Pesticide Residue Monitoring Program Fiscal Year 2019 Pesticide Report

U.S. Food and Drug Administration

https://www.fda.gov/food/chemicals-metals-pesticides-food/pesticides

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Acknowledgments

This report was compiled through the efforts of the following FDA staff: Laurie Bates, Mallory Kelly, Charlotte Liang, Sara McGrath, Standra Purnell, Jeffrey Read, Lauren Robin, Chris Sack, Xuhui Zhao, and Yu Cao in the Center for Food Safety and Applied Nutrition; Krisztina Wolf, Linda Benjamin, and David Edwards in the Center for Veterinary Medicine; and Michael McLaughlin and Mohammed Islam in the Office of Regulatory Affairs.

FDA Pesticide Residue Monitoring Program Reports and Data

For more information about FDA pesticide residue monitoring program reports, see https://www.fda.gov/food/pesticides/pesticide-residue-monitoring-program-reports-and-data. Since 1987, annual pesticide reports have been prepared to summarize results of the Food and Drug Administration's (FDA or the Agency) pesticide residue monitoring program. Reports from Fiscal Year (FY) 1987 to FY 1993 were published in the Journal of the Association of Official Analytical Chemists/Journal of AOAC International. FY 1993 and FY 1994 reports were published in the journal and also made available on the public FDA website (www.fda.gov). Subsequent reports are only available on the FDA website. Each report is available in the format(s) used at the time they were written.

In addition to the annual reports, specific pesticide monitoring data and statistical analyses of human and animal foods for each year are also available in text format on the FDA website as "database" files. The database files include statistical analysis of findings by multiple country/commodity/pesticide combinations, along with data for individual samples from which the summary information was compiled. Instructions and explanations of the data and statistical analyses are provided for each database file. The database files are available from FY 1996 on.

Executive Summary

Growers often use pesticides to protect their products from insects, weeds, fungi, and other pests. U.S. regulators help ensure that food produced with the use of pesticides is safe to eat by setting allowable levels called tolerances for pesticide chemical residues and by monitoring foods in the market to determine if those levels are being exceeded.
The role of the Environmental Protection Agency (EPA) is to establish pesticide tolerances on the amount of a pesticide chemical residue a food can contain. The Food and Drug Administration (FDA) is responsible for enforcing those tolerances for domestic foods shipped in interstate commerce and foods imported into the United States (U.S.).*

This report summarizes the results of FDA's pesticide monitoring program for Fiscal Year (FY) 2019. The findings show that the levels of pesticide chemical residues measured by FDA in the U.S. food supply are generally in compliance with EPA pesticide tolerances.

FDA employs a three-fold strategy to enforce EPA's pesticide tolerances in human and animal foods. In its regulatory pesticide residue monitoring program, FDA selectively monitors a broad range of domestic and import commodities for residues of over 800 different pesticides and selected industrial compounds. FDA may also carry out focused sampling surveys for specific commodities or selected pesticides of special interest. In addition, FDA monitors the levels of pesticide chemical residues in foods prepared for consumption in its Total Diet Study (TDS), an ongoing program that monitors contaminants and nutrients in the average U.S. diet.

In FY 2019 (October 1, 2018 through September 30, 2019), FDA analyzed 4,327 human food samples (1,258 domestic and 3,069 import samples) in its regulatory monitoring program. FDA collected domestic human food samples from 45 states and Puerto Rico and import human food samples from 84 countries.

FDA found that 98.7% of domestic and 89.1% of import human foods were compliant with federal standards. No pesticide chemical residues were found in 42.4% of the domestic and 49.4% of the import samples.

In FY 2019, FDA also analyzed 365 animal food samples (127 domestic and 238 import samples) for pesticides. The Agency found that 98.4% of domestic and 95.4% of import animal food samples were compliant with federal standards. No pesticide chemical residues were found in 40.9% of the domestic and 43.7% of the import animal food samples.

In some human food commodity groups, the violation rate was higher for import samples. The higher violation rate affirms the validity of the sampling design in targeting import commodities more likely to contain violative pesticide chemical residues, and the countries more likely to export them. Factors considered in targeting import commodities include past problem areas, findings from state and federal monitoring, and foreign pesticide usage data. For the FY 2019 report, FDA performed a supplemental analysis to determine if food

* With the exception of meat, poultry, *Siluriformes* fish, including catfish, and certain egg products regulated by the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA).

commodities with a violation rate less than 10 percent but with a significant difference between domestic and import violation rates also warrant increased sampling in the future.

In FY 2019, FDA conducted pesticide analyses for 153 domestic milk, shell eggs, honey, and game meat samples for the "Domestically Produced Animal-Derived Foods" assignment. No violative pesticide residues were found in any of the animal-derived foods, and 88.9% of the samples contained no residues.

Glossary and Abbreviations

TERM	DEFINITION
Action level	Food or feed may contain a pesticide chemical residue from sources of contamination that cannot be avoided by good agricultural or manufacturing practices, such as contamination by a pesticide that persists in the environment. In the absence of an EPA tolerance, or tolerance exemption, FDA may establish an "action level" for such unavoidable pesticide chemical residues. An action level is a recommended level of a contaminant not to exceed. An action level is not legally binding, and FDA may take enforcement action on a case-by-case basis whether a contaminant is below, at, or above an action level. (http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm077969.htm)
Agency	U.S. Food and Drug Administration
APEC	Asia-Pacific Economic Cooperation
CFR	U.S. Code of Federal Regulations
CFSAN	FDA Center for Food Safety and Applied Nutrition
Codex	Codex Alimentarius Commission
CVM	FDA Center for Veterinary Medicine
Domestic sample	Sample of a commodity produced and held for sale in the U.S.
DWPE	Detention Without Physical Examination
EPA	U.S. Environmental Protection Agency
FACTS	FDA Field Accomplishment and Compliance Tracking System database
FDA	U.S. Food and Drug Administration
FFDCA	Federal Food, Drug, and Cosmetic Act
FSCF	Food Safety Cooperation Forum
FSIS	USDA Food Safety and Inspection Service
FY	Fiscal Year
Import sample	Sample of products, which originate from another country, collected while the goods are in import status.
JIFSAN	Joint Institute for Food Safety and Applied Nutrition

LOD	Limit of Detection – The minimum concentration of a pesticide chemical residue that can be reliably distinguished from zero.[1]
LOQ	Limit of Quantitation – The minimum concentration of a pesticide chemical residue that can be quantified with acceptable precision.[1]
MOU	Memorandum of Understanding
MRL	Maximum Residue Level
MRM	Multiresidue Method – FDA pesticide method designed to analyze multiple pesticide chemical residues during a single analysis.
No-tolerance violation	Pesticide chemical residue found at, or above, the LOQ for pesticides in a commodity in which EPA has not established a tolerance for that particular pesticide/commodity combination or a tolerance exemption.
Over-tolerance violation	Pesticide chemical residue found at a level above an EPA tolerance.
ORA	FDA Office of Regulatory Affairs
PDP	USDA Pesticide Data Program
PPB	Parts per billion – residue concentration equivalent to microgram/kilogram
PPM	Parts per million – residue concentration equivalent to milligram/kilogram
SPS	Sanitary and Phytosanitary
SRM	Selective Residue Method – FDA pesticide method designed to analyze selected pesticide chemicals or a single pesticide chemical.
TDS	Total Diet Study
Tolerance	The EPA-established maximum residue level of a specific pesticide chemical that is permitted in or on a human or animal food in the United States. The tolerances are listed in 40 CFR Part 180 – Tolerances and Exemptions for Pesticide Chemical Residues in Food.
Trace level	Residue level less than the LOQ but greater than, or equal to, the LOD
USDA	U.S. Department of Agriculture
WTO	World Trade Organization

FDA Pesticide Residue Monitoring Program

Three federal government agencies share responsibility for the regulation and oversight of pesticide chemical residues in or on food. The U.S. Environmental Protection Agency (EPA) registers (i.e., approves) the use of pesticides and establishes tolerances for pesticide chemical residues in or on food resulting from the use of the pesticides. Tolerances are the EPA-established maximum residue levels (MRLs) of a specific pesticide chemical that is permitted in or on a human or animal food in the United States.[2] EPA also provides a strong U.S. preventive controls program by licensing pesticide applicators, conducting pesticide use inspections, and establishing and enforcing pesticide labeling provisions. The Food and Drug Administration (FDA) enforces tolerances in both import and domestic foods shipped in interstate commerce, except for meat, poultry, *Siluriformes* fish, including catfish, and certain egg products for which the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) is responsible. FDA also monitors pesticide chemical residue levels in commodities representative of the U.S. diet by carrying out market basket surveys under the Total Diet Study (TDS).

Regulatory Monitoring and Enforcement

FDA samples individual lots of domestically produced and imported foods and analyzes them to determine whether they contain pesticide chemical residues that are "unsafe" within the meaning of the Federal Food, Drug, and Cosmetic Act (FFDCA). This activity is carried out pursuant to the enforcement of tolerances established by EPA and includes the monitoring of food for residues of cancelled pesticides used in the past that persist in the environment, which may be addressed by FDA action levels. Domestic samples of foods produced and held for sale in the U.S. are typically collected close to the point of production in the distribution system, e.g., at growers, packers, and distributors. Import samples are collected when products are offered for entry into U.S. commerce. Because the EPA tolerances are established primarily for raw agricultural commodities, the emphasis of FDA's regulatory sampling is on the unwashed, whole (unpeeled) raw commodity; however, some processed foods are also sampled.

FDA may take regulatory action against food commodities containing pesticide chemical residues when they are found:

- at a level above an EPA tolerance for the pesticide/commodity combination, or
- in a commodity for which EPA has not established a tolerance or a tolerance exemption for that particular pesticide/commodity combination ("no tolerance" violations).

Foods may contain a pesticide chemical residue from sources of contamination that cannot be avoided by good agricultural or manufacturing practices, such as contamination by a pesticide that persists in the environment. FDA may establish an "action level" for unavoidable residues that do not have a tolerance or tolerance exemption. The action level is not legally binding, but FDA monitors unavoidable residues and may take enforcement action on a case-by-case basis, considering the action level and other factors.

For domestic foods, FDA may issue Warning Letters to the responsible growers and seek other sanctions such as seizure to remove the food from commerce or injunction to correct the cause of the violation. Shipments of import food commodities may be refused entry into U.S. commerce. The responsible firm(s) and product(s) may be placed on an import alert under "Detention Without Physical Examination," or DWPE, which may be invoked for future shipments of that firm's commodity based on the finding of a single violative shipment. Section 801 of the FFDCA authorizes FDA to refuse admission of regulated articles that appear to be adulterated or misbranded. Typically, the information to make this determination is obtained by physical examination of the entry, although it is not required. For example, entries of imported foods with a violative history would likely create the appearance of adulteration under the FFDCA for future shipments, based on the results obtained from previous examinations of the same foods that were found to contain violative pesticide residues. DWPE can be applied to a product or products from specific growers, manufacturers, or shippers, and may extend to a geographic area or country if the problem is demonstrated to be sufficiently broad-based.

FDA's import alerts describe firms and products currently subject to DWPE for pesticide chemical residues and other food-related violations. There are currently four import alerts that address food products that are subject to DWPE for pesticides:

- Import Alert 99-05: "Detention Without Physical Examination of Raw Agricultural Products for Pesticides"
- Import Alert 99-08: "Detention Without Physical Examination of Processed Human and Animal Foods for Pesticides"
- Import Alert 99-14: "Countrywide Detention Without Physical Examination of Raw Agricultural Products for Pesticides"
- Import Alert 99-15: "Countrywide Detention Without Physical Examination of Processed Foods for Pesticides"

Growers, manufacturers, and shippers that have products subject to DWPE within an import alert may be asked to provide evidence of compliance for each lot of product exported to the United States. This procedure places the burden of demonstrating product compliance with U.S. tolerances for pesticide chemical residues on the importer of record before the product can be released into domestic commerce. Firms can request removal of their product(s) from DWPE under an FDA import alert by petitioning the Agency and providing evidence establishing that the conditions that gave rise to the appearance of a violation have been resolved and that there is sufficient evidence for the Agency to have confidence that future entries will be in compliance with the FFDCA. Generally, a minimum of five consecutive non-violative commercial shipments, as demonstrated by providing FDA with acceptable reports of private laboratory analyses, as well as an effective, detailed approach to addressing the problem, is provided to support the corrective actions and removal of a grower's, manufacturer's, or shipper's product from DWPE.

