

## **E1 ESTABLISHMENT LOCATION and CONSTRUCTION**

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**Property and Surroundings** **E1.1 The establishment is located away from or protected against potential sources of external contaminants that may compromise the safety and suitability of food. Areas surrounding the establishment are maintained to prevent or minimize harbourage of pests and contaminants.**

**Location** Ideally, production facilities should be located away from areas where atmospheric dust (e.g., dust from parking lots, driveways or fields), smoke, objectionable odours (e.g., industrial manufacturing facilities or intensive livestock operations), airborne chemicals (e.g., pesticides or industrial pollutants) or vehicle exhaust pollution are present. Any of these pollutants may permeate the facility and contaminate food, food contact surfaces or food packaging materials with microorganisms, chemicals, dirt or other extraneous material. Environmentally polluted locations (e.g., old landfill or toxic waste sites) should also be avoided as building locations. Areas that are prone to infestations of pests (e.g., sites near swampy areas) should not be considered as building sites, nor should areas that are susceptible to flooding.

**Drainage** Standing water may result from poor drainage or occasional flooding of grounds, driveways or parking lots. This water may promote the proliferation of insects (e.g., breeding area for mosquitoes) and pests (e.g., source of drinking water for rodents, birds including seagulls and pigeons, raccoons, or reptiles). Standing water also encourages microbial contamination by generic *E. coli* that may be carried into the facility on mud and dirt by foot traffic, equipment or pallets. In addition, control of exterior water minimizes the potential for contamination by seepage into the facility.

**Grounds Maintenance** Grounds should be maintained. Debris, garbage, unused equipment, pallets, containers, tall vegetation and raw materials stored outside the facility encourage breeding and harbourage of pests such as mice, rats, raccoons, insects, birds, skunks, snakes and other wildlife. All may enter the building and contaminate food, food processing or food storage areas.

Vegetation surrounding the facility should be kept closely trimmed to a distance of at least 6 m from the facility. Garbage and other debris should be picked up immediately and placed in covered, pest-resistant containers.

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Supplies and equipment stored outside the building should be neatly stacked, elevated at least 15 cm off the ground, or stored on concrete slabs and located at least 6 m from the facility to discourage rodent and insect harbourage. Pipes stored within 6 m of the facility should have the ends sealed to prevent pest entry.

**Pest Deterrents** Mice and rats are discouraged by open spaces. A strip of vegetation-free, debris-free gravel a minimum of 75 cm wide and 10 cm deep around the perimeter of the production facility will discourage rodent entry. The wider the perimeter strip, the better. This strip is also an excellent location for traps and bait stations. (See Section O5 for more details regarding pest control.)

Minimize roosting and nesting sites on and near the production facility to discourage birds.

Outside lights should be located on standards away from the facility, not on the building. This will minimize insects swarming near open doors and windows after dark. Insects are less attracted to lights containing low ultraviolet levels.

Solid and liquid wastes should be stored in non-leaking, covered containers placed on concrete slabs. Exterior waste containers should be located far enough away (at least 10 m) from the production facility to discourage rodent travel between the two. Frequent emptying of waste containers (before they overflow or a minimum of once per week) will minimize their appeal to pests (e.g., rats, mice, flies, seagulls, etc.) and reduce odours. Areas around waste containers should be kept clean to make the area less attractive to pests and to minimize the potential for cross-contamination (e.g., by wheels of forklifts, shoes, etc.).

**Roadways** Paved driveways and parking areas are ideal. Where this is not possible, roadways should be properly graded, compacted and free of dust. Dust from unpaved driveways may be controlled with environmentally friendly dust suppressants (e.g., Tembec Dust Suppressant<sup>®</sup>, a non-toxic, biodegradable ammonium lignosulphonate pulping liquor). Calcium chloride is the most commonly used dust suppressant, and petroleum mixtures are also effective, but both are less environmentally safe. The Ministry of the Environment must approve all dust suppressants used in Ontario.

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Paved grounds and driveways should be swept (or washed) regularly to prevent dust and other potential contaminants from blowing into the building and transport vehicles. For large areas, a street sweeper can be an effective tool.

### **Building Exterior E1.2 Establishment exterior is structurally complete and suitable for the operations taking place within. Establishment exterior is protected against entry or harbourage of pests as well as entry of external contaminants.**

**Structure** Regardless of whether the facility is new or renovated, the exterior should be constructed of durable, weather-resistant materials. It should also be structurally sound and in good repair.

The design and construction of all facilities must conform to local building regulations. Information about the Ontario Building Code, the latest Code developments, and advice on interpreting Code requirements may be found at [www.obc.mah.gov.on.ca/scripts/index\\_.asp](http://www.obc.mah.gov.on.ca/scripts/index_.asp).

**Pest Deterrents** Openings in walls, foundations, eaves and the roof should be screened or sealed, as appropriate, to prevent entry of the outside elements (e.g., rain, snow), airborne contaminants (e.g., dust, smoke, odours), and pests (e.g., mice, pigeons, raccoons). Facility design and construction should also discourage harbourage of insects, birds, rodents and other vermin by minimizing exterior ledges, nooks and crannies where pests can feed, nest, travel and hide.

Facility doors and windows should be kept closed. When this is not possible, they should be screened (22 mesh or finer is suggested). All doors and windows should be tight, with cracks not exceeding 6 mm in height or width. Doors opening to the outside should be equipped with brush seals and should be fitted with self-closing devices. The use of air curtains provides extra protection against pest entry.

Dock doors should be kept closed to prevent bird, rodent and insect entry. Brush seals on dock leveller plates will discourage rodent entry. Dock canopies should be designed and constructed to deter birds roosting and nesting. Areas near the dock should be kept free of debris and spilled products. Dock door seals will prevent potentially contaminating runoff water from truck and trailer roofs entering the facility or dripping on product or raw materials as they are loaded or unloaded.

