# codex alimentarius commission



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS WORLD HEALTH ORGANIZATION



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Agenda Item 5

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# JOINT FAO/WHO FOOD STANDARDS PROGRAMME

# CODEX COMMITTEE ON FOOD HYGIENE

**Forty first Session** Coronado Hotel, San Diego, United States of America

## PROPOSED DRAFT ANNEX ON FRESH LEAFY VEGETABLES (Annex to the Code of Hygienic Practice for Fresh Fruits and Vegetables) (At Step 3)

Prepared by the United States with the help of Argentina, Angola, Australia, Brazil, Canada, China, Cuba, Denmark, Dominican Republic, the European Commission, Finland, France, Ghana, Hungary, Ireland, India, Italy, Japan, Kenya, Malaysia, the Netherlands, New Zealand, the Philippines, Spain, Sweden, Switzerland, Thailand, Uganda, United Kingdom, Zimbabwe, FAO, WHO, IACFO, and ICMSF

Governments and interested international organizations are invited to submit comments on the attached Proposed Draft Annex at Step 3 (see Appendix) and should do so in writing in conformity with the Uniform Procedure for the Elaboration of Codex Standards and Related Texts (see *Procedural Manual of the Codex Alimentarius Commission, Seventeenth Edition*) to: Ms Barbara McNiff, Staff Officer, Food Safety and Inspection Service, U.S. Department of Agriculture, Room 4870, 1400 Independence Avenue, SW, Washington, D.C. 20250, USA, FAX +1-202-690-4719, or email <u>Barbara.McNiff@fsis.usda.gov</u> with a copy to: Secretary, Codex Alimentarius Commission, Joint WHO/FAO Food Standards Programme, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy, by email <u>codex@fao.org</u> or fax: +39-06-5705-4593 **by 30 September 2009.** 

# BACKGROUND

At the 39<sup>th</sup> Session of CCFH, the Committee agreed to begin new work on an Annex on fresh leafy vegetable hygiene and agreed that the Delegation of the United States of America would lead this new work. An electronic working group<sup>1</sup>, led by United States and open to all interested parties, was established to develop the Annex for circulation for comment and consideration during the 40th Session of the Committee. The report of the FAO/WHO expert consultation was taken into consideration during the development of this Annex.

Prior to the 40<sup>th</sup> Session of CCFH, the draft document was circulated for country comment. Comments were received from Australia and Argentina prior to the 40<sup>th</sup> Session and CRD's were submitted by Brazil, Canada, the European Commission, Indonesia, Japan, Mexico, the Philippines and IACFO.

<sup>&</sup>lt;sup>1</sup> The first electronic working group was conducted in the traditional manner, i.e., a draft document was sent out to working group members for comment then comments were received and incorporated into the document. Subsequently, the revised document was sent out to working group members for a second review before translation and circulation for country comment by the Rome Secretariat prior to the 40<sup>th</sup> Session of CCFH.

2

During the 40<sup>th</sup> Session, the Delegation of the United States introduced the document and recalled that when the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003) was developed, it had been understood that the Code would be supplemented by annexes on specific commodities and that leafy green vegetables including fresh herbs had been identified as the commodity group of highest concern by an FAO/WHO Expert Meeting in September 2007. The Delegation further indicated that the proposed draft annex was based heavily on guidance provided by the FAO/WHO Expert Consultation (May 2008).

After the 40<sup>th</sup> Session, the United States Delegation revised the document in light of the country comments received prior to the 40<sup>th</sup> Session, the CRD's that were submitted during the 40<sup>th</sup> Session, the discussion that occurred during the 40<sup>th</sup> Session and the information received from the circular letter attached to the report of the 40<sup>th</sup> Session requesting further information on small-scale production and processing systems: wet systems used to produce leafy vegetables and herbs, including the production of watercress, herbs and other leafy greens in wet systems.

The United States Delegation, through the Rome Secretariat, circulated the revised version of the document to all Codex members along with an invitation to participate in the second electronic working group. Approximately 18 member countries and organizations<sup>2</sup> registered for the working group session that was held June 15-19, 2009.

The second electronic working group was conducted in a manner that differed from the first and much as a physical working group would have been conducted, in real-time and with the document being in front of the working group members who were viewing changes as they were being made. Through the use of available technology, the working group participants accessed the working document on-line and called into a teleconference during the time the document was being reviewed and discussed line-by-line. The working group sessions lasted an average of 3 hours each day for one week, alternating between morning and afternoon sessions to accommodate time zone differences of the participants. The draft document was circulated among the working group participants one final time to make sure the discussion during the week had been adequately captured. The present document is the result of that effort.

<sup>&</sup>lt;sup>2</sup> Argentina, Australia, Belgium, Brazil, Canada, European Commission, Germany, Ireland, Italy, Japan, New Zealand, Philippines, UK, FAO, IACFO, ICMSF, IIR and WHO

#### APPENDIX

# PROPOSED DRAFT ANNEX ON FRESH LEAFY VEGETABLES (Annex to the Code of Hygienic Practice for Fresh Fruits and Vegetables) (At Step 3)

## INTRODUCTION

Fresh leafy vegetables are grown, processed and consumed in multiple ways and in diverse conditions throughout the world. They are grown on farms that vary from very large to very small. Fresh leafy vegetables are marketed both locally and globally to provide year round availability to consumers and are sold as fresh, fresh-cut, pre-cut or ready-to-eat products such as pre-packaged salads.