Regulatory Monitoring Program Sampling Design

The goal of FDA's pesticide residue monitoring program is to carry out selective monitoring to achieve an adequate level of consumer protection. FDA samples are primarily of the surveillance type, meaning there is no specific prior knowledge or evidence that a particular food shipment contains illegal residues. However, FDA's monitoring is not random or statistically designed; rather, emphasis is given to the sampling of certain commodities. Commodity choice is based upon multiple factors, including:

- most frequently consumed or imported;
- commodities and places of origin with a history of violations;
- size of shipments;
- analysis of past problem areas;
- commodity/pesticide findings from state, USDA, and FDA monitoring;
- foreign pesticide usage data and regional intelligence on pesticide use;
- dietary significance of the food;
- volume and product value of individual commodities of domestic food produced and entered into interstate commerce and of import food offered for entry into the United States;
- origin of imported food; and
- chemical characteristics and toxicity of the pesticide(s) used.

One important consideration when designing the FDA pesticide residue monitoring program for human foods is the distinction between domestic and import commodities. Historically, the violation rate of import samples is 3-5 times higher than the rate for domestic samples. For example, in FY 2012-2018 the violation rate for domestic samples ranged from 0.9-3.8%, whereas the rate for import samples ranged from 9.4-12.9%. Because the violation rate of import samples is higher than for domestic samples, FDA allocates more resources towards testing import compared with domestic commodities. Typically, import commodities comprise about 70% of all samples analyzed each year.

In addition to increased sampling of import commodities, FDA targets specific commodities and countries that might warrant special attention based upon historically high violation rates and trends. FDA also utilizes available foreign pesticide usage data and data from the USDA's Pesticide Data Program (PDP), a statistically representative survey of pesticide residues in selected food commodities, to develop its sampling program (https://www.ams.usda.gov/datasets/pdp).

Other federal agencies and several states have their own monitoring programs for pesticides. Through collaboration and agreements, they provide FDA information and data on violative samples found in domestic commerce (see Cooperative Arrangements and International Activities section). FDA leverages these data to focus its resources where they are most efficiently and effectively used.

Sampling levels and bias for particular import or domestic commodities can vary significantly from year to year. Pesticide applications are modified in response to changing weather patterns, new or re-emergent pests, or developed resistance to pesticides. Targeted commodities may not be the largest imports by volume from a particular country.

A high violation rate for a targeted commodity does not mean that a country's overall violation rate for all commodities is high; rather, it affirms FDA's sampling design to select commodities and production sources that are likely to be higher risk.

In the early 1990s, FDA conducted statistically based, comprehensive incidence and level monitoring studies of four major foods and published the results.[3,4] Aside from these surveys, FDA has not attempted to develop a monitoring program that would be statistically based (i.e., based on incidence and level monitoring). The current pesticide sampling program, coupled with broad-based enforcement strategies for imports, allows FDA to achieve the program's main objective of consumer protection. Incidence and level monitoring data are available from FDA's TDS program and the USDA PDP.

Focused Sampling

In addition to samples collected for routine regulatory monitoring, FDA may conduct special "focused sampling" assignments to target specific food commodities for analysis. Focused sampling is generally used to follow up on suspected problem areas or to acquire residue data on selected commodities and/or selected pesticides, not usually or previously covered during regulatory monitoring. Typically, samples collected for a focused sampling assignment are analyzed using routine pesticide procedures; however, in some cases the samples are analyzed for targeted residues of interest.

Animal Food

In addition to monitoring food for human consumption, FDA samples and analyzes domestic and imported animal foods for pesticide chemical residues. FDA's Center for Veterinary Medicine (CVM) directs this portion of the Agency's surveillance program via its Animal Food Contaminants Program. CVM's program focuses on animal food that is consumed by livestock and poultry animals that ultimately become or produce food for human consumption, although some pet food samples are also included.

Analytical Methods and Pesticide Coverage

To analyze large numbers of samples with unknown pesticide treatment history, FDA uses multi-residue methods (MRMs) capable of simultaneously determining many different pesticide chemical residues. These MRMs are also able to detect many metabolites, impurities, and alteration products of pesticides, as well as selected industrial chemicals. In addition, FDA uses selective residue methods (SRMs) that target specific pesticides. SRMs are sometimes needed to analyze pesticides that are not adequately extracted or detected using standard MRMs or to target specific pesticide/commodity combinations. FDA pesticide SRMs are optimized to determine one or several specific pesticide chemical residues in foods. They are more resource intensive and therefore employed more judiciously. The complete list of pesticides analyzed in FY 2019 is provided in Appendix A.

FDA pesticide methods can detect approximately 85 percent of the pesticides with current or revoked EPA tolerances in Title 40 of the U.S. Code of Federal Regulations (CFR) part 180, as well as more than 400 other pesticide chemical residues that have no EPA tolerance.[†] By testing for pesticides without EPA tolerances, FDA provides protection against pesticides that do not have EPA approval. FDA continues to expand the scope of its analytical testing as new pesticides are registered by EPA, but acknowledges that some pesticides with EPA-established tolerances are not part of the current FDA testing scope, and FDA does not know the extent to which exposure to these pesticides may occur in the foods that FDA regulates.

The lower limit of residue measurement in FDA's determination of a specific pesticide is well below typical tolerance levels, which range from 0.01 to over 100 parts per million (ppm). Most pesticides analyzed can be quantified at FDA's default limit of quantitation (LOQ) of 0.01 ppm.[5] Residue levels detected above the limit of detection (LOD) but below the LOQ are designated as "trace" values.

FDA conducts ongoing research to update its pesticide residue monitoring program. This research includes testing the behavior of new or previously untested pesticides through existing analytical methods, as well as developing new methods to improve efficiencies and detection capabilities. Newer extraction procedures and more sensitive detection techniques have increasingly replaced older methods, allowing for a greater breadth of pesticide coverage.

FDA Total Diet Study

An important complement to FDA's regulatory pesticide residue monitoring program is the TDS program. TDS monitors levels of pesticide chemicals, toxic and nutritional elements, industrial chemicals, and radionuclides in foods representing the totality of the American diet. TDS is distinct from FDA's regulatory pesticide residue monitoring program. Regulatory monitoring determines pesticide chemical residues primarily in raw commodities, but TDS monitors foods prepared table-ready for consumption. TDS foods are analyzed at levels 10-100 times lower than the regulatory monitoring program, with residue levels as low as 0.1 parts per billion (ppb) reported routinely. Data from TDS can be used to calculate exposures to pesticides, nutrients, and contaminants from the U.S. diet, and to suggest potential areas of focus for FDA's food safety and nutrition programs. TDS pesticide results through FY 2017 were included in the pesticide residue monitoring program reports. TDS pesticide results from FY 2018 on will be posted on the FDA's TDS website, along with additional information about the history and design of the TDS.

Cooperative Agreements and International Activities

FDA collaborates with local, state, federal, and international authorities, leveraging their programs and capacities to maximize the effectiveness of its pesticide program. For example, the FDA and USDA have a Memorandum of Understanding (MOU) in which USDA alerts FDA monthly of presumptive tolerance violations they find in the PDP. FDA

[†] Additional information on EPA tolerances for pesticide ingredients can be found at: https://www.epa.gov/pesticide-tolerances/how-search-tolerances-pesticide-ingredients-code-federal-regulations (accessed July 18, 2021).

uses this information when designing the annual pesticide residue monitoring program, and for directing immediate sample collection efforts, as appropriate.

FDA-State Cooperation

FDA field offices interact with their counterparts in many states to enhance the effectiveness of the Agency's pesticide residue monitoring program. Partnership agreements and MOUs have been established between FDA and many state agencies. These agreements provide for more efficient residue monitoring by both parties by coordinating efforts, broadening coverage, and eliminating duplication of effort. These agreements are specific to each state and take into account available resources. The agreements stipulate how FDA and the state will jointly plan work for collecting and analyzing samples, sharing data, and enforcing compliance follow-up responsibilities for individual commodities of domestic and import products.

International Activities

As an agency of the U.S. government, FDA is subject to the obligations placed on World Trade Organization (WTO) members by the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). FDA's enforcement of pesticide residue tolerances and monitoring activities fall under the definition of sanitary measures within the SPS Agreement. FDA's obligations under this agreement include the requirement that its measures are based on an assessment, as appropriate to the circumstances, of the risk to human and animal life or health, and on international standards except when a more stringent standard can be scientifically supported. The measures must also be applied equally to domestic and import products unless there is scientifically based justification for doing otherwise. Similarly, FDA is subject to obligations arising from several bilateral and multilateral free trade agreements with U.S. trading partners that contain provisions on sanitary measures that are consistent with the provisions of the SPS Agreement.

FDA pesticide residue monitoring activities, for domestic and imported products, are a part of the Agency's overall food safety programs and are in keeping with these international obligations. Additionally, arrangements FDA makes with other countries with respect to food safety programs, and the activities that FDA carries out internationally with respect to food safety, can also affect how the agency's pesticide residue monitoring is conducted.

FDA maintains a number of cooperative arrangements with counterpart agencies in foreign governments including MOUs and Confidentiality Commitments. These arrangements most often contain information-sharing provisions that encompass the ability to share analytical findings about pesticide residues, while protecting any confidential information from external disclosure. Several of these MOUs have specific provisions relating to pesticide residue information sharing or cooperative efforts relating to pesticide residues.

FDA participates regularly in meetings with food safety regulatory agencies of foreign governments in a variety of settings, including bilateral and multilateral fora and in formal and informal technical and policy meetings. FDA carries out bilateral discussions on food safety with our regulatory partners from around the world; pesticide control programs and pesticide residue issues can be subjects for discussion at these meetings. Multilateral fora in which FDA participates include the Food Safety Cooperation Forum (FSCF) of the

Asia-Pacific Economic Cooperation (APEC), which promotes regulatory cooperation in food safety including information sharing on pesticide MRLs.

FDA also participates in the work of international standards-setting organizations, including that of the Codex Alimentarius Commission (Codex). Within Codex, FDA is an active participant in the work of the Codex Committee on Pesticide Residues. In addition, FDA supports the Joint Institute for Food Safety and Applied Nutrition (JIFSAN), which implements several training programs on pesticide risk assessment and the use of pesticide residue analytical methods.

Results and Discussion

This report discusses results of the FY 2019 FDA pesticide residue monitoring program, including routine monitoring and special assignments. Additionally, the report examines data to evaluate import products that may warrant special attention.

In FY 2019, FDA analyzed 4,692 samples under the regulatory monitoring program, of which 4,327 were human foods and 365 were animal foods. Results for the testing of human and animal foods are reviewed under separate headings, "Regulatory Monitoring of Human Foods" and "Regulatory Monitoring of Animal Foods." Sampling and analytical data were obtained from the FDA Field Accomplishment and Compliance Tracking System (FACTS) database. Results in this report represent samples with a collection date occurring in FY 2019.‡

Regulatory Monitoring of Human Foods

The 4,327 human foods analyzed in FY 2019 include results from 153 samples analyzed for the "Domestically Produced Animal-Derived Foods" assignment. Results of the assignment are discussed separately in the section "Focused Sampling"; however, the findings are included in the sample summaries and statistics for human foods.

Of the human foods analyzed for pesticides in FY 2019, 1,258 were domestic samples and 3,069 were import samples. Results for the domestic samples are tabulated in Appendix B, "Analysis of Domestic Human Foods by Commodity Group in FY 2019," and results for the import samples are tabulated in Appendix C, "Analysis of Import Human Foods by Commodity Group in FY 2019." Each appendix includes information on the total number of samples analyzed, the number and percentage of samples with no residues detected, and the number and percentage of violative samples including the nature of the violation (over-tolerance vs. no-tolerance). Results are summarized for all samples analyzed, by commodity groups and by subgroups.

