

5.4.3 Pest control systems

When primary production is carried out in indoor establishments (e.g. greenhouses), the recommendations in Section 6.3 Pest Control Systems of the *General Principles of Food Hygiene (CAC RCP-1969 rev 4-2003)* should be followed.

5.4.3.1 General

Pests pose a major threat to the safety and suitability of food. Pest infestations can occur where there are breeding sites and a supply of food. Good hygiene practices should be employed to avoid creating an environment conducive to pests. Good sanitation, inspection of incoming materials and good monitoring can minimize the likelihood of infestation and thereby limit the need for pesticides.

5.4.3.2 Preventing Access

Buildings should be kept in good repair and condition to prevent pest access and to eliminate potential breeding sites. Holes, drains and other places where pests are likely to gain access should be kept sealed. Wire mesh screens, for example on open windows, doors and ventilators, will reduce the problem of pest entry. Animals should, wherever possible, be excluded from the grounds of factories and food processing plants.

5.4.3.3 Harbourage and Infestation

The availability of food and water encourages pest harbourage and infestation. Potential food sources should be stored in pest-proof containers and/or stacked above the ground and away from walls. Areas both inside and outside food premises should be kept clean. Where appropriate, refuse should be stored in covered, pest-proof containers.

5.4.3.4 Monitoring and Detection

Establishments and surrounding areas should be regularly examined for evidence of infestation.

5.4.3.5 Eradication

Pest infestations should be dealt with immediately and without adversely affecting food safety or suitability. Treatment with chemical, physical or biological agents should be carried out without posing a threat to the safety or suitability of food.

5.4.4 Waste management

Suitable facility should be available for the storage and removal of waste. Waste must not be allowed to accumulate in fresh fruit and vegetable handling and storage areas or the adjoining environment. Storage areas for waste should be kept clean.

6 Packing establishment: design and facilities

6.1 Location

6.1.1 Establishments

Potential sources of contamination need to be considered when deciding where to locate food establishments, as well as the effectiveness of any reasonable measures that might be taken to protect food. Establishments should not be located anywhere where, after considering such protective measures, it is clear that there will remain a threat to food safety or suitability. In particular, establishments should normally be located away from:

a) environmentally polluted areas and industrial activities which pose a serious threat of contaminating food;
b) areas subject to flooding unless sufficient safeguards are provided;
c) areas prone to infestations of pests; and
d) areas where wastes, either solid or liquid, cannot be removed effectively

6.1.2 Equipment

Equipment should be located so that it:

a) permits adequate maintenance and cleaning;
b) functions in accordance with its intended use; and
c) facilitates good hygiene practices, including monitoring.

6.2 Premises and Rooms

6.2.1 Design and Layout

Where appropriate, the internal design and layout of food establishments should permit good food hygiene practices, including protection against cross-contamination between and during operations by foodstuffs.

6.2.2 Internal Structures and Fittings

Structures within food establishments should be soundly built of durable materials and be easy to maintain, clean and where appropriate, able to be disinfected. In particular the following specific conditions should be satisfied where necessary to protect the safety and suitability of food:

a) the surfaces of walls, partitions and floors should be made of impervious materials with no toxic effect in intended use;
b) walls and partitions should have a smooth surface up to a height appropriate to the operation;
c) floors should be constructed to allow adequate drainage and cleaning;
d) ceilings and overhead fixtures should be constructed and finished to minimize the build up of dirt and condensation, and the shedding of particles;
e) windows should be easy to clean, be constructed to minimize the build up of dirt and where necessary, be fitted with removable and cleanable insect-proof screens. Where necessary, windows should be fixed;
f) doors should have smooth, non-absorbent surfaces, and be easy to clean and, where necessary, disinfect; and
g) working surfaces that come into direct contact with food should be in sound condition, durable and easy to clean, maintain and disinfect. They should be made of smooth, non-absorbent materials, and inert to the food, to detergents and disinfectants under normal operating conditions.

6.2.3 Temporary/Mobile Premises and Vending Machines

Premises and structures covered here include market stalls, mobile sales and street vending vehicles, temporary premises in which food is handled such as tents and marquees.

Such premises and structures should be sited, designed and constructed to avoid, as far as reasonably practicable, contaminating food and harbouring pests.

In applying these specific conditions and requirements, any food hygiene hazards associated with such facilities should be adequately controlled to ensure the safety and suitability of food.

6.3 Equipment

6.3.1 General

Equipment and containers (other than once-only use containers and packaging) coming into contact with food, should be designed and constructed to ensure that, where necessary, they can be adequately cleaned, disinfected and maintained to avoid the contamination of food. Equipment and containers should be made of materials with no toxic effect in intended use. Where necessary, equipment should be durable and movable or capable of being disassembled to allow for maintenance, cleaning, disinfection, monitoring and, for example, to facilitate inspection for pests.

6.3.2 Food Control and Monitoring Equipment

In addition to the general requirements in Section 6.3.1: General, equipment used to cook, heat treat, cool, store or freeze food should be designed to achieve the required food temperatures as rapidly as necessary in the interests of food safety and suitability, and maintain them effectively. Such equipment should also be designed to allow temperatures to be monitored and controlled. Where necessary, such equipment should have effective means of controlling and monitoring humidity, air-flow and any other characteristic likely to have a detrimental effect on the safety or suitability of food. These requirements are intended to ensure that:

a) harmful or undesirable micro-organisms or their toxins are eliminated or reduced to safe levels or their survival and growth are effectively controlled;
b) where appropriate, critical limits established in HACCP-based plans can be monitored; and
c) temperatures and other conditions necessary to food safety and suitability can be rapidly achieved and maintained.

6.3.3 Containers for Waste and Inedible Substances

Containers for waste, by-products and inedible or dangerous substances, should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Containers used to hold dangerous substances should be identified and, where appropriate, be lockable to prevent malicious or accidental contamination of food.

6.4 Facilities

6.4.1 Water Supply

An adequate supply of potable water with appropriate facilities for its storage, distribution and temperature control, should be available whenever necessary to ensure the safety and suitability of food.

Potable water should be as specified in the latest edition of WHO Guidelines for Drinking Water Quality, or water of a higher standard. Non-potable water (for use in, for example, fire control, steam production, refrigeration and other similar purposes where it would not contaminate food), shall have a separate system. Non-potable water systems shall be identified and shall not connect with, or allow reflux into, potable water systems.

6.4.2 Drainage and Waste Disposal

Adequate drainage and waste disposal systems and facilities should be provided. They should be designed and constructed so that the risk of contaminating food or the potable water supply is avoided.

6.4.3 Cleaning

Adequate facilities, suitably designated, should be provided for cleaning food, utensils and equipment. Such facilities should have an adequate supply of hot and cold potable water where appropriate.

6.4.4 Personnel Hygiene Facilities and Toilets

Personnel hygiene facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained and to avoid contaminating food. Where appropriate, facilities should include:

a) adequate means of hygienically washing and drying hands, including wash basins and a supply of hot and cold (or suitably temperature controlled) water;
b) lavatories of appropriate hygienic design; and
c) adequate changing facilities for personnel.

Such facilities should be suitably located and designated.

6.4.5 Temperature Control

Depending on the nature of the food operations undertaken, adequate facilities should be available for heating, cooling, cooking, refrigerating and freezing food, for storing refrigerated or frozen foods, monitoring food temperatures, and when necessary, controlling ambient temperatures to ensure the safety and suitability of food.

6.4.6 Air Quality and Ventilation

Adequate means of natural or mechanical ventilation should be provided, in particular to:

a) minimize air-borne contamination of food, for example, from aerosols and condensation droplets;
b) control ambient temperatures;
c) control odours which might affect the suitability of food; and
d) control humidity, where necessary, to ensure the safety and suitability of food.

Ventilation systems should be designed and constructed so that air does not flow from contaminated areas to clean areas and, where necessary, they can be adequately maintained and cleaned.

6.4.7 Lighting

Adequate natural or artificial lighting should be provided to enable the undertaking to operate in a hygienic manner. Where necessary, lighting should not be such that the

resulting colour is misleading. The intensity should be adequate to the nature of the operation. Lighting fixtures should, where appropriate, be protected to ensure that food is not contaminated by breakages.

6.4.8 Storage

Where necessary, adequate facilities for the storage of food, ingredients and non-food chemicals (e.g. cleaning materials, lubricants, fuels) should be provided.

Where appropriate, food storage facilities should be designed and constructed to:

a) permit adequate maintenance and cleaning;
b) avoid pest access and harbourage;
c) enable food to be effectively protected from contamination during storage; and
d) where necessary, provide an environment which minimizes the deterioration of food (e.g. by temperature and humidity control).

The type of storage facilities required will depend on the nature of the food. Where necessary, separate, secure storage facilities for cleaning materials and hazardous substances should be provided.