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Exposed outside drains should be screened to prevent pest entry into the facility.

**Security** Security at food production facilities has recently received increased attention, especially in the United States. In some circumstances, improved security measures may be necessary to prevent entry of visitors who may intentionally or unintentionally contaminate the facility and/or food products. This may require a policy of new employee screening, restricted visitor entry, employee identification badges, a facility security system, perimeter fencing, exterior lighting or other measures.

## E2 ESTABLISHMENT DESIGN

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**Cross-Contamination Control** **E2.1 Establishment design or operational controls permit hygienic activities, including protection against cross-contamination of food, ingredients, packaging materials and food contact surfaces.**

In simple terms, cross-contamination control means controlling the transfer of microbiological, chemical and physical hazards **into** the facility and controlling the transfer of microbiological, chemical and physical hazards from one area to another **within** the facility. This can be accomplished by facility design and by controlling movement of people and materials in the plant.

**Separation** Facility design must separate incompatible operations to minimize the potential for cross-contamination between ingredients, food contact surfaces, packaging materials and finished food products. This may be achieved by:

- Physical separation (zone isolation)
  - Separate rooms for food processing, ingredient storage, and chemicals used for cleaning and sanitation, or
  - Adequate physical separation of designated work areas to prevent cross-contamination.
- Operational separation
  - Scheduling incompatible operations at different times with sufficient time between operations to clean and sanitize, or
  - Using dedicated equipment).

In production facilities that process multiple products, cleaning and sanitation should take place in the time between different production processes if possible. When this is not possible, scheduling activities with a higher risk of contamination after those of lower risk (e.g., minimally processed or raw product following cooked product) will help minimize potential cross-contamination.

**Food Handler Traffic Flow** Control of employee traffic flow is an effective way to avoid cross-contamination between different production areas. Employee shoes and boots, equipment (e.g., forklifts, handcarts, carts), and transportation devices (e.g., pallets, bins, etc.) may be a serious source of microbial, chemical or physical contamination.

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Traffic flow should be designed in such a way that employees do not pass through other production areas to get to their designated area. Ideally, employees should enter their designated work area from a change room or common hallway and pass through a foot sanitizer. Where direct entry is impossible, traffic flow should always be from “cleaner” areas to “dirtier” areas. To facilitate traffic flow in the opposite direction, (“dirty” to “clean”), facility design should incorporate areas where employees can change clothes and footwear between production areas. Facility design should also provide foot baths or sanitizing floor foamers at each entrance and an adequate number of strategically placed handwashing stations.

The flow of people and product and potential points of cross-contamination can both be identified in a facility schematic. If blueprints are available, they can be substituted.

- Identify each work area or room and the position of each piece of equipment.
- Plot the flow of people, ingredients, food products, packaging, chemicals, waste, etc. throughout the facility. Use different coloured arrows or different styles of dashes to distinguish the flow of each. Verify the accuracy of your diagram by walking through the plant during production.
- Identify the points of potential cross-contamination (biological, chemical and physical).
- Use the diagram to design improved traffic flow patterns.

It is sometimes helpful to identify acceptable employee traffic areas with wall signs or floor-painted routes. Travel in “restricted” areas can be discouraged by physical partition of storage, processing, and packaging areas. Except for emergency exits, the number of entry/exit doors should be limited to discourage traffic. Fewer entrances also minimize the expense of additional entrance equipment (e.g., floor foamers) and personnel supplies (e.g., fewer changes of hair nets, gloves, beard covers, etc. are required).

### **Ingredient/ Product Flow**

Flow should always be directly from one production area to the next with no backtracking or crossovers of “raw” products and/or ingredients with finished products. Ingredients should be brought directly from storage areas to the production area where they will be used. As with employees, they should not travel through another production area to get there.

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- Equipment/ Utensil Movement** The same rules that apply to human traffic patterns should also apply to equipment traffic patterns. Equipment (e.g., forklifts, handcarts, carts) and transportation devices (e.g., pallets, bins, etc.) should be restricted to designated areas. This will lessen the potential for tracking pathogen-containing material from one part of the facility to another. Equipment used for moving ingredients, packaging material and finished product throughout the facility should also be kept clean and maintained in good condition. When passing from “dirty” to “clean” areas, driving through floor foams will help sanitize tires.
- Waste Flow** Waste should never move through food processing, handling or storage areas when there is risk of contamination or cross-contamination with food, ingredients or packaging. Waste must never pass over production or packaging lines. To avoid cross-contamination with employees and equipment, care must be taken not to spill waste while emptying containers.
- Liquid waste (e.g., wastewater and sewage) systems must be of adequate size to handle operational volumes. Wastewater drainage and sewage systems should be equipped with appropriate traps and vents, fully separated so there are no cross-connections and clearly identified as to their function. These lines should not pass over or through production areas unless stringent precautions have been taken to prevent contamination in the event of leakage. In the event of a backup of wastewater or sewage, the affected areas must be thoroughly cleaned and sanitized before production resumes, and contaminated ingredients, packaging and products discarded.
- Colour Coding** Colour coding is an effective way to reduce the potential for cross-contamination by microorganisms.
- Establish an area in which a specific processing step will take place. Designate a colour for all food handling utensils, tools, and workers’ gloves and hairnets. Designate another colour (or variation of the food handling colour) for all cleaning and sanitation tools that will be used in that same area. These colours and these colours only should be used in the defined area.
- Utensil Cleaning Area** In order to prevent contamination, cross-contamination and recontamination, it is often necessary to clean and sanitize utensils and disassemble smaller equipment in a physically separate area or room. This

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area must be in a location convenient to the production area but one that does not require travel through other production areas to access.