International and national concerns have grown in response to recent outbreaks and reported illnesses linked to fresh leafy vegetables. A broad array of microbial pathogens have been associated with fresh leafy vegetables as reported in international outbreak data, including Enterohemorrhagic Escherichia coli, Salmonella enterica, Campylobacter spp, Shigella spp, Hepatitis A virus, Norovirus, Cyclospora cayetanensis, Cryptosporidium parvum, Yersinia pseudotuberculosis and Listeria monocytogenes. Epidemiological evidence, outbreak investigations and risk assessments have identified areas of risk for pathogen contamination of leafy vegetables including key risks from water, animals, workers and manure based soil amendments. Fresh leafy vegetables are grown and harvested in large volume, often for export and increasingly in places that are new to harvesting and distributing fresh leafy vegetables, therefore the potential for human pathogens to spread has also grown. Fresh leafy vegetables are marketed as diverse products including whole, unprocessed heads, loose leaves, mixed cut leaves and fresh herbs, and pre-cut packaged products. Fresh leafy vegetables are packed in diverse ways including field packed direct for market, in packing houses and processed for pre-cut products in sophisticated processing plants. As fresh, fresh-cut, pre-cut or ready to eat leafy vegetables move through the supply chain, there is also the potential for the introduction and growth of pathogens. There is no further processing treatment that would eliminate or inactivate the target microorganisms.

#### **1. OBJECTIVE OF THE ANNEX**

The objective of this annex is to provide specific guidance to reduce the microbial food safety risks associated with fresh leafy vegetables that are intended to be consumed without cooking during their production, harvesting, packing, processing, storage, distribution, marketing, and consumer use. This includes fresh leafy vegetables that are sold and marketed as fresh, pre-cut or ready-to-eat. Because of the diversity of leafy vegetables and practices and conditions used throughout the supply chain, recommendations to minimize microbial contamination will be most effective when adapted to specific operations.

# 2. SCOPE, USE AND DEFINITIONS

#### 2.1 SCOPE

This annex covers specific guidance related to the production, harvesting, packing, processing, storage, distribution, marketing, and consumer use of fresh leafy vegetables that could be consumed fresh, pre-cut or ready-to-eat.

Fresh leafy vegetables for purposes of this Annex include all vegetables of a leafy nature where the leaf is intended for consumption. Thus, all varieties of lettuce, spinach, cabbage, chicory, endive and radicchio and fresh herbs such as coriander/cilantro, basil, and parsley are included.

## 2.1.2 Roles of government, industry, and consumers

Refer to the General Principles of Food Hygiene (CAC/RCP 1-1969).

#### 2.2 USE

This annex follows the format of the Codex Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969) and should be used in conjunction with the General

Principles of Food Hygiene and the Code of Hygienic Practices for Fresh Fruit and Vegetables (CAC/RCP 53-2003) including the Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables.

## **2.3 DEFINITIONS**

Definitions of general expressions are included in the General Principles of Food Hygiene. For the purpose of this code, the following definitions apply:

**Hydroponic**: a general method for the production of plants in a water or plant medium, such as coconut husk fiber without soil; plants are grown using mineral nutrient solutions instead of soil. Plants may be grown with their roots in the mineral nutrient solution only, or in inert media such as perlite, gravel or mineral wool.

## **3. PRIMARY PRODUCTION OF FRESH LEAFY VEGETABLES**

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

## **3.1 ENVIRONMENTAL HYGIENE**

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Potential sources of environmental contamination should be identified prior to production activities. Assessment of environmental conditions is particularly important because subsequent steps may not be adequate to remove contamination that occurs during production and in some cases may lead to conditions that enable the growth of microbial pathogens.

Particular attention should be given to potential sources of faecal contamination in the production area, on near-by sites and to vectors which may introduce faecal contamination to the production and handling areas. These vectors include, but are not limited, to humans, domestic and wild animals, or indirectly via contaminated water, insects, workers, or fomites such as dust, tools and equipment.

#### **3.1.1 Location of the Production Site**

Production sites (indoor and outdoor) should be located to minimize the microbial risk from the nearby sites. Consideration of land location should include evaluating the slope, topographical, flood risk, and hydrological features of nearby sites in relationship to the production site.

Assessing environmental hygiene is particularly important in evaluating risks that arise from use of land nearby the production sites, for example feed lots, other animal production operations, hazardous waste sites, municipal and industrial waste treatment facilities, raw waste water disposal, septic systems, mining extraction sites, manure storage facilities, composting operations, landfill sites, bird and wildlife sanctuaries, urban or temporary residential sites, and campsites. The presence of such sites should be evaluated for their potential to contaminate the production site with microbial or other environmental hazards via, for example, run-off, fecal material, aerosols or organic waste.

Where the environment presents a risk to the production site, measures should be implemented to minimize the contamination of the fresh leafy vegetable production sites. Landscape changes, such as the construction of a shallow ditch, to prevent runoff from entering the field or in the case of aerosols, construction of an effective wind-break (natural such as trees or constructed) or use of a covering are examples of measures that can be used to reduce pathogen contamination of the production site.