7 Control of operation

7.1 Control of food hazards

Food business operators should control food hazards through the use of systems such as Hazard Analysis and Critical Control System and Guidelines for its Application (HACCP). They should:

a) identify any steps in their operations which are critical to the safety of food;
b) implement effective control procedures at those steps;
c) monitor control procedures to ensure their continuing effectiveness; and
d) review control procedures periodically, and whenever the operations change

These systems should be applied throughout the food chain to control food hygiene throughout the shelf-life of the product through proper product and process design. Control procedures may be simple, such as checking stock rotation calibrating equipment, or correctly loading refrigerated display units. In some cases a system based on expert advice, and involving documentation, may be appropriate. A model of such a food safety system is described in Hazard Analysis and Critical Control (HACCP) System and Guidelines for its Application (Annex III).

7.2 Key aspects of hygiene control systems

7.2.1 Time and temperature control

Inadequate food temperature control is one of the most common causes of foodborne illness or food spoilage. Such controls include time and temperature of cooking, cooling, processing and storage. Systems should be in place to ensure that temperature is controlled effectively where it is critical to the safety and suitability of food. Temperature control systems should take into account:

a) the nature of the food, e.g. its water activity, pH, and likely initial level and types of microorganisms;
b) the intended shelf-life of the product;
c) the method of packaging and processing; and
d) how the product is intended to be used, e.g. further cooking/processing or ready-to-eat.

Such systems should also specify tolerable limits for time and temperature variations. Temperature recording devices should be checked at regular intervals and tested for accuracy.

7.2.2 Specific process steps

7.2.2.1 Post-harvest water use

Water quality management will vary throughout all operations. Packers should follow GMPs to prevent or minimize the potential for the introduction or spread of pathogens in processing water. The quality of water used should be dependent on the stage of the operation. For example, clean water could be used for initial washing stages, whereas water used for final rinses should be of potable quality. To ensure the quality of the post-harvest water used, the following are recommended:

a) post-harvest systems that use water should be designed in a manner to minimize places where product lodges and dirt builds up
b) antimicrobial agents should only be used where absolutely necessary to minimize cross-contamination during post-harvest and where their use is in line with good hygienic practices. The levels of antimicrobial agents should be monitored and controlled to ensure that they are maintained at effective concentrations. Application of antimicrobial agents, followed by a wash as necessary, should be done to ensure that chemical residues do not exceed levels as recommended by the Codex Alimentarius Commission
c) where appropriate, the temperature of the post-harvest water should be controlled and monitored.

d) recycled water should be treated and maintained in conditions that do not constitute a risk to the safety of fresh fruits and vegetables. The treatment process should be effectively monitored and controlled

e) recycled water may be used with no further treatment provided its use does not constitute a risk to the safety of fresh fruits and vegetables (e.g. use of water recovered from the final wash for the first wash).

f) ice should be made from potable water. Ice should be produced, handled and stored to protect it from contamination.

7.2.2.2 Chemical treatments

Packers should only use chemicals for post-harvest treatments (e.g. waxes, fungicides) in accordance with the General Standards on Food Additives or with the Codex Pesticide Guidelines. These treatments should be carried out in accordance with the manufacturer's instructions for the intended purpose.

Sprayers for post-harvest treatments should be calibrated regularly to control the accuracy of the rate of application. They should be thoroughly washed in safe areas when used with different chemicals and on different fruits or vegetables to avoid contaminating the produce.

7.2.2.3 Cooling of fresh fruits and vegetables

Condensate and defrost water from evaporator type cooling systems (e.g. vacuum cooling, cold rooms) should not drip onto fresh fruits and vegetables. The inside of the cooling systems should be maintained clean.

Potable water should be used in cooling systems where water or ice is in direct contact with fresh fruits and vegetables (e.g. hydro cooling, ice cooling). The water quality in these systems should be controlled and maintained.

Forced-air cooling is the use of rapid movement of refrigerated air over fresh fruits and vegetables in cold rooms. Air cooling systems should be appropriately designed and maintained to avoid contaminating fresh produce.

7.2.2.4 Cold storage

When appropriate, fresh fruits and vegetables should be maintained at low temperatures after cooling to minimize microbial growth. The temperature of the cold storage should be controlled and monitored.

Condensate and defrost water from the cooling system in cold storage areas should not drip on to fresh fruits and vegetables. The inside of the cooling systems should be maintained in a clean and sanitary condition.

7.2.3 Microbial and other specifications

Management systems described in Section 7.1: Control of Food Hazards offer an effective way of ensuring the safety and suitability of food. Where microbial, chemical or physical specifications are used in any food control system, such specifications should be based on sound scientific principles and state, where appropriate, monitoring procedures, analytical methods and action limits.

7.2.4 Microbial cross-contamination

Pathogens can be transferred from one food to another, either by direct contact or by food handlers, contact surfaces or the air. Raw, unprocessed food should be effectively separated, either physically or by time, from ready-to-eat foods, with effective intermediate cleaning and where appropriate disinfection. Access to processing areas may need to be restricted or controlled. Where risks are particularly high, access to processing areas should be only via a changing facility. Personnel may need to be required to put on clean protective clothing including footwear and wash their hands before entering. Surfaces, utensils, equipment, fixtures and fittings should be thoroughly cleaned and where necessary disinfected after raw food, particularly meat and poultry, has been handled or processed.

7.2.5 Physical and chemical contamination

Systems should be in place to prevent contamination of foods by foreign bodies such as glass or metal shards from machinery, dust, harmful fumes and unwanted chemicals. In manufacturing and processing, suitable detection or screening devices should be used where necessary.

7.3 Incoming material requirements

No raw material or ingredient should be accepted by an establishment if it is known to contain parasites, undesirable microorganisms, pesticides, veterinary drugs or toxic, decomposed or extraneous substances which would not be reduced to an acceptable level by normal sorting and/or processing. Where appropriate, specifications for raw materials should be identified and applied.

Raw materials or ingredients should, where appropriate, be inspected and sorted before processing. Where necessary, laboratory tests should be made to establish fitness for use. Only sound, suitable raw materials or ingredients should be used.

Stocks of raw materials and ingredients should be subject to effective stock rotation (following first in, first out protocol)

7.4 Packaging

Packaging design and materials should provide adequate protection for products to minimize contamination, prevent damage, and accommodate proper labelling. Packaging materials or gases where used must be non-toxic and not pose a threat to the safety and suitability of food under the specified conditions of storage and use. Where appropriate, reusable packaging should be suitably durable, easy to clean and, where necessary, disinfect.

The packaging should comply with the requirements set under the Philippine National Standard Code of Practice for Packaging and Transport for Fresh Fruits and Vegetables.

7.5 Water

7.5.1 In contact with food

Only potable water, should be used in food handling and processing, with the following exceptions:

a) for steam production, fire control and other similar purposes not connected with food; and
b) in certain food processes, e.g. chilling, and in food handling areas, provided this does not constitute a hazard to the safety and suitability of food (e.g. the use of clean sea water).

Water recirculated for reuse should be treated and maintained in such a condition that no risk to the safety and suitability of food results from its use. The treatment process should be effectively monitored. Recirculated water which has received no further treatment and water recovered from processing of food by evaporation or drying may be used, provided its use does not constitute a risk to the safety and suitability of food.

7.5.2 Ice and Steam

Ice should be made from water that complies with the specifications described in Section 4.4.1: Water Supply of *Code of Practice of General Food Hygiene* (CAC RCP 1-1969, Rev 3 (1997) Ice and steam should be produced, handled and stored to protect them from contamination. Steam used in direct contact with food or food contact surfaces should not constitute a threat to the safety and suitability of food.

7.6 Management and Supervision

The type of control and supervision needed will depend on the size of the business, the nature of its activities and the types of food involved. Managers and supervisors should have enough knowledge of food hygiene principles and practices to be able to judge potential risks, take appropriate preventive and corrective action, and ensure that effective monitoring and supervision takes place.

7.7 Documentation and Records

Where appropriate, records of processing, production and distribution should be kept long enough to facilitate a recall and foodborne illness investigation, if required. This period could be much longer than the shelf life of fresh fruits and vegetables. Documentation can enhance the credibility and effectiveness of the food safety control system. The following practices are recommended:

a) growers should keep current all relevant information on agricultural activities such as the site of production, suppliers' information on
    - agricultural inputs,
    - lot numbers of agricultural inputs
    - irrigation practices,
    - use of agricultural chemicals,
    - water quality data,
    - pest control
    - cleaning schedules for indoor establishments, premises, facilities, equipment and containers
    - harvest and postharvest record
    - Workers' health, safety and welfare
    - Waste management
    - Sales record

b) packers should keep current all information concerning each lot such as:
    - information on incoming materials (e.g. information from growers, lot numbers)
    - data on the quality of processing water
    - pest control programs
    - cooling and storage temperatures
    - chemicals used in postharvest treatments, and

- cleaning schedules for premises, facilities, equipment and containers, etc.
- Workers' health, safety and welfare
- Waste management

7.8 Recall Procedures

Managers should ensure effective procedures are in place to deal with any food safety hazard and to enable the complete, rapid recall of any implicated lot of the finished food from the market. Where a product has been withdrawn because of an immediate health hazard, other products which are produced under similar conditions, and which may present a similar hazard to public health, should be evaluated for safety and may need to be withdrawn. The need for public warnings should be considered.