Results

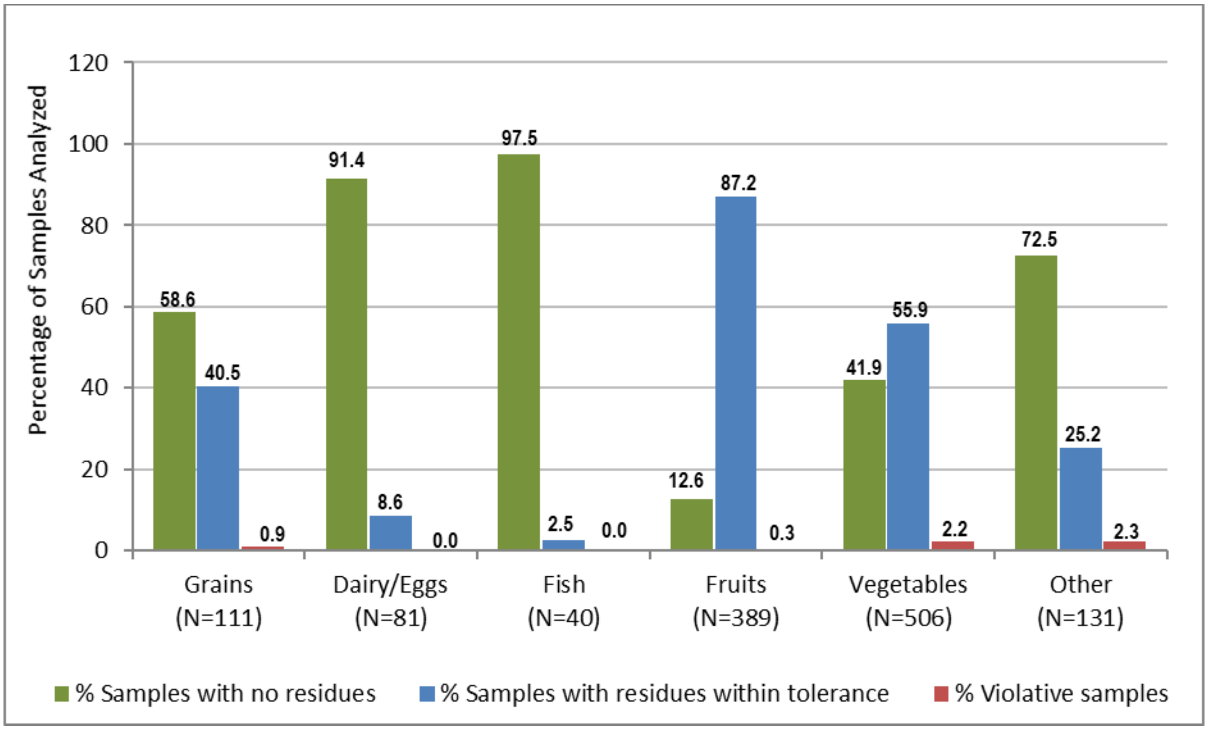
Of the 1,258 domestic samples analyzed in FY 2019, 98.7% were in compliance and 42.4% had no detectable residues (Appendix B). Samples collected under the domestic commodity groups "Fruits" and "Vegetables" accounted for the majority (71.1%) of domestic samples.

Figure 1 summarizes the number of samples analyzed and the residue findings in domestic samples by commodity groups. For the grains and grain products commodity group, no residues were detected in 58.6% of the 111 samples analyzed and 1 sample (0.9%) contained violative residues. In the milk/dairy products/eggs commodity group, 91.4% of the 81 samples analyzed contained no pesticide residues and none were violative. For the fish/shellfish/other aquatic products commodity group, 97.5% of the 40 samples analyzed contained no pesticide residues and none were violative. In the fruits commodity group,

‡ Sample collection and analysis was suspended for 35 days in FY 2019 due to the U.S. government furlough.

no residues were found in 12.6% of the 389 samples analyzed and 1 sample (0.3%) contained violative residues. For the vegetables commodity group, no residues were found in 41.9% of the 506 samples analyzed and 11 samples (2.2%) contained violative residues. In the commodity group of other food products, consisting largely of nuts, seeds, oils, honey, and spices, no residues were found in 72.5% of the 131 samples analyzed and 3 samples (2.3%) contained violative residues.

Figure 1. Results of Domestic Samples by Commodity Group



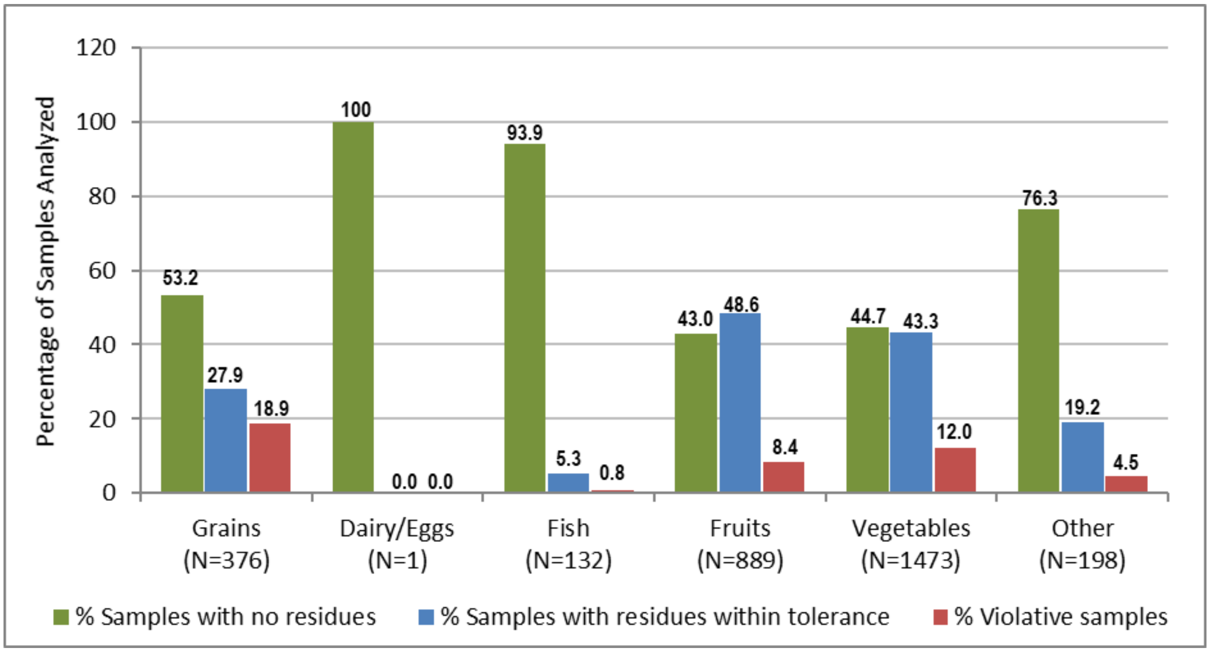
N = Number of samples analyzed for commodity group

Of the 3,069 import samples analyzed in FY 2019, 89.1% were in compliance and 49.4% had no detectable residues (Appendix C). Fruits and vegetables accounted for the majority (77.0%) of import samples.

Figure 2 summarizes the number of samples analyzed and the residue findings in import samples by commodity groups. In the import grains and grain products commodity group, 53.2% of the 376 samples analyzed had no detectable residues and 71 samples (18.9%) contained violative residues. Rice comprised most of the violations in this commodity group; 61 (85.9%) of the grain product violations were rice and rice products. For the import milk/dairy products/eggs commodity group, 1 egg sample was analyzed and contained no violative residues. For the import fish/shellfish/other aquatic products commodity group, 93.9% of the 132 samples analyzed had no detectable residues and 1 sample (0.8%) contained violative residues. For the import fruit commodity group, no residues were detected in 382 (43.0%) of 889 samples analyzed and 75 samples (8.4%) contained violative residues. Of the 1,473 import vegetable commodity group samples analyzed, 44.7% of the 658 samples had no detectable residues and 177 samples (12.0%)

had violative residues. In the commodity group of other import food products, 76.3% of the 198 samples analyzed had no residues detected and 9 samples (4.5%) had violative residues.

Figure 2. Results of Import Samples by Commodity Group

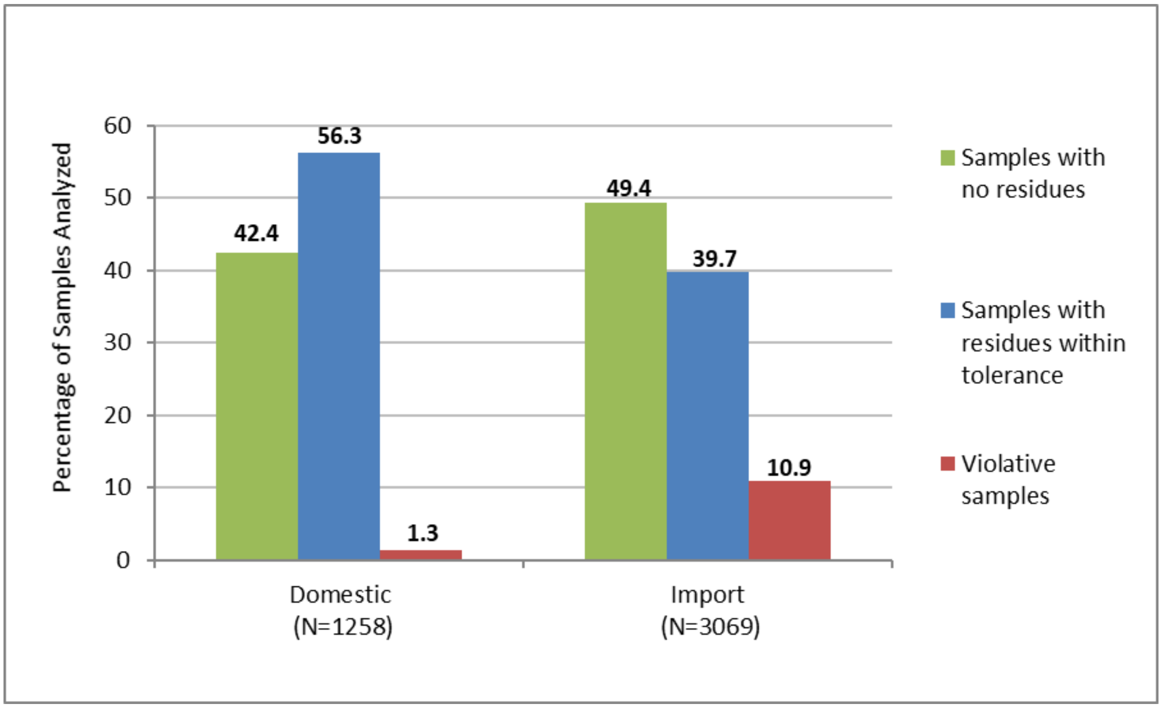


N = Number of samples analyzed for commodity group

Overall Results for Domestic and Import Human Food Samples

In total, 1,258 domestic and 3,069 import human food samples were collected and analyzed for the pesticides listed in Appendix A. No residues were found in 42.4% of domestic samples and 49.4% of import samples (Figure 3). Violative residues were found in 1.3% of the domestic samples and 10.9% of the import samples. The violation rate for both domestic and import samples in FY 2019 was consistent with recent years; for FY 2012-2018 the domestic violation rate ranged from 0.9-3.8% and the import violation rate ranged from 9.4 to 12.9%.

Figure 3. Summary of Results of Domestic and Import Human Food Samples



For many commodity groups, the violation rate was higher for import samples. For example, 18.9% of import grain samples were violative; however, only 0.9% of the domestic grain samples were violative. Similarly, 8.4% of the import fruit samples were violative compared with 0.3% of the domestic fruit samples, and 12.0% of import vegetable samples were violative, whereas 2.2% of domestic samples were violative. In the commodity group of other food products, the violation rate was 4.5% for import samples compared with 2.3% for domestic samples.

Of the 16 domestic violative samples, 13 contained pesticide chemical residues that have no EPA tolerance, i.e., no-tolerance violations, and 4 contained pesticide chemical residues that exceeded an EPA tolerance, i.e., over-tolerance violations. One sample had both no-tolerance and over-tolerance violations for different pesticides contained in the same sample.