The walls, floor and ceiling should be constructed of non-absorbent, non-toxic, smooth, corrosion-resistant materials that are able to withstand repeated cleaning. A list of acceptable materials is published by the CFIA. The *Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products* may be accessed at [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml). The area must be well ventilated. It should be supplied with sufficient quantities of hot and cold water at adequate pressure. Floors must be sufficiently sloped to allow water to drain to trapped, cleanable drains, and drainage lines should be large enough to carry peak loads of effluent. Design and construction must comply with local building codes.

**Personnel Facilities** **E2.2 Washrooms, change rooms, and lunch and break area(s) are provided and maintained to ensure that personal hygiene can be maintained to protect the safety and suitability of food. Washrooms are equipped with adequate lighting and an adequate number of flush toilets and handwashing stations; are free of condensation, excess moisture or odours; and are designed to prevent or minimize contamination.**

Employee facilities should include washrooms, change rooms and a separate eating area. All should be designed and constructed to permit easy cleaning and sanitation and to encourage personal hygiene. Dirty facilities may unintentionally contaminate food handlers who, in turn, can contaminate ingredients, packaging materials and finished products.

All personnel facilities should not open directly into food processing areas, should be equipped with proper ventilation, and should have automatic self-closing doors to minimize hand contact with contaminated knobs and door surfaces.

The floors, walls and ceilings of all washrooms, change rooms and lunchrooms should be constructed of non-absorbent, non-toxic, smooth, corrosion-resistant material that is able to withstand repeated cleaning. (See [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml) for a list of acceptable materials.) Floors should slope to functioning drains. If possible, toilets, partitions, sinks and other fixtures should be wall mounted to permit easy and thorough floor cleaning and sanitation. Tables and

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chairs in change and lunchrooms should be hard surfaced for ease of cleaning. All employee facilities should be cleaned daily.

Handwashing is the single most effective way to prevent the spread of communicable diseases. Sinks must be supplied with potable (suitable for drinking) water in adequate quantity and pressure. If possible, both hot and cold running water should be available with knee, thigh, foot or electric sensor controls so employees are not required to touch the taps after washing their hands. Where “hands-free” tap controls are not present, employees should close the tap control with their used single-use towel to avoid direct contact with their clean hands.

Single-use towels are the preferred method of hand drying. The rubbing action required to dry hands with single-use towels also removes microbes from hands. Common-use cloth towels become contaminated quickly and should never be used. Air dryers may recontaminate freshly washed hands with airborne contaminants.

Towel dispensers should be “hands free” so food handlers can pull out paper towels without touching the dispenser. Handwashing notices and instructions in languages appropriate for the employees should be posted in the washrooms.

Each sink should be equipped with liquid soap in a pump dispenser. Where appropriate, a hand sanitizer may also be provided. An adequate number of lined waste receptacles should be present, and they should never be allowed to overflow. Unlined waste receptacles should be cleaned after every emptying to discourage odours and pests.

Washrooms should have an adequate number of sinks and toilets for the number of people using them (a maximum 20 people per toilet is suggested. A fan, exhausting to outside the facility, should be connected to the light switch so when the washroom is in use (the light is turned on), the fan creates negative air pressure within the room. Lighting intensity should be 220 lux (20 foot candles) or greater to facilitate sanitation procedures (you can't properly clean what you can't see). See Section E3.2 for more lighting information.

As noted earlier, the design and construction of all facilities must conform to local municipal building regulations and the Ontario Building Code. Information about the Ontario Building Code, the latest Code

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developments and advice on interpreting Code requirements may be found at [www.obc.mah.gov.on.ca/scripts/index\\_.asp](http://www.obc.mah.gov.on.ca/scripts/index_.asp).

Ideally, washrooms should be located only in break areas and separated from production areas so doors do not open directly into a food production/packaging area. Preferably, doors should be self-closing so employees do not have to touch them after washing their hands. There should be an adequate number of hangers outside the entrance so that employees can remove protective clothing (aprons, gloves, etc.) before entering the washroom.

If a washroom is located immediately off a production or packaging area, in addition to the self-closing doors and clothes hangers noted above, entrance/exit equipment (e.g., foot bath) and personal supplies (e.g., hair nets, gloves, beard covers, etc.) must be provided.

A lockable locker or secure location should be provided for each employee. This will provide a safe place for personal belongings (e.g., jewellery) and discourage its presence in production areas. Lockers should be constructed of non-porous, cleanable material. They should be equipped with door vents to facilitate air flow into the locker. Locker tops should be sloped at 60° to prevent dust collection and use as a storage area.

Change rooms should also be cleaned daily. Lined garbage containers should be emptied daily and cleaned, if necessary. Soiled laundry should be collected in clearly marked, closed containers and removed regularly for cleaning.

Provisions should be made to store employees' lunches in the lunchroom. A glass-door display-type refrigerator will store lunches safely, deter theft and discourage pests. Employee food should never be stored in lockers. Lined garbage containers, especially those containing discarded food, should be emptied and cleaned regularly.

### **E3 ESTABLISHMENT INTERIOR**

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#### **Internal Structures and Fittings**

**E3.1 Internal rooms, structures and fittings are suitable and are maintained for the operations taking place within. Floor, ceilings, overheads, doors, windows, stairs and other structures are cleanable, properly maintained, exhibit no evidence of degradation that would cause contamination and are suitable for the activities in each area. The condition of internal rooms, structure and fittings protects the safety and suitability of food.**

A poorly designed facility may be difficult or impossible to keep clean. Attention to sanitation requirements during the design process can save time and resources and prevent problems later. Good design will also enhance production efficiencies.

The design and construction of all facilities must conform to local building regulations. Information about the Ontario Building Code, the latest Code developments and advice on interpreting Code requirements may be found at [www.obc.mah.gov.on.ca/scripts/index\\_.asp](http://www.obc.mah.gov.on.ca/scripts/index_.asp).