Recalled products should be held under supervision until they are destroyed, used for purposes other than human consumption, determined to be safe for human consumption, or reprocessed in a manner to ensure their safety.

In addition, where appropriate:

a) growers and packers should have programs to ensure effective lot identification. These programs should be able to trace the sites and agricultural inputs involved in primary production and the origin of incoming material at the packing establishment in case of suspected contamination
b) growers information should be linked with packers' information so that the system can trace products from the distributor to the field. Information that should be included are the date of harvest, farm identification, and, where possible, the persons who handled the fresh fruits or vegetables from the primary production site to the packing establishment

8 Packing Establishment: Maintenance and Sanitation

8.1 Maintenance and Cleaning

8.1.1 General

Establishments and equipment should be kept in an appropriate state of repair and condition to:

a) facilitate all sanitation procedures;
b) function as intended, particularly at critical steps (see Section 7.1: Control of Food Hazards)
c) prevent contamination of food, e.g. from metal shards, flaking plaster, debris and chemicals.

Cleaning should remove food residues and dirt which may be a source of contamination. The necessary cleaning methods and materials will depend on the nature of the food business. Disinfection may be necessary after cleaning.
Cleaning chemicals should be handled and used carefully and in accordance with manufacturers' instructions and kept in secured, designated storage area to avoid the risk of contaminating food. Only authorized personnel should have access to the area

Cleaning chemicals are stored in original container with a legible label and according to label directions or instructions from a competent authority. If a chemical is transferred to another container, the new container is clearly marked with the brand name, rate of use and expiration date.

8.1.2 Cleaning procedures and methods

Cleaning can be carried out by the separate or the combined use of physical methods, such as heat, scrubbing, turbulent flow, vacuum cleaning or other methods that avoid the use of water, and chemical methods using detergents, alkalis or acids. Cleaning procedures will involve, where appropriate:

a) removing gross debris from surfaces;
b) applying a detergent solution to loosen soil and bacterial film and hold them in solution or suspension;
c) rinsing with water which complies with Section 4.4.1: *Water Supply* of the *General Principles of Food Hygiene* (CAC RCP-1969 rev 4-2003), to remove loosened soil and residues of detergent;
d) dry cleaning or other appropriate methods for removing and collecting residues and debris; and
e) where necessary, disinfection with subsequent rinsing unless the manufacturers' instructions indicate on scientific basis that rinsing is not required.

8.2 Cleaning Programs

Cleaning and disinfection programs should ensure that all parts of the establishment are appropriately clean, and should including cleaning equipment (e.g., brush, sponge, mop, pail, basin, rag, etc.). Cleaning and disinfection programs should be continually and effectively monitored for their suitability and effectiveness and where necessary, documented. Where written cleaning programs are used, they should specify:

a) areas, items of equipment and utensils to be cleaned;
b) responsibility for particular tasks;
c) method and frequency of cleaning; and
d) monitoring arrangements.

Where appropriate, programs should be drawn up in consultation with relevant specialist expert advisors.

9 Packing Establishment: Personal Hygiene

9.1 Health Status

All employment requirements shall comply with national and local labor law, and where appropriate, relevant International Labor Organization (ILO) conventions.

People known, or suspected, to be suffering from, or to be a carrier of a disease or illness likely to be transmitted through food, should not be allowed to enter any food handling area if there is a likelihood of their contaminating food. Any person so affected should immediately report illness or symptoms of illness to the management. Medical examination of a food handler should be carried out if clinically or epidemiologically indicated.

9.2 Illness and injuries

Conditions which should be reported to management so that any need for medical examination and/or possible exclusion from food handling can be considered, include:

a) jaundice;
b) diarrhea;
c) vomiting;
d) fever;
e) sore throat with fever;
f) visibly infected skin lesions (boils, cuts, etc.); and
g) discharges from the ear, eye or nose.

9.3 Personal cleanliness

Food handlers should maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing, head covering, and footwear. Cuts and wounds, where personnel are permitted to continue working, should be covered by suitable waterproof dressings. Personnel should always wash their hands when personal cleanliness may affect food safety, for example:

a) at the start of food handling activities;
b) immediately after using the toilet; and
c) after handling raw food or any contaminated material, where this could result in contamination of other food items; they should avoid handling ready-to-eat food, where appropriate.

9.4 Personal Behavior

People engaged in food handling activities should refrain from behaviour which could result in contamination of food, for example:

a) smoking;
b) spitting;
c) chewing or eating and drinking;
d) sneezing or coughing over unprotected food
e) using mobile devices and other gadgets; and
f) applying cosmetics

Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

9.5 Visitors

Visitors to food manufacturing, processing or handling areas should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

10 Transportation

10.1 General

Food must be adequately protected during transport. The type of conveyances or containers required depends on the nature of the food and the conditions under which it has to be transported.

10.2 Requirements

Where necessary, conveyances and bulk containers should be designed and constructed so that they:

a) do not contaminate foods or packaging;
b) can be effectively cleaned and, where necessary, disinfected;
c) permit effective separation of different foods or foods from non-food items where necessary during transport;
d) provide effective protection from contamination, including dust and fumes;
e) can effectively maintain the temperature, humidity, atmosphere and other conditions necessary to protect food from harmful or undesirable microbial growth and deterioration likely to render it unsuitable for consumption; and
f) allow any necessary temperature, humidity and other conditions to be checked.

10.3 Use and maintenance

Conveyances and containers for transporting food should be kept in an appropriate state of cleanliness, repair and condition. Where the same conveyance or container is used for transporting different foods, or non-foods, effective cleaning and, where necessary, disinfection should take place between loads.

Where appropriate, particularly in bulk transport, containers and conveyances should be designated and marked for food use only and be used only for that purpose.

10.4 Food transportation units

The design of the food transportation unit should be such as to avoid cross contamination due to simultaneous or consecutive transport. Important aspect are cleanability and appropriate coatings.

Construction and design of the food transportation unit should facilitate inspection, cleaning, disinfection and when appropriate enable temperature control.

Use of means for cooling or heating should by design and construction be such as to avoid contamination. Although hot water and steam are preferred means of heating, other substances may be used on the basis of safety and risk evaluation and inspection procedures. Upon request by the competent authority, evidence may be required to demonstrate that the heating media employed have been properly evaluated and safely used.

Inner surface materials suitable for direct food contact should be used. These should be non-toxic, inert, or at least compatible with the transported food, and which do not transfer substances to the food or adversely affect the food. Stainless steel or surface coated with food-grade epoxy resins are most suitable. The interior design should eliminate areas that are difficult to access and clean.

The appropriate design of the food transportation unit should assist in preventing access of insects, vermin, etc., contamination from the environment, and when necessary, providing insulation against loss or gain of heat, adequate cooling or heating capacity, and facilitation of locking or sealing.

There should be appropriate facilities conveniently available for cleaning and, where appropriate disinfecting of the food transportation unit.

Auxiliary equipment should be (where appropriate) subjected to the above stated requirements.

To maintain sanitary conditions, facilities should be provided for the storage of pipes, hoses and other equipment used in the transfer of foods.

11 Product Information and Consumer Awareness

11.1 Lot Identification

Lot identification is essential in product recall and also helps effective stock rotation. Each container of food should be permanently marked to identify the producer and the lot. Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, Rev. 1(1991)) applies.

11.2 Product Information

All food products should be accompanied by or bear adequate information to enable the next person in the food chain to handle, display, store and prepare and use the product safely and correctly.

11.3 Labelling

Prepackaged foods should be labelled with clear instructions to enable the next person in the food chain to handle, display, store and use the product safely. *Codex General Standard for the Labelling of Pre-packaged Foods* (CODE X STAN 1-1985, Rev. (1991)) applies. It shall also comply with the guidelines set by the national competent authorities (e.g. Food and Drug Administration).

11.4 Consumer Education

Health education programs should cover general food hygiene. Such programs should enable consumers to understand the importance of any product information and to follow any instructions accompanying products, and make informed choices. In particular consumers should be informed of the relationship between time/temperature control and foodborne illness. Such programs should be spearheaded by relevant government agencies.

12 Training

12.1 Awareness and Responsibilities

Personnel associated with growing and harvesting should be aware of GAPs, good hygienic practices and their role and responsibility in protecting fresh fruits and vegetables from contamination or deterioration. Agricultural workers should have the necessary knowledge and skills to enable them to carry out agricultural activities and to handle fresh fruits and vegetables and agricultural inputs hygienically.

Personnel associated with packing should be aware of GMPs, good hygienic practices and their role and responsibility in protecting fresh fruits and vegetables from contamination or deterioration. Packers should have the necessary knowledge and skills to enable them to perform packing operations and to handle fresh fruits and vegetables in a way that minimizes the potential for microbial, chemical, or physical contamination.

All personnel who handle cleaning chemicals or other potentially hazardous chemicals should be trained in safe handling techniques. They should be aware of their role and responsibility in protecting fresh fruit and vegetables from contamination during cleaning and maintenance.