Of the 333 import violative samples, 308 had no-tolerance violations and 68 had over-tolerance violations; 43 samples had both no-tolerance and over-tolerance violations for different pesticides contained in the same sample.

Geographic Coverage

Domestic: A total of 1,258 domestic samples were collected from 45 states and Puerto Rico. Table 1 lists the number of domestic samples from each state and territory, in descending order. No domestic samples were collected from the states of Delaware, Hawaii, Nevada, Oklahoma, and Wyoming, or the District of Columbia.

Table 1. Domestic Samples Collected and Analyzed per State/Territory

State/Territory	Samples (N)	State/Territory	Samples (N)
California	178	Maryland	16
Illinois	85	Oregon	13
Minnesota	82	Kentucky	11
Texas	78	Alabama	10
Washington	70	North Carolina	10
Missouri	69	Puerto Rico	10
Kansas	66	Indiana	8
Ohio	58	Arizona	8
New York	55	Idaho	7
Wisconsin	51	Arkansas	6
Massachusetts	42	Mississippi	6
Florida	35	New Hampshire	5
Michigan	33	South Carolina	5
Colorado	31	South Dakota	5
Georgia	25	Connecticut	4
Louisiana	24	Utah	4
Tennessee	22	West Virginia	3
Iowa	20	Maine	2
Nebraska	20	Rhode Island	2
North Dakota	19	Vermont	2
New Jersey	19	Alaska	1
Pennsylvania	18	New Mexico	1
Virginia	18	Montana	1

Imports: A total of 3,069 import samples were collected representing food shipments from 84 countries/economies. Table 2 lists the number of samples and names of countries/economies from which ten or more samples were collected. Table 2a lists from left to right the countries/economies of origin that had fewer than ten samples collected, in order of decreasing number of samples.

Table 2. Import Samples per Country/Economy of Origin for Which Ten or More Samples Were Collected and Analyzed

Country/Economy	Samples (N)	Country/Economy	Samples (N)
Mexico	1221	Australia	24
India	221	Ecuador	24
Canada	211	Colombia	22
China	197	Belgium	21
Chile	95	Korea, Republic Of (South)	21
Thailand	90	Egypt	20
Peru	84	South Africa	20
Guatemala	72	Argentina	19
Vietnam	70	Taiwan	14
Italy	56	Algeria	13
Turkey	50	France	13
United States*	40	Greece	13
Dominican Republic	36	Israel	12
Spain	35	Morocco	12
Costa Rica	34	Lebanon	11
Afghanistan	30	Saudi Arabia	11
Pakistan	30	Indonesia	10
Brazil	28	Myanmar	10
Honduras	27		

*Indicates import samples collected while in interstate commerce.

Table 2a. Countries/Economies of Origin from Which Fewer Than Ten Samples Were Collected and Analyzed

Country/Economy		
Japan	Austria	Armenia
Philippines	Belize	Cameroon
Netherlands	Bulgaria	Denmark
Nicaragua	New Zealand	Guyana
Poland	Syrian Arab Republic	Haiti
Sri Lanka	Yemen	Hungary
Bangladesh	Cambodia	Kazakhstan
El Salvador	Ghana	Kosovo
Germany	Jamaica	Malaysia
United Arab Emirates	Jordan	Mozambique
Bolivia	Montenegro	Panama
Russia	Nigeria	Paraguay
Serbia	Togo	Senegal
Madagascar	Tunisia	Tanzania
Portugal	United Kingdom	Uruguay
Ukraine	Uzbekistan	

Pesticides Detected

In FY 2019, FDA pesticide methods could detect the 812 pesticides and industrial chemicals listed in Appendix A. Of these chemicals, residues of 209 different pesticides were actually found in the samples analyzed. They are listed from left to right in Table 3 in order of frequency of detection along with the number of samples in which they were found. No new pesticides were detected in FY 2019 that had not been detected previously by the FDA regulatory pesticide monitoring program.

Table 3. Pesticides Found in Human Foods in FY 2019 Listed in Order of Frequency

Pesticide (No. samples found)		
Imidacloprid (365)	Boscalid (296)	Azoxystrobin (286)
Pyraclostrobin (234)	Fludioxonil (232)	Thiamethoxam (200)
Acetamiprid (192)	Carbendazim (182)[†]	Tebuconazole (181)
Thiabendazole (180)	Cypermethrin (175)	Chlorpyrifos (159)
Fluopyram (156)	Clothianidin (147)	Chlorantraniliprole (139)
Imazalil (130)	Bifenthrin (127)	Cyprodinil (121)
Difenoconazole (119)	Propiconazole (119)	Lambda-cyhalothrin (104)
Malathion (104)	Metalaxyl (101)	Myclobutanil (100)
Piperonyl butoxide (95)	Pyrimethanil (95)	Permethrin (94)
Methoxyfenozide (90)	Buprofezin (88)	Linuron (80)
Flonicamid (72)	Glyphosate (70)	Fenpropathrin (65)
Trifloxystrobin (65)	Propamocarb (64)	Spinetoram (62)
Fluxapyroxad (61)	Flupyradifurone (60)	Dimethomorph (58)
Tricyclazole (58)	Chlorothalonil (56)	Dimethoate (55)
Fenhexamid (52)	Thiacloprid (49)	Spinosad (48)
Dinotefuran (47)	Isoprothiolane (47)	Fluopicolide (46)
Flutriafol (42)	Mandipropamid (42)	Diflubenzuron (41)
Methamidophos (41)	Chlorpropham (39)	Iprodione (39)
Cyfluthrin (38)	Methomyl (38)	Chlorfenapyr (37)
DCPA (36)	Captan (35)	Indoxacarb (35)
Acephate (34)	Flubendiamide (34)	Spirotetramat (34)
Penthiopyrad (31)	Fenpyroximate, e- (29)	Spirodiclofen (29)
Carbaryl (28)	Pyriproxyfen (28)	Cyantraniliprole (27)
Novaluron (27)	Thiophanate-methyl (27)	Bifenazate (26)
Diazinon (26)	Fenbuconazole (26)	Hexythiazox (24)
2,4-D (23)	Deltamethrin (23)	Pirimiphos methyl (20)

Pesticide (No. samples found)		
Quinoxyfen (20)	Sulfoxaflor (20)	DDT (19)
Fenamidone (19)	Haloxyfop (19)	Profenofos (19)
Famoxadone (18)	Spiromesifen (18)	Metrafenone (17)
Quinclorac (17)	Fipronil (16)	Pyridaben (16)
Ethoxyquin (15)	Phosmet (15)	Prochloraz (15)
Ametoctradin (14)	Diphenylamine (14)	Tetraconazole (14)
Tolfenpyrad (14)	Dichlorvos (13)	Cyromazine (12)
Oxamyl (12)	BAM (11)	Monocrotophos (11)
Triazophos (11)	Triflumizole (11)	Fenvalerate (10)
Prometryn (10)	Propargite (10)	Esfenvalerate (9)
Pyridalyl (9)	Trifluralin (9)	Cyazofamid (8)
Dicloran (8)	Fenobucarb (7)	Pendimethalin (7)
Carbofuran (6)	Clopyralid (6)	Cyflufenamid (6)
Dieldrin (6)	Dodine (6)	Emamectin benzoate (6)
Ethion (6)	Imazamox (6)	MGK 264 (6)
Penconazole (6)	Cyflumetofen (5)	Diafenthiuron (5)
Diuron (5)	Endosulfan (5)	Hexaconazole (5)
Lufenuron (5)	Methoprene (5)	4-CPA (4)
Abamectin (4)	Cymoxanil (4)	Cyproconazole (4)
Etoxazole (4)	Fenpropidin (4)	Kresoxim-methyl (4)
Oxathiapiprolin (4)	Phenylphenol, o- (4)	Quintozene (4)
Atrazine (3)	Chlorpyrifos methyl (3)	Diethofencarb (3)
Epoxiconazole (3)	Formetanate HCl (3)	Metolachlor (3)
Metribuzin (3)	Paclobutrazol (3)	Phorate (3)
Pymetrozine (3)	Pyriofenone (3)	Tebufenozide (3)
Acequinocyl (2)	Ethaboxam (2)	Fenbutatin oxide (2)
Fluoxastrobin (2)	Fluridone (2)	Isoprocarb (2)
MCPA (2)	Phosalone (2)	Phoxim (2)
Procymidone (2)	Quizalofop (2)	Thifluzamide (2)
Thiodicarb (2)	Triadimenol (2)	2,6-DIPN (1)
Acifluorfen (1)	Bendiocarb (1)	Benzovindiflupyr (1)
Biphenyl (1)	Bitertanol (1)	Bromopropylate (1)
Bupirimate (1)	Chlordane (1)	Coumaphos (1)

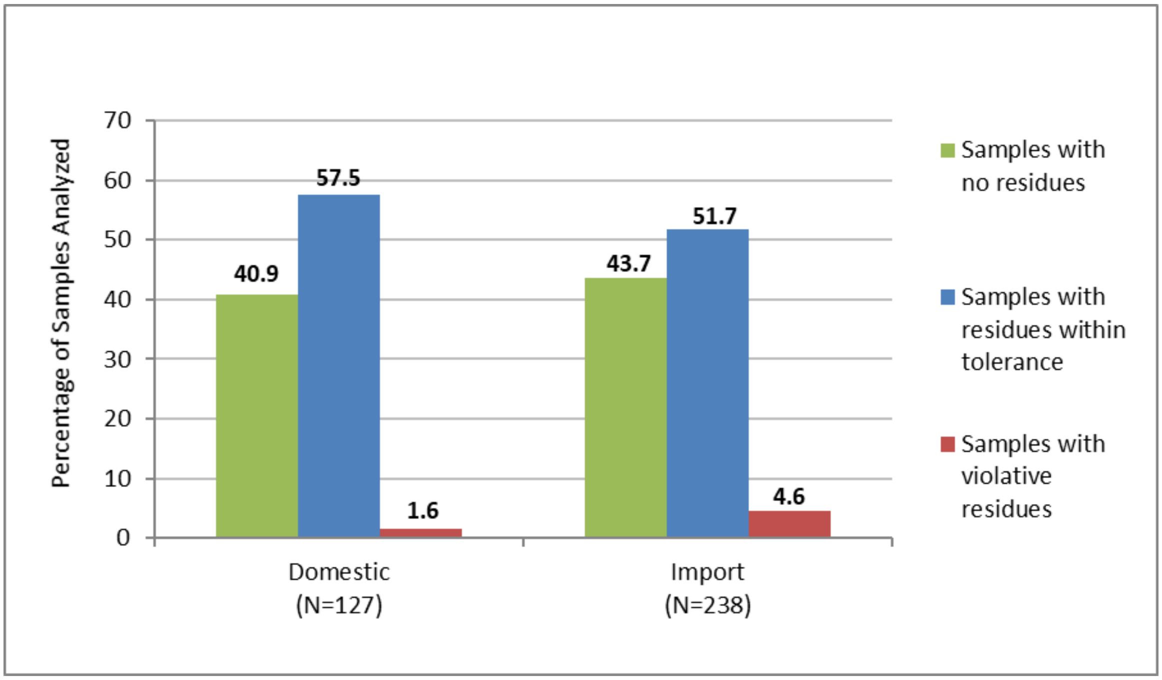
Pesticide (No. samples found)		
Crotoxyphos (1)	DEF (1)	Dicamba (1)
Dichlorprop (1)	Dicofol (1)	Diniconazole (1)
Etofenprox (1)	Fenazaquin (1)	Fenpropimorph (1)
Fluquinconazole (1)	Flusilazole (1)	Flutolanil (1)
Folpet (1)	Heptachlor (1)	Imazapyr (1)
Imazethapyr (1)	Indaziflam (1)	Isocarbophos (1)
Isofetamid (1)	Mepanipyrim (1)	Mepronil (1)
Methiocarb (1)	Oxyfluorfen (1)	Pentachlorophenol (1)
Phenmedipham (1)	Picloram (1)	Propoxur (1)
Resmethrin (1)	Spiroxamine (1)	Teflubenzuron (1)
Tri-allate (1)	Trichlorfon (1)	

† Carbendazim is both a fungicide and a degradant of thiophanate methyl; it was reported under the category of thiophanate methyl in the 2015 and 2016 pesticide residue monitoring reports.