#### **Floors**

Floors should be waterproof, non-absorbent, washable, non-toxic, easy to clean and sanitize, and durable for their intended use (e.g., some environments may be wet and corrosive while others may alternate between hot and cold). Floor surfaces should be textured enough to prevent slipping but smooth enough to allow for thorough cleaning. If floor coatings or tile are used, they must be inspected regularly for cracks and crevices and/or other damage. Cracks and crevices can create an environment (e.g., trap moisture and debris) suitable for microbial growth.

To prevent water pooling and potential microbial growth, floors should be smooth and have a continuous slope toward trapped drains. A 1–2 per cent slope is suggested. Areas that do not drain well must be mopped or squeegeed regularly to minimize pooling and the potential for cross-contamination. Because floor drains can sometimes harbour pathogenic microbes (e.g., *Listeria*), drain covers should be easily removable to facilitate regular cleaning.

If floor mats are used, they should be readily removable and be constructed of easily cleaned material.

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**Walls and Ceiling** All internal surfaces, structures and fittings should be constructed of non-absorbent, non-toxic, smooth, corrosion-resistant materials that are able to withstand repeated cleaning. As a minimum, walls should be smooth, waterproof and easy to clean to a height appropriate for the operation. Light-coloured walls and ceilings are most easily monitored for the presence of soil.

Growth of microorganisms or mould may result if walls and ceilings cannot be effectively cleaned. Materials that are not durable or suitable can deteriorate, resulting in physical contamination of food by flaking, peeling or rusting. The use of materials that cannot be adequately cleaned and disinfected should be avoided. The use of wood, even when a smooth, impervious material covers it, is not recommended. A list of acceptable materials may be found in the *Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products* published by the Canadian Food Inspection Agency. It may be accessed at [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml).

Structural seams, cracks and crevices in walls and ceilings should be sealed to thwart entry of insects and rodents and to inhibit debris collection and microbial contamination. The area where the wall meets the floor should be “coved” (rounded at a 2.5 cm radius or sloped at a 45–60° angle) to increase cleaning effectiveness. Installation of wall “bumpers” will lessen damage by forklifts, pallet jacks and other moving devices. Damage-caused holes can permit entry of pests and other contaminants. Bumpers and sloped curbs should also be sloped at a 45–60° angle.

Production facilities should have solid ceilings that cover areas where dirt can accumulate (e.g., rafter chords), birds can roost, and pests (e.g., rats, raccoons, pigeons) can nest and/or travel. Physical debris and microbially contaminated feces can fall from overhead structures, platforms, ladders, stairs, chutes, overhead utility installations, piping, etc. Areas where dirt and debris accumulate must be cleaned regularly. Ladders and walkways over production areas should be equipped with kick plates at least 10 cm in height to protect exposed food, ingredients, food contact surfaces and packaging materials.

Pipelines, electrical conduit, air lines and ducting should be mounted away from the ceiling to allow for cleaning and should be insulated to eliminate condensation. Only smooth hanger rods should be used instead of angle

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iron or threaded rods that can collect dust and soil. As an alternative, these service lines can be structurally enclosed at the ceiling or in the attic.

Ceilings should be designed so they minimize condensation (e.g., insulated) and hard surfaced so they do not absorb moisture, which encourages mould growth. Ceilings should be constructed from materials that do not flake or peel and are easy to clean.

Any painted or coated surfaces should be inspected often for signs of chipping, peeling, flaking or other loose particles. Repairs should be made immediately to eliminate these physical hazards.

**Windows and Doors** Windows should be tight fitting to prevent entry of pests and airborne contaminants. Window sills and ledges should be sloped at 45–60° to lessen the accumulation of dust and dirt and to discourage their use as a shelf.

Windows that do not open should be sealed. Windows that open must be fitted with screens fine enough (22 mesh or finer is suggested) to not only prevent entrance of insects but also allow easily removal for cleaning. Windows (both interior and exterior) that view food processing areas should not be opened. Repair damaged windows and screens promptly.

When possible, windows should be constructed of unbreakable material. Where glass windows are installed, they should be protected against breakage to minimize the potential for contamination by broken glass.

Doors should have smooth, non-absorbent surfaces, be easy to clean and sanitize, and be able to withstand normal use and cleaning. They should be wide enough to allow product and vehicles to pass through without contacting (and potentially damaging) the door frame. Exterior doors, cold storage room doors and production area doors should be self-closing. All doors must be tight fitting and may be equipped with brush seals to discourage pest entry. A mouse can gain entry through an opening the width of a lead pencil (6 mm).

**Dry Storage Areas** Establishment interior requirements also apply to storage areas. Floors should be waterproof, non-absorbent, washable, non-toxic, easy to clean and disinfect, and be properly drained. All internal walls, ceilings, structures and fittings should be constructed of non-absorbent, non-toxic, smooth, corrosion-resistant materials that are able to withstand repeated

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cleaning. Paint may be used in this non-production area only if it is the only practical solution for a smooth, easily cleanable surface. However, surfaces must be free of chipping, peeling, and flaking paint, or other loose particles.

Doors should be tight fitting and easy to clean and sanitize. Windows also should be tight fitting and protected against breakage if not constructed from unbreakable material. Lighting should be of the correct intensity (see Section E3.2) and protected against breakage. Ventilation systems should be adequately screened and designed to remove excess heat and humidity without cross-contamination (see Section E3.4).

**Coolers/Freezers** Establishment interior requirements also apply to the interiors of coolers and freezers. Floors should be waterproof, non-absorbent, washable, non-toxic, and easy to clean and disinfect, and be properly drained. All internal walls, ceilings, structures, and fittings should be constructed of non-absorbent, non-toxic, smooth, corrosion-resistant materials that are able to withstand repeated cleaning. Doors should be tight fitting and easy to clean and sanitize. Lighting should be of the correct intensity and shielded to prevent accidental breakage.

