2018/19 Annual Report

National Microbiological Monitoring Program and Food Safety Oversight Program

Canada

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Summary

The Canadian Food Inspection Agency (CFIA) develops and delivers programs and services designed to protect Canadians from preventable food safety hazards. The CFIA works to ensure that food safety emergencies are effectively managed, that the public is aware of and contributes to food safety, and that consumers and the marketplace are protected from unfair practices. Canada's food safety requirements apply equally to the domestic and imported food sectors.

The National Microbiological Monitoring Program (NMMP) is a food surveillance program managed by the CFIA to verify industry compliance with microbial standards, facilitate access of Canadian food products to international markets, provide information on the effectiveness of food safety control measures and interventions, and maintain consumer confidence in the safety of the food supply. Under the NMMP, a broad range of imported and domestic food products are sampled by CFIA inspectors. These food products are frequently sampled at federally registered establishments (i.e., those that produce food products that are exported or traded inter-provincially), which are inspected by CFIA inspectors, but samples may also be collected at other establishment types, such as warehouses, distribution centres, and wholesalers.

The Food Safety Oversight (FSO) Program is another food surveillance program that was introduced to complement the NMMP by increasing CFIA's oversight over fresh fruit and vegetables, fish and seafood and manufactured products. Some FSO samples are collected by CFIA inspectors but the majority are collected at retail by contracted samplers.

Food products of the following commodities were tested under the NMMP and FSO programs in the 2018/19 fiscal year: red meat and poultry products, shell eggs and egg products, dairy products, fish and seafood, fresh fruits and vegetables, processed fruit and vegetable products, and manufactured food products. Food-hazard combinations deemed to pose the greatest potential health risks, recent outbreaks of foodborne illnesses, emerging food-hazard combinations and historical levels of compliance are taken into consideration when selecting foods for testing under NMMP and FSO monitoring sampling plans. Under the NMMP and FSO programs, environmental sampling was also performed at Canadian federally registered establishments to verify the producer's ability to control the presence of pathogens within the processing environment and confirm that food products are produced under sanitary conditions.

All product and environmental samples collected under the NMMP and FSO programs were tested at CFIA laboratories to verify industry compliance with food microbiological safety and quality standards. All samples were subject to follow-up actions by both industry and the CFIA. Such follow-up actions could include follow-up inspections, additional sampling, product disposal, corrective action requests, food safety investigations, product recalls, etc.

In the 2018/19 fiscal year, 12899 tests were performed on 5308 domestic and imported food products collected from under the NMMP to verify compliance with food safety standards. Specifically, 8856 tests were performed on 3913 domestic products and 4043 tests were performed on 1395 imported products. Results indicated that domestic products were 99.9% compliant whereas imported products were 99.2% compliant. Overall, a 99.7% compliance rate was observed for combined domestic and imported products. In addition, there were 2039 tests performed on 1666 environmental samples, which were assessed as 98.1% compliant.

In the 2018/19 fiscal year, 9228 tests were performed on 2742 domestic, imported, and unknown origin food products collected under the FSO Program to verify compliance with food safety standards. Specifically, 2249 tests were performed on 660 domestic products; 6848 tests were performed on 2032 imported products; and 131 tests were performed on 50 food products of unknown origin. Results indicated that domestic products were 98.2 % compliant, imported products were 99.9% compliant, and food products of unknown origin were 100 % compliant. Overall, a 99.6% compliance rate was observed for domestic, imported, and unknown origin products. In addition, there were 22 tests performed on 22 environmental samples under the FSO program, which were assessed as 100% compliant.

The results of the 2018/19 NMMP and FSO sampling activities indicated that the vast majority of food products available in Canada between April 1, 2018 and March 31, 2019 were compliant with food safety standards. The few noncompliant samples that were detected resulted in follow-up actions by the CFIA and industry. These actions allowed the CFIA to continue to safeguard Canada's food system and the health and well-being of Canadians.

What Are The NMMP and FSO Programs?

The National Microbiological Monitoring Program (NMMP) is a food surveillance program managed by the CFIA to verify industry compliance with microbial standards, facilitate access of Canadian food products to international markets, provide information on the effectiveness of food safety control measures and interventions, and maintain consumer confidence in the safety of the food supply. Under the NMMP, a broad range of imported and domestic food products are sampled at federally registered establishments (i.e., those that produce food products that are exported or traded inter-provincially), which are inspected by CFIA inspectors, but samples may also be collected at other establishment types, such as warehouses, distribution centres, and wholesalers.

The Food Safety Oversight (FSO) Program was introduced to complement the NMMP by increasing oversight over fresh fruit and vegetables, fish and seafood, and manufactured products. Some FSO samples were collected by CFIA inspectors, but the majority were collected at retail by contracted samplers.

All NMMP and FSO samples were tested at CFIA laboratories to verify industry compliance with food microbiological safety and quality standards. All samples were subject to appropriate follow-up actions by both industry and the CFIA e.g., follow-up inspection, additional sampling, product disposal, corrective action requests, food safety investigations, product recalls, etc.

In addition to the NMMP and FSO programs, the CFIA also manages the Targeted Survey Program, another food microbial surveillance program which operates at the retail level. While the NMMP and FSO monitor established food hazards, the purpose of Targeted Surveys is to generate baseline information on the occurrence of additional potential hazards in foods. Should a food-hazard combination be identified under these Targeted Surveys, the food product may be subsequently monitored under the NMMP.

What Was Sampled?

In the 2018/19 fiscal year, domestic and imported food products of the following commodities were tested: red meat and poultry products; shell eggs and egg products; dairy products; fresh and ready-to-eat (RTE) fresh-cut fruits and vegetables; processed fruit and vegetable products, fish and seafood products and manufactured products. For the purpose of this report, domestic food products normally included unprocessed or minimally processed food products that were grown/ raised in Canada and food products that were processed or manufactured in Canada. Imported food products included unprocessed or minimally processed food products that were grown/ raised outside of Canada and food products that were processed or manufactured outside of Canada.

Food products within these commodities were selected for testing on the basis of known food-hazard combinations. The number of samples that were taken for each product depended on various factors, including the number of establishments producing the food product, whether the food product would be consumed directly or would undergo further preparation, historical compliance levels, market access requirements, etc.

Sampling of imported food was performed at points of entry, distribution facilities and at retail, therefore test results of imported foods reflected the conditions the foods were exposed to during processing, handling and storage. Imported foods are required to meet the same safety standards as domestic products.

In addition to sampling domestic and imported food products, the CFIA also tested environmental samples collected from domestic food processing environments to verify the producer’s ability to control the presence of pathogens within the processing environment and that food products were produced under sanitary conditions.

The CFIA’s role is to provide oversight and verify that the industry is producing safe food and complying with standards in place. Industry is responsible for implementing controls and practices,

which may include sampling and testing programs, to ensure that all food they produce or import into Canada is safe. Therefore, the CFIA does not test all imported or domestically produced lots of food. In the 2018/19 fiscal year, a randomized strategy was employed under the NMMP and FSO programs to test representative samples of these foods.

What Tests Were Performed?

Food and environmental samples collected under the NMMP and FSO programs were tested for microorganisms associated with known food-hazard combinations or manufacturing processes. Certain food samples were also tested for physicochemical properties or non-microbial indicators (see below). The majority of methods used for testing are found in Health Canada's Compendium of Analytical Methods (Health Canada, 2008a). Non-compendium or modified versions of compendium methods were also used when appropriate. These methods included both rapid screening and confirmatory methods.

Pathogens are microorganisms that can cause illness when consumed. Samples collected under the NMMP and FSO programs were tested for the following pathogens in the 2018/19 fiscal year: *Escherichia coli* O157:H7, *Staphylococcus aureus, Listeria monocytogenes, Salmonella* spp., *Cronobacter* spp., *Vibrio* spp., *Trichinella spiralis, Toxoplasma* spp., *Giardia* spp., *Cryptosporidium* spp., *Cyclospora* spp., Norovirus (Genotypes I and II) and Hepatitis A virus.

Indicator organisms are microorganisms that do not cause illness but may be associated with pathogens or unsanitary practices. The presence of high levels of indicator organisms does not always imply the existence of a food-related health hazard but can expose unsanitary practices and conditions under which pathogens could contaminate food products. The following indicator organisms were tested by the NMMP and FSO programs in the 2018/19 fiscal year: generic *E. coli*, *Listeria* spp., Enterobacteriaceae, coliforms and Aerobic Colony Counts (ACC).

Physiochemical characteristics of foods are evaluated to assess the ability of such foods to support microbial growth. The physiochemical indicators tested for under the NMMP and FSO Program in the 2018/19 fiscal year were salt, pH and water activity.

Lastly, non-microbial indicators are not designed to determine the presence or absence of microorganisms. These criteria are used to obtain information pertaining to other aspects of food safety. Such tests may be performed to identify manufacturing processes that could support the introduction of potential food safety hazards. The following non-microbial indicators were tested for under the NMMP and FSO programs in the 2018/19 fiscal year: presence of central nervous system tissue, meat species verification and phosphatase testing.

How Were Samples Assessed?

Microbial test results are assessed using assessment criteria specific to a food type and test of interest. These assessment criteria set clear limits in determining if food products are safe for consumption and/or

produced under conditions compliant with food standards. In Canada, Health Canada's Standards and Guidelines for Microbiological Safety of Food – An Interpretive Summary (Health Canada, 2008b) contains microbiological assessment criteria based on current regulatory standards and guidelines. Additional information on assessment criteria is also found in Health Canada's Policies on *Listeria monocytogenes* in Ready-to-Eat Foods (Health Canada, 2011) and *E. coli* O157:H7 and *E. coli* O157:NM in Raw Beef (Health Canada, 2014). International standards, such as those outlined by the International Commission on Microbiological Specifications for Foods (ICMSF), may also provide information on microbiological assessment criteria when appropriate (ICMSF, 2011).

Microbial assessment criteria for *L. monocytogenes* in RTE food products in Canada are based upon Health Canada's Policy on *Listeria monocytogenes* in Ready-to-Eat Foods (Health Canada, 2011). This policy considers the levels of *L. monocytogenes* in a food and the potential for growth of *L. monocytogenes* in a particular food when assessing the risk. As such, the assessment criteria specific to *L. monocytogenes* in RTE foods differ depending on if the product can support the growth of *L. monocytogenes* (Category 1 product) or if limited (<100 CFU/g) or no growth can occur throughout the stated shelf-life (Category 2 product).

Samples collected and tested under the NMMP and FSO programs were assessed using assessment criteria based on information from these sources. Samples collected by CFIA inspectors typically consisted of multiple sample units, representatively sampled from the same lot of product. In contrast, contracted samplers collecting samples at retail could not representatively sample multiple units from the same lot due to limited product availability. For these samples, therefore, a single sample unit was collected. Because of these differences in sample collection, NMMP and FSO samples collected by CFIA inspectors were assessed using different assessment criteria than FSO samples collected at retail by contracted samplers (Appendix I and Appendix II, respectively) and their results are presented separately.

On the basis of these assessment criteria, samples tested were considered Satisfactory, Unsatisfactory or Investigative. A Satisfactory result indicated that there were no concerns identified with the food as all test results were considered acceptable by the assessment criteria. An Unsatisfactory result indicated that one or more test results were considered unacceptable by the assessment criteria and the sample therefore did not meet regulatory standards and guidelines. An Investigative result indicated that the sample was considered acceptable based on the assessment criteria, but that there was an indication that manufacturing practices should be investigated further to ensure good manufacturing practices are in place. Thus, appropriate follow-up actions were taken in response to both Unsatisfactory and Investigative samples.

At the time of writing this report, no assessment guidelines had been established in Canada for parasites and/or viruses in fresh or frozen produce. In addition, the analytical methods used to analyse these samples only detected the presence of parasite/viral genetic material and could not discriminate between

viable (potentially infectious) and non-viable (non-infectious) parasites/viruses. The detection of parasite/viral genetic material was therefore assessed as Investigative, indicating that further consideration was warranted to determine which follow-up actions would be the most appropriate.

Percent compliance levels were reported for each food type and analyte tested. Both Satisfactory and Investigative samples are considered acceptable based on the assessment criteria as their test results indicate they are compliant with standards. Therefore, percent compliance values for this report were calculated as the number of Satisfactory and Investigative samples divided by the total number of samples tested. The significance of percent compliance values derived from small numbers of samples/tests should be interpreted with caution. For this report, we considered that this included percent compliance values derived from fewer than 50 samples.

What Were The 2018/19 NMMP Results for Red Meat and Poultry Products?

i) Ready-to-Eat Meat Products

Ready-to-eat meats are defined as meat products that have been subjected to a process sufficient to control and/or inactivate microorganisms so that they do not require further preparation before consumption except washing, thawing or exposing to sufficient heat to warm the products without cooking them. Ready-to-eat meats have been associated with foodborne illness due to recontamination from raw or undercooked products or exposure to environmental contaminants while being handled in processing establishments, catering establishments and in the home kitchen.