Regulatory Monitoring of Animal Foods

In FY 2019, FDA analyzed 365 animal food samples for pesticides. Figure 4 summarizes the number of samples analyzed and residue findings in domestic and import samples.

Figure 4. Summary of Results of Domestic and Import Animal Food Samples



Of the 365 animal food samples, 127 samples were domestic and 238 samples were imports. No residues were found in 52 (40.9%) of the 127 domestic samples, and 2 samples (1.6%) were violative. Of the 238 import samples, 104 (43.7%) contained no residues and 11 samples (4.6%) were violative. All 13 violations for FY 2019 were no tolerance violations.

The violation rate of 1.6% for domestic animal foods in FY 2019 is consistent with violation rates for recent years FY 2012-2018, i.e., 0.8-3.8%. The violation rate of 4.6% for import animal foods is consistent with FY 2012-2018; i.e., 1.9-5.6%.

Table 4 summarizes residue findings for eight different animal food categories.

Table 4. Summary of Animal Foods by Commodity Type

Commodity Type	Samples Analyzed N	Without Residues N (%)†	Violative Samples N (%)†
Whole and Ground Grains/Seeds	132	85 (64.4)	5 (3.8)
Mixed Livestock Food Rations	55	13 (23.6)	1 (1.8)
Medicated Livestock Food Rations	14	1 (7.1)	0 (0)
Plant Byproducts	74	29 (39.2)	2 (2.7)
Hay and Silage	18	4 (22.2)	3 (16.7)
Animal Byproducts	5	1 (20.0)	0 (0)
Pet Food/Treats	62	20 (32.3)	1 (1.6)
Other Animal Food Ingredients	5	3 (60.0)	1 (20.0)
Totals – All Samples	**365**	**156 (42.7)**	**13 (3.6)**

†Percentage of the number of samples analyzed per commodity type.

Commodities commonly used to feed livestock that produce food for human consumption—i.e., Whole and Ground Grains/Seeds, Mixed Livestock Food Rations, Medicated Livestock Food Rations, Plant Byproducts, and Hay and Silage—comprised the majority (80.3%) of the samples analyzed. Of these 293 samples, 11 (3.8%) were found violative.

Geographic Coverage

Domestic: A total of 127 domestic samples were collected from 32 states. Table 5 lists the number of domestic samples from each state in descending order. No domestic samples were collected from the states of Alaska, Arizona, Connecticut, Georgia, Hawaii, Massachusetts, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, Rhode Island, South Carolina, Utah, Vermont, West Virginia, Wyoming, or the District of Columbia.

Table 5. Domestic Animal Food Samples Collected and Analyzed per State

State/Territory	Samples (N)	State/Territory	Samples (N)
Nebraska	15	Idaho	2
Texas	12	Florida	2
Kansas	11	Iowa	2
California	10	Louisiana	2
Colorado	9	New York	2
Missouri	9	Oklahoma	2
Wisconsin	6	Delaware	1
Tennessee	6	Illinois	1
Ohio	5	Indiana	1
Washington	4	Maryland	1
Pennsylvania	4	Alabama	1
Kentucky	3	Michigan	1
Arkansas	3	Mississippi	1
Minnesota	3	Montana	1
North Dakota	3	South Dakota	1
Virginia	2	Maine	1

Imports: A total of 238 import samples were collected representing animal food samples from 23 countries/economies. Table 6 lists the number of samples and names of the countries/economies of origin from left to right and in order of decreasing number of samples.

Table 6. Import Animal Food Samples Collected and Analyzed per Country/Economy of Origin

Country/Economy	Samples (N)	Country/Economy	Samples (N)
Canada	166	New Zealand	2
Mexico	11	Chile	1
Australia	9	Czech Republic	1
India	9	Denmark	1
Serbia	7	Ethiopia	1
Thailand	5	Guatemala	1
China	4	Honduras	1
Germany	4	Ireland	1
United States*	4	Poland	1
Norway	3	United Kingdom	1
Argentina	2	Vietnam	1
France	2		

* Indicates import samples collected while in interstate commerce

Pesticides Detected

All animal foods were analyzed for 812 different pesticides and industrial chemicals using the FDA pesticide MRMs (Appendix A). The glyphosate SRM was used to test 107 (45 domestic and 62 import) animal food samples for glyphosate and glufosinate and the acid herbicides SRM was used to test 150 samples (39 domestic and 111 import) for the presence of acid herbicides. In FY 2019, residues of 92 different pesticides were found in the 365 animal food samples analyzed. They are listed from left to right in Table 7 in order of frequency of detection along with the number of samples in which they were found.

For all samples, ethoxyquin, glyphosate, malathion, and piperonyl butoxide were the most frequently found pesticide chemicals. Ethoxyquin, while registered as a pesticide for use on pears, is used as an approved food additive for specific uses as a preservative in animal foods,[6] which explains why it is so commonly seen. In FY 2019, ethoxyquin was found in 64 (17.5%) samples of the commodities analyzed. The residue levels in all samples were well below the food additive approved use level of 150 ppm. Glyphosate was detected in 62 (57.9%) of the 107 samples tested, none of which were violative. Malathion was found in 54 (14.8%) of the samples; one sample of imported canola fines had a no tolerance violation. Piperonyl butoxide, a synergist used in combination with pyrethrins for control of insects, was found in 46 (12.6%) samples of the commodities analyzed, none of which were violative.

Overall, for animal food samples analyzed in FY 2019, no pesticide residues were found above tolerances established by the EPA. All violations observed were no-tolerance violations. The pesticides were (n = number of samples): dimethoate (3), glufosinate (3), pirimiphos methyl (2), 4-CPA (1), carbendazim (1), chlorpropham (1), cyproconazole (1), difenoconazole (1), diphenylamine (1), epoxiconazole (1), malathion (1), oxamyl (1), pendimethalin (1), tebuconazole (1), trifloxystrobin (1).

Table 7. Pesticides Found in Animal Foods in FY 2019 Listed in Order of Frequency

Pesticide (No. Samples Detected)		
Ethoxyquin (64)	Glyphosate (62)	Malathion (54)
Piperonyl butoxide (46)	Boscalid (21)	2,4-D (16)
Tebuconazole (16)	Chlorpyrifos methyl (9)	Methoprene (9)
Pirimiphos methyl (9)	Chlorpropham (8)	Carbendazim (7)
Chlorpyrifos (7)	Diflubenzuron (7)	Imidacloprid (7)
Azoxystrobin (6)	Glufosinate (6)	Pendimethalin (6)
Pyraclostrobin (6)	Spinosad (6)	Difenoconazole (5)
Metconazole (5)	Thiamethoxam (5)	Clothianidin (4)
Deltamethrin (4)	Dimethoate (4)	Fluopyram (4)
MCPA (4)	Ametryn (3)	Clopyralid (3)
Cypermethrin (3)	DDT (3)	Flutriafol (3)
Fluxapyroxad (3)	Mandipropamid (3)	MGK 264 (3)
Pyrimethanil (3)	Trifloxystrobin (3)	4-CPA (2)
Ametoctradin (2)	Bifenthrin (2)	Chlorantraniliprole (2)
Dicamba (2)	Diphenylamine (2)	Fenhexamid (2)
Flonicamid (2)	Fludioxonil (2)	Metalaxyl (2)
Methoxyfenozide (2)	Metrafenone (2)	Metribuzin (2)
Permethrin (2)	Propamocarb (2)	Propiconazole (2)
Thiabendazole (2)	Thiophanate-methyl (2)	Acetamiprid (1)
BAM (1)	Benzovindiflupyr (1)	BHC (1)
Bromoxynil (1)	Captan (1)	Carbofuran (1)
Chlordane (1)	Cyproconazole (1)	Cyprodinil (1)
Dichlorvos (1)	Dicloran (1)	Dicrotophos (1)
Dimethomorph (1)	Dinotefuran (1)	Epoxiconazole (1)
Fenamidone (1)	Fenbuconazole (1)	Fluopicolide (1)
Flupyradifurone (1)	Fluridone (1)	Flutolanil (1)
Imazalil (1)	Imazamox (1)	Indoxacarb (1)
Lambda-cyhalothrin (1)	Methomyl (1)	Oxamyl (1)
Penthiopyrad (1)	Phenylphenol, o- (1)	Phosmet (1)
Propargite (1)	Propoxycarbazone (1)	Quinclorac (1)
Resmethrin (1)	Tolfenpyrad (1)	

Focused Sampling

In FY 2019, FDA conducted pesticide analyses for the field assignment "Domestically Produced Animal-Derived Foods" (Animal-Derived Foods) for which selected animal-derived foods were analyzed for pesticides and other chemical contaminants. FDA collected and analyzed 153 samples, consisting of 38 domestic milk, 42 shell eggs, 62 honey, and 11 game meat samples. Results are listed in Table 8.

Table 8. Pesticides Found in Samples Analyzed for the Animal-Derived Foods Assignment

<table>
<tr><th>Commodity</th><th>Samples Analyzed
N</th><th>Without Residues
N (%)</th><th>Violative Samples
N (%)</th></tr>
<tr><td>Total</td><td>153</td><td>136 (88.9)</td><td>2 (1.3)</td></tr>
<tr><td>Milk</td><td>38</td><td>38 (100)</td><td>0</td></tr>
<tr><td>Eggs</td><td>42</td><td>35 (83.3)</td><td>0</td></tr>
<tr><td>Honey</td><td>62</td><td>53 (85.5)</td><td>2 (3.22)</td></tr>
<tr><td>Bison</td><td>5</td><td>4 (80)</td><td>0</td></tr>
<tr><td>Elk</td><td>2</td><td colspan="2" rowspan="3">No residues found</td></tr>
<tr><td>Rabbit</td><td>2</td></tr>
<tr><td>Venison</td><td>2</td></tr>
</table>

No violative pesticide residues were found in any of the Animal-Derived Food commodities except in honey. One domestic honey sample contained violative residues of flonicamid and flupyradifurone, and one sample had a violative residue of sulfoxaflor. Flupyradifurone, flonicamid, and sulfoxaflor are registered for use on a variety of fruits and vegetables and were likely detected in honey due to inadvertent contamination introduced by bees as they collect nectar from flowers.

Imported Products That May Warrant Special Attention

The design of the FDA pesticide program focuses on products that have a history of violations or are suspected of violations, based on information such as reports from other agencies and pesticide usage data. Historically, the violation rate for import foods is higher than for domestic foods; results from FY 2019 continue that trend.[7] The violation rate for import foods (10.9%) was over 8 times higher than the rate for domestic foods (1.3%). The majority of the violations for import commodities are no-tolerance violations, with approximately 80% of residues with levels < 0.1 ppm. Examination of the FY 2019 pesticide data from the analysis of imported human foods indicates that the commodities listed in Table 9 may warrant increased sampling of import products in the future.

The following criteria were applied to the FY 2019 data to select import commodities that may warrant special attention:

- commodities with at least 20 samples analyzed OR with a minimum of 3 violations, and
- a violation rate of 10% or higher.

Table 9 lists the import commodities analyzed in FY 2019 that meet the above criteria. The commodities are sorted alphabetically and include the total number of samples analyzed and violation rate per commodity.

Some of the commodity counts in Table 9 differ from those found in Appendix C because of differences in the way commodities are grouped. To simplify reporting in Appendix C, similar commodities sometimes have been consolidated; however, in Table 9, those same commodities might be extracted and reported separately. For example, Appendix C indicates FDA analyzed 275 import rice and rice products in FY 2019. Table 9 indicates that rice is flagged for special attention, but only lists 268 samples. The other 7 rice samples from Appendix C have been excluded from Table 9 because they are processed products, e.g., rice flour.