Cooler and freezer loading doors should be equipped with PVC curtains that overlap at least 13 mm to help maintain cooler/freezer temperature when the door is open. Because they drag across ingredients, food products and equipment as it moves in and out of the cooler, these curtains have the potential to cross-contaminate. For this reason, they should be cleaned and sanitized regularly.

Coolers and freezers should be free of condensation. However, in case of equipment failure or loss of power, condensation collection pans and/or drain pans should be located beneath refrigeration equipment, coils, and pipes to protect food and/or food ingredients. Regular inspection and cleaning of these collection pans is required.

The key to cold chain management is frequent temperature measurement. Monitoring may be accomplished either manually or with an alarmed temperature tracking system. Thermometers should be calibrated regularly following manufacturer's directions. Refrigeration equipment should be kept in good repair. Instead of one large unit, many operators use two smaller refrigeration units in order to maintain some degree of cooling in the event of the failure of one.

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Too high temperatures can hasten fruit and vegetable ripening and their subsequent deterioration. This accelerated bacterial and fungal spoilage creates a potential food safety hazard. Reducing storage temperatures can slow deterioration. Controlled atmosphere (CA) can also slow deterioration when used in conjunction with storage temperature levels most appropriate to the particular fruit or vegetable. A further strategy may be removal of ethylene gas (the “ripening hormone”) from the cooler where climacteric fruits and vegetables (e.g., apples, cantaloupes, honeydew melons, peaches, pears, tomatoes, watermelons) are stored. Adequate ventilation and/or ethylene scrubbers will remove ethylene, thereby minimizing its effect in quickening the rate of ripening.

### **Lighting E3.2 The establishment has appropriate lighting to facilitate all activities including processing, inspection, cleaning and sanitizing, and maintenance. Lighting is of a design and type that does not contribute to a misleading assessment of food.**

In sorting, inspection and grading areas, the quality of light is important in order to determine true food colour. Natural light is best, but often an impractical lighting option. Most fluorescent and incandescent light bulbs generate only a portion of the full light spectrum. This results in a misleading evaluation of food colour. In areas where true food colour evaluation is required, full-light-spectrum bulbs should be used.

Lux is the metric measurement unit for light intensity. One lux equals the total intensity of light that falls on a 1 sq. m surface that is 1 m away from a one-candle-power light source. Under the Imperial system, one foot candle equals the total intensity of light that falls upon a 1 sq. ft surface that is placed one foot away from a point source of light that equals one candle power. Since there are 10.76 sq. ft per sq. m, there are 10.76 lux per foot candle.

It is recommended that lighting intensity should not be less than:

- 540 lux (50 foot candles) in food processing and inspection areas
- 220 lux (20 foot candles) in work areas
- 110 lux (10 foot candles) in storage and other areas including change and washrooms.

Light intensity should be checked at least twice per year.

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**Lighting Fixtures E3.3 Light bulbs and fixtures in areas of exposed food, ingredients, packaging materials or food contact surfaces are equipped with shatterproof bulbs or breakage shields to prevent or minimize contamination of food if breakage occurs.**

Lighting fixtures must be securely suspended or fastened to the ceiling so they cannot fall onto food, processing lines or people.

Light bulbs and fixtures over food, ingredients, packaging materials and food contact surfaces should be equipped with shatterproof bulbs or be protected with an unbreakable shield to trap fragments in the event of bulb breakage. Bulbs should also be protected against accidental breakage.

All fixtures and bulbs should be easy to clean. Regular cleaning will ensure that they do not contribute to contaminants falling on to food, ingredients, packaging materials and food contact surfaces. Cleaning will also maintain light quantity and quality.

The cleanliness of lights should be monitored during regular premise inspection.

**Air Quality and Ventilation E3.4 The establishment has and uses ventilation to keep rooms free of excessive heat, humidity, steam, vapours, smoke, particulates and condensation. Ventilation openings have screens or filters that can be easily cleaned or changed. Ventilation systems do not permit air to flow from contaminated areas to clean areas.**

The volume of air exchange should be adequate to prevent excessive heat, steam, vapours, smoke, condensation and dust; to discourage the growth of mould and mildew; and to remove contaminated air. Either a natural (e.g., open screened windows) or a mechanical system may be employed. Natural ventilation is not a realistic option in large or sensitive food handling areas.

Air intakes should not be located in areas where they may take in contaminated air. Intakes, including those for air compressors, should be equipped with tight-fitting screens and filters. Very fine filters (e.g., 0.1 microns) will remove airborne bacteria, yeast, mould and some viruses. Screens and filters should be easy to remove for cleaning or replacement and should be serviced regularly.

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Fans, air ducts and other ventilation equipment should be kept clean and well maintained. It is a good practice to test interior air regularly for biological, chemical and physical contaminants.

Pneumatic equipment systems (e.g., air compressors) should be fitted with an air dryer(s) to remove water and an air filter(s) to remove water, oil, oil vapour, dust and other contaminants. Filters should be monitored/cleaned regularly. As with facility air, air in the pneumatic system should also be tested regularly for contaminants.

In microbiologically sensitive areas, a positive air pressure system should be used (outdoor air is drawn in and the increased pressure forces stale, potentially contaminated indoor air out of the room). Positive air pressure should be highest in the packaging area and progressively lower back through to the receiving area. In this scenario, the direction of airflow is always from a microbiologically “clean” area (e.g., packaging) to a “dirtier” area (e.g., receiving).

### Drainage and Sewage Systems

**E3.5 The establishment has and uses drainage and liquid disposal systems that are maintained to protect the safety and suitability of food and potable water supply. Drainage and liquid disposal systems are equipped with back-flow preventers and no cross-connections exist with drainage or waste systems and potable water lines. Pooling of water and liquids is prevented or addressed.**

There should be an adequate number of floor drains to effectively drain liquids. A suggested guideline is one floor drain per 40 sq. m of floor area. The minimum recommended drain cover size is 30 cm<sup>2</sup>. Drains can harbour *Listeria* and other pathogens, so drain covers should be easily removable to allow regular cleaning.