Under the NMMP in 2018/19, RTE meat products were sampled and tested for the following pathogens of concern: *Salmonella* spp., *L. monocytogenes,* and *E. coli* O157:H7 (only on fermented RTE products containing beef). Additional RTE meat products were tested for *L. monocytogenes* only. A total of 1030 domestic samples were tested and determined to be 100 % compliant (Table 1). Two Category 2 products, cooked chicken breast and sausages, were assessed as Investigative due to the detection of low levels (≤100 CFU/g) of *L. monocytogenes.* An additional 98 imported RTE meat products were tested (Table 1), the majority of which originated from the United States (Figure 1). The imported products tested were 100 % compliant. Four Category 2 products, two prosciutto and one salami product from Italy and one sliced chorizo product, from Spain, were assessed as Investigative due to the detection of low levels (of (≤100 CFU/g) *L. monocytogenes.*

Table 1: Assessment of Domestic and Imported Ready-to-Eat Meat Products Sampled by CFIA inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance

Domestic					
L. monocytogenes [b]	1030	1028	2	0	100
Salmonella spp.	428	428	n/a	0	100
E. coli O157:H7	6	6	n/a	0	100[c]
Total Domestic Samples	**1030**	**1028**	**2**	**0**	**100**
Imported					
L. monocytogenes [b]	98	94	4	0	100
Salmonella spp.	98	98	n/a	0	100
E. coli O157:H7	5	5	n/a	0	100[c]
Total Imported Samples	**98**	**94**	**4**	**0**	**100**
Total Samples	**1128**	**1122**	**6**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c]Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

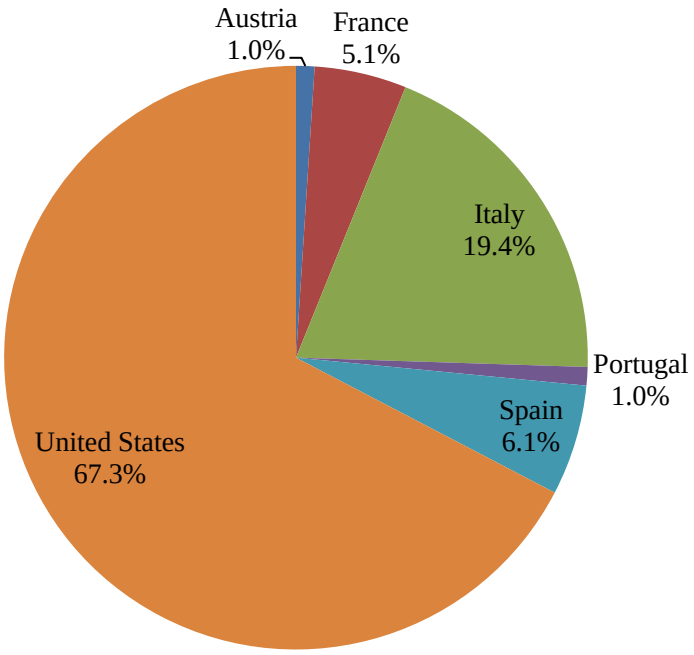


Figure 1. Percent Distribution of Imported Ready-To-Eat Meat Products Analyzed by Country of Origin (n=98).

ii) Precursor Materials and Raw Ground Beef/Veal

Precursor materials include any raw beef or veal products intended to be used for production of finished raw ground beef/veal products (i.e., raw ground beef/veal). This includes, but is not limited to, trims, bench trims, boneless beef, course ground beef, hearts, head meat, cheek meat, tongue roots and weasand meat. It also includes primal cuts, such as chucks, if they are intended to be used for production of finished raw ground beef/veal products. Pathogens, such as *E. coli* O157:H7 can contaminate the outer surfaces of whole intact pieces of precursor materials during slaughter and this contamination may be introduced into raw ground beef/veal during grinding. Illness due to *E. coli* O157:H7 have occurred in ground beef/veal products that were not fully cooked.

Under the NMMP in 2018/19, precursor materials and raw ground beef/veal were sampled and tested for *E. coli* O157:H7 and generic *E. coli*. A total of 741 domestic precursor material samples and 640 domestic raw ground beef/veal samples were tested and determined to be 100 % compliant (Table 2). Of the domestic samples, 6 precursor material samples and 7 raw ground product samples were assessed as Investigative due to the detection of elevated levels of generic *E. coli* (>100 CFU/g). An additional 34 imported precursor material samples and 11 imported raw ground beef/veal samples from Australia, Chile, New Zealand, the United Kingdom, the United States and Uruguay were tested (Figure 2). One imported precursor material samples (from Uruguay) was assessed as Investigative due to the detection of elevated levels of generic *E.coli* (>100 CFU/g). No *E. coli* O157:H7 was detected in any of the imported products. All samples were determined to be compliant (Table 2).

Table 2: **Assessment of Domestic and Imported Precursor Material and Raw Ground Beef/Veal Sampled by CFIA Inspectors Under the NMMP**

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic Precursor Material					
E.coli O157:H7	741	741	n/a	0	100
Generic *E.coli*[b]	741	735	6	n/a	100
Domestic Raw Ground Beef/ Veal					
E.coli O157:H7	640	640	n/a	0	100
Generic *E.coli*[b]	640	633	7	n/a	100
Total Domestic Samples	**1381**	**1368**	**13**	**0**	**100**
Imported Precursor Material					
E.coli O157:H7	34	34	n/a	0	100[c]
Generic *E.coli*[b]	34	33	1	n/a	100[c]
Imported Raw Ground Beef/ Veal					
E.coli O157:H7	11	11	n/a	0	100[c]
Generic *E.coli*[b]	11	11	0	n/a	100[c]

Total Imported Samples	**45**	**44**	**1**	**0**	**100[c]**
Total Samples	**1426**	**1412**	**14**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Generic *E. coli* >100 CFU/g detected = Investigative.
[c] Due to small sample/test numbers the significance of the compliance percentage should be interpreted with caution.

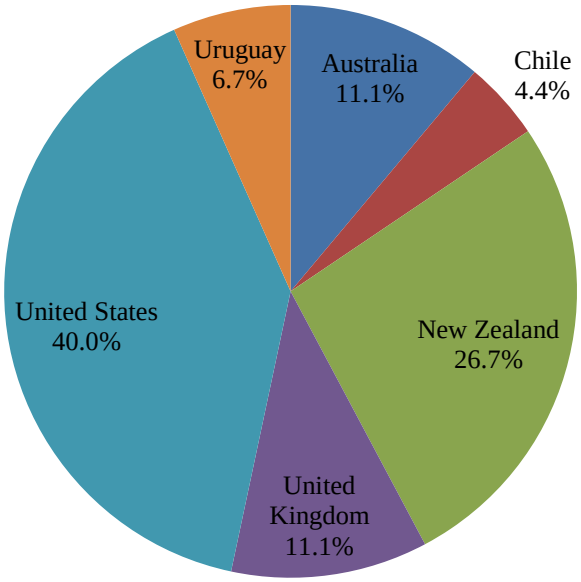


Figure 2. Percent Distribution of Imported Precursor Material and Raw Ground Beef/Veal Analyzed by Country of Origin (n=45).

iii) Raw Mechanically Separated Beef and Finely Textured Beef

Mechanically separated beef and finely textured beef are edible beef products obtained by mechanically separating most of the bone and cartilage from portions of beef from which the bone and cartilage have not been previously removed. Bovine Spongiform Encephalopathy (BSE), more commonly known as Mad Cow Disease, is a progressive, degenerative neurological disease. The BSE prion is able to infect humans, causing variant Creutzfeld-Jakob Disease (vCJD; FDA, 2012), through human consumption of contaminated meat products from BSE-infected cattle. Since BSE may be present in central nervous system (CNS) tissue of BSE-infected cattle, the spinal cord is removed from beef carcasses and portions of beef prior to their use as material for mechanical separation (CFIA, 2019). The CFIA tests domestic mechanically separated and finely textured beef products to verify the absence of CNS tissue. Although detection of CNS tissue in a meat product does not necessarily mean the BSE prion is present, detection

of CNS tissue is a trigger for follow up actions to ensure that the establishment in question is producing this type of product in a manner that meets Canadian standards.

In 2018/19, 25 domestic mechanically separated beef and finely textured beef samples were tested under the NMMP for the presence of CNS tissue, two of which were found to contain CNS tissue.

iv) Raw Pork and Wild Boar

Human infection by the parasitic roundworm *Trichinella spiralis* is traditionally associated with ingestion of infected raw and undercooked pork. Because of modern production methods of raising pigs in confinement and high quality feed, *T. spiralis* is rare in Canadian domestic swine populations. However, precautions must remain in effect due to the presence of *T. spiralis* in wildlife and the potential for its sporadic transfer to domestic herds. Government testing for *T. spiralis* in commercial pork and wild boar establishments also supports the Canadian pork industry's continued access to international markets.

Under the NMMP in 2018/19, market hogs, breeder hogs and wild boar were tested for *T. spiralis.* The analytical methodology for testing *T. spiralis* in pork allows for tissues from up to 100 animals to be pooled and submitted for analysis. A total of 328 samples representing 28,605 individual animals were tested under the NMMP. *T. spiralis* was not detected in any of these samples.

v) Meat Species Verification

Meat species verification is conducted on meat products to detect the presence of meat species not listed on the product label. In some cases, an operator may fraudulently substitute less expensive types of meat for some or all of the more expensive meat declared on the label. In other cases, the presence of other meat species may occur due to improper cleaning of equipment and contamination during processing, thus from a food safety perspective, species verification is performed to assess the effectiveness of sanitation procedures within the establishment.

The CFIA performs meat species verification on imported meat products. Products with label claims indicating they are composed of a single species or a combination of specific species are tested to verify these label claims. Selected products are those that have been ground to the point where it is impossible to determine through visual examination what species has been used. This includes raw ground meat products, RTE products and other products which have received heat treatment. Domestic establishments producing such products are subject to visual inspections by CFIA inspectors, and domestic samples may be taken under directed sampling activities for investigative purposes.

In 2018/19, 20 imported meat products, the majority originating from the United States (Figure 3), were tested to verify the meat species claimed. All samples were found to be compliant.

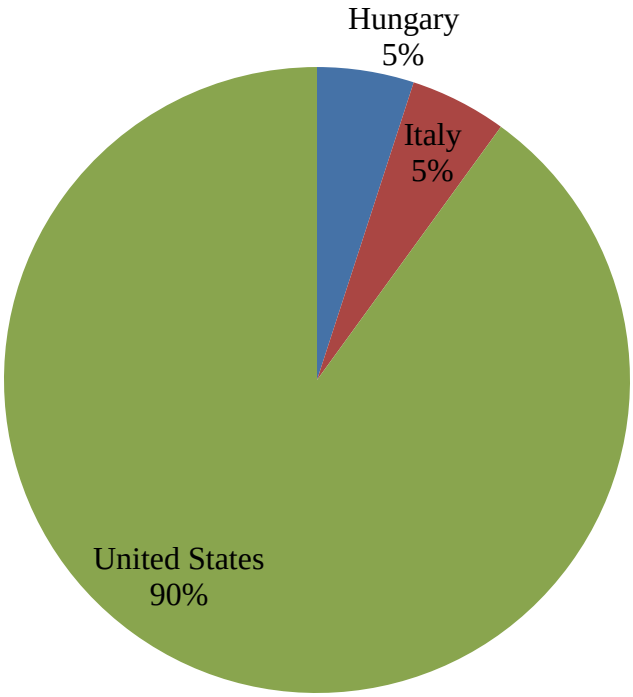


Figure 3. Percent Distribution of Imported Single Species Meat Products Analyzed by Country of Origin (n=20).

vi) Environmental Testing in RTE Meat Establishments

Environmental testing is also carried out at domestic federally registered RTE meat product establishments to verify the establishment's ability to control the presence of *Listeria* spp. within the processing environment. Surfaces within the RTE meat product establishments are swabbed during production, and the swabs are composited and tested for *Listeria* spp. If *Listeria* spp. are detected in an environmental sample, the sample is further tested to determine if *L. monocytogenes* is present.

In 2018/19, 957 environmental samples representing approximately 9,570 food contact surfaces from 204 domestic federally registered establishments producing RTE meat products were tested for *Listeria* spp. and *L. monocytogenes* under the NMMP. Nine of the samples were assessed as Unsatisfactory due the detection of *L. monocytogenes.* Fifteen of the samples were assessed as Investigative due to the detection of *Listeria* spp. The compliance rate was determined to be 99.1 %.

vii) Compliance History

The historical compliance levels of domestic and imported red meat and poultry products tested under the NMMP between April 1, 2015 and March 31, 2019 are summarized in Table 3. Consistently high compliance levels were observed in most samples of RTE meat products, precursor materials and raw ground beef/veal, raw pork and wild boar, and in environmental samples.

Table 3: Historical percent compliance and number of samples (n) of Red Meat and Poultry Products

	2018/19	2017/18	2016/17	2015/16
RTE Meat Products	100 % (1128)	99.6 % (1105)	99.7 % (1106)	99.6 % (1105)
Precursor Materials and Raw Ground Beef/Veal	100 % (1426)	99.6 % (1410)	99.8 % (1424)	99.7 % (1429)
Raw Mechanically Separated and Finely Textured Beef	92.0 %[a,b] (25)	96.7 %[a,b] (30)	90.0 %[a,b] (30)	97.5 %[a,b] (35)
Raw Pork and Wild Boar	100 % (328)	100 % (332)	100 % (327)	100 % (347)
Meat Species verification	100 %[a] (20)	100 %[a] (25)	95.5 %[a] (22)	100 %[a] (19)
Environmental Testing	99.1 % (957)	98.9 % (957)	99.1 % (937)	99.3 % (941)

[a] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution,
[b] Note that although CNS tissue was found, these samples were deemed compliant.

What Were The 2018/19 NMMP Results for Shell Eggs and Egg Products?

i) Shell Eggs

Shell eggs are a potential source of *Salmonella* spp. The risk of illness from consuming *Salmonella* spp. in shell eggs could be increased by the fact that eggs are often consumed raw or undercooked. In Canada, eggs that are exported or traded inter-provincially are graded, sized and packed at egg grading stations registered by the CFIA. *Salmonella* spp. contamination in Canadian shell eggs is rare so instead of testing shell eggs, environmental sampling and testing of egg grading stations for *Salmonella* spp. is performed to determine compliance with Canadian standards (see section iii). Under the NMMP, only imported shell eggs are sampled and tested for *Salmonella* spp.

In 2018/19, a total of 324 imported shell egg samples, all from the United States, were tested under the NMMP. Each sample consisted of 12 eggs thus a total of 3888 eggs were tested. No *Salmonella* spp. was detected, and samples were 100 % compliant.

ii) Egg Products

Egg products include all frozen, liquid, or dried egg products which are subjected to the process of pasteurization. In addition to *Salmonella* spp. associated with shell eggs, other microorganisms may be introduced during the production of egg products.

Under the NMMP in 2018/19, domestic and imported egg products were tested for ACC, coliforms, *L. monocytogenes* and *Salmonella* spp. A total of 317 domestic and 17 imported egg products were tested, of which 100% were compliant (Table 4).