Table 9. Import Commodities That May Warrant Special Attention

Commodity[†]	Samples Analyzed (N)	Violation Rate (%)
Carrot*	49	14.3
Celery*	21	14.3
Chana dal	7	42.9
Cilantro*	71	31.0
Dates	45	22.2
Dragon fruit*	19	26.3
Figs	18	22.2
Kale	17	17.7
Mung beans	32	18.8
Mushrooms and fungi*	47	21.3
Nectarine	7	42.9
Peas*	59	20.3
Pepper, hot*	132	12.1
Pepper, sweet*	52	11.5
Pineapple	30	10.0
Prickly pear*	10	40.0
Radish*	46	21.7
Raisins*	34	11.8
Rice*	268	22.4
Spinach*	36	27.8
Strawberries	41	12.2
String beans*	24	25.0
Taro, Dasheen*	9	77.8
Yam/Sweet potato*	29	10.3

[†]Data listed for the commodities in this table are based upon specific product definitions and may not be directly comparable to product summary subcategories listed in Appendix C.

*Commodity was on the FY 2018 table of import commodities warranting special attention.

Imported Products That May Warrant Special Attention, Supplemental Analysis

For the FY 2019 report, FDA performed a supplemental analysis to determine if food commodities with a violation rate less than 10 percent but with a significant difference between domestic and import violation rates also warrant increased sampling in the future. For this analysis, we included samples that met the following criteria:

- samples were in the FY 2015-2019 dataset,
- at least 30 samples per commodity were collected from FY 2015-2019,
- both import and domestic samples were collected, and
- the import violation rate was greater than or equal to 3 times the domestic violation rate.

A total of 24 commodities were identified that met the above criteria. Of those 24 commodities, 12 commodities had been identified previously as imports warranting special attention, therefore the supplemental analysis did not provide additional information. Table 10 lists the 12 newly identified commodities that met the criteria. Most of the 12 identified commodities were sampled heavily compared to other commodities over the 5-year period, especially imports (e.g., 30–420 samples). Since half the commodities were captured in the annual analysis and significant numbers of samples already are analyzed for most commodities listed in Table 10, the supplemental analysis shows that the Agency's current sampling and analysis strategies capture the commodities that truly warrant special attention. However, for the commodities with import violation rates near 10 percent or where the number of import samples collected is relatively low, an increase in the number of import samples collected may be warranted in future years. As a result of this analysis, the numbers of samples requested for cabbage, lemons, lettuce, and soybeans were increased for FY 2022 sampling.

Table 10. Supplemental Analysis Results: Commodities with Violation Rates Less Than 10% Where Import Violation Rate was Greater Than or Equal to 3 Times the Domestic Violation Rate*

Commodity	Domestic Samples Analyzed (N)	Import Samples Analyzed (N)	Domestic Violation Rate (%)	Import Violation Rate (%)
Lettuce	92	185	2.2	9.7
Cabbage	41	116	2.4	9.5
Lemon	34	80	0	8.8
Peach	276	420	1.5	7.4
Soybeans	435	98	1.2	6.1
Beans, dried	89	318	0	5.4
Potatoes	93	153	0	4.6
Apples	321	200	0.6	4.0
Turnip, parsnip	51	30	0	3.3
Wheat	139	166	0.7	3.0
Olives	37	223	0	1.8
Corn	472	193	0.2	1.6

* Data in this table represent FY 2015-2019. The minimum number of samples deemed sufficient to assess adequacy of sampling and violation rate over a 5-year period was 30 samples per commodity.

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Appendices

Appendix A lists the 812 pesticides and industrial chemicals analyzed using FDA methods in FY 2019. The MRM method is used to analyze the majority of pesticides (781), and two SRMs were used to analyze (1) glyphosate, glufosinate, and their degradation products (glyphosate SRM) and (2) 27 selected acid herbicides (acid herbicides SRM). In addition to these chemicals, FDA analytical procedures detect other metabolites and isomers associated with the pesticides listed in Appendix A.

All residue findings for human foods are summarized in Appendices B (domestic) and C (import). In FY 2019, 137 different domestic human food commodities and 398 different import human food commodities were tested. In both appendices, all commodities have been assigned to the same six commodity groups:

Grains and Grain Products

Milk/Dairy Products/Eggs

Fish/Shellfish/Other Aquatic Products

Fruits

Vegetables

Other Food Products

Commodities are further categorized within each commodity group. For example, the subcategories for domestic commodities listed under the "Grains and Grain Products" commodity group in Appendix B include:

Barley and barley products

Corn and corn products

Oats and oat products

Rice and rice products

Soybeans and soybean products

Wheat and wheat products

Other grains and grain products

Each of these subcategories includes commodities derived from a single agricultural commodity. For example, the subcategory "Wheat and wheat products" includes commodities composed exclusively, or almost exclusively, from wheat, such as whole wheat grain, milled wheat, wheat flour, enriched wheat flour, wheat germ, wheat malt, wheat bran, and wheat gluten.

The subcategories within each commodity group may differ between the appendices for domestic and import commodities. This is because the numbers and kinds of individual commodities available are different for domestic and import commodities. For example, under the "Fruit" commodity group, 44 subcategories are listed for the import samples in Appendix C, but only 17 subcategories are listed for the domestic samples in Appendix B. The additional import "Fruit" subcategories are mostly for fruits not available domestically.

Appendix A. Pesticides and Industrial Chemicals Analyzed by FDA Pesticide Methods in FY 2019

Pesticides		
2,4,5-T	2,4,5-T-methyl ester	2,4-D[1]
2,4-D-methyl ester	2,4-D-sec-butyl ester	2,4-DB[1]
2,4-DB-methyl ester	2,6-Dimethylaniline	2,6-DIPN
3-(hydroxymethylphosphinyl)-propanoic acid[6]	3,4-Dichloroaniline[2]	3,5-Dichloroaniline[3]
4-CPA[1]	Abamectin	Acephate
Acequinocyl	Acetamiprid	Acetochlor
Acibenzolar-S-methyl	Acifluorfen[1]	Acifluorfen-methyl ester
Aclonifen	Acrinathrin	Akton
Alachlor	Alanycarb	Aldicarb
Aldrin	Allethrin	Allidochlor
Ametoctradin	Ametryn	Amicarbazone
Amidithion	Amidoflumet	Aminocarb
Aminopyralid[1]	Amisulbrom	Amitraz
Ancymidol	Anilazine	Anilofos
Aramite	Aspon	Atraton
Atrazine	Azaconazole	Azamethiphos
Azinphos-ethyl	Azinphos-methyl	Aziprotryne
Azocyclotin	Azoxystrobin	BAM[4]
Barban	Beflubutamid	Benalaxyl
Benazolin	Bendiocarb	Benfluralin
Benfuracarb	Benfuresate	Benodanil
Benoxacor	Bentazon	Benthiavalicarb-isopropyl
Benzovindiflupyr	Benzoximate	Benzoylprop-ethyl
Benzyl benzoate	BHC	Bicyclopyrone
Bifenazate	Bifenox	Bifenthrin
Binapacryl	Biphenyl	Bistrifluron
Bitertanol	Bithionol	Bixafen
Boscalid	Bromacil	Bromfenvinphos methyl
Bromfenvinphos-ethyl	Bromobutide	Bromocyclen
Bromophos	Bromophos-ethyl	Bromopropylate
Bromoxynil octanoate	Bromoxynil[1]	Bromuconazole
Bufencarb	Bupirimate	Buprofezin
Butachlor	Butafenacil	Butamifos
Butocarboxim	Butoxycarboxim	Butralin
Butylate	Cadusafos	Cafenstrole
Captafol	Captan	Carbaryl
Carbendazim[5]	Carbetamide	Carbofuran
Carbophenothion	Carbosulfan	Carboxin

Pesticides		
Carfentrazone-ethyl ester	Carpropamid	Chloramben-methyl ester
Chlorantraniliprole	Chlorbenside	Chlorbicyclen
Chlorbromuron	Chlorbufam	Chlordane
Chlordecone	Chlordimeform	Chlorethoxyfos
Chlorfenapyr	Chlorfenethol	Chlorfenprop-methyl
Chlorfenvinphos	Chlorfenvinphos-methyl	Chlorfluazuron
Chlorflurecol-methyl	Chlorimuron-ethyl	Chlormephos
Chlornitrofen	Chlorobenzilate	Chloroneb
Chloropropylate	Chlorothalonil	Chlorotoluron
Chloroxuron	Chlorpropham	Chlorpyrifos
Chlorpyrifos methyl	Chlorthiamid	Chlorthion
Chlorthiophos	Chlozolinate	Chromafenozide
Cinerin	Cinidon-ethyl	Clethodim
Clodinafop-propargyl	Cloethocarb	Clofentezine
Clomazone	Clopyralid[1]	Cloquintocet-mexyl
Clothianidin	Coumaphos	Crimidine
Crotoxyphos	Crufomate	Cumyluron
Cyanazine	Cyanofenphos	Cyanophos
Cyantraniliprole	Cyazofamid	Cyclafuramid
Cycloate	Cycloxydime	Cycluron
Cyenopyrafen	Cyflufenamid	Cyflumetofen
Cyfluthrin	Cyhalofop-butyl ester	Cyhexatin
Cymiazole	Cymoxanil	Cypermethrin
Cyphenothrin	Cyprazine	Cyproconazole
Cyprodinil	Cyprofuram	Cyromazine
Cythioate	Daimuron	Dazomet
DCPA	DDT	DEET
DEF	Deltamethrin	Demephion
Demeton	Desmedipham	Desmetryn
Diafenthiuron	Dialifor	Diallate
Diamidafos	Diazinon	Dicamba[1]
Dicamba methyl ester	Dicapthon	Dichlobenil
Dichlofenthion	Dichlofluanid	Dichlone
Dichlormid	Dichlorobenzene, 1,3-	Dichlorophen
Dichlorprop[1]	Dichlorprop-methyl ester	Dichlorvos
Diclobutrazol	Diclocymet	Diclofop[1]
Diclofop-methyl	Diclomezine	Dicloran
Dicofol	Dicrotophos	Dicryl
Dicyclanil	Dieldrin	Diethatyl-ethyl
Diethofencarb	Difenoconazole	Difenoxuron
Diflovidazin	Diflubenzuron	Diflufenican
Diflufenzopyr[1]	Diflumetorim	Dimefluthrin

Pesticides		
Dimefox	Dimepiperate	Dimethachlone
Dimethachlor	Dimethametryn	Dimethenamid
Dimethipin	Dimethirimol	Dimethoate
Dimethomorph	Dimetilan	Dimoxystrobin
Diniconazole	Dinitramine	Dinobuton
Dinocap	Dinoseb	Dinoseb acetate
Dinoseb-methyl ester	Dinotefuran	Dinoterb acetate
Diofenolan	Diothyl	Dioxacarb
Dioxathion	Diphacinone	Diphenamid
Diphenylamine	Dipropetryn	Disulfoton
Ditalimfos	Dithianon	Dithiopyr
Diuron	DNOC	Dodemorph
Dodine	Doramectin	Drazoxolon
Edifenphos	Emamectin benzoate	Empenthrin
Endosulfan	Endrin	EPN
Epoxiconazole	Eprinomectin	EPTC
Esfenvalerate	Esprocarb	Etaconazole
Ethaboxam	Ethalfluralin	Ethidimuron
Ethiofencarb	Ethiolate	Ethion
Ethiprole	Ethirimol	Ethofumesate
Ethoprop	Ethoxyfen-ethyl	Ethoxyquin
Ethychlozate	Etobenzanid	Etofenprox
Etoxazole	Etridiazole	Etrimfos
Eugenol	Famoxadone	Famphur
Fenamidone	Fenamiphos	Fenarimol
Fenazaflor	Fenazaquin	Fenbuconazole
Fenbutatin oxide	Fenchlorazole-ethyl	Fenclorim
Fenfuram	Fenhexamid	Fenitrothion
Fenobucarb (BPMC)	Fenothiocarb	Fenoxanil
Fenoxaprop-ethyl	Fenoxycarb	Fenpiclonil
Fenpropathrin	Fenpropidin	Fenpropimorph
Fenpyrazamine	Fenpyroximate, e-	Fenson
Fensulfothion	Fenthion	Fenuron
Fenvalerate	Ferimzone	Fipronil
Flamprop-isopropyl	Flamprop-methyl	Flonicamid
Fluacrypyrim	Fluazifop-butyl ester	Fluazifop-p-butyl
Fluazinam	Fluazolate	Fluazuron
Flubendiamide	Flubenzimine	Fluchloralin
Flucycloxuron	Flucythrinate	Fludioxonil
Fluensulfone	Flufenacet	Flufenoxuron
Flufenpyr-ethyl	Flufiprole	Flumetralin
Flumetsulam	Flumiclorac-pentyl	Flumioxazin