Floors must be adequately sloped toward the drains. A uniform floor slope of one to two per cent (2–4 cm) toward the drain is suggested. Always check with your local municipal building department before beginning new construction or undertaking renovations.

All drains should be trapped and vented and of adequate size to carry peak drainage loads. A minimum diameter of 10 cm is recommended. Where trench drains are used, they should flow from “cleaner” to “dirtier” areas.

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Potable and non-potable water (effluent) systems must also be completely independent of each other and of sewage systems.

Potable water pipes should be clearly identified (e.g., colour coded) to avoid confusion with those carrying wastewater and sewage. Water systems should be equipped with back-flow prevention devices to prevent potential siphoning of contaminated liquids into the potable water supply (e.g., by hoses left lying on the floor).

Waste disposal systems should be constructed of corrosion-resistant material and be well maintained. Design should be such that there is no risk of cross-contamination of the potable water supply. The sewer system should not be interconnected with the food production drainage (effluent) system in order to reduce the potential for cross-contamination in the event of a malfunction (e.g., sewage backup into production areas).

Effluent or sewage lines should not pass over or through production areas where leaks could contaminate food, ingredients, packaging materials and food contact surfaces. However, if they do, covering these lines or placing a catch-trough below is not recommended. Such devices serve only to camouflage leakage problems that require immediate attention. In the event of a backup of wastewater or sewage, the affected areas must be thoroughly cleaned and sanitized before production resumes, and contaminated food products, ingredients and packaging materials discarded.

In contrast to effluent or sewage lines, overhead water lines that may create condensation should be wrapped with insulation and covered with a plastic sleeve.

Equipment drain lines should not discharge into work or traffic areas or into areas that are difficult to clean.

All drainage and sewage discharges must meet local building code regulations.

### E4 EQUIPMENT

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#### Equipment Design, Construction and Installation

**E4.1 Equipment and utensils that may impact on food safety are constructed of non-toxic materials, exhibit no signs of degradation that could contaminate food, and are easy to clean, sanitize and maintain. Equipment design, location, construction and installation promote effective assessment, maintenance, and cleaning and sanitizing activities. Adequate equipment or facilities are available for the activities conducted to protect the safety and suitability of food. Equipment functions in accordance with its intended use.**

Equipment should be designed, constructed and installed so that it performs its intended function; is accessible for cleaning, sanitizing, maintenance and inspection; and minimizes the potential for biological, chemical and physical contamination during operations. This applies to all holding, conveying, processing, and packaging equipment and utensils.

Design deficiencies (e.g., microbial growth niches) must be operationally managed. The fewer the number of design deficiencies, the lower the number of corrective people-dependent procedures required during operations.

All food contact surfaces must be non-toxic, non-reactive and non-contaminating to the food. Surfaces must also be non-absorbent, smooth, corrosion resistant, easily cleanable and able to withstand repeated cleaning without deterioration for the lifetime of the equipment. To avoid creation of corroded or pitted areas where microbes can hide, live and survive, equipment must be constructed of materials that are compatible with the product being produced, cleaning and sanitizing chemicals being used, and procedures used during cleaning and sanitation. In most instances, this means that food contact surfaces must be constructed of stainless steel (300 series) or food-grade plastic. Avoid using wood and other similar materials that cannot be adequately cleaned and disinfected. The use of soft metals, those subject to corrosion, and painted surfaces is not recommended.

A list of acceptable materials, coatings and paints published by the CFIA may be found in the *Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products* at [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml). Those without Internet access should contact their local CFIA office (listed in the federal government section of the telephone directory Blue Pages).

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Equipment should have a simple, open design that permits ready access for inspection, maintenance, cleaning and sanitation. All enclosed equipment should have an adequate number of inspection and cleanout doors. For ease of accessibility, equipment components should be easy to dismantle without specialized tools. Equipment design should also minimize opportunities for product and moisture accumulation and eliminate points where microbes can enter, grow and reproduce.

An article outlining ten principles of sanitary equipment design developed by the American Meat Institute (AMI) may be accessed at [www.foodsafetymagazine.com/issues/0306/colclean0306.htm](http://www.foodsafetymagazine.com/issues/0306/colclean0306.htm). While the article applies specifically to meat plants, among buyers there are rising expectations for the same equipment design standards in fruit- and vegetable-processing facilities.

**Surfaces** Food contact surfaces of both equipment and utensils should be free of niches such as crevices, stress cracks, open or gaping seams, pitted surfaces, bolt rivets, protruding edges, roll-under edges, recesses and creases that can trap food residues and encourage microbial growth. For the same reason, there should be no dead ends or dead spaces. There should be no evidence of, or opportunity for, rust or mould.

Welds should be continuous, ground smooth and polished to the texture of adjoining surfaces. Surfaces should be butt-welded to reduce microbial hiding places often found when overlap welding is used. Caulking, rather than continuous welds, is **not** acceptable.

The use of rivets, bolts, studs or tack welds to attach mounting plates, brackets, junction boxes, nameplates and end caps creates an entry point for water and a harbourage site for microorganisms. Whenever possible, continuous welds should be used instead of fasteners.

Inspection doors and control devices such as push buttons, switches and valve handles should be designed, constructed and installed in such a way that they do not allow penetration or accumulation of food materials or moisture, which encourages microbial growth. The same stipulations apply to electrical control panels, junction boxes, chain and belt guards, etc. Each enclosure should be sloped on top to prevent use as a storage and/or dust-gathering area.

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The use of polyvinyl chloride (PVC) piping should be restricted to non-food use because the porous interior wall of this type of pipe may harbour microbes.