12.2 Training Programs

Personnel involve in primary production and postharvest operations should undergo regular training relevant to their area of responsibility

12.2.1 Factors to take into account in assessing the level of training required in growing, harvesting and packing activities include the following:

a) nature of the fruit or vegetable, in particular its ability to sustain growth of pathogenic microorganisms;
b) agricultural techniques and the agricultural inputs used in the primary production including the probability of microbial, chemical and physical contamination;
c) assigned area of responsibility of the employee and associated hazards and controls; manner in which fresh fruits and vegetables are processed and packaged including the probability of contamination or microbial growth;
d) conditions under which fresh fruits and vegetables will be stored; and
e) extent and nature of processing or further preparation by the consumer before final consumption

12.2.2 Topics to be considered for training programs include, but are not limited to, the following:

a) importance of good health and hygiene for personal health and food safety;
b) importance of hand washing for food safety and the importance of proper hand washing techniques;
c) importance of using sanitary facilities to reduce the potential for contaminating fields, produce, other workers, and water supplies; and
d) techniques for hygienic handling and storage of fresh fruits and vegetables by transporters, distributers, storage handlers and consumer

12.3 Instruction and supervision

Periodic assessments of the effectiveness of training and instruction programs should be made by the establishment as well as routine supervision and checks to ensure that procedures are being carried out effectively.

Managers and supervisors of food processes should have the necessary knowledge of food hygiene principles and practices to be able to judge potential risks and take the necessary action to remedy deficiencies.

12.4 Refresher training

Training programs should be routinely reviewed and updated where necessary. Systems should be in place to ensure that food handlers remain aware of all procedures necessary to maintain the safety and suitability of food.

13. Bibliography

Central Research Institute for Dry Land Agriculture. Retrieved from: http://compostclub.org/wp-content/uploads/2010/06/2273.pdf on July 03, 2017.

Introduction to Hazardous Identification: US Environmental Protection Agency. Retrieved from: https://www.epa.gov/sites/production/files/2015-09/documents/hwid05.pdf on July 03, 2017.

ANNEX I

ANNEX FOR READY-TO-EAT FRESH PRE-CUT FRUITS AND VEGETABLES

Introduction

The health benefits associated with fresh fruits and vegetables combined with the on–going consumer interest in the availability of a variety of ready-to-eat foods have contributed to a substantial increase in the popularity of pre-cut fruits and vegetables. Because of the increased convenience and consumption of pre-cut fruits and vegetables in and away from the home, the preparation of these products has moved from the point of consumption to the food processor or retailer. The processing of fresh produce without proper sanitation procedures in place in the manufacturing environment may enhance the potential for contamination by microbiological pathogens. The potential for pathogens to survive or grow may be enhanced by the high moisture and nutrient content of fresh-cut fruits and vegetables, the absence of a lethal process to eliminate them, and the potential for temperature abuse during processing, storage, transport, and retail display.

Some of the microbiological pathogens associated with fresh fruits and vegetables include *Salmonella spp., Shigella spp.,* pathogenic strains of *Escherichia coli, Listeria monocytogenes,* Norwalk-like virus and hepatitis A virus and parasites such as *Cyclospora*. Some of these pathogens are associated with the agricultural environment, whereas others are associated with infected workers or contaminated water. Because of the ability for pathogens to survive and grow on fresh produce, it is important for the pre-cut industry to follow good hygienic practices to ensure the microbiological safety of its products.

1. Objective

Hygienic recommendations for the primary production of fresh fruits and vegetables are covered under the Code of Practice for Fresh Fruits and Vegetables. This Annex recommends the application of Good Manufacturing Practices (GMPs) for all stages involved in the production of ready-to-eat fresh pre-cut fruits and vegetables, from receipt of raw materials to distribution of finished products.

The primary objective of this Annex is to identify GMPs that will help control microbiological, physical, and chemical hazards associated with the processing of fresh pre-cut fruits and vegetables. Particular attention is given to minimizing microbiological hazards. This Annex provides elements that should be taken into account in the production, processing and distribution of these foods.

2. Scope, use and definitions

2.1 Scope

This Annex specifically applies to ready-to-eat fresh fruit and vegetables that have been peeled, cut or otherwise physically altered from their original form but remain in the fresh state and particularly those that are intended to be consumed raw. This Annex applies irrespective of where the operations take place (e.g. in the field, at the farm, at the retailer, at the wholesaler, at the processing establishment, etc.).

For some establishments that process fresh pre-cut fruit and vegetables, this Annex will cover all operations from receipt of raw material to the distribution of the final product. For other establishments, (e.g. those that use ready-to-eat pre-cut fresh fruit and vegetables in combination with other products, such as sauces, meat, cheese, etc.) only the specific sections that relate to the processing of the fresh pre-cut fruit and vegetable components will apply.

This Annex does not directly apply to fresh fruit and vegetables that have been trimmed leaving the food intact. Nor does it apply to other fresh fruit and vegetables that are pre-cut but are destined for further processing that would be expected to eliminate any pathogen that may be present (e.g. cooking, juice processing, fermentation) nor to fresh fruit or vegetable juices. However, some of the basic principles of the Annex could still be applicable to such products.

Packaging includes single serving containers (e.g., sealed pouches or plastic trays), larger consumer or institutional size packages and bulk containers. This Annex concentrates on microbial hazards and addresses physical and chemical hazards only in so far as these relate to GMPs.

2.2 Use

This document follows the format of the Recommended International Code of Practice -- General Principles of Food Hygiene CAC/RCP 1-1969, Rev 3 (1997) and should be used in conjunction with the General Principles of Food Hygiene and the Code of Hygienic Practice for Fresh Fruits and Vegetables.

2.3 Definitions

Processor - the person responsible for the management of the activities associated with the production of ready-to-eat fresh pre-cut fruits and vegetables.

3. Primary production

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables.

4. Establishment: design and facilities

Refer to the General Principles of Food Hygiene. In addition:

4.4 Facilities

4.4.2 Drainage and waste disposal

The processing of products covered by this Annex generates a large quantity of waste that can serve as food and shelter for pests. It is therefore very important to plan an effective waste disposal system. This system should always be maintained in good condition so it does not become a source of product contamination.

5. Control of operations

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

5.1 Control of food hazards

For the products covered by this Annex it should be recognised that while processing may reduce the level of contamination initially present on the raw materials, it will not be able to guarantee elimination of such contamination. Consequently, the processor should ensure that steps are taken by their suppliers (growers, harvesters, packers and distributors) to minimise contamination of the raw materials during primary production. It is recommended that processors ensure that their suppliers have adopted the principles outlined in the Code of Hygienic Practice for Fresh Fruits and Vegetables.

There are certain pathogens, *Listeria monocytogenes* and *Clostridium botulinum*, which present specific concern in relation to ready to eat fresh pre-cut vegetables packaged in a modified atmosphere. Processors should ensure that they have addressed all relevant safety issues relating to the use of such packaging.

5.2 Key aspects of control systems

5.2.2 Specific process steps

5.2.2.1 Receipt and inspection of raw materials

During unloading of raw material, verify the cleanliness of the food transportation unit and raw materials for evidence of contamination and deterioration

5.2.2.2 Preparation of raw material before processing

Physical hazards (such as the presence of animal and plant debris, metal, and other foreign material) should be removed through manual sorting or the use of detectors, such as metal detectors. Raw materials should be trimmed to remove any damaged, rotten or mouldy material.

5.2.2.3 Washing and microbiological decontamination

Refer to section 5.2.2.1 of the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

Water used for final rinses should be of potable quality, particularly for these products as they are not likely to be washed before consumption.

5.2.2.4 Pre-cooling Fresh Fruit and Vegetables

Refer to section 5.2.2.3 of the Code of Hygienic Practice for Fresh Fruits and Vegetables.

5.2.2.5 Cutting, slicing, shredding, and similar pre-cut processes

Procedures should be in place to minimize contamination with physical (e.g. metal) and microbiological contaminants during cutting, slicing, shredding or similar pre-cut processes.

5.2.2.6 Washing after cutting, slicing, shredding, and similar pre-cut processes

Washing cut produce with potable water may reduce microbiological contamination. In addition, it removes some of the cellular fluids that were released during the cutting process thereby reducing the level of available nutrients for microbiological growth. The following should be considered:

• Water should be replaced at sufficient frequency to prevent the build-up of organic material and prevent cross-contamination.

• Antimicrobial agents should be used, where necessary, to minimize cross-contamination during washing and where their use is in line with good hygienic practices. The antimicrobial agents levels should be monitored and controlled to ensure that they are maintained at effective concentrations. Application of antimicrobial agents, followed by a wash as necessary, should be done to ensure that chemical residues do not exceed levels as recommended by the Codex Alimentarius Commission.

• Drying or draining to remove water after washing is important to minimize microbiological growth.

5.2.2.7 Cold Storage

Refer to section 5.2.2.4 of the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

Pre-cut fresh fruits and vegetables should be maintained at low temperatures at all stages, from cutting through distribution to minimise microbiological growth.