#### 3.1.2 Previous and current use of the site

If the evaluation of previous and present usage of the primary production area and the nearby sites identifies potential microbial hazards that are at levels that pose a risk to humans, including faecal and other organic waste contamination and potential environmental hazards, fresh leafy vegetables should not be grown on the land until the risks have been reduced to acceptable levels.

#### 3.1.3 Wildlife, livestock, and human activity

Domestic and wild animals, such as dogs, cattle, chickens, horses, wild pigs, reptiles and amphibians can present a risk both from direct contamination of the crop and soil as well as from contamination of surface water sources and other inputs.

- Domestic and wild animals should be excluded from production and handling areas, as far as possible, using appropriate biological, cultural, physical and chemical pest control methods. Methods selected should comply with local, regional, and national environmental and animal protection regulations.
- Production and handling areas should be properly maintained (*e.g.* minimizing standing water and/or access to water sources, keeping areas free of clutter and waste) to reduce the likelihood of vector attraction.
- Existing practices should be reviewed to assess the prevalence and likelihood of deposits of animal faeces coming into contact with crops. Considering this potential source of contamination, efforts should be made to protect fresh leafy vegetable growing areas from animals. When appropriate, this may require the use of physical barriers (*e.g.* fences), active deterrents (*e.g.* noise makers, scarecrows, images of owls, foil strips) and/or cultural methods (*e.g.* crop rotation).

Wild birds and animals represent a particularly difficult risk to manage because their presence is intermittent and harder to track. Fields should be monitored for animal activity (*e.g.* presence of tracks, faeces, crop damage from grazing, etc.), particularly near harvesting. If present, consideration should be given to the risks and whether affected crop areas should be harvested.

# **3.2 HYGIENIC PRIMARY PRODUCTION OF FRESH LEAFY VEGETABLES**

#### **3.2.1 Agricultural input requirements**

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

## **3.2.1.1** Water for primary production

In general, production water that meets the microbiological standards established for drinking water provides the best control of microbial hazards. The source of the water used for production and the method of delivery can affect the risk of contamination for fresh leafy vegetables. Growers should seek appropriate guidance on water quality and delivery methods to minimize the potential for contamination with microbial pathogens.

Growers and harvesters should identify the sources of water used on the farm (municipality, re-used irrigation water, reclaimed wastewater, discharge water from aquaculture, well, open canal, reservoir, rivers, lakes, farm ponds, *etc.*). Growers should assess and manage the risk posed by these waters as follows:

- Assess the potential for microbial contamination (e.g., from livestock, human habitation, sewage treatment, manure and composting operations) and the water's suitability for its intended use and reassess the potential for microbial contamination if events, environmental conditions or other conditions indicate that water quality may have changed.
- Identify corrective actions to prevent or minimize contamination. Possible corrective actions may include fencing to prevent large animal contact, appropriate well casing and head maintenance and placement of wells, filtering water, not stirring the sediment when drawing water, building settling or holding ponds, and water treatment facilities. Settling or holding ponds that are used for subsequent irrigation may be microbiologically safe but may attract animals or in other ways increase the microbial risks associated with water for irrigating crops. If water treatment is needed, consult with water safety authorities.
- Determine if analytical testing should be done to evaluate the suitability of water for each intended use. Analytical testing may be necessary after a change in irrigation water source, flooding or a heavy rainfall when water is at a higher risk of contamination. If testing, determine and document what tests need to be performed, how often tests should be conducted, what the test outcomes indicate, and how tests will be used to define corrective actions. The frequency of testing will partially depend on the water source (less for adequately maintained deep wells, more for surface water) and the risks of environmental contamination including intermittent or temporary contamination (*e.g.* heavy rain, flooding, *etc.*). If testing is limited to non-pathogenic indicators, frequent water tests may be useful to establish the baseline water quality so that changes in the levels of contamination can be identified. Obtain municipal water test results when available. If the water source is found to have unacceptable levels of indicator organisms or is known to be contaminated, corrective actions should be taken to ensure that the water is suitable for its intended use. Testing

frequency should be increased until consecutive results are within the acceptable range.

## 3.2.1.1.1 Water for irrigation

The quality of water varies widely by type of source. The risk of contamination with pathogens generally increases according to the following ranking:

- 1. Potable (lowest risk)
- 2. Clean water
  - Rain water provided the integrity of the water distribution system is maintained
  - Water in deep wells, provided they are maintained, monitored and capped
  - Water in shallow wells provided they are maintained, monitored and capped
- 3. Adequately treated reclaimed or wastewater
- 4. Water in shallow or deep wells due to inadequate installation or improper maintenance
- 5. Surface waters, particularly in proximity to animals, human habitation and their waste, presents a higher risk due to its vulnerability to environmental sources of contamination
- 6. Raw or inadequately treated waste water (highest risk)

Other options should be considered to improve microbial quality of surface waters, such as sand filtration or storage in catchments or reservoirs to achieve partial biological treatment. The efficacy of these treatments should be evaluated and monitored.

Before using reclaimed or wastewater for crop irrigation, consult with an expert to assess the relative risk and determine the suitability of the water source. Reclaimed wastewater subjected to different levels of treatment should be in compliance with WHO guidelines for safe use of wastewater, excreta and grey water, wastewater use in agriculture, in agricultural production specifically on irrigating vegetables marketed to consumers as fresh, pre-cut or ready-to-eat.