Table 4: **Assessment of Domestic and Imported Processed Egg Products Sampled by CFIA Inspectors Under the NMMP**

Analysis	# Tests	# Satisfactory	# Investigative [c]	# Unsatisfactory	% Compliance
Domestic [a]					
ACC	270	270	n/a	0	100
Coliforms	270	270	n/a	0	100
L. monocytogenes [b]	317	317	0	0	100
Salmonella spp.	317	317	n/a	0	100
Total Domestic Samples	**317**	**317**	**0**	**0**	**100**
Imported					
ACC	17	17	n/a	0	100 [d]

Coliforms	17	17	n/a	0	100[d]
L. monocytogenes[b]	17	17	0	0	100[d]
Salmonella spp.	17	17	n/a	0	100[d]
Total Imported Samples	**17**	**17**	**0**	**0**	**100[d]**
Total Samples	**334**	**334**	**0**	**0**	**100**

[a] The number of domestic samples tested for *L. monocytogenes* and *Salmonella* spp. exceeds the number of samples tested for ACC and coliforms because only these two analyses were performed on product samples taken simultaneously with environmental samples.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] n/a = not applicable. The assessment (Investigative) does not apply.
[d] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

iii) Environmental Testing in Domestic Shell Egg Grading Stations and Egg Product Processing Establishments

Environmental testing of surfaces and wash water is carried out at domestic federally registered shell egg grading stations and egg product processing establishments to verify the operator systems' ability to control contaminants within the processing environment.

At shell egg grading stations in Canada, eggs are washed, checked for cracks, weighed, sorted and packaged. Within these domestic shell egg grading stations, surfaces from both graded and ungraded product areas within the establishments were swabbed under the NMMP in 2018/19, and the swabs from each area were composited and tested for *Salmonella* spp. A total 554 tests for *Salmonella* spp. were performed on 278 composited environmental samples (food contact and non-food contact surfaces) (Table 5), representing approximately 2780 surfaces within the shell egg grading establishments. Of these, nine samples tested positive for *Salmonella* spp. for an overall compliance rate of 99.3%.

Processed egg products are produced at egg product processing establishments in Canada. In domestic egg product processing establishments, surface swabs are taken on food contact surfaces and non-food contact surfaces along the manufacturing line, both prior to production and during production. Samples taken prior to production were tested for *Salmonella* spp., while samples taken during production were tested for *Salmonella* spp. and *L. monocytogenes*. If *Listeria* spp. were detected, the sample was further tested to determine if *L. monocytogenes* is present. Under the NMMP in 2018/19, 48 environmental samples, comprising of 47 tests for *Listeria* spp. and 96 tests (prior to production and during production) for *Salmonella* spp. (Table 5), representing approximately 480 surfaces from both raw and finished product areas within the processing establishments, were tested with an overall compliance rate of 97.9%.

Within both domestic shell egg grading stations and domestic egg product processing establishments, wash water environmental samples are also collected and tested for ACC. Although high levels of ACC are not a health concern, their presence may indicate inadequate practices at the establishment to ensure that the microbial quality of the wash water is controlled. Under the NMMP in 2018/19, 254 environmental wash water samples were tested, and 18 of these samples were found to contain high levels of ACC for a 92.9 % compliance rate (Table 5).

In total, in 2018/19, 580 environmental samples were tested with an overall compliance rate of 96.4%.

Table 5: Assessment of Environmental Samples from Domestic Shell Egg Grading Stations and Egg Product Processing Establishments Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Shell Egg Grading Station Environmental Swabs					
Salmonella spp.	554	552	n/a	2	99.6
Total Egg Grading Station Samples	**278**	**276**	**n/a**	**2**	**99.3**
Egg Processing Establishment Environmental Swabs					
L. monocytogenes[b]	47	47	0	0	100
Salmonella spp.	96	95	n/a	1	99.0
Total Egg Processing Samples	**48**	**47**	**0**	**1**	**97.9**
Wash Water Environmental Samples					
ACC	254	236	n/a	18	92.9
Total Environmental Samples	**580**	**559**	**0**	**21**	**96.4**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = *Listeria* spp. detected.

iv) Compliance History

The historical compliance levels and number of samples of domestic and imported shell eggs and egg products and environmental samples tested under the NMMP between April 1, 2015 and March 31, 2019 are summarized in Table 6. Compliance levels for both product and environmental samples were consistent over the years. Compliance levels of samples of shell eggs and egg products were higher than those of environmental samples.

Table 6: Historical percent compliance and number of samples (n) of Shell Eggs and Egg Products

	2018/19	2017/18	2016/17	2015/16
Shell Eggs	100 % (324)	100 % (300)	100 % (291)	100 % (276)
Egg Products	100 % (334)	99.7 % (335)	100 % (339)	100 % (341)
Environmental Testing	96.4 % (580)	95.0 % (646)	95.7 % (631)	96.1 % (689)

What Were The 2018/19 NMMP Results for Dairy Products?

i) Fluid Milk Products

Fluid milk products include all grades of milk, chocolate milk, coffee creams and specialty products. Imported fluid milk represents only about 1% of what is consumed by Canadians (Catford *et al*, 2014); therefore only domestic fluid milk products are tested under the NMMP.

Under the NMMP in 2018/19, fluid milk products at domestic dairy producers were tested for generic *E. coli* and *L. monocytogenes*. A total of 88 domestic fluid milk products were tested, all of which were compliant (Table 7).

Table 7: **Assessment of Domestic Fluid Milk Products Sampled by CFIA Inspectors under the NMMP**

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Generic *E.coli*	88	88	n/a	0	100
L. monocytogenes	88	88	n/a	0	100
Total Samples	**88**	**88**	**n/a**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.

ii) Cheese Products

Cheese is a manufactured product for which microbial contamination may be introduced during handling and fermentation. A broad range of types of cheeses made from various milk sources, of various moisture contents and using various manufacturing techniques are tested. Because the microbial contaminants in cheese products made from pasteurized milk and those made from raw milk may differ, the sampling results for these two categories of cheese products will be presented separately.

Under the NMMP in 2018/19, domestic and imported cheeses were sampled and tested for generic *E. coli*, *Salmonella* spp., *L. monocytogenes*, and *S. aureus*. In addition, *E. coli* O157:H7 testing was performed on cheeses claimed to be made from raw milk, and phosphatase testing was performed, when deemed appropriate, to verify claims of pasteurization. A total of 356 domestic pasteurized milk cheeses were tested and determined to be 99.7% compliant (Table 8). One domestic sample of cheese, a cream cheese, was Unsatisfactory due to high levels of *S. aureus*. In addition, 176 samples of imported

pasteurized milk cheeses were tested and found to be 97.2% compliant (Table 8). The largest proportion of these samples was from France and Italy but numerous other countries were also represented (Figure 4). Of these imported cheeses, five cheese samples, three from Italy and two from Greece, were Unsatisfactory due to detection of a high level of generic *E. coli*. One Category 1 cheese sample, from Greece, was Unsatisfactory due to the detection of *L. monocytogenes*.

Table 8: Assessment of Domestic and Imported Pasteurized Milk Cheeses Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic Pasteurized Milk Cheese					
Generic *E. coli*	356	356	n/a	0	100
Salmonella spp.	356	356	n/a	0	100
L. monocytogenes[b]	356	356	0	0	100
S. aureus	355	354	n/a	1	99.7
Phosphatase	0	0	n/a	0	n/a
Total Domestic Samples	**356**	**355**	**0**	**1**	**99.7**
Imported Pasteurized Milk Cheese					
Generic *E. coli*	176	171	n/a	5	97.2
Salmonella spp.	176	176	n/a	0	100
L. monocytogenes[b]	176	175	0	1	99.4
S. aureus	176	176	n/a	0	100
Phosphatase	0	0	n/a	0	n/a
Total Imported Samples	**176**	**171**	**0**	**5**	**97.2**
Total Samples	**532**	**526**	**0**	**6**	**98.9**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

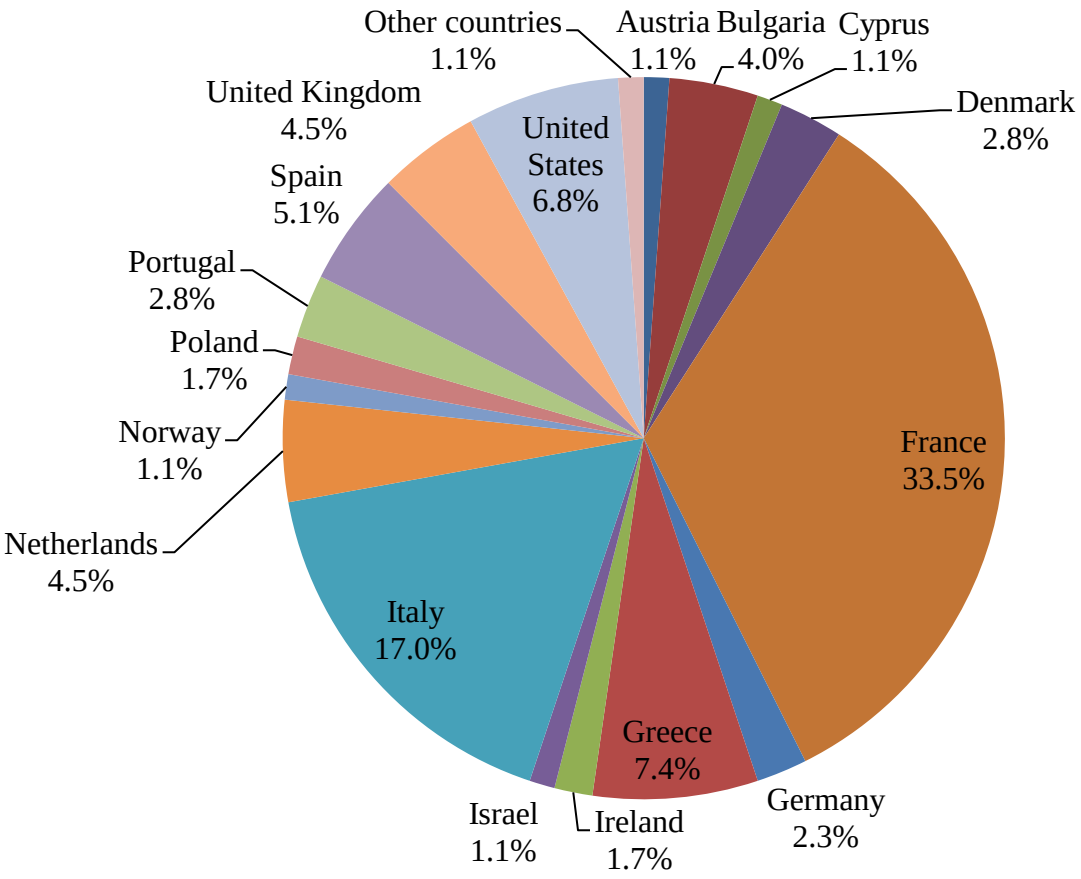


Figure 4. Percent Distribution of Imported Pasteurized Milk Cheeses Analyzed by Country of Origin (n=176).

Under the NMMP in 2018/19, 38 domestic cheeses made with raw milk were tested and were determined to be 100% compliant (Table 9). In addition, 84 imported raw milk cheese samples were tested and were determined to be 95.2% compliant. The largest proportion of the imported raw milk cheeses sampled was from France but cheeses from numerous other countries were also tested (Figure 5). Two Category 1 cheese samples, from France and from Italy, were Unsatisfactory due to the detection of *L. monocytogenes*. Two samples of cheese from France were Unsatisfactory due to high levels of generic *E. coli*.

Table 5: Assessment of Domestic and Imported Raw Milk Cheeses Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic Raw Milk Cheese					
Generic *E. coli*	38	38	n/a	0	100[c]
E. coli O157:H7	38	38	n/a	0	100[c]
Salmonella spp.	38	38	n/a	0	100[c]
L. monocytogenes[b]	38	38	0	0	100[c]
S. aureus	38	38	n/a	0	100[c]
Total Domestic Samples	**38**	**38**	**n/a**	**0**	**100[c]**
Imported Raw Milk Cheese					
Generic *E. coli*	84	84	n/a	0	100
E. coli O157:H7	84	84	n/a	0	100
Salmonella spp.	84	84	n/a	0	100
L. monocytogenes[b]	84	82	0	2	97.6
S. aureus	84	82	n/a	2	97.6
Total Imported Samples	**84**	**80**	**n/a**	**4**	**95.2**
Total Samples	**122**	**118**	**n/a**	**4**	**96.7**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

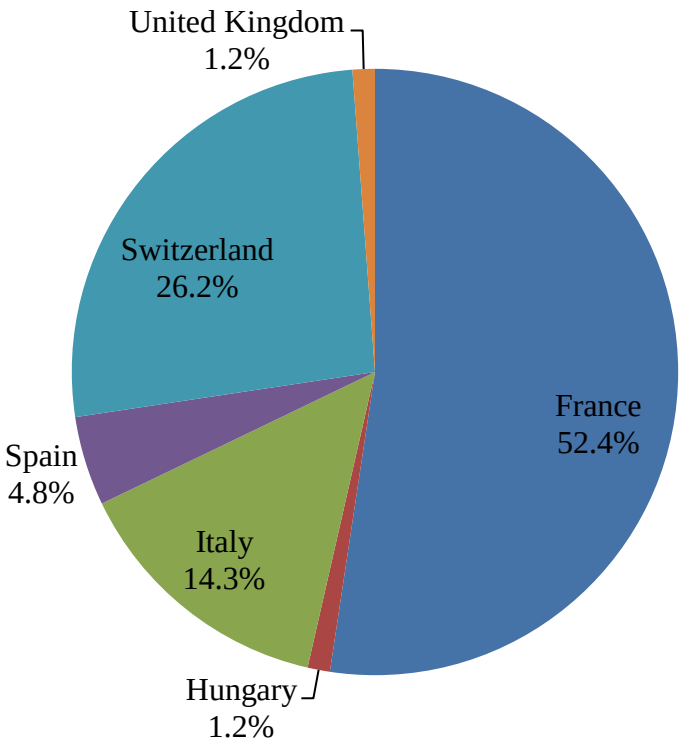


Figure 1. Percent Distribution of Imported Raw Milk Cheeses Analyzed by Country of Origin (n=84).

iii) Environmental Testing in Cheese Manufacturing Establishments

Environmental testing is carried out at domestic federally registered cheese establishments to verify the operator systems' ability to control the presence of *Listeria* spp. within the processing environment. Under the NMMP in 2018/19, surfaces within these establishments were swabbed and the swabs from each area were composited and tested for *Listeria* spp. If *Listeria* spp. were detected in an environmental sample, the sample was further tested to determine if *L. monocytogenes* is present.