5.7 Documentation and records

Where appropriate, records should be maintained to adequately reflect product information, such as product formulations or specifications and operational controls. Maintaining adequate documentation and records of processing operations is important in the event of recall of with fresh pre-cut fruits and vegetables. Records should be kept long enough to facilitate recalls and foodborne illness investigations, if required. This period will likely be much longer than the shelf life of the product. Some examples of records to keep are the following:

- Fresh fruit and vegetable supplier records
- Water quality and supply records
- Equipment monitoring and maintenance records
- Equipment calibration records
- Sanitation records
- Product processing records
- Pest control records
- Distribution records

5.8 Recall procedures

Refer to the General Principles of Food Hygiene.

6. Establishment: maintenance and sanitation

Refer to the General Principles of Food Hygiene.

7. Establishment: personal hygiene

Refer to the General Principles of Food Hygiene.

8. Transportation

Refer to the General Principles of Food Hygiene and the Code of Hygienic Practice for Fresh Fruits and Vegetables.

9. Product information and consumer awareness

Refer to the General Principles of Food Hygiene.

10. Training

Refer to the General Principles of Food Hygiene and the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

10.2 Training programs

To evaluate the level of training required of persons responsible for the production of fresh pre-cut fruits and vegetables, the additional following factors should be taken into account:

- packaging systems used for fresh pre-cut fruits and vegetables, including the risks of contamination or microbiological growth involved in this method;
- importance of temperature control and GMPs.

ANNEX II
ANNEX FOR SPROUT PRODUCTION

Introduction

In recent years the popularity of sprouted seeds has increased dramatically and are favoured by many for their nutritional value. However, the recent increase in reports of food borne illness associated with raw sprouts has raised concerns from public health agencies and consumers about the safety of these products.

The microbial pathogens associated with sprouted seeds are for example *Salmonella spp, pathogenic E. coli, Listeria monocytogenes, and Shigella spp*. Outbreak investigations have indicated that microorganisms found on sprouts most likely originate from the seeds. Most seeds supplied to sprout producers are produced primarily for forage or animal grazing where the Good Agricultural Practices (GAPs) necessary to prevent microbial contamination of seeds intended for sprouting are not followed, especially through the misuse of natural fertilizers or contaminated irrigation water. As a result, the seeds may be contaminated in the field or during harvesting, storage or transportation. Typically, the germination process in sprout production involves keeping seeds warm and moist for two to ten days. In these conditions, if low levels of microbial contaminants are present on seeds, they can quickly reach levels high enough to cause illness.

The scientific literature proposes microbiological decontamination of seeds treatments which can achieve different levels of pathogen reduction. There is currently no treatment available that can guarantee pathogen free seeds. Research is in progress to find efficient microbiological decontamination treatments which would provide sufficient pathogen reduction on seeds especially if pathogens are internalized.

1. Objectives

This annex recommends control measures to occur in two areas: during seed production and during sprout production. During seed production, conditioning and storage, the application of Good Agricultural Practices (GAPs) and Good Hygienic Practices (GHPs) are aimed at preventing microbial pathogen contamination of seeds. During sprout production, the microbiological decontamination of seeds step is aimed at reducing potential contaminants and the good hygienic practices at preventing the introduction of microbial pathogens and minimizing their potential growth. The degree of control in these two areas has a significant impact on the safety of sprouts.

2. Scope, use and definition

2.1 Scope

This annex covers the hygienic practices that are specific for the primary production of seeds for sprouting and the production of sprouts for human consumption in order to produce a safe and wholesome product.

2.2 Use

This annex follows the format of the Recommended International Code of Practice – General Principles of Food Hygiene CAC/RCP 1-1969, Rev 3 (1997) and should be used in conjunction with the General Principles of Food Hygiene and the Code of Hygienic Practice for Fresh Fruit and Vegetables.

2.3 Definitions

2.3.1
seed producer
any person responsible for the management of activities associated with the primary production of seeds including post-harvest practices

2.3.2
seed distributor
any person responsible for the distribution of seeds (handling, storage and transportation) to sprout producers. Seed distributors may deal with single or multiple seed producers and can be producers themselves

2.3.3
sprout producer
any person responsible for the management of the activities associated with the production of sprouted seeds

2.34
spent irrigation water
water that has been in contact with sprouts during the sprouting process

3. Primary production of seeds

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

3.2 Hygienic production of seeds

3.2.1.2 Manure and biosolids

When seeds are destined for the production of sprouts for human consumption, wild or domestic animals should not be allowed to graze in the fields where seeds are grown (e.g., employing sheep for spring clip back of alfalfa).

It is particularly important to prevent microbial contamination during the production of seeds which will be used to produce sprouts for human consumption because of the potential for pathogens to grow during the sprouting process. Consequently, manure, biosolids and other natural fertilizers should only be used when they have undergone treatments which achieve a high level of pathogen reduction.

3.2.1.4 Agricultural chemicals

Seed producers should only use chemicals (e.g., pesticides, desiccants) which are acceptable for seeds intended for the production of sprouts for human consumption.

3.2.4 Equipment associated with growing and harvesting

Prior to harvest, harvesting equipment should be adjusted to minimize soil intake and seed damage and should be cleaned from any debris or earth. Diseased or damaged seeds, which could be susceptible to microbial contamination, should not be used for the production of sprouts for human consumption.

3.3 Handling, storage and transport

Seeds produced for the production of sprouts for human consumption should be segregated from product to be seeded or planted for animal feed (e.g., for forage or animal grazing) and clearly labelled.

Recognising that seeds are vulnerable to microbial pathogens during thrashing and drying, adequate care is needed to maintain sanitation in drying yards, and exposure of seeds to mist, high humidity and fog should be avoided.

3.4 Analyses

Seed producers, distributors, and sprout producers should test lots of seeds for microbial pathogens using internationally accepted analytical methods. Sprouting seeds before testing increases the possibility of finding pathogens that may be present. If lots of seeds are found to be contaminated, they should not be sold or used for the production of sprouts for human consumption. Because of the limitations associated with sampling methods and analytical tests, failure to find contamination does not guarantee that the seeds are pathogen free. However, if contamination is found at this stage, it allows seeds to be diverted or destroyed before entering sprout production for human consumption. Seed producers, distributors and sprout producers should refer to the *Principles for the Establishment and Application of Microbiological Criteria for Foods*, CAC/GL 21-1977, for guidance on establishing a sampling plan.

3.5 Recall procedures

Seed producers for the production of sprouts for human consumption should ensure that records and recall procedures are in place to effectively respond to health risk situations. Procedures should enable the complete and rapid recall of any implicated seed. The procedures should also assist in providing detailed information for the identification and investigation of any contaminated seeds and sprouts. The following should be adopted:

• Seed production and distribution practices should be in place to minimize the quantity of seed identified as a single lot and avoid the mixing of multiple lots that would complicate recalls and provide greater opportunity for cross-contamination. Seed producers and distributors and sprout producers should maintain records for each lot. The lot number, producer and country of origin should be indicated on each container.

• Seed producers should have a system to: effectively identify lots, trace the production sites and agricultural inputs associated with the lots, and allow physical retrieval of the seeds in case of a suspected hazard.

• Where a lot has been recalled because of a health hazard, other lots that were produced under similar conditions (e.g., on the same production sites or with the same agricultural inputs) and which may present a similar hazard should be evaluated for safety. Any lot presenting a similar risk should be recalled. Blends containing potentially contaminated seeds must also be recalled.

• Seeds which may present a hazard must be held and detained until they are disposed of properly.

4. Establishment for sprout production

Refer to the General Principles of Food Hygiene. In addition:

4.2.1 Design and layout

Where appropriate, the internal design and layout of sprout establishments should permit Good Hygiene Practices, including protection against cross-contamination between and during operations. Storage, seed rinsing and microbiological decontamination, germination and packaging areas should be physically separated from each other.

5. Control of operation

Refer to the General Principles of Food Hygiene. In addition:

5.2.2 Specific process steps in sprout production

5.2.2.1 Water use during sprout production

Water quality management will vary throughout all operations. Sprout producers should follow GMPs to minimize the potential for the introduction or spread of pathogens in

processing water. The quality of water used should be dependent on the stage of the operation. Because of the potential for pathogen proliferation during the sprouting process, clean water could be used for initial washing stages, whereas water used later in the sprout production process (i.e., for the rinse following the microbiological decontamination of seed, and subsequent operations) should be preferably of potable quality or at least clean water.

5.2.2.2 Initial rinse

The seeds should be rinsed thoroughly before the microbiological decontamination treatment to remove dirt and increase the efficiency of this treatment.

Seeds should be rinsed and thoroughly agitated in large volumes of clean water, in such a way to maximize surface contact. The process should be repeated until most of the dirt is removed and rinse water remains clear.

5.2.2.3 Microbiological decontamination of seeds

Due to the difficulty of obtaining seeds which can be guaranteed as pathogen free, it is recommended that seeds be treated prior to the sprouting process. Although there are other options like the use of lactic acid bacteria, liquid microbiological decontamination treatment is generally used. During this treatment sprout producers should adhere to the following:

- All containers used for microbiological decontamination of seeds should be cleaned and disinfected prior to use.
- Seeds should be well agitated in large volumes of antimicrobial agent to maximise surface contact.
- The duration of treatment and the concentration of antimicrobial agent used should be accurately measured and recorded.
- Strict measures should be in place to prevent re-contamination of seeds after the microbiological decontamination treatment.
- Antimicrobial agent should be used according to manufacturer's instructions for their intended use.

