X.   Environmental Monitoring Program (EMP) - Resources

NOTE:	NOTE: The Appendices were originally developed for Canadian operations, and provide examples only, based on Canadian and international resources. If your operation is outside of Canada, the following information may be relevant to you. It is recommended that you check whether country-specific requirements or guidance are available instead.

An environmental monitoring program (EMP) is an evaluation of the effectiveness of the microbial controls in place to prevent contamination of product. The EMP will help to assess the overall effectiveness of sanitation protocols, employee practices and operational methods as well as provide necessary information to prevent possible microbial contamination of products. Once established, the EMP is specific to the operation that designed and implemented the program.

There are a number of ways to set up an EMP. The information below is designed to give an overview and provide some templates of how an operation may set up an EMP for their operation.

1. It is best practice to determine numbered zones within your operation prior to performing a risk assessment. The four-zone system below begins at the food contact surfaces and extends to areas not in close proximity to food contact surfaces.

   The following chart could be used as a template to determine the zones within an operation. Before completing the chart it is recommended that the person responsible tours the entire operation, including all packing/repacking areas, storage areas, receiving and loading docks, employee facilities such as lunch/break rooms, washrooms, maintenance areas, offices, and any other areas that may be operation specific.

ZONE		Surfaces/Areas Specific to Your Operation (List ALL relevant)
Zone 1 Food contact surfaces	Handling, sorting, grading, packing, cooling, washing, rinsing, etc. equipment, tables, knives, scales, employees' hands, etc.	
Zone 2 Non-food contact surfaces that are in close proximity to food contact surfaces	Equipment framework, drip shields, control panels and buttons, overhead pipes directly over Zone 1 surfaces, computer screens, maintenance tools, etc.	

Zone 3 Non-food contact surfaces that are NOT in close proximity to food contact surfaces. (These could lead to product cross-contamination through employees, movement of equipment, inherent risk, etc.)	Floors, walls, ceilings, drains, condensate drip pans, hoses, carts, forklifts, garbage containers, pallets, brooms, mops, squeegees, toolboxes, cell phones, etc.	
Zone 4 Areas NOT in close proximity to food contact surfaces (These could lead to cross-contamination if not well-maintained)	Hallways, receiving/loading docks, washrooms, lunch/break rooms, maintenance room, offices, etc.	

2. Carry out a risk assessment of all the zones. Pay particular attention to surfaces/areas within the operation where inputs, practices or the environment could be a potential source of contamination and/or have a higher risk of cross-contamination.
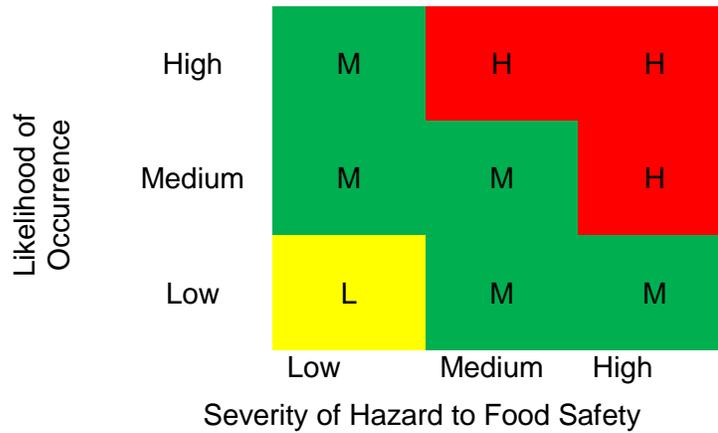
   Sampling should focus on high-risk areas such as:
   - Surfaces/Areas which are often wet
   - Surfaces/Areas with high humidity
   - Surfaces/Areas where dirtier activities occur
   - Surfaces/Areas with high levels of staff activity
   - Surfaces/Areas with high levels of equipment movement
   - Areas that are cooled (e.g., with a condenser unit)
   - Handling/storage of higher risk product(s)

   Considerations:
   o Some higher risk products include leafy greens, berries, cantaloupe, tomatoes, etc.
   o The inherent characteristics of products may make them high risk (e.g., ability to internalize water, large surface area, etc.)
   o Product that is eaten raw may be a higher risk commodity than those that are generally cooked
   o Handling practices (e.g., washing, rinsing, trimming, etc.) may make the commodity higher risk
   o A combination of the above may make a lower risk commodity higher risk

   Not all operations have the same risk, therefore not all programs look the same. One tool that could be used is a risk assessment tool (e.g., likelihood vs. severity matrix) like the one below.