A total of 131 environmental samples, representing approximately 1,310 food contact surfaces from 127 domestic federally registered establishments producing cheese products were tested for *Listeria* spp. The samples were 98.5 % compliant.

iv) Compliance History

The historical compliance levels and number of samples of domestic and imported dairy products tested under the NMMP between April 1, 2015 and March 31, 2019 are shown in Table 10. Compliance levels were consistent for all products over the years, with those for raw milk cheeses being lower than those for cheeses made with pasteurized milk.

Table 9: Historical percent compliance and number of samples (n) of Dairy Products

	2018/19	2017/18	2016/17	2015/16
Fluid Milk	100 % (88)	100 % (91)	100 % (96)	100 % (81)
Pasteurized Milk Cheese	98.9 % (532)	98.7 % (519)	98.7 % (457)	98.7 % (463)
Raw Milk Cheese	96.7 % (122)	96.6 % (119)	96.0 % (149)	94.8 % (175)
Environmental Testing	98.5 % (131)	100 % (128)	99.1 % (122)	100 % (138)

What Were The 2018/19 NMMP/FSO Results for Fresh and RTE Fresh-Cut Fruits and Vegetables?

i) Fresh Fruits and Ready-to-Eat Fresh-Cut Fruits

Whole fresh fruits may be contaminated with pathogens. Ready-to-eat fresh-cut fruits may also be exposed to environmental contaminants during processing. Both whole fresh and RTE fresh-cut fruits are often consumed without further processing that might kill or remove pathogens thus, if pathogens are present, they are a food safety concern. Because the microbial contaminants in whole fresh and RTE fresh-cut fruits may differ, the sampling results for these two categories of products will be presented separately.

A variety of domestic and imported whole fresh fruits were targeted for sampling at both federally registered establishments and at retail under the NMMP and FSO programs in 2018/19 (Figure 6). Some of these whole fresh fruit samples were tested for the bacteria generic *E. coli, E. coli* O157:H7, *Salmonella* spp. and *Shigella* spp. Whole cantaloupe samples could not be tested for generic *E. coli* due to difficulty extracting this particular microorganism from its netted rind. Imported berries were tested for the parasite *Cyclospora*.

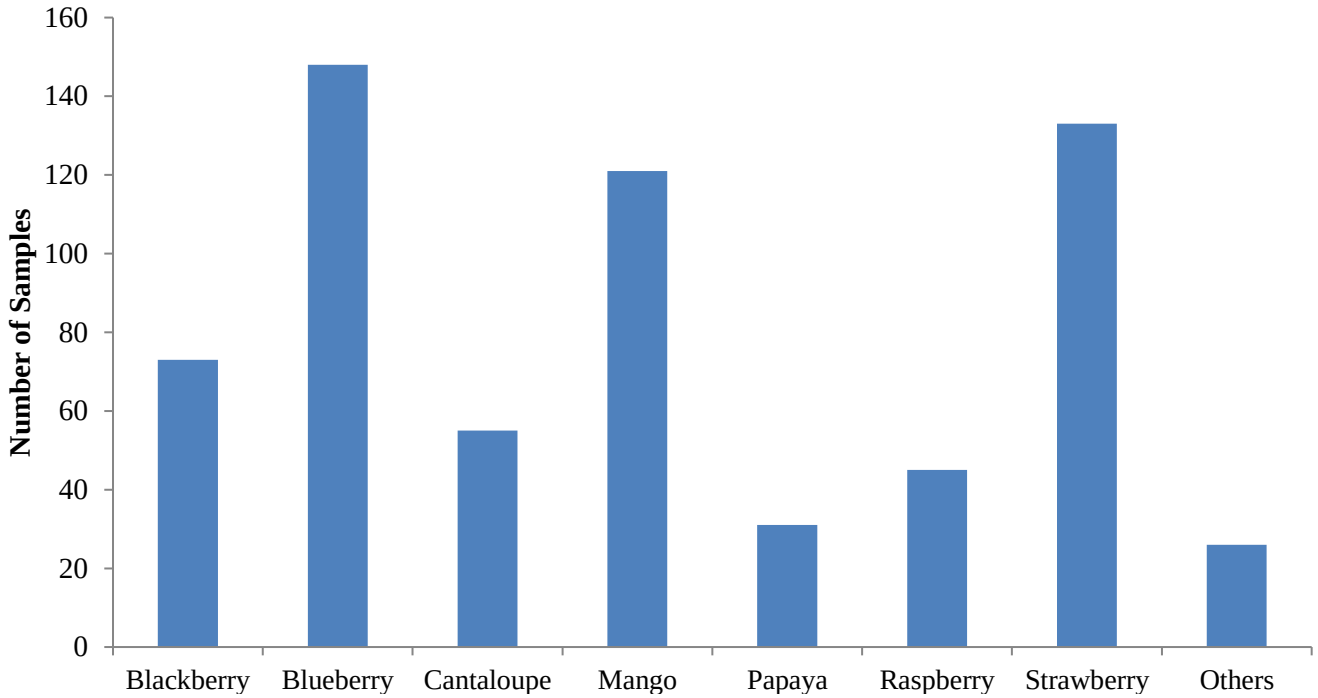


Figure 2. Number and Types of Whole Fresh Fruits and Ready-To-Eat Fresh-Cut Fruits Sampled Under the NMMP and FSO programs.

Table 11 summarizes test results of whole fresh fruit samples collected by CFIA inspectors under the NMMP and FSO. A total of 31 domestic whole fresh fruit samples and 157 imported whole fresh fruit samples were tested for bacteria. Both domestic and imported whole fresh fruit samples were 100 % compliant. An additional 40 samples of fresh berries were tested for *Cyclospora* and were 100 % compliant.

Table 11: Assessment of Domestic and Imported Whole Fresh Fruit Sampled by CFIA Inspectors Under the NMMP and FSO

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory[a]	% Compliance
Domestic					
Generic *E. coli*	25	25	n/a	0	100[b]
E. coli O157:H7	31	31	n/a	0	100[b]
Salmonella spp.	31	31	n/a	0	100[b]
Shigella spp.	31	31	n/a	0	100[b]
Total Domestic Samples	**31**	**31**	**n/a**	**0**	**100[b]**
Imported					
Generic *E. coli*	67	67	n/a	0	100
E. coli O157:H7	157	157	n/a	0	100
Salmonella spp.	157	157	n/a	0	100
Shigella spp.	157	157	n/a	0	100
Cyclospora spp.	40	40	0	n/a	100[b]
Total Imported Samples	**197**	**197**	**n/a**	**0**	**100**
Total Samples	**228**	**228**	**n/a**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative/ Unsatisfactory) does not apply.
[b] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

Table 12 summarizes test results of whole fresh fruit samples collected at retail. A total of 135 domestic whole fresh fruit samples and 260 imported whole fresh fruit samples were tested for bacteria. All samples were compliant.

Table 12: Assessment of Domestic and Imported Whole Fresh Fruit Sampled at Retail Under the FSO

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory[a]	% Compliance
Domestic					
Generic *E. coli*	133	133	0	0	100
E. coli O157:H7	135	135	n/a	0	100
Salmonella spp.	135	135	n/a	0	100
Shigella spp.	135	135	n/a	0	100
Total Domestic Samples	**135**	**135**	**0**	**0**	**100**
Imported					
Generic *E. coli*	142	142	0	0	100
E. coli O157:H7	260	260	n/a	0	100
Salmonella spp.	260	260	n/a	0	100
Shigella spp.	260	260	n/a	0	100
Total Imported Samples	**260**	**260**	**0**	**n/a**	**100**
Total Samples	**395**	**395**	**0**	**n/a**	**100**

[a] n/a = not applicable. The assessment (Investigative/Unsatisfactory) does not apply.

Domestic RTE fresh-cut fruits were also targeted for sampling under the NMMP and FSO programs in 2018/19 (Figure 6). All RTE fresh-cut fruits were tested for generic *E. coli*, *E. coli* O157:H7, *L. monocytogenes*, *Salmonella* spp. and *Shigella* spp., except for whole cantaloupe which could not be tested for generic *E. coli* due to difficulty extracting this particular microorganism from its netted rind.

Table 13 summarizes test results of RTE fresh-cut fruit samples collected by CFIA inspectors under the NMMP and FSO. A total of 9 domestic and one imported RTE fresh-cut fruit samples were tested for bacteria. Since RTE fresh-cut fruit is minimally processed, the country in which fruit used in an RTE fresh-cut fruit product is grown normally determines whether the product is considered domestic or imported. These RTE fresh-cut fruit samples, however, were collected to assess the impact of the processing environment within Canadian federally registered establishments on the microbial profile of the products. Thus, for these RTE fresh-cut fruit samples only, fruit that were grown in other countries but minimally processed to produce RTE fresh-cut fruit in Canada were also considered domestic. All RTE fresh-cut fruit samples collected by CFIA inspectors under the NMMP and FSO were compliant.

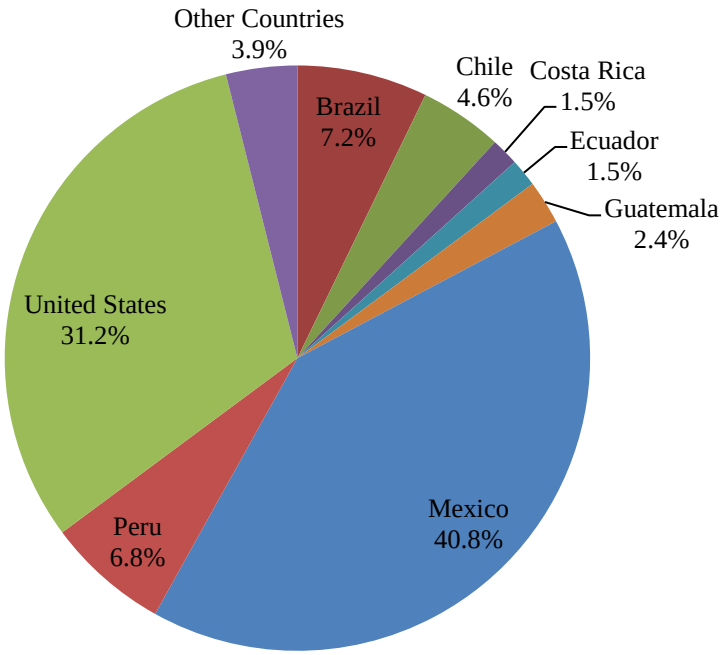
Table 13: Assessment of Domestic Ready-To-Eat Fresh-Cut Fruit Sampled by CFIA Inspectors Under the NMMP and FSO

Analysis	# Tests	# Satisfactory	# Investigative [a]	# Unsatisfactory	% Compliance
Domestic/Domestically Processed					
Generic *E. coli*	9	9	n/a	0	100[c]
E. coli O157:H7	9	9	n/a	0	100[c]
L. monocytogenes[b]	9	9	0	0	100[c]
Salmonella spp.	9	9	n/a	0	100[c]
Shigella spp.	9	9	n/a	0	100[c]
Imported					
Generic *E. coli*	1	1	n/a	0	100[c]
E. coli O157:H7	1	1	n/a	0	100[c]
L. monocytogenes[b]	1	1	0	0	100[c]
Salmonella spp.	1	1	n/a	0	100[c]
Shigella spp.	1	1	n/a	0	100[c]
Total Samples	**10**	**10**	**0**	**0**	**100[c]**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

The majority of the 458 imported whole fresh fruit and RTE fresh-cut fruit samples collected under the NMMP and FSO programs in 2018/19 were from Mexico and the United States (Figure 7). The overall compliance rate was 100 %.

Figure 3. Percent Distribution of Imported Fresh Fruit and Ready-To-Eat Fresh-Cut Fruit Samples Analyzed by Country of Origin (n=458).



ii) Fresh Vegetables and Ready-to-Eat Fresh-Cut Vegetables

Fresh vegetables may be contaminated with pathogenic microorganisms. Ready-to-eat fresh-cut vegetables may also be exposed to environmental contaminants during processing. These products are often consumed without further processing that might kill or remove pathogens thus, if pathogens are present, they are a food safety concern. Because the microbial contaminants in fresh and RTE fresh-cut vegetables may differ, the sampling results for these two categories of products will be presented separately.

A variety of domestic and imported whole fresh vegetables were targeted for sampling under the NMMP and FSO programs in 2018/19 (Figure 8). Some of these whole fresh vegetable samples were tested for the bacteria generic *E. coli*, *E. coli* O157:H7, *Salmonella* spp. and *Shigella* spp. Other whole fresh vegetable samples were tested for the bacteria generic *E. coli*. The remaining whole fresh vegetable samples, which consisted of domestic leafy greens and imported fresh herbs, were tested for the viruses Norovirus Genotypes I and II, and Hepatitis A virus, and the parasites *Giardia*, *Cyclospora*, *Cryptosporidium* and *Toxoplasma*.