**Connections** Connection joints and overlapping parts provide excellent places for contaminants to hide but do not allow adequate room for cleaning water to force out microbe-harboring food particles. Where welding is not feasible, bolts through stainless steel spacers should be used to hold parts tightly together while keeping food particles and microbes from hiding and allowing plenty of space for wash water. Domed stainless steel nuts or nuts with plastic tops and bottoms should cover bolt threads to block microbes from growing on unexposed threads.

**Drainage Holes** Accumulated water or product liquid can harbour microorganisms and create an environment for their growth. Cleaning and sanitation chemicals may also pool on equipment, causing a chemical contamination risk. To prevent this, equipment drain holes should be adequate in number and size and strategically located to allow easy, unobstructed liquid and product drainage.

**Conveyor Belts** Frayed conveyor belts can also be a source of physical and microbial contamination. Smooth, non-porous modular plastic or stainless steel belts do not fray and are easier to clean than flat belts. Hinges on modular belts should open wide enough around the sprockets to allow cleaning water access to all areas but be tight enough on the surface to prevent food particle accumulation.

**Working Space** Equipment should be installed with enough working space to permit inspection, facilitate ease of cleaning and sanitation either in place or disassembled, and allow maintenance and lubrication. To allow access for cleaning, equipment should be separated by 45–90 cm and should be installed at least 75 cm from walls, 20 cm above the floor and 45 cm below the ceiling.

Motors and drives should be mounted to the side or below food contact surfaces (30 cm below food level is generally suggested as a suitable distance). If motors can be mounted only above food, drip pans must be installed under the motor/drive to catch leaking lubricants. For these pans to be effective, they must be inspected and cleaned regularly.

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**Motors, Drives** Where possible, bearings should be self-lubricating and sealed. Where lubrication is required, only food-grade lubricants that will not contribute unacceptable contamination must be used. The CFIA's *Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products* provides a list of acceptable lubricants. It may be accessed at [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml).

Faulty shaft seals on production equipment may allow product to leak outside the line, where microbial growth can occur. These microorganisms may grow then back to the product side of the seal. To prevent the passage of microorganisms, double seals with microbiocidal barrier liquids should be used. However, if these barriers are not replaced on a timely basis, they may also become a growth medium for microorganisms. Worn and/or cracked gaskets are also excellent sites for microbial harbourage and contamination.

Motors should be fully enclosed, splash-proof, explosion-proof and sealed to prevent contamination by moisture, dust and pests, and to lessen the risk of food contamination and of personal injury to employees. Drives, pulleys and other rotating parts should be covered for the same reasons. Whenever possible, direct-drive motors should be used instead of a chain-driven gearbox combination. Splash and safety guards should be easily removable for cleaning. All moving parts should be designed to be easily repaired or replaced with minimal disruption to production and low contamination risk to product in the event of mechanical failure.

**Support Structures** To avoid collection of dust, horizontal equipment structural supports should be constructed of round tubing or set diagonally if square tubing or angle iron is used. Upright floor supports should be free of floor flanges where microbes can hide and grow in residue accumulation.

Framework should be constructed so that moisture and soil cannot penetrate. Hollow areas (e.g., frames, rollers, etc.) that cannot be eliminated should be permanently sealed.

**Controls** Pipe valves, equipment "kill" switches and operating controls should be easily accessible and easy to operate should there be a leak or mechanical malfunction. Quick stoppage will result in less contamination and less product loss.

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Wall-mounted control boxes, switch boxes, electrical conduit, sinks, pipes, etc. should be mounted away from the wall for ease of cleaning (a minimum of 2.5 cm is suggested). Where direct wall mounting is unavoidable, caulking may be used to prevent microbial and/or soil niches. Ceiling-mounted devices (such as refrigeration units) should be installed tight to the ceiling so no difficult top-of-unit cleaning is required.

**Refrigeration Units** Refrigeration units should be sized to cool product quickly and to maintain constant and correct temperatures for their particular application. All refrigerated areas should be equipped with temperature measurement and/or temperature recording devices. Installation of equipment-failure alarm systems should be considered, as well.

Evaporator drip pans in refrigerated rooms should be equipped with drain lines to remove condensate. Evaporator units (pans, fans, etc.) should be inspected regularly for dirt and mould formation and cleaned as required. Refrigeration and drainage lines should be constructed of corrosion-resistant materials (e.g., stainless steel or copper) to prevent physical contamination of loose material falling into ingredients or finished product. Pipe insulation should be kept in good repair for the same reason.

**Compressors** Air compressor units should be oil free to prevent cross-contamination of an oil odour and/or taste in food products. Potentially contaminating moisture may be removed with air dryers and/or traps. Traps and air filters should be cleaned and/or replaced regularly. Along with sampling room air, producers may also sample compressed air for contaminants including yeast and moulds.

**Containers** Containers, vehicles and other equipment used in the facility to transport raw materials, packaging materials and finished product should be kept clean and well maintained to reduce the potential for cross-contamination. To accomplish this, separate wash areas/rooms should be provided for cleaning raw materials handling containers and equipment, and for cleaning finished food product containers and equipment.

**Utensils** No wooden-handled utensils (e.g., brooms, brushes, squeegees) should be used in a food production facility. All must be constructed from food-grade materials to facilitate effective cleaning.

Clean-out-of-place (COP) tanks should be provided for cleaning small equipment parts and utensils. Clean utensils, small tools and protective

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apparel (e.g., aprons) used during food processing activities should be stored on non-toxic, non-reactive, non-absorbent, smooth, corrosion-resistant surfaces, shelving, hooks or racks (e.g., stainless steel or food-grade plastic).

Equipment, utensils, brushes and containers used for cleaning and sanitizing should be colour coded or labelled to identify their intended use and the area to which their use is restricted. All cleaning and sanitizing devices must be constructed of easily cleanable, non-absorbent (some natural fibres used in brushes can absorb, and later release, bacteria and viruses), non-toxic material. Following use, cleaning equipment should be stored grouped according to its intended use, separated from cleaning equipment with other intended uses, and away from food processing areas.