Pesticides		
Flumorph	Fluometuron	Fluopicolide
Fluopyram	Fluoranthene	Fluorene
Fluorochloridone	Fluorodifen	Fluoroglycofen
Fluoroimide	Fluotrimazole	Fluoxastrobin
Flupyradifurone	Fluquinconazole	Flurenol-n-butyl ester
Flurenol-methyl ester	Fluridone	Fluroxypyr[1]
Fluroxypyr meptyl	Flurprimidol	Flurtamone
Flusilazole	Flusulfamide	Fluthiacet-methyl
Flutolanil	Flutriafol	Fluvalinate
Fluxapyroxad	Folpet	Fomesafen
Fonofos	Forchlorfenuron	Formetanate
Formothion	Fosthiazate	Fosthietan
Fuberidazole	Furalaxyl	Furametpyr
Furathiocarb	Furilazole	Furmecyclox
Gardona	Glufosinate[6]	Glyphosate[6]
Halauxifen-methyl	Halfenprox	Halofenozide
Haloxyfop[1]	Haloxyfop-methyl	Heptachlor
Heptenophos	Hexachlorobutadiene	Hexachlorophene
Hexaconazole	Hexaflumuron	Hexazinone
Hexythiazox	Hydramethylnon	Hydroprene
IBP	Imazalil	Imazamethabenz[1]
Imazamethabenz-methyl ester	Imazamox[1]	Imazapic[1]
Imazapyr[1]	Imazaquin[1]	Imazasulfuron
Imazethapyr[1]	Imibenconazole	Imidacloprid
Imiprothrin	Indanofan	Indaziflam
Indoxacarb	Ioxynil	Ipconazole
Ipfencarbazone	Iprodione	Iprovalicarb
Isazofos	Isobenzan	Isocarbamid
Isocarbophos	Isodrin	Isofenphos
Isofetamid	Isomethiozin	Isoprocarb
Isopropalin	Isoprothiolane	Isoproturon
Isopyrazam	Isotianil	Isoxaben
Isoxadifen-ethyl	Isoxaflutole	Isoxathion
Ivermectin	Jodfenphos	Karbutilate
Kinoprene	Kresoxim-methyl	Lactofen
Lambda-cyhalothrin	Lenacil	Leptophos
Lindane	Linuron	Lufenuron
Malathion	Maleic hydrazide	Mandestrobin
Mandipropamid	MCPA[1]	MCPA-methyl ester
MCPA-butoxyethyl ester	MCPB[1]	MCPB-methyl ester
Mecarbam	Mecoprop[1]	Mecoprop-methyl ester
Mefenacet	Mefenpyr-diethyl	Mefentrifluconazole

Pesticides		
Mefluidide	Mepanipyrim	Meperfluthrin
Mephosfolan	Mepronil	Meptyldinocap
Mesotrione	Metaflumizone	Metalaxyl
Metaldehyde	Metamifop	Metamitron
Metazachlor	Metconazole	Methabenzthiazuron
Methacrifos	Methamidophos	Methfuroxam
Methidathion	Methiocarb	Methomyl
Methoprene	Methoprotryne	Methoxychlor
Methoxyfenozide	Methyldymron	Metobromuron
Metofluthrin	Metolachlor	Metolcarb
Metominostrobin	Metoxuron	Metrafenone
Metribuzin	Metsulfuron methyl	Mevinphos
Mexacarbate	MGK-264	MGK-326
Mirex	Molinate	Momfluorothrin
Monalide	Monocrotophos	Moxidectin
Myclobutanil	N-acetylglufosinate[6]	Naftalofos
Naled	Naphthalene	Naphthaleneacetamide
Naphthalic anhydride	Naproanilide	Napropamide
Naptalam	Neburon	Nicotine
Nitenpyram	Nitralin	Nitrapyrin
Nitrofen	Nitrothal-isopropyl	Norea
Norflurazon	Novaluron	Noviflumuron
Nuarimol	Octhilinone	Octyldiphenyl PO_4
Ofurace	Orbencarb	Orysastrobin
Oryzalin	Ovex	Oxabetrinil
Oxadiazon	Oxadixyl	Oxamyl
Oxathiapiprolin	Oxpoconazole	Oxydemeton-methyl
Oxydeprofos	Oxyfluorfen	Oxythioquinox
Paclobutrazol	Parathion	Parathion-methyl
PCBs	Pebulate	Penconazole
Pencycuron	Pendimethalin	Penflufen
Pentachlorophenol[1]	Pentanochlor	Penthiopyrad
Pentoxazone	Permethrin	Perthane
Pethoxamid	Phenkapton	Phenmedipham
Phenol	Phenothiazine	Phenothrin
Phenthoate	Phenylphenol, o-	Phorate
Phosalone	Phosfolan	Phosmet
Phosphamidon	Phoxim	Phthalide
Picloram[1]	Picloram-methyl ester	Picolinafen
Picoxystrobin	Pindone	Pinoxaden
Piperalin	Piperonyl butoxide	Piperophos
Pirimicarb	Pirimiphos-ethyl	Pirimiphos-methyl

Pesticides		
Plifenate	Potasan	Prallethrin
Pretilachlor	Probenazole	Prochloraz
Procymidone	Prodiamine	Profenofos
Profluralin	Profoxydim	Prohydrojasmon
Promecarb	Prometon	Prometryn
Pronamide	Propachlor	Propamocarb
Propanil	Propaphos	Propaquizafop
Propargite	Propazine	Propetamphos
Propham	Propiconazole	Propisochlor
Propoxur	Propoxycarbazone	Proquinazid
Prosulfocarb	Prothioconazole	Prothiofos
Prothoate	Prynachlor	Pydiflumetofen
Pymetrozine	Pyracarbolid	Pyraclofos
Pyraclostrobin	Pyraflufen-ethyl	Pyrazon
Pyrazophos	Pyrazoxyfen	Pyrene
Pyrethrins	Pyribencarb	Pyributicarb
Pyridaben	Pyridalyl	Pyridaphenthion
Pyridate	Pyridinitril	Pyrifenox
Pyrifluquinazon	Pyriftalid	Pyrimethanil
Pyrimidifen	Pyriminobac-methyl	Pyriofenone
Pyriproxyfen	Pyroquilon	Pyroxasulfone
Quinalphos	Quinclorac[1]	Quinoclamine
Quinoxyfen	Quintozene	Quizalofop[1]
Quizalofop-ethyl ester	Rabenzazole	Resmethrin
Ronnel	Rotenone	Saflufenacil
Salithion	Schradan	Sebuthylazine
Secbumeton	Sedaxane	Sethoxydim
Siduron	Silafluofen	Silthiofam
Silvex	Silvex-methyl ester	Simazine
Simeconazole	Simetryne	Spinetoram
Spinosad	Spirodiclofen	Spiromesifen
Spirotetramat	Spiroxamine	Sulfallate
Sulfentrazone	Sulfluramid	Sulfotepp
Sulfoxaflor	Sulprofos	Swep
TCMTB	Tebuconazole	Tebufenozide
Tebufenpyrad	Tebupirimfos	Tebutam
Tebuthiuron	Tecnazene	Teflubenzuron
Tefluthrin	Temephos	TEPP
Tepraloxydim	Terbacil	Terbucarb
Terbufos	Terbumeton	Terbuthylazine
Terbutryn	Tetrachlorophenol	Tetraconazole
Tetradifon	Tetramethrin	Tetrasul

Pesticides		
Thenylchor	Thiabendazole	Thiacloprid
Thiamethoxam	Thiazopyr	Thidiazuron
Thifluzamide	Thiobencarb	Thiocyclam
Thiodicarb	Thiofanox	Thiometon
Thionazin	Thiophanate-methyl	Thioquinox
Tiadinil	Tiocarbazil	Tioxazafen
Tolclofos-methyl	Tolfenpyrad	Tolpyralate
Tolyfluanid	Toxaphene	Tralkoxydim
Transfluthrin	Triadimefon	Triadimenol
Tri-allate	Triamiphos	Triapenthenol
Triazamate	Triazophos	Triazoxide
Tributoxy PO_4	Trichlamide	Trichlorfon
Trichlorobenzene, 1,2,4-	Trichloronat	Trichlorophenol
Triclopyr[1]	Triclopyr butoxyethyl ester	Triclosan
Tricyclazole	Tridemorph	Tridiphane
Trietazine	Trifenmorph	Trifloxystrobin
Trifloxysulfuron sodium salt	Triflumizole	Triflumuron
Trifluralin	Triflusulfuron-methyl ester	Triforine
Trimethacarb	Triphenyl PO_4	Tris(1,3-dichloro-2-propyl) PO_4
Tris(beta-chloroethyl) PO_4	Tris(chloropropyl) PO_4	Triticonazole
Tycor	Uniconazole	Valifenalate
Vamidothion	Vernolate	Vinclozolin
XMC	Zoxamide	

[1] Acid herbicide included within the scope of the acid herbicides SRM.
[2] 3,4-Dichloroaniline is a metabolite of multiple pesticides.
[3] 3,5-Dichloroaniline is a metabolite of vinclozolin.
[4] BAM is a degradant of both fluopicolide and dichlobenil.
[5] Carbendazim is both a fungicide and a degradant of thiophanate methyl; it was reported under the category of thiophanate methyl in the 2015 and 2016 pesticide residue monitoring reports.
[6] Glyphosate, glufosinate, and their degradants 3-(hydroxymethylphosphinyl)-propanoic acid and N-acetylglufosinate are within the scope of the glyphosate SRM.

Appendix B. Analysis of Domestic Human Foods by Commodity Group in FY 2019

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Totals - All Domestic Samples	**1258**	**534 (42.4)**	**16 (1.3)**	**4**	**13**
Grains and Grain Products					
Barley and barley products	1	1 (100)	0	0	0
Corn and corn products	26	17 (65.4)	0	0	0
Oats and oat products	14	5 (35.7)	0	0	0
Rice and rice products	20	11 (55.0)	1 (5.0)	1	0
Soybeans and soybean products	20	17 (85.0)	0	0	0
Wheat and wheat products	21	9 (42.9)	0	0	0
Other grains and grain products	9	5 (55.6)	0	0	0
Group Subtotal	**111**	**65 (58.6)**	**1 (0.9)**	**1**	**0**
Milk/Dairy Products/Eggs					
Eggs	42	35 (83.3)	0	0	0
Milk, cream and cheese products	39	39 (100)	0	0	0
Group Subtotal	**81**	**74 (91.4)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Fish and fish products	31	30 (96.8)	0	0	0
Shellfish and Crustaceans	9	9 (100)	0	0	0
Group Subtotal	**40**	**39 (97.5)**	**0**	**0**	**0**
Fruits					
Apple fruit/juice	37	3 (8.1)	0	0	0
Apricot fruit/juice	15	1 (6.7)	1 (6.7)	0	1
Blackberry fruit/juice	18	2 (11.1)	0	0	0
Blueberry fruit/juice	18	4 (22.2)	0	0	0
Cantaloupe	23	5 (21.7)	0	0	0
Cherry fruit/juice	18	0	0	0	0
Grapefruit fruit/juice	22	1 (4.5)	0	0	0
Grape fruit/juice, raisins	43	2 (4.7)	0	0	0
Lemon fruit/juice	12	0	0	0	0
Nectarine fruit/juice	19	2 (10.5)	0	0	0
Orange fruit/juice	28	0	0	0	0
Peach fruit/juice	21	1 (4.8)	0	0	0
Pear fruit/juice	17	5 (29.4)	0	0	0
Plum fruit/juice, prunes	19	1 (5.3)	0	0	0
Strawberry fruit/juice	21	0	0	0	0
Watermelon fruit/juice	8	3 (37.5)	0	0	0
Other fruits/fruit products	50	19 (38.0)	0	0	0