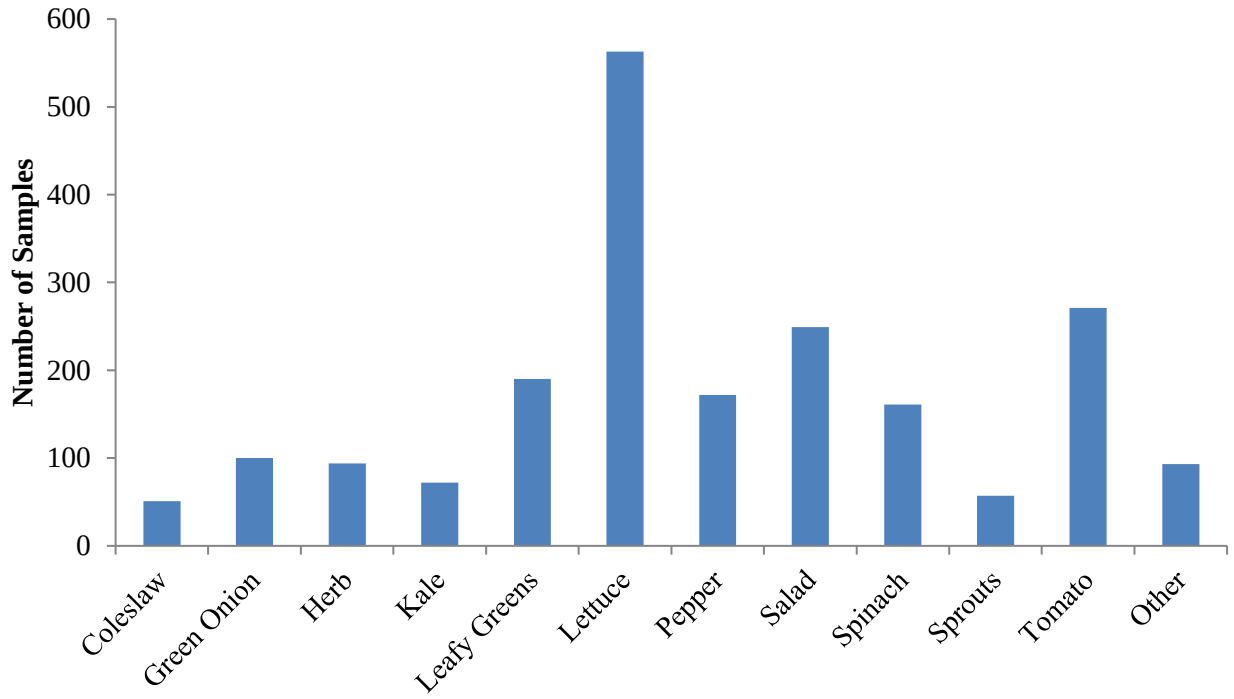


Figure 4. Number and Types of Fresh Whole Vegetables and Ready-To-Eat Fresh-Cut Vegetables Sampled under the NMMP and FSO Programs.

Table 14 summarizes test results of whole fresh vegetable samples collected by CFIA inspectors under the NMMP and FSO. A total of 286 domestic whole fresh vegetable samples and 336 imported whole fresh vegetable samples were tested for bacteria. The domestic whole fresh vegetable samples were 99.7% compliant, and the imported whole fresh vegetable samples were 99.1 % compliant. One domestic sample of sprouts, one imported chili pepper sample and one herb sample from Vietnam, were determined to be Unsatisfactory due to the presence of *Salmonella*. One imported herb sample from Vietnam was determined to be Unsatisfactory due to high levels of generic *E. coli*.

Table 14: Assessment of Domestic and Imported Whole Fresh Vegetables Sampled by CFIA Inspectors Under the NMMP and FSO

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic					
Generic *E. coli*	226	226	n/a	0	100
E. coli O157:H7	286	286	n/a	0	100
Salmonella spp.	286	285	n/a	1	99.7
Shigella spp.	226	226	n/a	0	100
Total Domestic Samples	**286**	**285**	**n/a**	**1**	**99.7**

Imported					
Generic *E. coli*	336	335	n/a	1	99.7
E. coli O157:H7	336	336	n/a	0	100
Salmonella spp.	336	334	n/a	2	99.4
Shigella spp.	336	336	n/a	0	100
Total Imported Samples	**336**	**333**	**n/a**	**3**	**99.1**
Total Samples	**622**	**618**	**n/a**	**4**	**99.4**

[a] n/a = not applicable. The assessment (Investigative) does not apply.

Table 15 summarizes test results of all whole fresh vegetable samples collected at retail. A total of 147 domestic whole fresh vegetable samples and 248 imported whole fresh vegetable samples were tested for bacteria. In addition, 143 domestic and 148 imported leafy greens were tested for viruses and 392 imported leafy greens and herbs were tested for parasites. The domestic and imported whole fresh vegetable samples were 100 % compliant. One domestic sample of herb was determined to be Investigative due to the detection of Norovirus Genotype II viral genetic material.

Table 15: Assessment of Domestic and Imported Whole Fresh Vegetables Sampled at Retail Under the FSO

Product Type	Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory[a]	% Compliance
Domestic						
Whole Fresh Vegetables	Generic *E. coli*	147	147	n/a	0	100
	E. coli O157:H7	147	147	n/a	0	100
	Salmonella spp.	147	147	n/a	0	100
	Shigella spp.	147	147	n/a	0	100
Leafy Greens and Fresh Herbs	Hepatitis A	143	143	0	n/a	100
	Norovirus Genotype I	143	143	0	n/a	100
	Norovirus Genotype II	143	142	1	n/a	100
Total Domestic Samples		**290**	**289**	**1**	**0**	**100**
Imported						
	Generic *E. coli*	248	248	n/a	0	100

Whole Fresh Vegetables	*E. coli* O157:H7	248	248	n/a	0	100
	Salmonella spp.	248	248	n/a	0	100
	Shigella spp.	247	247	n/a	0	100
Leafy Greens and Fresh Herbs	Hepatitis A	148	148	0	n/a	100
	Norovirus Genotype I	148	148	0	n/a	100
	Norovirus Genotype II	148	148	0	n/a	100
Leafy Greens and Salads	*Cryptosporidium*	392	392	0	n/a	100
	Giardia	144	144	0	n/a	100
	Toxoplasma	392	392	0	n/a	100
	Cyclospora	392	394	0	n/a	100
Total Imported Samples		**788**	**788**	**0**	**0**	**100**
Total Samples		**1078**	**1077**	**1**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative/ Unsatisfactory) does not apply.
[b]Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

A variety of RTE fresh-cut vegetables were also sampled under the NMMP and FSO programs in 2018/19 (Figure 9). Ready-to-eat fresh-cut vegetables were tested for generic *E. coli*, *E. coli* O157:H7, *L. monocytogenes*, *Salmonella* spp. and *Shigella* spp.

Tables 16 summarize test results of RTE fresh-cut vegetable samples collected at by CFIA inspectors under the NMMP and FSO. A total of 39 domestic and 42 imported RTE fresh-cut vegetable samples were tested for bacteria. Since RTE fresh-cut vegetables are minimally processed, the country in which a vegetable used in an RTE fresh-cut vegetable product is grown normally determines whether the product is considered domestic or imported. These RTE fresh-cut vegetable samples, however, were collected to assess the impact of the processing environment within Canadian establishments on the microbial profile of the products. Thus, for these RTE fresh-cut vegetable samples only, vegetables that were grown in other countries but minimally processed to produce RTE fresh-cut vegetable in Canada were also considered domestic. The overall compliance rate for domestic/domestically processed was determined to be 92.3 %. Of the samples collected at Canadian establishments, two domestic samples of Category 1 sliced mushrooms was assessed as Unsatisfactory due to the detection of *L. monocytogenes*, and one sample of cabbage was assessed as Unsatisfactory due to high levels of generic *E. coli*. The imported samples had a compliance rate of 100 %.

Table 16: Assessment of Domestic and Imported Ready-To-Eat Fresh-Cut Vegetables Sampled by CFIA Inspectors under the NMMP and FSO

Product Type / Pathogen	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic/Domestically Processed					

Generic *E. coli*	39	38	n/a	1	95.0[c]
E. coli O157:H7	39	39	n/a	0	100[c]
L. monocytogenes[b]	35	33	0	2	94.3[c]
Salmonella spp.	39	39	n/a	0	100[c]
Shigella spp.	39	39	n/a	0	100[c]
Total Domestic/ Domestically Processed Samples	**39**	**36**	**0**	**3**	**92.3[c]**
Imported					
Generic *E. coli*	42	42	n/a	0	100[c]
E. coli O157:H7	42	42	n/a	0	100[c]
L. monocytogenes[b]	36	36	0	0	100[c]
Salmonella spp.	42	42	n/a	0	100[c]
Shigella spp.	42	42	n/a	0	100[c]
Total Imported Samples	**42**	**42**	**0**	**0**	**100[c]**
Total Samples	**81**	**78**	**0**	**3**	**96.3**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

Table 17 summarizes test results for the domestic and imported RTE fresh-cut vegetable samples. A total of 38 domestic and 259 imported RTE fresh-cut vegetable samples collected at retail were tested for bacteria. The domestic samples were 100 % compliant. Two Category 1 samples (two salads) imported from the United States were assessed as Unsatisfactory as they were found to contain *L. monocytogenes*. The overall compliance rate for the imported samples was determined to be 99.2%.

Table 17: Assessment of Domestic and Imported Ready-To-Eat Fresh-Cut Vegetables Sampled at Retail Under the FSO

Product Type / Pathogen	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic					
Generic *E. coli*	38	38	0	0	100[c]
E. coli O157:H7	38	38	n/a	0	100[c]
L. monocytogenes[b]	38	38	0	0	100[c]
Salmonella spp.	38	38	n/a	0	100[c]
Shigella spp.	38	38	n/a	0	100[c]

Total Domestic Samples	**38**	**38**	**0**	**0**	**100[c]**
Imported					
Generic *E. coli*	259	259	0	0	100
E. coli O157:H7	259	259	n/a	0	100
L. monocytogenes[b]	259	257	0	2	99.2
Salmonella spp.	259	259	n/a	0	100
Shigella spp.	256	256	n/a	0	100
Total Imported Samples	**259**	**257**	**0**	**2**	**99.2**
Total Samples	**297**	**295**	**0**	**2**	**99.3**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = ≤ 100 CFU/g of *L. monocytogenes* in a Category 2 product; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

The 1425 imported fresh vegetables and RTE fresh-cut vegetable samples tested in 2018/19 had an overall compliance of 99.7%. The majority of these originated from the United States and Mexico (Figure 9).

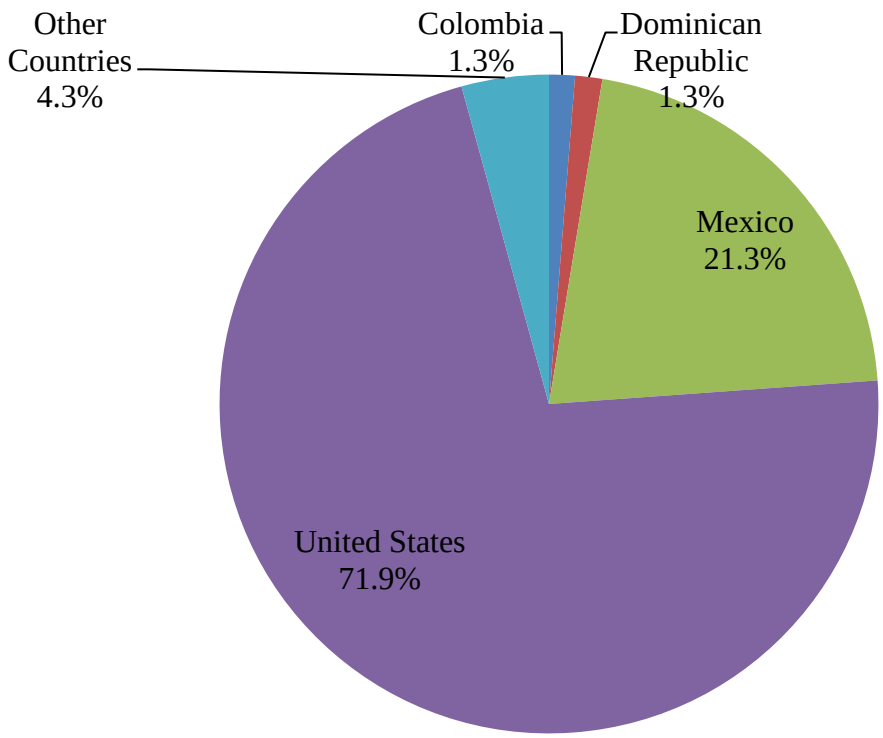


Figure 5. Percent Distribution of Imported Fresh Vegetable and Ready-To-Eat Fresh-Cut Vegetable Samples Analyzed by Country of Origin (n=1425).

iii) Environmental Testing in Domestic Fresh-cut Fruit and Vegetable Manufacturing Establishments

Environmental testing is carried out at domestic federally registered RTE fresh-cut fruit and vegetable establishments to verify the operator systems' ability to control the presence of *Listeria* spp. within the processing environment. Under the FSO Program in 2018/19, surfaces within these establishments were swabbed and the swabs from each area were composited and tested for *Listeria* spp. If *Listeria* spp. were detected in an environmental sample, the sample was further tested to determine which *Listeria* species were present.

A total of 11 environmental samples, representing approximately 110 food contact surfaces from 11 domestic federally registered establishments producing fresh-cut fruit and vegetable products were tested for *Listeria* spp. The compliance rate was 100%. One environmental swab was Investigative due to the presence of *Listeria* spp. other than *L. monocytogenes*.

iv) Compliance History

The historical compliance levels and number of samples of domestic and imported fresh fruit and vegetables and RTE fresh-cut fruit and vegetables tested under the NMMP and FSO programs between April 1, 2015 and March 31, 2019 is shown in Table 18. Compliance levels of samples of these products were consistent over the years.

Table 18: Historical percent compliance and number of samples (n) of Fresh Fruit and Vegetables

	2018/19	2017/18	2016/17	2015/16
Fresh Fruit	100 % (623)	100 % (599)	100 % (889)	99.9 % (674)[b]
Fresh-Cut Fruit	100 % (10)[a]	100 % (10)[a]	100 % (17)	100 % (28)[a,b]
Fresh Vegetables	99.8 % (1700)	99.8 % (1680)	99.8 % (1665)	99.7 % (1492)[b]
Fresh-Cut Vegetables	98.7 % (378)	99.0 % (393)	99.4 % (322)	98.2 % (116)[b]
Environmental Testing	100 % (11)	100 % (25)	97.1 % (34)	91.7 % (12)

[a] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.
[b] The increase in overall numbers for 2015/16 are due to the addition of the FSO samples.

What Were The 2018/19 NMMP/FSO Results for Processed Fruit and Vegetable Products?

i) Refrigerated and Shelf-Stable Pickled Products

Pickled products are acidified low-acid foods to which acid(s) are added to decrease their pH to at least 4.6. These foods include, but are not limited to green olives, pickles, pickled eggplant, pickled peppers, pickled artichoke hearts, pickled asparagus. Some pickled products require refrigeration to maintain their shelf-life, while others can be stored at room temperature. In Canada, establishments producing shelf-stable pickled products are inspected by the CFIA to confirm that these products are produced under good manufacturing conditions. Under the NMMP, only imported shelf-stable pickled products are sampled and tested for pH, water activity and salt content to verify that these products are produced in such a way that they do not support the growth of microbial pathogens.