#### Irrigation Method

The type of irrigation or application method affects the risk of contamination. The timing, the quality of water used, and whether the water has direct contact with the edible portion of the plant should all be considered when selecting the type of irrigation or application method to use.

Growers should:

- Evaluate the water distribution system to determine if a contamination source is evident and can be eliminated.
- Establish no-harvest zones if irrigation source water is known to or likely to contain human pathogens and where failure at connections results in overspray of plants or localized flooding.

Overhead irrigation presents the highest risk of contamination because it wets the edible portion of the crop. The duration for wetting can be several hours, and the physical force of water droplet impact may drive contamination into protected sites on the leaf. Therefore, only the clean water should be used for this type of irrigation.

Subsurface or drip irrigation that results in no wetting of the plant is the irrigation method with the least risk of contamination, although these methods can still experience localized problems. For drip-irrigation, care should be taken to avoid creating pools of water on the soil surface or in furrows that may come into contact with the edible portion of the crop.

Irrigation of fresh leafy vegetables that have physical characteristics such as rough surfaces where water may accumulate, a vase-like growth characteristic, or high density seeding or transplant rates should be irrigated with only clean water. Irrigation of these products should be applied in a way to minimize wetting of the edible portion because the plant characteristics can provide niches for microbial attachment and survival.

## 3.2.1.1.2 Water for fertilizers, pest control and other agricultural chemicals

Clean water should be used in the application of aqueous fertilizers, pesticides, and other agricultural chemicals that are directly applied to edible portions of the fresh leafy vegetables, especially close to harvest. Human pathogens can survive and grow in many agrichemicals including pesticides. The application of pesticide solutions contaminated with human pathogens to the surface of leafy vegetables is known to constitute a risk, particularly near harvest time.

## 3.2.1.1.3 Hydroponic water

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables in association with 3.2.1.1. In addition, the following should be considered:

Microbial risks of water used in growing fresh leafy vegetables hydroponically may differ from the microbial risks of water used to irrigate leafy vegetables in soil because the water in hydroponic production is used for both irrigation and as the growth medium. The growth medium may enhance the survival of pathogens. It is especially critical in hydroponic operations to maintain the water quality to reduce the risk of contamination and survival of pathogens.

## **3.2.1.1.4** Water for harvesting and other agricultural uses

Water for other agricultural uses includes dust abatement, hydration, as a lubricant, and to maintain roads, yards, and parking lots so that they do not constitute a source of contamination in areas where fresh leafy vegetables are exposed. If sprinkling water using mechanical means to minimize dust on dirt roads within or near the fields, then use clean water to avoid the aerosolization and spread of pathogens.

Fresh leafy vegetables may be sprayed with small amounts of water during machine harvest or in the field container just after harvest to hydrate crops. Water may also be used to facilitate the handling of leafy vegetables in the field. Clean water should be used in processes were there is direct contact between the water and edible portions of the leafy vegetables. It is understood that products at this point are not considered ready-to-eat and may be washed or further processed.

## 3.2.1.2 Manure, biosolids and natural fertilizers

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Manure, biosolids and other natural fertilizers may contain human or animal waste, animal parts or products, or be composed primarily of plant materials. Because of this, natural fertilizers and other soil amendments may contain human pathogens that may persist for weeks or even months, particularly if treatment of these materials is inadequate.

Proper treatment of biosolids, manures and by-products using treatments (e.g. heat, chemical, or biological) will reduce the risk of potential human pathogen survival. The persistence of human pathogens in soil depends on many factors (soil type, relative humidity, temperature, Ultraviolet Index<sup>3</sup> and pathogen type among other known factors). Composting, if done properly, can be a practical and efficient method to inactivate human pathogens in manure. When using aerobic methods, compost heaps should be regularly and thoroughly turned so that all of the material will be exposed to elevated temperatures because pathogens; however, special consideration should be given to determine the length of time needed to inactivate pathogens that may be present.

Fresh leafy vegetables may be contaminated through direct contact with contaminated soil amendments. Therefore manure, biosolids, and other natural fertilizers should not be applied to leafy vegetables after plant emergence unless it can be demonstrated that product contamination will not occur. Field soil contaminated with human pathogens may also provide a means of fresh leafy vegetables contamination via rain splash or plant uptake. Therefore, establishing suitably conservative pre-plant fertilizer intervals appropriate for

<sup>&</sup>lt;sup>3</sup> Ultraviolet Index (UVI): a measure of the solar ultraviolet intensity at the earth's surface that indicates the day's exposure to ultraviolet rays. The UV Index is measured around noon for a one-hour period and rated on a scale of 0 to 15 based on international guidelines for UVI reporting established by the World Health Organization.

# CX/FH 09/41/5

specific regional and field conditions is an effective step towards minimizing risk. Competent authorities should provide guidance on appropriate intervals.

## 3.2.1.3 Soil

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

## **3.2.1.4 Agricultural chemicals**

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

## **3.2.1.5** Biological control

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

3.2.2 Indoor facilities associated with growing and harvesting (protected agricultural structures)

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Protected agricultural structures, including greenhouses, high tunnels, hoop houses, and shade house structures, provide some degree of control over various environmental factors.