5.2.2.4 Rinse after seed treatment

As appropriate, seeds should be thoroughly rinsed after the microbiological decontamination treatment with potable water or at least clean water. Rinsing should be repeated sufficiently to eliminate antimicrobial agent.

5.2.2.5 Pre-germination soak

Soaking is often necessary to improve germination. When soaking, the sprout producer should adhere to the following:

• All containers used for soaking should be cleaned and disinfected prior to use.

• Seeds should be soaked in cleaned water for the shortest possible time to minimize microbial growth.

• This step may also employ antimicrobial agents.

• After soaking, seeds should be rinsed thoroughly with potable water or at least clean water.

5.2.2.6 Germination

During germination, keep the environment and equipment clean to avoid potential contamination. All equipment should be cleaned and disinfected before each new batch.

• Only potable water should be used.

• Where necessary and when used, soils or other matrices should be treated (e.g., pasteurized) to achieve a high degree of microbial reduction.

5.2.2.7 Harvesting

All equipment should be cleaned and disinfected before each new batch. Harvesting should be done with cleaned and disinfected tools dedicated for this use.

5.2.2.8 Final rinse and cooling

A final water rinse will remove hulls, cool product, and may reduce microbial contamination on sprouts. The following should be adopted:

• As appropriate, sprouts should be rinsed in cold potable water to lower sprout temperature and slow down microbial growth.

• Water should be changed, as needed (e.g., between batches), to prevent cross-contamination.

• Sprouts should be drained using appropriate equipment (e.g. food grade centrifugal dryer) that is clean and disinfected prior to use.

• If additional cooling time is necessary, steps should be taken to facilitate rapid cooling (e.g., placed in smaller containers with adequate air flow between containers).

5.2.2.9 Storage of finished product

• Where appropriate, sprouts should be kept under cold temperature (e.g. 50C) that will minimize microbial growth for the intended shelf life of the product. Regular and effective monitoring of temperature of storage areas and transport vehicles should be carried out.

5.2.3 Microbiological and other specifications

It is recommended that seed and sprouts or spent irrigation water be tested for the presence of pathogens.

5.2.3.1 Testing of seed lots before entering production

It is recommended that each new lot of seeds received at the sprouting facility is tested before entering production (i.e. before the microbiological decontamination of seeds).

• The seed sample selected for testing should be sprouted prior to analysis to increase the potential to detect pathogens if present. Analysis may be performed on the sprouted seeds or the water used to sprout the sample.

• Seed samples for microbial analysis should not be subject to any microbiological decontamination treatment at the sprouting facility.

5.2.3.2 Testing of sprouts and/or spent irrigation water

Current seed treatments cannot guarantee total elimination of pathogens. Further, if even a few pathogens survive the microbiological decontamination treatment, they can grow to high numbers during sprouting. Therefore, producers should have in place a sampling/testing plan to regularly monitor for pathogens at one or more stages after the start of germination.

• Analyses can be performed during the germination process (e.g., spent irrigation water or sprouts) and/or finished product may be analysed after harvest.

• Testing spent irrigation water is a good indicator of microbial conditions of sprouts. It is homogeneous and is simpler to analyse. Further, sampling spent irrigation water (or sprouts) during germination allows earlier results compared to testing finished product.

• Because of the sporadic nature of seed contamination, it is recommended that producers test every production lot.

5.2.4 Microbiological cross-contamination

Sprout producers should adhere to the following:

The traffic pattern of employees should prevent cross-contamination of sprouts. For example: the employees should avoid going back and forth to various areas of production. The employees should not go from a potentially contaminated area to the germination

and/or packaging area unless they have washed their hands and changed to clean protective clothing.

5.3 Incoming material requirements

5.3.1 Specifications for incoming seeds

• Sprout producers should recommend that seed producers adopt good agricultural practices and provide evidence that the product was grown according to section 3 of this Annex and the Code of Hygienic Practice for Fresh Fruits and Vegetables.

• Seed and sprout producers should obtain assurance from seed producers or distributors that chemical residues of each incoming lot are within the limits established by the Codex Alimentarius Commission and, where appropriate, they should obtain certificates of analysis for microbial pathogens of concern.

5.3.2 Control of incoming seeds

Seed containers should be examined at their arrival to minimize the potential for introducing obvious contaminants in the establishment.

• Seed containers should be examined for physical damage (e.g., holes from rodents) and signs of contamination (e.g., stains, rodent, insects, faeces, urine, foreign material, etc.). If found to be damaged, contaminated or potentially contaminated, its contents should not be used for the production of sprouts for human consumption.

• If seed lots are analysed for the presence of microbial pathogens of concern, these should not be used until results of analysis are available.

5.3.3 Seed storage

Seeds should be handled and stored in a manner that will prevent damage and contamination.

• Seeds should be stored off the floor, away from walls and in proper storage conditions to prevent mould and bacterial growth and facilitate pest control inspection.

• Open containers should be stored in such a way that they are protected from pests and other sources of contamination.

5.7 Documentation and records

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

Written records that accurately reflect product information and operational controls should be available to demonstrate the adequacy of the production activities.

• Upon receipt of seeds, records should be maintained of the seed supplier, the lot number and the country of origin to facilitate recall procedures.

• Records should be legible, permanent and accurate. Records should include written procedures, controls, limits, monitoring results and subsequent follow-up documents. Records must include: seed sources and lot numbers, water analysis results, sanitation checks, pest control monitoring, sprout lot codes, analysis results, production volumes, storage temperature monitoring, product distribution and consumer complaints.

Records should be kept long enough to facilitate recalls and food borne illness investigation, if required. This period will likely be much longer than the shelf life of the product.

6. Establishment: maintenance and sanitation

Refer to the General Principles of Food Hygiene.

7. Establishment: personal hygiene

Refer to the General Principles of Food Hygiene.

8. Transportation

Refer to the General Principles of Food Hygiene.

9. Product information and consumer awareness

Refer to the general principles of food hygiene.

10. Training

Refer to the General Principles of Food Hygiene. In addition:

10.1 awareness and responsibilities

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition:

• The producer should have a written training program that is routinely reviewed and updated. Systems should be in place to ensure that food handlers remain aware of all procedures necessary to maintain the safety of sprouts.

ANNEX III
HAZARD ANALYSIS AND CRITICAL CONTROL POINT (HACCP) SYSTEM AND GUIDELINES FOR ITS APPLICATION

1 Preamble

The first section of this document sets out the principles of the Hazard Analysis and Critical Control Point (HACCP) system adopted by the Codex Alimentarius Commission. The second section

The HACCP system, which is science based and systematic, identifies specific hazards and measures for their control to ensure the safety of food. HACCP is a tool to assess hazards and establish control systems that focus on prevention rather than relying mainly on end-product testing. Any HACCP system is capable of accommodating change, such as advances in equipment design, processing procedures or technological developments.

HACCP can be applied throughout the food chain from primary production to final consumption and its implementation should be guided by scientific evidence of risks to human health. As well as enhancing food safety, implementation of HACCP can provide other significant benefits. In addition, the application of HACCP systems can aid inspection by regulatory authorities and promote international trade by increasing confidence in food safety.

The successful application of HACCP requires the full commitment and involvement of management and the work force. It also requires a multidisciplinary approach; this multidisciplinary approach should include, when appropriate, expertise in agronomy, veterinary health, production, microbiology, medicine, public health, food technology, environmental health, chemistry and engineering, according to the particular study. The application of HACCP is compatible with the implementation of quality management systems, such as the ISO 9000 series, and is the system of choice in the management of food safety within such systems.

While the application of HACCP to food safety was considered here, the concept can be applied to other aspects of food quality.

2 Definitions

2.1.
control (verb)
to take all necessary actions to ensure and maintain compliance with criteria established in the HACCP plan
2.2

control (noun)
state wherein correct procedures are being followed and criteria are being met

2.3
control measure
any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level

2.4
corrective action
any action to be taken when the results of monitoring at the CCP indicate a loss of control

2.5
Critical Control Point (CCP)
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

2.6
critical limit
criterion which separates acceptability from unacceptability

2.7
deviation
failure to meet a critical limit

2.8
flow diagram
systematic representation of the sequence of steps or operations used in the production or manufacture of a particular food item

2.9
HACCP
system which identifies, evaluates, and controls hazards which are significant for food safety

2.10
HACCP plan
document prepared in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety in the segment of the food chain under consideration

2.11

hazard
biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect

2.12
hazard analysis
process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan

2.13
monitor
act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control

2.14
step
point, procedure, operation or stage in the food chain including raw materials, from primary production to final consumption

2.15
validation
obtaining evidence that the elements of the HACCP plan are effective

2.16
verification
application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance with the HACCP plan

3 Principles of the HACCP system

The HACCP system consists of the following seven principles:

3.1 Principle 1

Conduct a hazard analysis.

3.2 Principle 2

Determine the Critical Control Points (CCPs).

3.3 Principle 3

Establish critical limit(s).

3.4 Principle 4

Establish a system to monitor control of the CCP.