Likelihood of Occurrence (vertical axis) / Severity of Hazard to Food Safety (horizontal axis)

	Low	Medium	High
High	M	H	H
Medium	M	M	H
Low	L	M	M

3. Determine which surfaces/areas may be included in the environmental monitoring sampling plan, using the risk assessment as guidance. Note: *ONLY those surfaces/areas where it is deemed necessary (e.g., through careful consideration of risk) to obtain microbiological evidence of potential contamination need to be listed.*

List the specific surface/area:

1. _____

2. _____

3. _____

4. _____

5. _____

4. Develop a sampling plan for the identified surfaces/areas (listed above). **Below is an example of a sampling plan**. This is ONLY a template to show what information is required. It is NOT stating which surfaces/areas should be sampled, what frequency of testing must occur, nor which test should be chosen. *The operation must determine that, again based on risk.*

Ideally, sampling should take place at the "dirtiest" time of the operation (e.g., right before shutting down for cleaning). Sampling sites should be those where microbial harborage is more likely, such as crevices, rough surfaces or surfaces/areas that are harder to access.

It is important to test for the microorganisms or indicators that are relevant to your type of operation.

Example of a sampling plan:

Zone	Identified Surface/Area	Frequency of Testing	Testing For?
Zone 1	Conveyor #3 for product	Monthly	Aerobic Plate Count (APC)
Zone 2	Packing line #1 equipment framework	Monthly	Aerobic Plate Count (APC)
Zone 3	Packing line floor drain #4	Monthly	Aerobic Plate Count (APC)
Zone 4	Employee breakroom	Monthly	Aerobic Plate Count (APC)

There are a number of resources available to help operations establish and implement their environmental monitoring program. A few are listed below for your information. Note that some of these resources are not specific to whole fruits and vegetables, but the information can be used to customize your own EMP.

General information on Environmental Monitoring Programs:

- AIB International. General Guidance for Establishing an Environmental Monitoring Program.
  https://www.aibinternational.com/aibonline_/www.aibonline.org/newsletter/Magazine/Mar_Apr2012/5Guideance.pdf

- AIB International. Environmental Monitoring Program: An Early Warning System for Microbiological Hazards
  https://www.aibinternational.com/aibonline_/www.aibonline.org/newsletter/Magazine/Nov_Dec2013/EPMEarlyWarningHazards.pdf

- The SQF Code and Environmental Monitoring Programs Presentation
  http://ontariotenderfruit.ca/uploads/file/Th_FoodSafety_1000_Schreurs.pdf

- United Fresh Produce Association. Guidance on Environmental Monitoring and Control of Listeria for the Fresh Produce Industry.
  https://www.centerforproducesafety.org/amass/documents/document/263/Listeria%20Guidance%20UFPA%202013.pdf

- FDA. Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables. https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-guide-minimize-microbial-food-safety-hazards-fresh-cut-fruits-and-vegetables

- FDA. Control of Listeria monocytogenes in Ready-To-Eat Foods: Guidance for Industry (Draft Guidance). https://www.fda.gov/regulatory-information/search-fda-guidance-documents/draft-guidance-industry-control-listeria-monocytogenes-ready-eat-foods

- 3M, Cornell University. Environmental Monitoring Handbook for the Food and Beverage industry. https://multimedia.3m.com/mws/media/1684575O/environmental-monitoring-handbook.pdf
  NOTE: This resource does NOT cover fresh fruits and vegetables, but contains a lot of general information about EMPs, testing information, sampling plans, how to swab, etc.

Information Specific to Sampling and Testing:

- OMAFRA. Environmental Monitoring Programs: Swabbing to Verity Sanitation Effectiveness in Foods of Plan Origin Facilities. http://www.omafra.gov.on.ca/english/food/inspection/fruitveg/emp-swabbing.htm

- United Fresh. Microbiological Testing of Fresh Produce (White Paper). https://www.unitedfresh.org/content/uploads/2014/07/FST_MicroWhite-Paper.pdf

Training:

Operations may also require training to help in establishing their EMP. A number of training facilities offer training on setting up EMPs including the following (*Note*: this is not an inclusive list and is subject to change. CanadaGAP does not endorse specific training or training institutions):

- https://www.sgs.ca/en/training-services/industry-based-training/agriculture-and-food/fsma-training/environmental-monitoring-program-emp-training-for-food-facilities
- https://www.nsflearn.com/us/courses/fundamentals-developing-your-environmental-monitoring-program-webinar