#### 3.2.2.1 Location, design and layout

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

#### **Protected agricultural structures**

Some protected agricultural structures are located in the field (hoop houses, high tunnels, etc.) Factors that influence the magnitude and frequency of the transfer of pathogenic microorganisms in the field, such as the climate, weather, topology, hydrology and other geographic characteristics in or nearby the field may pose a similar risk for certain protective structures.

The methods for adequate maintenance of the environment around the structures include, but are not limited to:

- Properly storing equipment, removing litter and waste, and cutting weeds or grass within the immediate vicinity of the plant buildings or structures that may constitute an attractant, breeding place, or harborage for pests.
- Adequately draining areas that may contribute contamination to food by
  - o providing a breeding place for pests
  - o runoff, leakage, or pooled/settled water flowing into food growing areas,
  - o transfer of contaminants via equipment or foot traffic
- The land nearby certain protective structures (high tunnel, hoop house, *etc.*) should not be a significant source of contamination. Appropriate measures should be taken to minimize any relative risks from surrounding land use or environment. These measures may include berms, fences, ditches, buffer zones or other strategies to effectively mitigate any hazards.

#### 3.2.2.2 Water supply

Refer to 3.2.1.1.1 (Soil Irrigation) and 3.2.1.1.3 (Hydroponic Water)

#### 3.2.2.3 Drainage and waste disposal

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

- Good drainage should be maintained around the structure to eliminate standing water.
- Waste disposal systems and facilities should be provided. All refuse should be disposed of in containers with lids and stored away from the facility to prevent harborage of pests.
- Refuse containers should be emptied regularly.

# 3.2.2.4 Cleaning, maintenance and sanitation

- Workers and visitors should take effective measures (e.g., wash hands) before entering greenhouses.
- Plant debris and cull piles should be removed promptly from inside the structure. There should be no plant refuse around the outside of the structure or nearby to attract or harbor pests.

# 3.2.3 Personnel health, hygiene and sanitary facilities

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Hygiene and health requirements should be followed to ensure that personnel who come directly into contact with leafy vegetables during or after harvesting are not likely to contaminate them.

- Each operator should have written Standard Operating Procedures (SOPs) that relate to health, hygiene and sanitary facilities. The SOPs should address worker training, facilities and supplies to enable workers to practice proper hygiene, and company policies relating to expectations for worker hygiene as well as illness reporting.
- All workers should properly wash their hands using soap and clean, running water before handling leafy vegetables, particularly during harvesting and post harvest handling. Workers should be trained in proper technique for hand washing and drying.
- If gloves are used, a procedure for glove use in the field should be documented and followed. If the gloves are reusable, they should be made of materials that are readily cleaned and sanitized, should be cleaned as needed and stored appropriately. If disposable gloves are used, they should be discarded when they become torn, soiled, or otherwise contaminated.
- Visitors should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.
- Non-essential persons and casual visitors, particularly children, should not be allowed in the harvest area as they may present an increased risk of contamination.

# 3.2.3.1 Personnel hygiene and sanitary facilities

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

• All workers should be trained in proper use of hygienic facilities. Training should include toilet use, proper disposal of toilet paper or equivalent, and proper hand washing and drying procedures.

As far as possible, such facilities should be located close to the field and readily accessible to the work area:

- Sanitary facilities should be located in a manner to encourage their use and reduce the likelihood that workers will relieve themselves in the field. Facilities should be in sufficient number to accommodate personnel (e.g. 1 per 10 people) and be appropriate for both genders if workforce contains males and females.
- Portable facilities should not be located or cleaned in cultivation areas or near irrigation water sources or conveyance systems. Growers should have a standard plan that identifies the areas where it is safe to put portable facilities and to prevent traffic in case of a spill.
- Facilities should include clean running water, soap, toilet paper or equivalent, and single use paper towels or equivalent.

# 3.2.3.2 Health status

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

- Farm and packinghouse managers should be encouraged to observe symptoms of diarrheal or food transmissible communicable diseases and reassign workers as appropriate.
- Employees should be encouraged to notice and report symptoms of diarrheal or food transmissible communicable diseases.

# **3.2.3.3 Personal cleanliness**

When personnel are permitted to continue working with cuts and wounds covered by water proof dressings, they should wear gloves to cover the bandages thereby providing a secondary barrier between them and the fresh leafy vegetables they handle.

• Workers should wear clean clothes and bathe regularly.

## 3.2.3.4 Personal behavior

- Growers should provide areas away from the field and packing lines for workers to take breaks and eat. For worker convenience, these areas should contain toilet and hand washing facilities so workers can practice proper hygiene.
- Personal items (e.g., purses, backpacks, clothes, etc.) should be stored away from production areas.

## 3.2.4 Equipment associated with growing and harvesting

Refer to the Code of Hygienic Practices for Fresh Fruits and Vegetables. In addition, the following should be considered:

Growers and harvesters should adopt the following sanitary practices:

- Employees should be trained to follow SOPs for the maintenance requirements of equipment used for growing and harvesting.
- All safety guards should be used and maintained according to manufacturers' instructions. Such equipment should be maintained in good order.
- Equipment used to harvest leafy vegetables by cutting or mowing should be thoroughly cleaned and sanitized before use and cutting edges should be kept smooth and sharp.