3.5 Principle 5

Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.

3.6 Principle 6

Establish procedures for verification to confirm that the HACCP system is working effectively.

3.7 Principle 7

Establish documentation concerning all procedures and records appropriate to these principles and their application.

GUIDELINES FOR THE APPLICATION OF THE HACCP SYSTEM

Introduction

Prior to application of HACCP to any sector of the food chain, that sector should have in place prerequisite programs such as good hygienic practices according to the Codex General Principles of Food Hygiene, the appropriate Codex Codes of Practice, and appropriate food safety requirements. These prerequisite programs to HACCP, including training, should be well established, fully operational and verified in order to facilitate the successful application and implementation of the HACCP system.

For all types of food business, management awareness and commitment is necessary for implementation of an effective HACCP system. The effectiveness will also rely upon management and employees having the appropriate HACCP knowledge and skills.

During hazard identification, evaluation, and subsequent operations in designing and applying HACCP systems, consideration must be given to the impact of raw materials, ingredients, food manufacturing practices, role of manufacturing processes to control hazards, likely end-use of the product, categories of consumers of concern, and epidemiological evidence relative to food safety.

The intent of the HACCP system is to focus control at Critical Control Points (CCPs). Redesign of the operation should be considered if a hazard which must be controlled is identified but no CCPs are found.

HACCP should be applied to each specific operation separately. CCPs identified in any given example in any Codex Code of Hygienic Practice might not be the only ones identified for a specific application or might be of a different nature. The HACCP application should be reviewed and necessary changes made when any modification is made in the product, process, or any step.

The application of the HACCP principles should be the responsibility of each individual businesses. However, it is recognised by governments and businesses that there may be obstacles that hinder the effective application of the HACCP principles by individual business. This is particularly relevant in small and/or less developed businesses. While it is recognized that when applying HACCP, flexibility appropriate to the business is important, all seven principles must be applied in the HACCP system. This flexibility should take into account the nature and size of the operation, including the human and financial resources, infrastructure, processes, knowledge and practical constraints.

Small and/or less developed businesses do not always have the resources and the necessary expertise on site for the development and implementation of an effective HACCP plan. In such situations, expert advice should be obtained from other sources, which may include: trade and industry associations, independent experts and regulatory authorities. HACCP literature and especially sector-specific HACCP guides can be valuable. HACCP guidance developed by experts relevant to the process or type of operation may provide a useful tool for businesses in designing and implementing the HACCP plan. Where businesses are using expertly developed HACCP guidance, it is essential that it is specific to the foods and/or processes under consideration. More detailed information on the obstacles in implementing HACCP, particularly in reference to SLDBs, and recommendations in resolving these obstacles, can be found in “Obstacles to the Application of HACCP, Particularly in Small and Less Developed Businesses, and Approaches to Overcome Them” (document in preparation by FAO/WHO).

The efficacy of any HACCP system will nevertheless rely on management and employees having the appropriate HACCP knowledge and skills, therefore ongoing training is necessary for all levels of employees and managers, as appropriate.

Application

The application of HACCP principles consists of the following tasks as identified in the Logic Sequence for Application of HACCP (Diagram 1).

1. Assemble HACCP team

The food operation should assure that the appropriate product specific knowledge and expertise is available for the development of an effective HACCP plan. Optimally, this may be accomplished by assembling a multidisciplinary team. Where such expertise is not available on site, expert advice should be obtained from other sources, such as, trade and industry associations, independent experts, regulatory authorities, HACCP literature and HACCP guidance (including sector-specific HACCP guides). It may be possible that a well-trained individual with access to such guidance is able to implement HACCP inhouse. The scope of the HACCP plan should be identified. The scope should describe which segment of the food chain is involved and the general classes of hazards to be addressed (e.g. does it cover all classes of hazards or only selected classes).

2. Describe product

A full description of the product should be drawn up, including relevant safety information such as: composition, physical/chemical structure (including Aw, pH, etc), microcidal/static treatments (heat treatment, freezing, brining, smoking, etc), packaging, durability and storage conditions and method of distribution. Within businesses with multiple products, for example, catering operations, it may be effective to group products with similar characteristics or processing steps, for the purpose of development of the HACCP plan.

3. Identify intended use

The intended use should be based on the expected uses of the product by the end user or consumer. In specific cases, vulnerable groups of the population, e.g. institutional feeding, may have to be considered.

4. Construct flow diagram

The flow diagram should be constructed by the HACCP team (see also paragraph 1 above). The flow diagram should cover all steps in the operation for a specific product. The same flow diagram may be used for a number of products that are manufactured using similar

processing steps. When applying HACCP to a given operation, consideration should be given to steps preceding and following the specified operation.

5. On-site confirmation of flow diagram

Steps must be taken to confirm the processing operation against the flow diagram during all stages and hours of operation and amend the flow diagram where appropriate. The confirmation of the flow diagram should be performed by a person or persons with sufficient knowledge of the processing operation.

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

(SEE PRINCIPLE 1)

The HACCP team (see "assemble HACCP team" above) should list all of the hazards that may be reasonably expected to occur at each step according to the scope from primary production, processing, manufacture, and distribution until the point of consumption.

The HACCP team (see "assemble HACCP team") should next conduct a hazard analysis to identify for the HACCP plan, which hazards are of such a nature that their elimination or reduction to acceptable levels is essential to the production of a safe food.

In conducting the hazard analysis, wherever possible the following should be included:
- the likely occurrence of hazards and severity of their adverse health effects;
- the qualitative and/or quantitative evaluation of the presence of hazards;
- survival or multiplication of micro-organisms of concern;
- production or persistence in foods of toxins, chemicals or physical agents; and,
- conditions leading to the above.

Consideration should be given to what control measures, if any exist, can be applied to each hazard.
More than one control measure may be required to control a specific hazard(s) and more than one hazard may be controlled by a specified control measure.

7. Determine Critical Control Points

(SEE PRINCIPLE 2)

There may be more than one CCP at which control is applied to address the same hazard. The determination of a CCP in the HACCP system can be facilitated by the application of a decision tree (e.g., Diagram 2), which indicates a logic reasoning approach. Application of a decision tree should be flexible, given whether the operation is for production, slaughter, processing, storage, distribution or other. It should be used for guidance when determining

CCPs. This example of a decision tree may not be applicable to all situations. Other approaches may be used. Training in the application of the decision tree is recommended.

If a hazard has been identified at a step where control is necessary for safety, and no control measure exists at that step, or any other, then the product or process should be modified at that step, or at any earlier or later stage, to include a control measure.

8. Establish critical limits for each CCP

(SEE PRINCIPLE 3)

Critical limits must be specified and validated for each Critical Control Point. In some cases more than one critical limit will be elaborated at a particular step. Criteria often used include measurements of temperature, time, moisture level, pH, Aw, available chlorine, and sensory parameters such as visual appearance and texture.

Where HACCP guidance developed by experts has been used to establish the critical limits, care should be taken to ensure that these limits fully apply to the specific operation, product or groups of products under consideration. These critical limits should be measurable.

9. Establish a monitoring system for each CCP

(SEE PRINCIPLE 4)

Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. The monitoring procedures must be able to detect loss of control at the CCP. Further, monitoring should ideally provide this information in time to make adjustments to ensure control of the process to prevent violating the critical limits. Where possible, process adjustments should be made when monitoring results indicate a trend towards loss of control at a CCP. The adjustments should be taken before a deviation occurs. Data derived from monitoring must be evaluated by a designated person with knowledge and authority to carry out corrective actions when indicated. If monitoring is not continuous, then the amount or frequency of monitoring must be sufficient to guarantee the CCP is in control. Most monitoring procedures for CCPs will need to be done rapidly because they relate to online processes and there will not be time for lengthy analytical testing. Physical and chemical measurements are often preferred to microbiological testing because they may be done rapidly and can often indicate the microbiological control of the product.

All records and documents associated with monitoring CCPs must be signed by the person(s) doing the monitoring and by a responsible reviewing official(s) of the company.

10. Establish corrective actions

(SEE PRINCIPLE 5)

Specific corrective actions must be developed for each CCP in the HACCP system in order to deal with deviations when they occur.

The actions must ensure that the CCP has been brought under control. Actions taken must also include proper disposition of the affected product. Deviation and product disposition procedures must be documented in the HACCP record keeping.

11. Establish verification procedures

(SEE PRINCIPLE 6)

Establish procedures for verification. Verification and auditing methods, procedures and tests, including random sampling and analysis, can be used to determine if the HACCP system is working correctly. The frequency of verification should be sufficient to confirm that the HACCP system is working effectively.

Verification should be carried out by someone other than the person who is responsible for performing the monitoring and corrective actions. Where certain verification activities cannot be performed in house, verification should be performed on behalf of the business by external experts or qualified third parties.

Examples of verification activities include:
• Review of the HACCP system and plan and its records;
• Review of deviations and product dispositions;
• Confirmation that CCPs are kept under control.

Where possible, validation activities should include actions to confirm the efficacy of all elements of the HACCP system.