According to the Health Canada's Policy on *Listeria monocytogenes* in Ready-to-Eat Foods (Health Canada, 2011), Category 2B products are not considered to support the growth of *L. monocytogenes*. Refrigerated pickles are considered Category 2B products and are thus given a lower priority for regulatory oversight and *L. monocytogenes* testing (Health Canada, 2011). Therefore, only a small number of domestic and imported refrigerated pickled products are tested under the NMMP, and testing is restricted to *L. monocytogenes*.

In 2018/19, 19 samples of imported shelf-stable pickled products, collected at by CFIA inspectors under the NMMP were tested for pH, salt content and water activity. All samples were compliant (Table 19). Six domestic and imported refrigerated pickled products were also tested under the NMMP for *L. monocytogenes* (Table 20). No *L. monocytogenes* was detected. The imported shelf-stable and refrigerated pickled products originated from a variety of countries (Figure 10).

Table 19: Assessment of Domestic and Imported Pickled Products Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Imported Shelf-Stable Pickled Products					
pH[c]	19	19	0	0	100[b]
Salt content	19	19	n/a	0	100[b]
Water activity[c]	18	18	0	0	100[b]
Total Imported Acidified Samples	**19**	**19**	**0**	**0**	**100**[b]
Domestic Refrigerated Pickled Products					
L. monocytogenes[c]	3	3	0	0	100[b]
Imported Refrigerated Pickled Products					
L. monocytogenes[c]	3	3	0	0	100[b]
Total Samples	**25**	**25**	**0**	**0**	**100**[b]

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.
[c] Investigative = low levels of *L. monocytogenes* in Category 2 products; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.

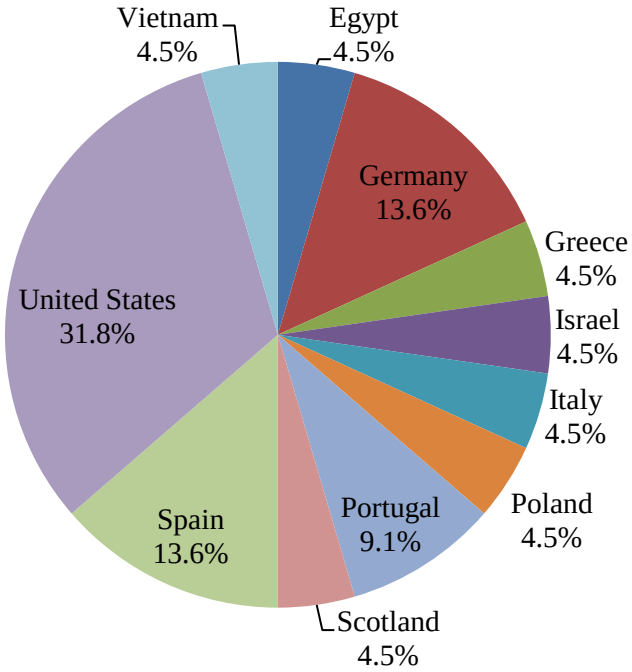


Figure 6. Percent Distribution of Imported Shelf-Stable and Refrigerated Pickled Products Analyzed by Country of Origin (n=22).

ii) Frozen Fruits

Frozen fruits may be contaminated with pathogens. These products are often consumed without further processing that might kill or remove pathogens thus, if pathogens are present, they would present a food safety concern. A variety of domestic and imported frozen fruits were targeted for sampling under the NMMP and FSO programs in 2018/19. Some of these frozen fruit samples were tested for the bacteria *L. monocytogenes* and *Salmonella* spp. (frozen berries only). Other frozen fruit samples (berries only) were tested for the viruses: Hepatitis A, Norovirus Genotype I and Norovirus Genotype II.

Table 20 summarizes test results of frozen fruit samples collected at collected at by CFIA inspectors under the NMMP and FSO. A total of 2 domestic frozen fruit samples and 8 imported frozen fruit samples were tested for bacteria. All samples were compliant.

Table 20: Assessment of Domestic and Imported Frozen Fruit Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic					
L. monocytogenes[b]	2	2	0	0	100[c]
Salmonella spp.	2	2	n/a	0	100[c]
Total Domestic Samples	**2**	**2**	**n/a**	**0**	**100[c]**
Imported					
L. monocytogenes[b]	8	8	0	0	100[c]
Salmonella spp.	7	7	n/a	0	100[c]
Total Imported Samples	**8**	**8**	**n/a**	**0**	**100[c]**
Total Samples	**10**	**10**	**n/a**	**0**	**100[c]**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = low levels of *L. monocytogenes* in Category 2 products; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

Table 21 summarizes test results of frozen fruit samples collected at retail. A total of 84 domestic frozen fruit samples, 483 imported frozen fruit samples, and 31 frozen fruit samples of unknown origin were tested for viruses. These products of unknown origin are products where the country of origin of the frozen berries was not listed on the packaging, e.g. only the importer was listed. The domestic, domestic/imported and unknown country of origin samples were 100% compliant. One sample of frozen raspberry, from Chile, was assessed as Investigative due to the detection of Norovirus Genotype II viral genetic material.

Table 21: Assessment of Domestic and Imported Frozen Fruit (Berries) Sampled at Retail Under the FSO

Analysis	# Tests	# Satisfactory	# Investigative	# Unsatisfactory [a]	% Compliance
Domestic					
Hepatitis A	84	84	0	n/a	100
Norovirus Genotype I	84	84	0	n/a	100
Norovirus Genotype II	84	84	0	n/a	100
Total Domestic Samples	**84**	**84**	**0**	**n/a**	**100**
Imported					
Hepatitis A	483	483	0	n/a	100
Norovirus Genotype I	483	483	0	n/a	100
Norovirus Genotype II	483	482	1	n/a	100
Total Imported Samples	**483**	**482**	**1**	**n/a**	**100**
Unknown Country of Origin					
Hepatitis A	31	31	0	n/a	100[b]
Norovirus Genotype I	31	31	0	n/a	100[b]
Norovirus Genotype II	31	31	0	n/a	100[b]
Total Unknown Samples	**31**	**31**	**0**	**n/a**	**100[b]**
Total Samples	**598**	**597**	**1**	**n/a**	**100**

[a] n/a = not applicable. The assessment (Unsatisfactory) does not apply.
[b] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

The 483 imported frozen fruit samples tested in 2018/19 had an overall compliance of 100%. The majority of these originated from Chile and Mexico (Figure 11).

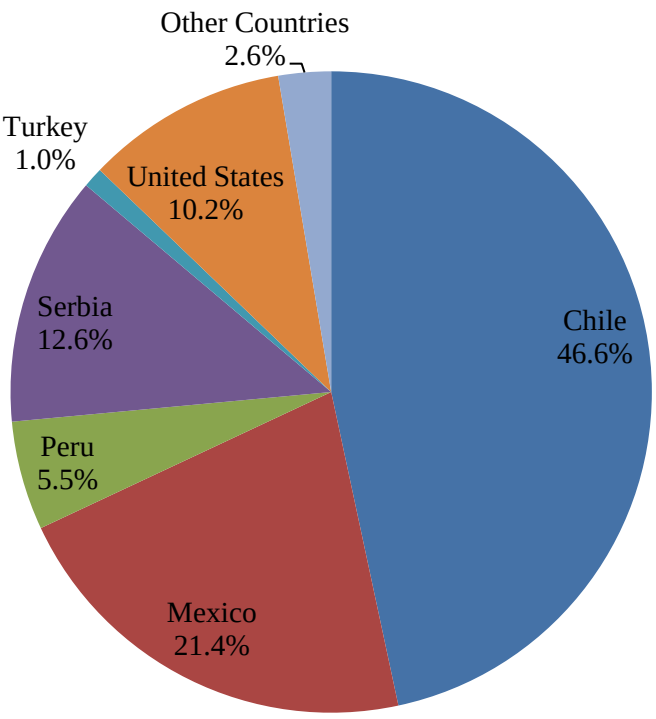


Figure 7. Percent Distribution of Imported Frozen Fruit Analyzed by Country of Origin (n=491).

iii) Frozen Vegetables

Frozen vegetables may be contaminated with pathogens. Typically, frozen vegetables are heated or cooked prior to serving. Many frozen vegetables are clearly labelled with cooking instructions that, if followed, will kill any pathogens that may be present but some types of frozen vegetables are not clearly labelled with cooking instructions, for example, frozen spinach. Frozen vegetables that are not clearly labelled with cooking instructions are not always subjected to cooking prior to consumption and thus may be considered RTE. For this reason, products that were clearly labelled with cooking instructions were subjected to different tests than those that were not clearly labelled with cooking instructions. Frozen vegetables with cooking instructions were tested for the indicator organisms ACC and generic *E. coli* to confirm that these products are produced under good manufacturing conditions. Frozen vegetables without cooking instructions were tested for *L. monocytogenes*.

Table 22 summarizes test results of frozen vegetables, both with and without cooking instructions, collected under the NMMP in 2018/19. In total 18 domestic frozen vegetable samples with cooking instructions and 38 imported frozen vegetable samples with cooking instructions were tested for

indicator organisms. All were compliant, although three samples from China, Costa Rica and Spain, were assessed as Investigative due to high levels of ACC. Five samples of imported frozen vegetables without cooking instructions were also tested for *L. monocytogenes.* All samples were compliant (Table 22).

Table 22: Assessment of Domestic and Imported Frozen Vegetables Sampled by CFIA Inspectors Under the NMMP

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic Frozen Vegetables w/ cooking instructions					
ACC	18	18	n/a	0	100[c]
Generic *E. coli*	18	18	n/a	0	100[c]
Total Domestic w/ cooking Samples	**18**	**18**	**n/a**	**0**	**100[c]**
Imported Frozen Vegetables w/ cooking instructions					
ACC	38	35	3	0	100[c]
Generic *E. coli*	38	38	n/a	0	100[c]
Total Imported w/cooking Samples	**38**	**35**	**3**	**0**	**100[c]**
Imported Frozen Vegetables w/out cooking instructions					
L. monocytogenes[b]	5	5	0	0	100[c]
Total Samples	**61**	**58**	**3**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.
[b] Investigative = low levels of *L. monocytogenes* were detected in Category 2 products. Unsatisfactory = >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[c] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

The 43 imported frozen vegetable samples, with and without cooking instructions, that were tested under the NMMP in 2018/19 originated from a variety of countries (Figure 12). These samples had a compliance rate of 100%.

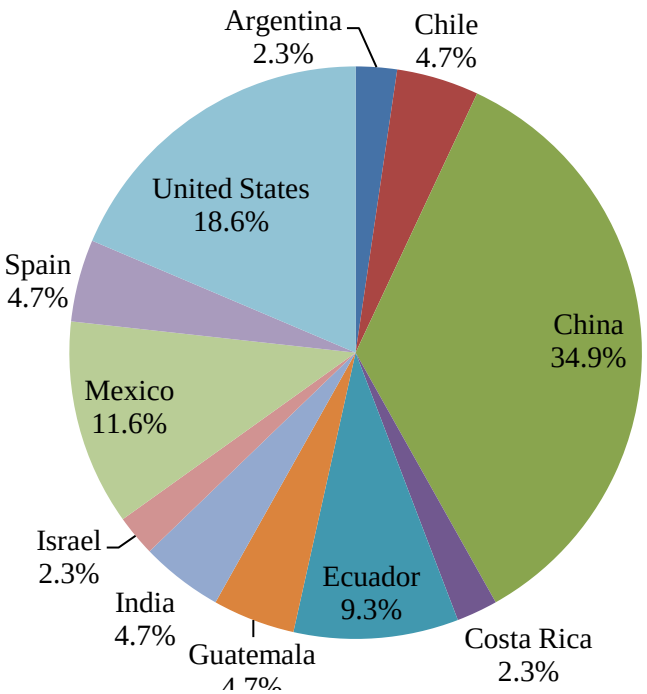


Figure 8. Percent Distribution of Imported Frozen Vegetables (With and Without Cooking Instructions) Analyzed by Country of Origin (n=43).

iv) Compliance History

The historical compliance levels and number of samples of domestic and imported processed fruit and vegetables tested under the NMMP and FSO programs between April 1, 2015 and March 31, 2019 is shown in Table 23. Compliance levels of samples of these products were consistent over the years.

Table 23: Historical percent compliance and number of samples (n) of Processed Fruit and Vegetable Products

	2018/19	2017/18	2016/17	2015/16
Shelf-Stable Pickled	100 % (23)[a]	100 % (23)[a]	100 % (22)[a]	100 % (18)[a]
Refrigerated Pickled	100 % (5)[a]	100 % (5)[a]	100 % (6)[a]	100 % (5)[a]
Frozen Fruit	100 % (606)[b]	100 % (606)[b]	100 % (312)[b]	100 % (266)[b]
Frozen Vegetables	100 % (65)	100 % (65)	90.9 % (55)	96.5 % (57)

[a] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.
[b] The increase in overall numbers for 2015/16 are due to the addition of the FSO samples.

What Were The 2018/19 FSO Results for Manufactured Food Products?

i) Tahini

Tahini may be contaminated with pathogenic microorganisms. Tahini is often incorporated into foods, such as hummus, which are not subsequently heated to reduce microbial growth and which would possess sufficient water activity to permit growth of *Salmonella* spp. if improperly stored (i.e., temperature abuse). These products are often consumed without further processing that might kill or remove pathogens thus, if pathogens are present, they are a food safety concern. Tahini products were targeted for sampling at retail under the FSO Program. Tahini samples were tested for the bacteria *Salmonella.*

Table 24 summarizes test results for imported tahini samples collected by third-party contracted samplers under the FSO in 2018/19. In total, 95 samples were tested for *Salmonella* spp. The compliance rate was 100 %.

Table 24: Assessment of Imported Tahini Sampled at Retail Under the FSO

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Imported					
Salmonella spp.	95	95	n/a	0	100
Total Samples	**95**	**95**	**n/a**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.

The 95 imported tahini samples that were tested under the FSO program in 2018/19 originated mainly from Lebanon (Figure 13). These samples had a compliance rate of 100%.