#### **3.3 HANDLING, STORAGE AND TRANSPORT**

#### 3.3.1 Prevention of cross-contamination

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

- The field should be evaluated for the presence of hazards or contamination prior to harvest to determine if the field should be harvested.
- Written standard operating procedures (SOPs) should be developed for appropriate handling, storage, and transport.
- Excessive dirt and caked mud should be removed from product and/or containers during harvest.
- If water is used to remove dirt and debris from leafy vegetables in the field, clean water should be used.

Harvesting methods vary depending upon the characteristics of the product. Mechanical harvesting provides opportunity for increased surface contact exposure and may cause damage that could lead to penetration of plant tissues by microorganisms. Specific control measures should be implemented to minimize the risk of contamination from microorganisms associated with the method.

- Personal hygiene is critical with manual harvesting due to the amount of human handling that could lead to contamination of the leafy vegetables.
- Proper cleaning and sanitation of equipment is also important for manual and mechanical harvesting, since knives and other equipment used can wound fresh leafy vegetables, lead to cross contamination, and provide entry for contaminants that may be in soil and water.
- Over-filling of totes and bins should be avoided to prevent transfer of contaminants to produce during stacking.

# 3.3.2 Storage and transport from the field to the packing facility

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables and the Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food. In addition, the following should be considered:

Fresh leafy vegetables may be transported to the packing, cooling and cold storage facility by numerous modes of transportation. Transportation should be managed to reduce or control the risk of contamination. Each company should have its own standard operating procedure (SOP) for shipping containers/trailers to verify that they are clean, sanitary, and in good structural condition.

Fresh produce should not be transported in vehicles used previously to carry animal manure or biosolids.

Fresh leafy vegetables are perishable products that should be carefully handled. Damage will adversely affect the quality of the product and may increase its potential for microbial contamination. Damaged product should be discarded.

- Maintaining optimum temperatures between 1-5°C throughout supply chain for fresh leafy vegetables will limit microbial proliferation and depending on the type of the product may be optimum for quality. Holding fresh leafy vegetables at temperatures above 5°C should be minimized as it increases the risk of pathogen growth if pathogens are present. Consideration should be given to the type of product, particularly certain fresh herbs (e.g. basil and shiso) that are chill sensitive and may require higher storage temperatures to prevent quality deterioration that could leave the product vulnerable to foodborne pathogens.
- Cover product to maintain integrity of the load.

## 3.4 CLEANING, MAINTENANCE AND SANITATION

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

## 3.4.1 Cleaning programs

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

- Harvesting containers that come into direct contact with leafy vegetables should not be utilized for purposes other than holding product (*e.g.*, should not hold personal items, waste, *etc.*).
- Single use primary containers such as cardboard boxes or clamshells should not be reused in food contact applications.
- Containers should be covered and stored in a location and in a manner to prevent possible contamination (*e.g.*, pests, birds, rodents, dust, water, etc.).
- Damaged containers should be repaired or replaced.
- Containers that come into direct contact with the soil should not be stacked in such a manner as to allow soil and debris to contaminate fresh leafy vegetables.
- Policies should be established for the control of equipment when it is not in use, including policies for the removal of equipment from the work area or site and for the use of scabbards, sheathes or other storage equipment.
- Harvesting equipment, including hand harvesting implements (knives, pruners, corers, machetes) that come in direct contact with fresh leafy vegetables, should be cleaned and sanitized at least daily or as the situation warrants.
- Clean water should be used to clean all equipment directly contacting fresh leafy vegetables, including farm machinery, harvesting and transportation equipment, containers and implements.

#### 3.4.2 Cleaning procedures and methods

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

• Cleaning and disinfection programs should not be carried out in a location where the rinse might contaminate fresh leafy vegetables.

• Where appropriate or necessary, cleaning and sanitizing procedures should be tested to ensure their effectiveness.

# 3.4.3 Pest control systems

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

## 3.4.4 Waste management

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

# 4. PACKING ESTABLISHMENT: DESIGN AND FACILITIES

Refer to General Principles of Food Hygiene and the General Code for Hygienic Control of *Listeria monocytogenes* in Ready-to-eat Foods. In addition, the following should be considered:

Packing activities can occur in the field or in facilities. Field pack operations should implement the same sanitary practices where practical or modify as needed to minimize risks.

The provisions below apply to facilities that pack, cool and process fresh leafy vegetables.

## 4.1.1 Establishments

## 4.1.2 Equipment

Refer to the General Principles of Food Hygiene. In addition, the following should be considered:

- Floors and walls should be of a material that is easily cleanable and does not pose a risk for harborage or growth of foodborne microorganisms.
- Pipes should not leak and condensation should be minimized to avoid dripping on product or packing equipment

#### 4.4.2 Drainage and waste disposal

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

Adequate drainage is critical to packing, cooling and processing facilities to avoid the risk of contaminating the fresh leafy vegetables. To ensure adequate drainage of standing water:

- Drainage in the facility should be designed with sloped floors to effectively drain standing water.
- Floors should be kept as dry as possible using appropriate methods.
- Food handlers should have proper training to remove standing water or push standing water to the drains.
- Drains should be cleaned periodically to prevent build-up of biofilms that may contain organisms of concern (*e.g.*, *Listeria monocytogenes*).
- Areas for garbage recyclables and compostable waste should be identified and all waste should be stored and disposed of in a manner to minimize contamination.
- Waste should be disposed of on a frequent basis to avoid attracting pests (e.g. flies, rodents).