**Tools** Tools should be constructed from materials that are resistant to cracks and scratches (where microorganisms can grow) and are easy to clean. A documented system (e.g., a Standard Operating Practices or SOP) should be in place to describe how tools should be cleaned, who is responsible for cleaning them, how often they should be cleaned, and how and where they should be stored. Tools should be well maintained but replaced as soon as they become worn or are in poor condition.

**Detection Devices** To ensure protection of food products, installation of screens, magnets, metal detectors or other equipment is often necessary. Each must be located where it can provide maximum protection during processing. For example, the greatest benefit from a metal detector is achieved when it is positioned to check product as it enters its final packaging. All protective equipment must be properly maintained and calibrated.

Process monitoring and control devices should be plentiful and easy to read and interpret.

### **Waste Containers and Utensils**

**E4.2 Containers and utensils used for collection and holding of waste and inedible or hazardous substances are clearly identified, function properly, exhibit no signs of degradation that could led to the contamination of food, and can be cleaned and maintained. Containers and utensils are cleaned prior to entering food processing, handling or storage areas.**

Waste containers within the production facility used for collecting solid or inedible waste or hazardous material should be clearly identified for their

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intended use. If not clearly identified, there is risk of cross-contamination if food products are inadvertently placed in containers meant for non-food use. Colour coding can be an effective differentiation tool. Containers should be of adequate size for the amount of waste generated and fully covered with easy-opening lids that prevent accidental spillage and entry of pests.

Waste containers should be leak-proof, waterproof, and constructed of durable, easy-to-clean material. Leak-proof plastic or wet-strength liners may be used. Containers must be cleaned inside and out before being taken into food processing, handling or storage areas. Areas used for cleaning waste containers should be physically or operationally separated from production areas.

Waste should never move through food processing, handling or storage areas when there is risk of contamination or cross-contamination with food, ingredients and packaging. It must never pass over food processing lines. To avoid cross-contamination with employees and equipment, care must be taken not to spill waste while emptying containers.

**Handwashing Stations** **E4.3 An adequate number of conveniently located and readily accessible hand washing stations are provided in areas where exposed food, ingredients and packaging materials are processed or handled, and in washrooms and other locations necessary to prevent or minimize contamination. Hand washing stations are properly installed and maintained and are provided with warm potable water, soap, a hygienic drying apparatus and a cleanable waste receptacle.**

During production activities, employees' hands often become soiled. In addition to employee washrooms, the production area should be equipped with handwashing stations. Every facility should have a sufficient number of handwashing stations to allow employees to wash their hands without waiting. The number of stations will depend on the size of the production area and the number of employees. As a starting point, one handwashing station should be provided for every 75 sq. m of food production area.

Each station should be equipped with potable warm water, liquid soap in a pump dispenser, disposable paper towels and cleanable waste container. Paper towel dispensers should allow the paper towel to be pulled out without the freshly washed hands touching the dispenser. A hand sanitizer

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may also be provided. Ideally, tap operation should be “hands free” to prevent recontamination of hands. These facilities must be easily accessible, and access to them must not require travel through another processing area.

Handwashing stations must be kept clean so they do not become a source of contamination. They should never be used for purposes other than handwashing (e.g., washing utensils). Each should be equipped with a trapped drain.

Signs in appropriate languages should be installed to remind employees to wash and sanitize their hands before they begin work, after each absence from their workstation and any other time that their hands become soiled.

While it may sound simplistic, employees must be trained to wash their hands correctly. Section O1.2 discusses proper handwashing techniques in detail.

In some production facilities, boot-sanitizing baths may be installed at all entrances to processing areas. Sanitizing solutions must be changed often in order to retain an effective sanitizing level of 500 parts per million.

### E5 WATER SAFETY

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#### **Adequate Supply and Protection of Water, Ice and Steam**

**E5.1 Potable water, ice and steam are supplied at volumes, pressures and temperatures necessary for all sanitation and operational activities. Appropriate facilities for water storage, treatment, distribution and temperature control are available to protect the safety and suitability of food.**

As noted earlier, potable water systems should be separate from non-potable water (e.g., wastewater, auxiliary lines such as sprinkler systems and sewage lines) and should be clearly identified (e.g., by colour coding or labelling).

All hoses and taps supplying potable water should be equipped with back-flow devices. When used as an extension of a water outlet, hoses and taps have the potential to siphon contaminated water back into the potable water supply if there is sufficient pressure difference.

For example: A garden hose is left running on the floor. A floor drain backs up so there is effluent on the floor. Just then, a large capacity water pipe in another section of the facility is turned on, significantly lowering pressure throughout the system and drawing water toward the large capacity pipe. As a result, effluent is siphoned into the water system through the hose lying on the floor, contaminating the water system.

To prevent this reverse flow (back-flow), back-flow devices (e.g., vacuum breaker or check valve) must be installed in **every** potable water outlet.

When not in use, hoses should be coiled neatly and stored so they do not impede floor drainage or trap waterborne contaminants. Storage should be on hangers where they will not contact ingredients, food contact surfaces, packaging materials or finished food products. Hoses should also be cleaned externally and internally (e.g., with a turbulent air/water mixture) on a regular schedule to remove dirt and microbial contaminants.

#### **Recirculated Water**

Recycled/recirculated water (including that used as wash water) must be confined to a clearly identified, separate system.

#### **Water Transportation /Storage**

Water/ice transportation and storage containers must be constructed of food-grade materials. Both must meet construction criteria outlined in the CFIA's *Reference Listing of Accepted Construction Materials, Packaging*

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*Materials and Non-Food Chemical Products*. It may be accessed at [www.inspection.gc.ca/english/ppc/reference/u2e.shtml](http://www.inspection.gc.ca/english/ppc/reference/u2e.shtml).