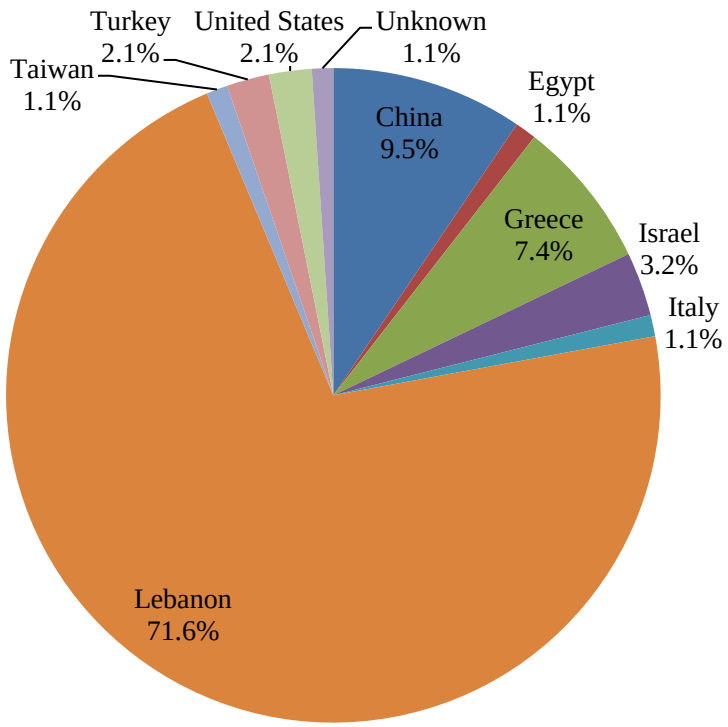


Figure 9. Percent Distribution of Imported Tahini Analyzed by Country of Origin (n=95).

ii) Powdered Infant Formula

Powdered infant may be contaminated with pathogenic microorganisms. Powdered infant formula is commonly consumed by newborns and infants in Canada. Unfortunately, the consumption of reconstituted powdered infant formula has been associated with recalls and outbreaks of foodborne illnesses in Canada and worldwide, with the main pathogens of concern being *Cronobacter* species (spp.) and *Salmonella* spp. While very rare, infections with these pathogens in babies can be fatal. Contamination can occur at any point in the food production chain and have been previously traced back during food safety investigations to the production facility and equipment used to prepare the infant formula. Powdered infant formula products were targeted for sampling at retail under the FSO Program. Powdered infant formula samples were tested for the Enterobacteriaceae and *Cronobacter* spp.

Table 25 summarizes test results for powdered infant formula samples collected by third-party contracted samplers under the FSO in 2018-19. In total, 149 samples were tested for both Enterobacteriaceae and *Cronobacter* spp. The compliance rate was 100 %.

Table 25: Assessment of Domestic and Imported Powdered Infant Formula Sampled at Retail Under the FSO

Analysis	# Tests	# Satisfactory	# Investigative[a]	# Unsatisfactory	% Compliance
Domestic					
Enterobacteriaceae	1	1	0	n/a	100[c]
Cronobacter spp.	1	1	n/a	0	100[c]
Total Domestic Samples	**1**	**1**	**0**	**0**	**100[c]**
Imported					
Enterobacteriaceae	129	129	0	n/a	100
Cronobacter spp.	129	129	n/a	0	100
Total Imported Samples	**129**	**129**	**0**	**0**	**100**
Unknown Country of Origin					
Enterobacteriaceae	19	19	0	n/a	100[c]
Cronobacter spp.	19	19	n/a	0	100[c]
Total Unknown Samples	**19**	**19**	**0**	**0**	**100[c]**
Total Samples	**149**	**149**	**0**	**0**	**100**

[a] n/a = not applicable. The assessment (Investigative) does not apply.

The 129 imported powdered infant formula samples that were tested under the FSO program in 2018/19 originated from Ireland, Netherlands and the United States (Figure 14). These samples had a compliance rate of 100%.

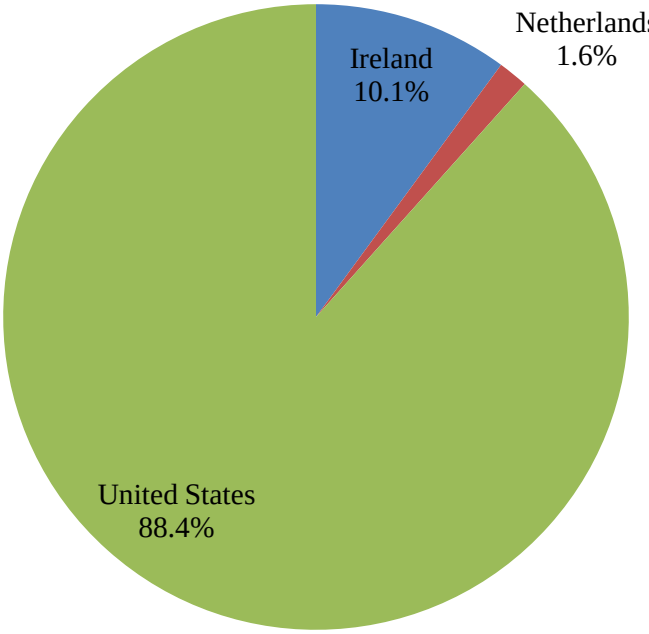


Figure 10. Percent Distribution of Imported Powdered Infant Formula Analyzed by Country of Origin (n=129).

What Were The 2018/19 FSO Results for Fish and Seafood Products?

i) Fish and Seafood Products

Raw fish and seafood may be contaminated with pathogenic microorganisms. Ready-to-eat fish and seafood may become exposed to environmental contaminants during processing. These products are often consumed without further processing that might kill or remove pathogens, thus if pathogens are present, they are a food safety concern. Raw molluscan shellfish and RTE fish products were targeted for sampling by CFIA inspectors at federally registered establishments and at retail under the FSO Program. The raw bivalve molluscan shellfish were tested for the bacteria *Vibrio parahaemolyticus,* and the RTE fish products were tested for other bacteria: generic *E. coli, L. monocytogenes, Salmonella* and *S. aureus*.

Table 26 summarizes test results for domestic raw molluscan shellfish samples collected by CFIA inspectors under the FSO in 2018/19. In total, 74 domestic raw molluscan shellfish samples were tested for *V. parahaemolyticus*. The compliance rate was 86.5%.

Table 26: **Assessment of Domestic Raw Molluscan Shellfish Sampled by CFIA Inspectors Under the FSO**

Analysis	# Tests	# Satisfactory	# Investigative [a]	# Unsatisfactory	% Compliance
Domestic					
Vibrio parahaemolyticus	74	64	n/a	10	86.5
Total Samples	**74**	**64**	**n/a**	**10**	**86.5**

[a] n/a = not applicable. The assessment (Investigative) does not apply.

Table 27 summarizes test results for imported RTE fish products collected at retail under the FSO in 2018/19. In total, 75 RTE fish samples, the majority originating from the United States (Figure 15), were tested for generic *E. coli*, *L. monocytogenes*, *Salmonella* and *S. aureus* and were determined to be 100% compliant.

Table 27: **Assessment of Imported Ready-to-Eat Fish Products Sampled at Retail Under the FSO**

Analysis	# Tests	# Satisfactory	# Investigative [b]	# Unsatisfactory	% Compliance
Imported					
Generic *E. coli*	75	75	0	0	100
L. monocytogenes[a]	75	75	0	0	100
Salmonella spp.	75	75	n/a	0	100
S. aureus	75	75	0	0	100
Total Samples	**75**	**75**	**0**	**0**	**100**

[a] Investigative = low levels of *L. monocytogenes* in Category 2 products; Unsatisfactory = *L. monocytogenes* detected in Category 1 products or >100 CFU/g of *L. monocytogenes* in a Category 2 product.
[b] n/a = not applicable. The assessment (Investigative) does not apply.

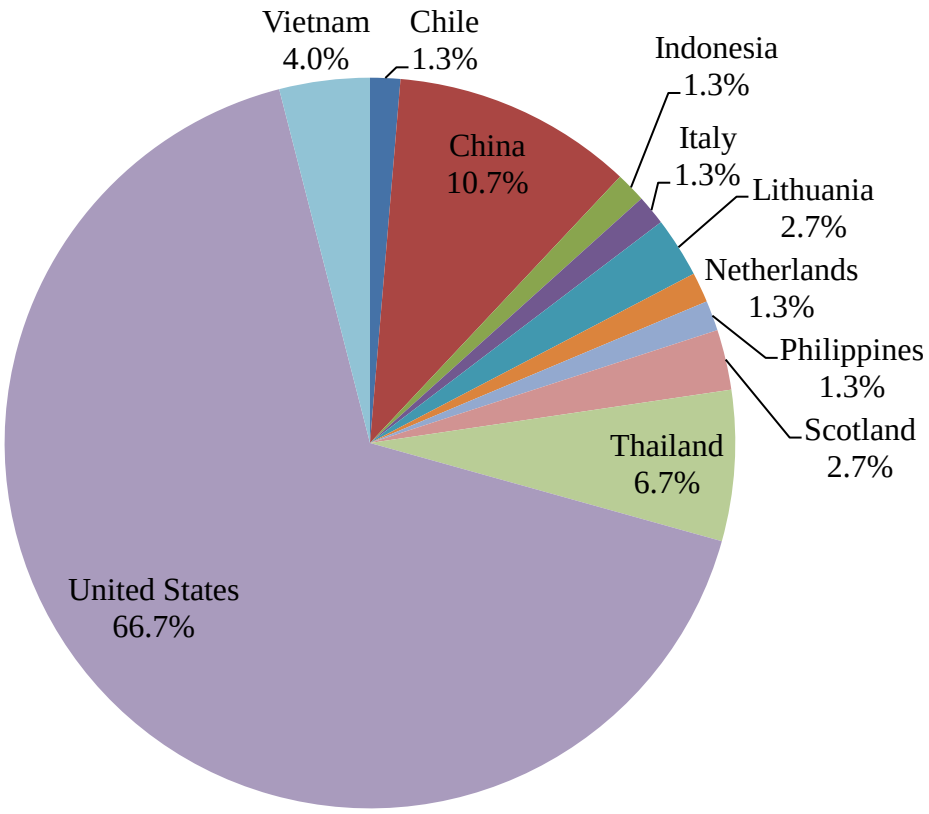


Figure 11. Percent Distribution of Imported Ready-to-Eat Fish Products Analyzed by Country of Origin (n=75).

ii) Environmental Testing in Domestic Fish and Fish Products Manufacturing Establishments

Environmental testing is carried out at domestic federally registered RTE fish establishments to verify the operator systems' ability to control the presence of *Listeria* spp. within the processing environment. Under the FSO Program in 2018/19, surfaces within these establishments were swabbed and the swabs from each area were composited and tested for *Listeria* spp. If *Listeria* spp. was detected in an environmental sample, the sample was further tested to determine which *Listeria* species were present.

A total of 11 environmental samples, representing approximately 110 food contact surfaces from 11 domestic federally registered establishments producing ready-to-eat fish products were tested for *Listeria* spp. The overall compliance rate was 100%.

iii) Compliance History

The historical compliance levels and number of samples of domestic and imported fish and seafood products tested under the FSO program between April 1, 2015 and March 31, 2019 is shown in Table 28. Compliance levels of samples of these products were consistent over the years.

Table 28: Historical percent compliance and number of samples (n) of Fish and Seafood Products

	2018/19	2017/18	2016/17	2015/16
Raw Molluscan Shellfish	86.5 % (74)	92.2 % (77)	100 % (49)[a]	85.7 % (14)[a]
Ready-to-Eat Fish	100 % (75)	100 % (78)	100 % (70)	100 % (72)
Environmental Testing	100 % (11)[a]	100 % (14)[a]	100 % (11)[a]	-

[a] Due to small sample/test number, the significance of the compliance percentage should be interpreted with caution.

What Do The NMMP/FSO Results Mean?

In the 2018/19 fiscal year, 12899 tests were performed on 5308 domestic and imported food products collected from under the NMMP. Specifically, 8856 tests were performed on 3913 domestic products and 4043 tests were performed on 1395 imported products to verify compliance with food safety standards. Results indicated that domestic products were 99.9% compliant whereas imported products were 99.2% compliant. Overall, a 99.7% compliance rate was observed for combined domestic and imported products. In addition, there were 2039 tests performed on 1666 environmental samples, which were assessed as 98.1% compliant.

In 2018/19 fiscal year, 9228 tests were performed on 2742 domestic, imported, and unknown origin food products collected under the FSO Program. Specifically, 2249 tests were performed on 660 domestic products; 6848 tests were performed on 2032 imported products; and 131 tests were performed on 50 food products of unknown origin. Results indicated that domestic products were 98.2 % compliant, imported products were 99.9% compliant, and food products of unknown origin were 100 % compliant. Overall, a 99.6% compliance rate was observed for domestic, imported, and unknown origin products. In addition, there were 22 tests performed on 22 environmental samples under the FSO program, which were assessed as 100% compliant.

These results indicate that Canada maintains a very high overall level of quality and safety, for both domestic and imported food products and for the environments under which domestic products were produced. In addition, the levels of compliance observed in the 2018/19 fiscal year were relatively consistent with previous years, indicating that this high level of quality and safety is being maintained over time (Table 29).

Table 29: Historical percent compliance and number of samples (n) of the NMMP and FSO Programs

	2018/19	2017/18	2016/17	2015/16
Product Samples	99.6 % (8027)	99.6 % (7754)	99.6 % (7647)	99.6 % (7856)
Domestic	99.7 % (4573)	99.5 % (4562)	99.8 % (4639)	99.7 % (4687)
Imported	99.6 % (3427)	99.6 % (3162)	99.4 % (2997)	99.4 % (3169)
Other[a]	100% (50)	100% (27)	100% (27)	-
Environmental Samples	98.1 % (1688)	97.6 % (1770)	97.9 % (1735)	98.1 % (1780)

[a] An additional 50 products whose origin was unknown were tested and found to be 100 % compliant.