# 5. CONTROL OF OPERATION

# **5.1 Control of Food Hazards**

Establishments should pay special attention to product flow and segregation from incoming soiled to outgoing washed product to avoid cross-contamination.

Refer to General Code of Hygienic Practice for Fresh Fruits and Vegetables (Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables).

# 5.2 KEY ASPECTS OF HYGIENE CONTROL SYSTEMS

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables (Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables).

# **5.2.1** Time and temperature control

Refer to the General Principles of Food Hygiene.

## 5.2.2 Specific process steps

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables and the Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables.

## 5.2.2.1 Receipt and inspection of raw materials

Refer to the Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables. In addition, the following should be considered:

Prior to preparation, damaged or decayed material (both at harvest and at the processing plant) should be trimmed and/or discarded.

#### 5.2.2.2 Post-harvest water use

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

- 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 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.
- Clean or preferably potable water should be used when water is applied under pressure or vacuum during washing as these processes may alter the leaf structure and force pathogens into plant cells.
- Where appropriate, the pH, hardness, temperature of the post-harvest water should be controlled and monitored, e.g., where these impact the efficacy of the antimicrobial treatments.
- Water recirculated for reuse in the establishment should be treated and maintained in conditions that do not constitute a risk to the safety of fresh leafy vegetables. For example the following may be used to maintain the suitability of the water: primary screening, secondary filtration, and antimicrobial treatment process.

#### **5.2.2.3** Chemical treatments

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

# **5.2.2.4 Cooling of fresh leafy vegetables**

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Fresh leafy vegetables can be cooled immediately after harvest by either using ice (parsley), forced-air cooling, vacuum cooling (iceberg lettuce), hydrocooling, or spray-vacuum (hydrovac) cooling. Water used in postharvest operations may contaminate fresh leafy vegetables if there is direct contact of water containing human pathogens with edible portions of the plant.

For fresh leafy vegetables and the control of inputs such as water used for cooling, particular attention should be paid to:

- Water used to cool fresh leafy vegetables should be free from human pathogens.
- Water that is used in hydrovacs should be clean or preferably potable. Water that is used only once and is not recirculated is preferable. If recirculated water is used, water disinfectant at sufficient levels to reduce the potential risk of cross-contamination should be used and monitored.
- Cooling equipment should be cleaned and sanitized on a regular basis according to written procedures to ensure that the potential for cross contamination is minimized.

# 5.2.2.5 Cold storage

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

# 5.2.2.6 Cutting, slicing, shredding, and similar pre-cut processes

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables (Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables). In addition, the following should be considered:

- Maintain sharpness and condition of knives and cutting edges to maintain product quality and safety.
- Cutting equipment should be cleaned and sanitized on a regular basis according to written procedures to ensure that the potential for cross contamination is minimized

# 5.2.2.7 Washing after cutting, slicing, shredding, and other similar pre-cut processes

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables (Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables).

# 5.2.3 Microbiological and other specifications

Refer to the General Principles of Food Hygiene. In addition, the following should be considered:

Microbiological testing can be a useful tool to evaluate and verify the effectiveness of safety and sanitation practices, provide information about an environment, a process, and even a specific product lot, when sampling plans and methodology are properly designed and performed. The intended use of information obtained (*e.g.* evaluating the effectiveness of a sanitation practice, evaluating the risk posed by a particular hazard, etc.) can aid in determining what microorganisms are most appropriate to test for. Test methods should be selected that are validated for the intended use. Consideration should be given to ensure proper design of a microbiological testing program. Trend analysis of testing data should be undertaken to evaluate the effectiveness of food safety systems.

# 5.2.4 Microbial cross-contamination

Refer to the General Principles of Food Hygiene.

# 5.2.5 Physical and chemical contamination

Refer to the General Principles of Food Hygiene.

# **5.3 INCOMING MATERIAL REQUIREMENTS**

Refer to the General Principles of Food Hygiene.

# **5.4 PACKING**

Refer to the General Principles of Food Hygiene.

# 5.5 WATER USED IN THE PACKING ESTABLISHMENT

Refer to the General Principles of Food Hygiene.

# 5.6 MANAGEMENT AND SUPERVISION

Refer to the General Principles of Food Hygiene.

# 5.7 DOCUMENTATION AND RECORDS

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables (Annex for Ready-To-Eat Fresh Pre-Cut Fruits and Vegetables). In addition, the following should be considered:

[A comprehensive written food safety plan that includes a written description of each of the hazards identified in assessing environmental hygiene and the steps that will be implemented to address each hazard should be prepared. The description should include, but is not limited to: an evaluation of the production site, water and distribution system, manure use and composting procedures, personnel illness reporting policy, sanitation procedures, and training programs.]

The following are examples of the types of records that should be retained:

- Microbiological testing results and trend analyses
- Water testing results
- Employee training records

- Pest control records
- Cleaning and sanitation reports
- Equipment monitoring and maintenance records
- Inspection/audit records

# 5.8 TRACEABILITY AND RECALL PROCEDURES

Refer to Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

Traceability is the ability to follow movement of the product through all stages in the supply chain from production to distribution.