12. Establish Documentation and Record Keeping

(SEE PRINCIPLE 7)

Efficient and accurate record keeping is essential to the application of a HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation and sufficient to assist the business to verify that the HACCP controls are in place and being maintained. Expertly developed HACCP guidance materials (e.g. sector-specific HACCP guides) may be utilised as part of the documentation, provided that those materials reflect the specific food operations of the business.

Documentation examples are:

- Hazard analysis;
- CCP determination;
- Critical limit determination.

Record examples are:

- CCP monitoring activities;
- Deviations and associated corrective actions;

- Verification procedures performed;
- Modifications to the HACCP plan;

An example of a HACCP worksheet for the development of a HACCP plan is attached as Diagram 3. A simple record-keeping system can be effective and easily communicated to employees. It may be integrated into existing operations and may use existing paperwork, such as delivery invoices and checklists to record, for example, product temperatures.

Training

Training of personnel in industry, government and academia in HACCP principles and applications and increasing awareness of consumers are essential elements for the effective implementation of HACCP. As an aid in developing specific training to support a HACCP plan, working instructions and procedures should be developed which define the tasks of the operating personnel to be stationed at each Critical Control Point.

Cooperation between primary producer, industry, trade groups, consumer organisations, and responsible authorities is of vital important. Opportunities should be provided for the joint training of industry and control authorities to encourage and maintain a continuous dialogue and create a climate of understanding in the practical application of HACCP.

Diagram 1
Logic Sequence for Application of HACCP

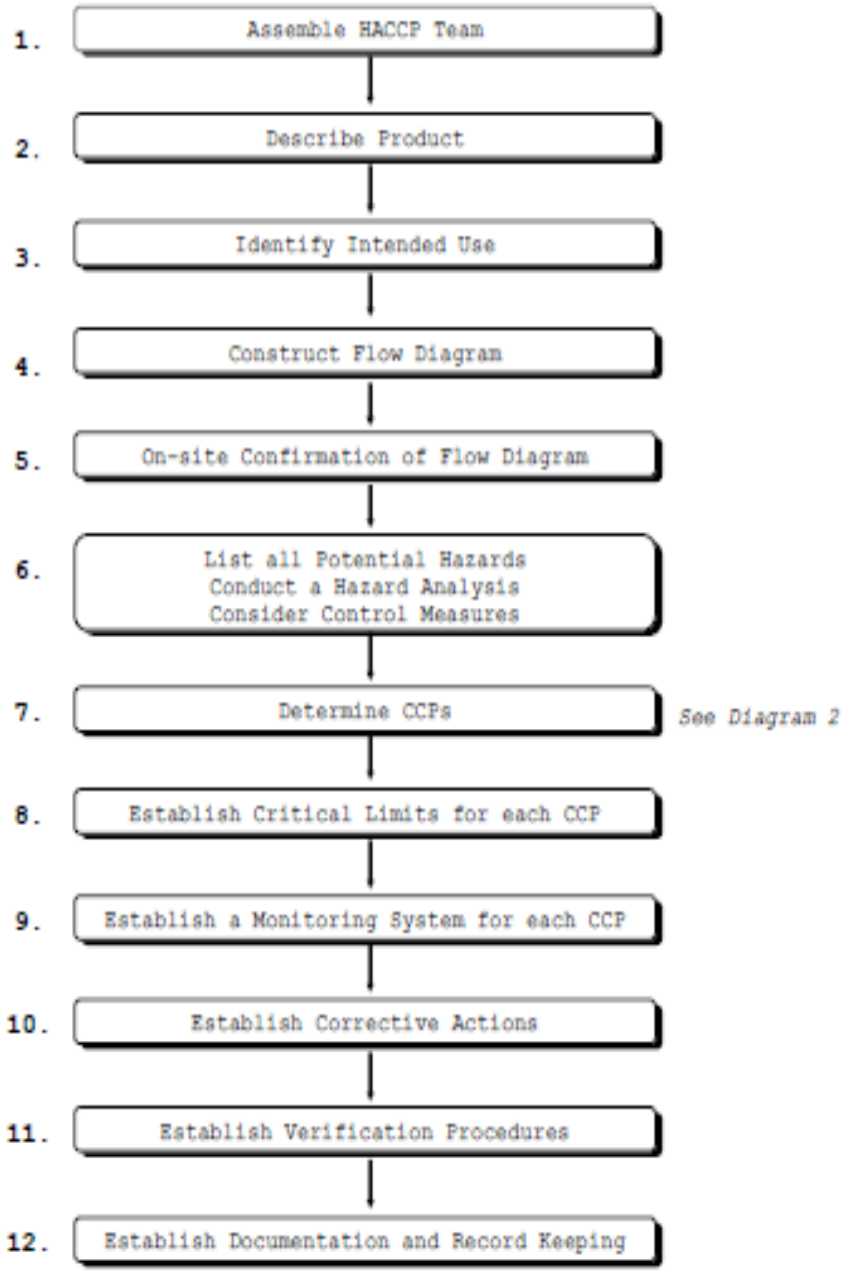
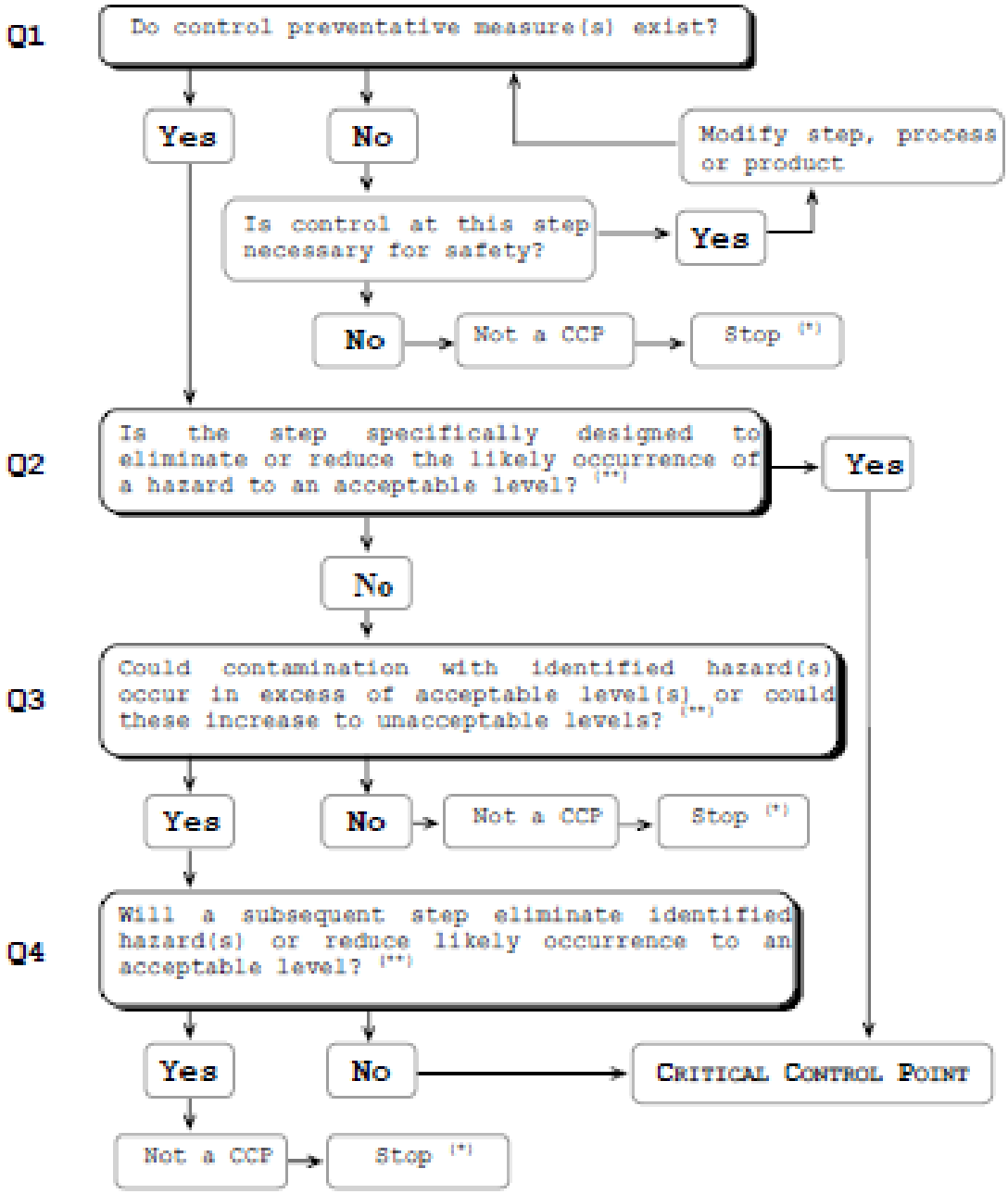


Diagram 2
Example of Decision Tree to Identify CCPs

(answer questions in sequence)



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

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

Diagram 3

2158

Example of a HACCP Worksheet

1. Describe Product

2. Diagram Process Flow

3.

LIST							
Step	Hazard(s)	Control Measure(s)	CCPs	Critical Limit(s)	Monitoring Procedure(s)	Corrective Action(s)	Record(s)

4. Verification