A total of 32 product samples and 33 environmental samples were assessed as noncompliant in 2018/19 under the NMMP and FSO programs. Of the 32 noncompliant food product samples, 25 were assessed as noncompliant due to the presence of one or more pathogens and 7 were assessed as noncompliant due to the presence of high levels of indicator organisms. Of the 33 noncompliant environmental samples, 15 were assessed as noncompliant due to the presence of one or more pathogens, while the remaining 18 were assessed as noncompliant due to the presence of high levels of indicator organisms. The presence of a pathogen in a food sample represents a direct food hazard. The presence of a pathogen in an environmental sample indicates that pathogens are present in the production environment and that the food product is at a higher risk of being contaminated. The presence of high levels of indicator organisms does not always imply the existence of a food-related health hazard but can expose unsanitary practices and conditions under which pathogenic microorganism could contaminate food products.

A total of 27 product samples and 15 environmental samples were considered to be compliant but were assessed as Investigative in 2018/19 under the NMMP and FSO programs. Of these Investigative product samples, 6 were assessed as such due to the presence of *L. monocytogenes* detected at low levels (<100 CFU/g). Seventeen product samples were deemed Investigative due to the presence of generic *E. coli* and two products samples were deemed Investigative due to the presence of viral genetic material (both Norovirus Genotype II). Two product samples were considered to be compliant but was assessed as Investigative due to the presence of CNS tissue. The 15 environmental samples were found to be contaminated with *Listeria* spp., however, *L. monocytogenes* was not detected.

Food safety is a collective responsibility of government, industry and consumers. All food producers/importers are responsible under Canadian law for the safety of the food they produce and distribute. In 2018/19, under the NMMP and FSO programs, the CFIA tested food and environmental samples to verify that they met their obligations. Follow-up actions taken by both industry and the CFIA

acted to improve Canadian manufacturing processes and identify imported products that did not meet Canadian standards.

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Appendix I: Assessment Criteria for NMMP/FSO Samples Collected by CFIA Inspectors

Assessment criteria (n, c, m and M) are used to assess test results to determine if a sample is Satisfactory, Unsatisfactory or Investigative. For all sample plans, "n" represents the number of sample units (i.e., subsamples) from a single lot of product to be analyzed. Collectively, these samples units represent one sample. "c" represents the maximum allowable number of unacceptable sample units in a 2-class plan (i.e, only two possible results) or marginally acceptable sample units in a 3-class plan. "m" represents a microbiological limit which, in a 2-class plan, separates sample units of acceptable from unacceptable quality or, in a 3-class plan, "m" separates sample units of acceptable quality from those of marginally acceptable quality. "M" represents a microbiological limit which, in a 3-class plan, separates sample units of marginally acceptable quality from those of unacceptable quality.

A Satisfactory result indicates that the sample was considered acceptable by the assessment criteria for all tests. An Unsatisfactory result indicates that the sample was considered unacceptable by the assessment criteria for one or more tests. An Investigative result indicates that, based on the assessment criteria, the sample was acceptable but that manufacturing practices should be investigated further to ensure good manufacturing practices are in place.

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Red Meat & Poultry Products and Environmental								
Category 1 RTE Meat Products	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Category 2 RTE Meat Products	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested
RTE Meat Products	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected
RTE Dry & Semi-dry Fermented Meat Products	*E. coli* O157:H7	5	0	0	-	Not Detected	n/a	Detected
Raw Ground Beef/Veal	generic *E. coli*	5	0	10^2	-	≤10^2/g	>10^2/g	n/a
Raw Ground Beef/Veal	*E. coli* O157:H7	5	0	0	-	Not Detected	n/a	Detected

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Beef/Veal Trims	generic *E. coli*	60	0	10^2	-	≤10^2/g	>10^2/g	n/a
Beef/Veal Trims	*E. coli* O157:H7	60	0	0	-	Not Detected	n/a	Detected
Mechanically Separated & Finely Textured Beef	CNS	3	n/a			Not Detected	Detected	n/a
Pork Carcasses	*Trichinella spiralis*	100	n/a			Not Detected	n/a	Detected
Raw Meat & RTE Meat Products	Species Verification	1	n/a			Detected as declared or not detected and not declared	n/a	Not detected but declared or detected but not declared
Environmental - RTE Meat Establishments	*Listeria* spp.	10	n/a			Not Detected	*Listeria* spp. other than *L. monocytogenes* detected	*L. monocytogenes* detected
Shell Egg & Processed Egg Products and Environmental								
Shell Eggs	*Salmonella* spp.	12	0	0	-	Not Detected	n/a	Detected
Processed Egg	ACC	5	0	5×10^4	-	≤m/g	n/a	>m/g in one or more sample units
Processed Egg	Coliforms	5	0	10	-	≤m/g	n/a	>m/g in one or more sample units
Processed & Cooked Egg Products	*Salmonella* spp.	10	0	0	-	Not Detected	n/a	Detected
Category 1 RTE Processed Egg Products	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Category 2 RTE Processed Egg Products	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Egg Wash Water - Basket Washer	ACC	1	n/d	n/d	10^5	≤10^5/mL	n/a	>10^5 /mL
Egg Wash Water - Recirculating Washer	ACC	3	n/d	n/d	10^5	≤10^5/mL	n/a	>10^5/mL
Environmental - Shell Egg Grading Station (FCS, NFCS)	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected
Environmental - Processed Egg (FCS, NFCS)	*Listeria* spp.	5	0	0	-	Not Detected	*Listeria* spp. other than *L. monocytogenes* detected	*L. monocytogenes* detected
Environmental - Processed Egg (FCS, NFCS)	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected
Dairy Products and Environmental								
Fluid Milk Products	generic *E. coli*	5	0	0	-	Not Detected	n/a	Detected
Category 1 RTE Fluid Milk Products	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Cheese (pasteurized milk)	generic *E. coli*	5	2	10^2	2×10^3	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Cheese (raw milk)	generic *E. coli*	5	2	5×10^2	2×10^3	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Cheese (raw milk)	*E. coli* O157:H7	5	0	0	-	Not Detected	n/a	Detected
Cheese (pasteurized and raw milk)	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Category 1 RTE Cheese Products (pasteurized and raw milk)	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Category 2 RTE Cheese Products (pasteurized and raw milk)	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested
Cheese (pasteurized milk)	*S. aureus*	5	2	10^2	10^4	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Cheese (raw milk)	*S. aureus*	5	2	10^3	10^4	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Cheese (pasteurized milk)	Phosphatase	3	2	5ug	10ug	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if C is exceeded
Environmental - Cheese (FCS) & Dairy (FCS, NFCS) Processors	*Listeria* spp.	10	0	0	-	Not Detected	*Listeria* spp. other than *L. monocytogenes* detected	*L. monocytogenes* detected
Fresh Fruits & Vegetables and Environmental								
Fresh and RTE Fresh-Cut Fruits & Vegetables	generic *E. coli*	5	2	10^2	10^3	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Fresh and RTE Fresh-Cut Fruits & Vegetables	*E. coli* O157:H7	5	0	0	-	Not Detected	n/a	Detected
Sprouted Seeds and Beans	generic *E. coli*	5	2	10^2	10^3	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Sprouted Seeds and Beans	*E. coli* O157:H7	5	0	0	-	Not Detected	n/a	Detected
Fresh and RTE Fresh-Cut Fruits & Vegetables	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected
Fresh and RTE Fresh-Cut Fruits & Vegetables	*Shigella* spp.	5	0	0	-	Not Detected	n/a	Detected
Category 1 RTE Fresh-Cut Fruit & Vegetable Products	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Category 2 RTE Fresh-Cut Fruit & Vegetable Products	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested
Blackberries and Raspberries	*Cyclospora*	5	0	0	-	Not Detected	Detected	n/a
Environmental - Fresh Produce Producers (FCS)	*Listeria* spp.	10	0	0	-	Not Detected	*Listeria* spp. other than *L. mono*	*L. monocytogenes* detected
Environmental Samples of Food Contact Surface (FCS) for Domestic Fresh-Cut facilities	*Listeria* spp.	-	n/a			Not Detected	*Listeria* spp. other than *L. mono*	*L. monocytogenes* detected
Environmental Samples of Food Contact Surface (FCS) for Domestic Fresh-Cut facilities	*Salmonella* spp.	-	n/a			Not Detected	n/a	Detected
Processed Products								

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
Shelf-Stable Pickled Products	a_w	5	1	0.85	0.87	≤m/g or if c is not exceeded	>0.85 but ≤0.87 in more than 1 unit when pH >4.8 in any unit	>0.87 in any unit when pH >4.8 in any unit
Shelf-Stable Pickled Products	pH	5	1	4.6	4.8	≤m/g or if c is not exceeded	>4.6 but ≤4.8 in more than 1 unit when a_w >0.87 in any unit	>4.8 in any unit when a_w >0.87 in any unit
Category 1 Refrigerated Pickled Products	*L. monocytogenes*	5	0	0	-	Not Detected	n/a	Detected
Category 2 Refrigerated Pickled Products	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested
Frozen Vegetables	ACC	5	0	2.5×10^5	-	≤m/g	>m/g	n/a
Frozen Vegetables	generic *E. coli*	5	2	10^2	10^3	≤m/g or if c is not exceeded	n/a	>M/g in one or more sample units or if c is exceeded
Frozen Berries	*Salmonella* spp.	5	0	0	-	Not Detected	n/a	Detected
Frozen Fruit & Vegetable Products (Category 2)	*L. monocytogenes*	5	0	100	-	Not Detected	≤m/g in all sub sample units tested	>m/g in any sub sample unit tested
Fish								
Raw molluscan shellfish	*Vibrio parahaemolyticus*	5	0	10^2	n/a	≤m	n/a	>m in any sample unit
Environmental Samples of Food Contact Surface (FCS)	*Listeria* spp.	-	n/a			Not Detected	*Listeria* spp. other than *L. mono*	*L. monocytogenes* detected

Commodity	Analyte	n	c	m	M	Satisfactory	Investigative	Unsatisfactory
for Domestic RTE Fish Facilities								

n/a = not applicable; n/d = not determined

Appendix II: Assessment Criteria for FSO Samples Collected at Retail

As for products collected at federally registered establishments, samples collected at retail are assessed using assessment criteria to determine if a sample was Satisfactory, Unsatisfactory or Investigative. For these samples, it was not possible to representatively sample multiple units from the same lot due to limited product availability so a single sample unit was collected. Because of differences in sample collection, retail samples were not assessed using the same n, c, m and M parameters used to assess samples collected at federally registered establishments. Retail samples were assessed using alternative criteria. These alternative criteria were not intended to determine a level of risk. Instead, they allowed the laboratory to be able to assess each result on an individual basis and informed risk management decisions by CFIA's Policy and Programs Branch and/or Operations Branch.

As with the assessment criteria for samples collected by CFIA inspectors at federally registered establishments (Appendix I), a Satisfactory result indicates that the sample was considered acceptable by the assessment criteria, an Unsatisfactory result indicates that the sample was considered unacceptable by the assessment criteria and an Investigative result indicates that, based on the assessment criteria, the sample was acceptable but that manufacturing practices should be investigated further to ensure good manufacturing practices are in place.

Commodity	Analyte	n	Satisfactory	Investigative	Unsatisfactory
Fresh Fruits & Vegetables and Environmental					
Fresh and RTE Fresh-Cut Fruits & Vegetables	generic *E. coli*	1	≤ 10^2 cfu/g or MPN/g	10^2 – 10^3 cfu/g or MPN/g	≥ 10^3 cfu/g or MPN/g
Fresh and RTE Fresh-Cut Fruits & Vegetables	*E. coli* O157:H7/NM	1	Not Detected	n/a	Detected
Fresh and RTE Fresh-Cut Fruits & Vegetables	*Salmonella* spp.	1	Not Detected	n/a	Detected
Fresh and RTE Fresh-Cut Fruits & Vegetables	*Shigella* spp.	1	Not Detected	n/a	Detected

Commodity	Analyte	n	Satisfactory	Investigative	Unsatisfactory
Category 1 RTE Fresh-Cut Fruit & Vegetable Products	*L. monocytogenes*	1	Not Detected	n/a	Detected
Category 2 RTE Fresh-Cut Fruit & Vegetable Products	*L. monocytogenes*	1	Not Detected	≤ 10^2 m/g in all sub sample units tested	>m/g in any sub sample unit tested
Leafy Greens	*Giardia*	1	Not Detected	Detected	n/a
Leafy Greens	*Toxoplasma*	1	Not Detected	Detected	n/a
Leafy Greens	*Cyclospora*	1	Not Detected	Detected	n/a
Leafy Greens	*Cryptosporidium*	1	Not Detected	Detected	n/a
Leafy Greens and Herbs	Hepatitis A	1	Not Detected	Detected	n/a
Leafy Greens and Herbs	Norovirus Genotype I	1	Not Detected	Detected	n/a
Leafy Greens and Herbs	Norovirus Genotype II	1	Not Detected	Detected	n/a
Processed Products					
Fresh/Frozen Berries	Hepatitis A	1	Not Detected	Detected	n/a
Fresh/Frozen Berries	Norovirus Genotype I	1	Not Detected	Detected	n/a
Fresh/Frozen Berries	Norovirus Genotype II	1	Not Detected	Detected	n/a
Fish					
RTE Fish	generic *E. coli*	1	≤ 4 cfu/g or MPN/g	4 – 40 cfu/g or MPN/g	≥ 40 cfu/g or MPN/g
RTE Fish	*S. aureus*	1	≤ 10^3 cfu/g or MPN/g	10^3 – 10^4 cfu/g or MPN/g	≥ 10^4 cfu/g or MPN/g

Commodity	Analyte	n	Satisfactory	Investigative	Unsatisfactory
RTE Fish	*Salmonella* spp.	1	Not Detected	n/a	Detected
Category 1 RTE Fish	*L. monocytogenes*	1	Not Detected	n/a	Detected
Category 2 RTE Fish	*L. monocytogenes*	1	Not Detected	≤ 10^2 m/g in all sub sample units tested	>m/g in any sub sample unit tested
Manufactured Food Products					
Tahini	*Salmonella* spp.	1	Not Detected	n/a	Detected
Powdered Infant Formula	*Enterobacteriaceae*	1	Not Detected	Detected	n/a
Powdered Infant Formula	*Cronobacter* spp.	1	Not Detected	n/a	Detected

n/a = not applicable