- Detailed records should be kept that link each supplier of the product with the immediate subsequent recipient of the food throughout the supply chain. The information should include, if available, the packer name, address, and phone, date packed, date released, type of food including brand name and specific variety (*e.g.*, Romaine lettuce rather than just lettuce), lot identification, and number of items,
- The following are examples of the types of records that should be retained to facilitate traceability:
  - Shipping documents
  - o Invoices
  - Other records maintained by the firm that identifies the supplier and the buyer
  - Operators such as growers and producers and, in cases where contract harvesters are used, harvesters should keep current all relevant information on agricultural activities such as information concerning each lot, date harvested, grower contact information, harvest practices, if water used in harvesting, water quality.
- In fresh-cut, pre-cut or ready-to-eat salad operations, multiple ingredients from different sources may be combined in a single package. This practice can complicate efforts to trace leafy vegetables to their source. The processors should consider establishing and maintaining records to identify the source of each ingredient in the product.

# 6. PACKING ESTABLISHMENT: MAINTENANCE AND SANITATION

Refer to the General principles of Food Hygiene.

# 7. PACKING ESTABLISHMENT: PERSONAL HYGIENE

Refer to the General Principles of Food Hygiene.

# 8. TRANSPORTATION

Refer to the General Principles of Food Hygiene and to the Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food.

# 9. PRODUCT INFORMATION AND CONSUMER AWARENESS

Refer to the General Principles of Food Hygiene.

# 9.3 Labeling

Refer to the Code of Hygienic Practice for Refrigerated Packaged Foods with Extended Shelf Life CAC/RCP 46-(1999). In addition, the following should be considered:

Label information needs to be clear and easy to read with specific directions for product storage and use, including regarding the 'use-by'<sup>4</sup> date or other shelf-life indicators when provided. Consumers need clear guidance on keeping washed RTE bagged fresh leafy salads refrigerated until used.

<sup>&</sup>lt;sup>4</sup> The date after which the product should not be consumed. It is determined from the date of production, utilizing the product shelf life, building in a margin of safety as determined by the manufacturer.

# 9.4 Consumer education

Refer to the General Principles of Food Hygiene. In addition, the following should be considered:

All stakeholders–government, industry, consumer organizations and the media—should work together to communicate clear consistent messages on handling fresh leafy vegetables safely to avoid giving contradictory advice and causing confusion.

Consumer information on handling fresh leafy vegetables safely should cover:

- Selecting produce in the marketplace (supermarkets, retailers)--Many fresh leafy vegetables such as lettuce are fragile and must be handled with care to avoid mechanical damage and to minimize discoloration and pathological problems.
- Transporting to home--Increases in product temperatures during transportation can be considerable. Time in transit for fresh leafy vegetables between retail/markets and the home should be kept as short as possible.
- Storage/ refrigeration of fresh leafy vegetables
- Washing leafy vegetables as appropriate with potable running water. Products labeled washed and ready-to-eat should not be rewashed.
- Correct hand washing methods using soap and potable water before handling fresh leafy vegetables should continue to be promoted to consumers.
- Cross-contamination--Consumers need to handle, prepare and store fresh leafy vegetables safely to avoid cross-contamination with pathogens from various sources *e.g.* hands, sinks, cutting boards, raw meats.
- Specific information for fresh-cut, pre-cut or ready-to-eat bagged salads--Consumers need specific and clear guidance on how to safely handle fresh-cut, pre-cut or ready-to-eat (RTE) leafy vegetables Clear labeling is therefore important. There is anecdotal evidence to suggest that some consumers find it difficult to distinguish between produce that can be consumed without further washing and that which requires washing before consumption, particularly bagged produce such as herbs and spinach.

# **10. TRAINING**

Refer to the General Principles of Food Hygiene except for section 10.1 and 10.2.

# 10.1 AWARENESS AND RESPONSIBILITIES

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

• Making education and training a priority for all personnel

# **10.2 TRAINING PROGRAMMES**

Refer to the Code of Hygienic Practice for Fresh Fruits and Vegetables. In addition, the following should be considered:

All personnel involved in fresh leafy vegetable operations should receive training appropriate to their tasks and should be assessed while performing their duties to ensure tasks are being completed correctly. Training should be delivered in a language and manner to facilitate understanding of the information and expectations. Training programs should be designed to help personnel understand what is expected of them and why and it should emphasize the importance of using hygienic practices. A well-designed training programme considers the barriers to learning of the trainees and develops training methods and materials to overcome those barriers.

To accommodate the complexity of situations that exist in fresh leafy vegetable operations, the following training considerations should be addressed:

• Longstanding entrenched trainee behaviors, attitudes and social taboos

- Transient nature of workforce with no prior training in food safety and hygiene
- Children/infants, who may accompany parents working in the field with the potential for transfer of pathogens with a human reservoir
- Diverse cultural, social and traditional practices
- Literacy and education level
- Language and dialect of trainees
- Need to make food safety practices realistic and easy to implement (identify enabling factors, motivators and incentives)
- Raising awareness among trainees of symptoms and signs of disease and encourage them to act upon it (take personal responsibility for health)
- Importance of food safety training when new crops are being grown for the first time

Training programs should be regular, updated particularly when there is a change in product variety or process recorded, monitored for effectiveness and modified when necessary.

Increased emphasis on training in cold chain logistics and management is recommended in line with advancing knowledge and technologies for both refrigeration and temperature monitoring and expanding international trade.