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Group Subtotal	**389**	**49 (12.6)**	**1 (0.3)**	**0**	**1**
Vegetables					
Asparagus	10	6 (60.0)	1 (10.0)	0	1
Broccoli	20	7 (35.0)	1 (5.0)	0	1
Cabbage	20	12 (60.0)	0	0	0
Carrots	21	7 (33.3)	0	0	0
Celery	19	1 (5.3)	0	0	0
Cilantro	21	3 (14.3)	3 (14.3)	0	3
Corn	2	2 (100)	0	0	0
Cucumbers	18	11 (61.1)	0	0	0
Eggplant	15	9 (60.0)	1 (6.7)	0	1
Kale	20	3 (15.0)	2 (10.0)	1	1
Lettuce, head	20	6 (30.0)	0	0	0
Mushrooms and truffles	17	10 (58.8)	0	0	0
Onions/leeks/scallions/shallots	21	18 (85.7)	0	0	0
Peas (green/snow/sugar/sweet)	16	3 (18.8)	1 (6.2)	0	1
Peppers, hot	16	6 (37.5)	0	0	0
Peppers, sweet	18	4 (22.2)	1 (5.6)	1	0
Potatoes	21	3 (14.3)	0	0	0
Radishes	18	13 (72.2)	0	0	0
Squash	20	11 (55.0)	0	0	0
Spinach	19	1 (5.3)	0	0	0
String beans (green/snap/pole/long)	19	11 (57.9)	0	0	0
Sweet potatoes	18	4 (22.2)	0	0	0
Tomatoes	18	9 (50.0)	0	0	0
Other bean and pea products	18	9 (50.0)	0	0	0
Other leaf and stem vegetables	39	15 (38.5)	0	0	0
Other root and tuber vegetables	35	25 (71.4)	1 (2.9)	1	1
Other vegetables/vegetable products	7	3 (42.9)	0	0	0
Group Subtotal	**506**	**212 (41.9)**	**11 (2.2)**	**3**	**9**
Other Food Products					
Edible seeds and seed products	10	7 (70.0)	1 (10.0)	0	1
Animal products/byproducts	11	10 (90.9)	0	0	0
Honey	63	54 (85.7)	1 (1.6)	0	1
Peanuts and peanut products	9	4 (44.4)	1 (11.1)	0	1
Other nuts and nut products	38	20 (52.6)	0	0	0
Group Subtotal	**131**	**95 (72.5)**	**3 (2.3)**	**0**	**3**

†Percentage of the number of samples analyzed per commodity group
*Total number of violative samples may not equal sum of samples with over tolerance and no tolerance violations because one sample can contain pesticide chemical residues of both violation types.

Appendix C. Analysis of Import Human Foods by Commodity Group in FY 2019

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Totals - All Import Samples	**3069**	**1516 (49.4)**	**333 (10.9)**	**68**	**308**
Grains and Grain Products					
Barley and barley products	6	3 (50.0)	0	0	0
Breakfast cereals	1	1 (100)	0	0	0
Corn and corn products	15	12 (80.0)	0	0	0
Macaroni and noodles	26	9 (34.6)	8 (30.8)	0	8
Oats and oat products	7	3 (42.9)	0	0	0
Rice and rice products	276	146 (52.9)	61 (22.2)	25	58
Wheat and wheat products	27	15 (55.6)	0	0	0
Other grains and grain products	18	11 (61.1)	2 (11.1)	0	2
Group Subtotal	**376**	**200 (53.2)**	**71 (18.9)**	**25**	**68**
Milk/Dairy Products/Eggs					
Eggs	1	1 (100)	0	0	0
Group Subtotal	**1**	**1 (100)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Aquaculture seafood	88	81 (92.0)	1 (1.1)	0	1
Fish and fish products	24	23 (95.8)	0	0	0
Shellfish and crustaceans	17	17 (100)	0	0	0
Other aquatic animals and products	3	3 (100)	0	0	0
Group Subtotal	**132**	**124 (93.9)**	**1 (0.8)**	**0**	**1**
Fruits					
Ackees, lychees, longans	7	4 (57.1)	0	0	0
Apple fruit/juice	19	3 (15.8)	0	0	0
Apricot fruit/juice	27	9 (33.3)	0	0	0
Avocado fruit/juice	13	10 (76.9)	0	0	0
Bananas, plantains	24	11 (45.8)	1 (4.2)	1	0
Bitter melon	2	0	1 (50.0)	1	0
Blackberry fruit/juice	14	2 (14.3)	2 (14.3)	1	1
Blueberry fruit/juice	44	7 (15.9)	2 (4.5)	1	1
Cantaloupe	12	0	0	0	0
Cherry fruit/juice	8	1 (12.5)	0	0	0
Clementine fruit/juice	1	0	0	0	0
Cranberry fruit/juice	3	1 (33.3)	0	0	0
Currant fruit/juice	1	1 (100)	0	0	0
Date fruit/juice	46	35 (76.1)	10 (21.7)	1	10

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Dragon fruit/juice	19	6 (31.6)	5 (26.3)	0	5
Fig fruit/juice	18	10 (55.6)	4 (22.2)	1	3
Fruit jams, jellies, preserves, syrups, toppings	6	4 (66.7)	0	0	0
Grapefruit fruit/juice	11	1 (9.1)	0	0	0
Grapes fruit/juice, raisins	59	20 (33.9)	6 (10.2)	2	5
Guava fruit/juice	3	3 (100)	0	0	0
Honeydew melon	13	2 (15.4)	0	0	0
Kiwi fruit/juice	2	2 (100)	0	0	0
Lemon fruit/juice	29	2 (6.9)	2 (6.9)	0	2
Lime fruit/juice	62	10 (16.1)	4 (6.5)	0	4
Mango fruit/juice	87	75 (86.2)	4 (4.6)	0	4
Nectarine fruit/juice	7	0	3 (42.9)	0	3
Olives	31	27 (87.1)	1 (3.2)	0	1
Orange fruit/juice	28	16 (57.1)	0	0	0
Papaya fruit/juice	53	8 (15.1)	4 (7.5)	1	3
Peach fruit/juice	27	4 (14.8)	2 (7.4)	0	2
Pear fruit/juice	9	2 (22.2)	2 (22.2)	0	2
Pineapple fruit/juice	30	15 (50.0)	3 (10.0)	0	3
Plum fruit/juice, prunes	18	10 (55.6)	0	0	0
Pomegranate fruit/juice	2	2 (100)	0	0	0
Prickly pear fruit/juice	10	2 (20.0)	4 (40.0)	0	4
Raspberry fruit/juice	18	13 (72.2)	1 (5.6)	0	1
Strawberry fruit/juice	42	11 (26.2)	5 (11.9)	0	5
Watermelon	18	8 (44.4)	0	0	0
Other berry fruit/juice	9	5 (55.6)	0	0	0
Other citrus fruit/juice	4	0	0	0	0
Other fruits and fruit products	15	9 (60.0)	6 (40.0)	3	6
Other melons/vine fruit/juice	2	0	0	0	0
Other pome/core fruit/juice	1	1 (100)	0	0	0
Other sub-tropical fruit/juice	35	30 (85.7)	3 (8.6)	1	3
Group Subtotal	**889**	**382 (43)**	**75 (8.4)**	**13**	**68**
<u>Vegetables</u>					
Artichokes	13	12 (92.3)	0	0	0
Asparagus	38	28 (73.7)	0	0	0
Bamboo shoots	2	2 (100)	0	0	0
Bok choy and Chinese cabbage	3	1 (33.3)	0	0	0
Broccoli	34	16 (47.1)	2 (5.9)	0	2
Brussels sprouts	27	9 (33.3)	0	0	0
Cabbage	29	16 (55.2)	1 (3.4)	1	1
Carrots	49	27 (55.1)	7 (14.3)	0	7
Cassava	8	8 (100)	0	0	0

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Cauliflower	8	7 (87.5)	0	0	0
Celery	23	5 (21.7)	3 (13.0)	0	3
Choyote	24	17 (70.8)	2 (8.3)	0	2
Cilantro	71	11 (15.5)	22 (31.0)	3	21
Collards	2	1 (50.0)	0	0	0
Corn	15	13 (86.7)	1 (6.7)	0	1
Cucumbers	45	9 (20.0)	1 (2.2)	1	0
Eggplant	25	7 (28.0)	3 (12.0)	2	1
Garbanzo beans	24	15 (62.5)	2 (8.3)	0	2
Garlic	31	26 (83.9)	0	0	0
Ginger	43	29 (67.4)	3 (7.0)	0	3
Kale	17	4 (23.5)	3 (17.6)	1	2
Kidney beans	23	20 (87.0)	0	0	0
Lettuce, head	15	7 (46.7)	0	0	0
Lettuce, leaf	13	5 (38.5)	0	0	0
Mung beans	32	17 (53.1)	6 (18.8)	1	5
Mushrooms/truffles/fungi	47	34 (72.3)	10 (21.3)	0	10
Okra	3	1 (33.3)	1 (33.3)	1	0
Onions/leeks/scallions/shallots	72	40 (55.6)	5 (6.9)	1	5
Peas (green/snow/sugar/sweet)	61	22 (36.1)	12 (19.7)	2	10
Peppers, hot	132	23 (17.4)	16 (12.1)	3	15
Peppers, sweet	53	10 (18.9)	6 (11.3)	1	5
Potatoes	35	6 (17.1)	0	0	0
Pumpkins	2	1 (50.0)	0	0	0
Radishes	48	23 (47.9)	10 (20.8)	3	9
Red beets	5	5 (100)	0	0	0
Soybeans	17	9 (52.9)	1 (5.9)	0	1
Spinach	36	9 (25.0)	10 (27.8)	1	9
Squash	53	21 (39.6)	1 (1.9)	0	1
String beans (green/snap/pole/long)	33	12 (36.4)	8 (24.2)	3	7
Sweet potatoes	29	22 (75.9)	3 (10.3)	0	3
Taro/dasheen	9	1 (11.1)	7 (77.8)	0	7
Tomatoes/tomatillos	48	12 (25.0)	3 (6.2)	0	3
Turnips	2	1 (50.0)	0	0	0
Vegetables, breaded, or with sauce	5	3 (60.0)	1 (20.0)	0	1
Vegetables, other, or mixed	33	23 (69.7)	2 (6.5)	0	2
Other bean and pea vegetables (pulses)	74	42 (56.8)	9 (12.2)	0	9
Other cucurbit vegetables	3	0	0	0	0
Other leaf and stem vegetables	51	20 (39.2)	15 (29.4)	4	15
Other root and tuber vegetables	8	6 (75.0)	1 (12.5)	0	1
Group Subtotal	**1473**	**658 (44.7)**	**177 (12)**	**28**	**163**

Commodity Group	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Over Tolerance Violations N	No Tolerance Violations N
Other Food Products					
Baby foods/formula	1	1 (100)	0	0	0
Beverages and beverage bases	1	0	0	0	0
Candy, confections, cocoa products	1	0	0	0	0
Coconut and coconut products	6	6 (100)	0	0	0
Dietary supplement, botanical/herbal	1	1 (100)	0	0	0
Dietary supplement, other	5	3 (60.0)	0	0	0
Flavorings and extracts	1	1 (100)	0	0	0
Food additives, colors, flavorings, extracts	2	0	1 (50.0)	0	1
Honey and honey products	42	39 (92.9)	0	0	0
Nuts, almonds	10	8 (80.0)	0	0	0
Nuts, cashews	9	6 (66.7)	0	0	0
Nuts, other and nut products	19	12 (63.2)	1 (5.3)	1	1
Nuts, peanuts and peanut products	6	3 (50.0)	0	0	0
Nuts, pecans	19	14 (73.7)	1 (5.3)	1	0
Oil, olive	9	9 (100)	0	0	0
Oil, vegetable	3	2 (66.7)	0	0	0
Oil, vegetable, seed stock	1	0	0	0	0
Seeds, edible and seed products	47	40 (85.1)	2 (4.3)	0	2
Spices, capsicums	2	0	1 (50.0)	0	1
Spices	6	3 (50.0)	1 (16.7)	0	1
Tea	2	0	2 (100)	0	2
Other food products	5	3 (60.0)	0	0	0
Group Subtotal	**198**	**151 (76.3)**	**9 (4.5)**	**2**	**8**

†Percentage of the number of samples analyzed per commodity group.
*Total number of violative samples may not equal sum of samples with over tolerance and no tolerance violations because one sample can contain pesticide chemical residues of both violation types.