Pesticide Residue Monitoring Program Fiscal Year 2017 Pesticide Report

U.S. Food and Drug Administration

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

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Acknowledgments

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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 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 met.

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 FY 2017. 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 700 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 2017 (October 1, 2016 through September 30, 2017), FDA analyzed 6,069 human food samples (1,799 domestic and 4,270 import samples) in its regulatory monitoring program. We collected domestic human food samples from 48 states and Puerto Rico and import human food samples from 100 countries.

FDA found that 96.2% of domestic and 89.6% of import human foods were compliant with federal standards. No pesticide chemical residues were found in 52.5% of the domestic and 50.0% of the import samples that we analyzed.

In FY 2017, FDA also analyzed 435 animal food samples (258 domestic and 177 import samples) for pesticides. The Agency found that 98.8% of domestic and 94.4% of import animal food samples were compliant with federal standards. No pesticide chemical residues were found in 40.7% of the domestic and 52.0% of the import animal food samples. Most of the animal food samples were for livestock or poultry; 57 of the samples were pet food.

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

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

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.

In FY 2017, FDA conducted pesticide analyses for two field assignments. In the first assignment, 550 domestic milk, shell eggs, honey, and game meat samples were analyzed for "Domestically Produced Animal-Derived Foods." No residues were found in any of the milk or game meat samples, 87.5% of the egg samples, and 77.3% of the honey samples.

The second assignment conducted in FY 2017 was the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment; the second year of a two-year assignment that began in FY 2016. For this assignment two selective residue methods (SRMs) were used to analyze (1) glyphosate and glufosinate (glyphosate SRM) and (2) 28 selected acid herbicides (acid herbicides SRM). In FY 2017, we analyzed for glyphosate and glufosinate residue levels in 119 samples (including corn, soybeans, milk, and eggs). No samples contained violative levels of glyphosate or glufosinate. In addition, no glyphosate or glufosinate residues were found in milk and egg samples, and no residues were found in 82.1% of the corn samples and 60.0% of the soybean samples.

We determined acid herbicide residue levels in 228 samples, including six grain crops (corn, soybeans, barley, rice, wheat, and oats) and eight root crops (potatoes, turnips, sugar beets, peanuts, carrots, radishes, beets, and sweet potatoes). No residues were found in 89.0% of the samples and none contained violative residues.

In summary, in FY 2017, FDA concluded the Herbicides assignment that began in FY 2016, with a total of 879 samples of corn, soy, milk and eggs analyzed for glyphosate and glufosinate, and 1119 samples of selected grains and root crops analyzed for acid herbicides over the two-year period. Residues of glyphosate or glufosinate were not found in any egg or milk samples. Glyphosate and/or glufosinate residues were found in 59.5% of the corn and soy grain samples, but none exceeded the established tolerances. Acid herbicide residues were found in 11.8% of the samples, with only one residue found to be violative (a residue of 2,4-D was found at 0.127 ppm, exceeding the soybean tolerance of 0.02 ppm).

FDA analyzed 1,064 total samples in the TDS program in FY 2017. No foods contained violative pesticide levels. The most frequently observed pesticide chemical residues are consistent with those reported in FY 2016. Residues of 157 different pesticides were found in the TDS foods, most frequently at trace levels. Of all the residues found in TDS foods, 87% percent were at levels below 0.01 parts per million (ppm), and 2% were above 0.1 ppm.

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
FFDCA	Federal Food, Drug, and Cosmetic Act
FDA	U.S. Food and Drug Administration
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

Term	Definition
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, a quantifiable level 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 foods and domestic foods shipped in interstate commerce, except for meat, poultry, 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 import 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., 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
- when present in a commodity for which EPA has not established a tolerance or a tolerance exemption for that particular pesticide/commodity combination ("no tolerance" violations).

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. 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 invoke 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. Firms may be placed under an import alert (http://www.accessdata.fda.gov/cms_ia/ialist.html) and "Detention Without Physical Examination," or DWPE, may be invoked for future shipments of that firm's commodity based on the finding of a single violative shipment. Congress has authorized FDA to refuse admission of regulated articles based on information that causes an article to appear to violate the FFDCA. Typically, the information is obtained by physical examination of the entry, although physical examination is not required. For example, entries of imported foods with a violative history would likely create an 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 current DWPEs for pesticide chemical residues and other food issues. There are currently four import alerts that address food products that are under 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 under import alert must 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 before the entry can be released into domestic commerce. Firms can have their product(s) removed 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. Additionally, a minimum of five consecutive non-violative commercial shipments, as demonstrated by providing FDA with acceptable reports of private laboratory analyses, is expected in order to remove a grower's, manufacturer's, or shipper's product from an import alert. Removal of a countrywide or geographic area import alert would typically require submission to FDA of an effective, detailed approach to correcting the problem, along with acceptable laboratory reports demonstrating compliance of the commodity in question.

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 2012-2016 the violation rate for domestic samples ranged from 0.9-2.8%, whereas the rate for import samples ranged from 9.4-12.6%. Because the violation rate of import samples is higher than for domestic samples, FDA allocates more of its 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 sampling guidance (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.

Considering the above and available Agency resources, FDA has not attempted to develop a monitoring program that would be statistically based. 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.

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; but in some cases, targeted residues of interest are analyzed.

In the early 1990s, FDA conducted statistically-based, comprehensive incidence and level monitoring studies of four major foods and published the results.[3,4] However, due to resource constraints, incidence and level monitoring was replaced by regulatory-based "focused sampling." Incidence and level monitoring data are provided by FDA's TDS program and the USDA PDP.

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 both multi-residue methods (MRMs) capable of simultaneously determining many different pesticide chemical residues and selective residue methods (SRMs) that target specific pesticide(s). The complete list of pesticides analyzed in FY 2017 is provided in Appendix A.

The FDA MRMs can detect the majority of the approximately 400 pesticides with EPA tolerances in Title 40 of the U.S. Code of Federal Regulations (CFR) part 180, and many others that have no EPA tolerances. These MRMs are also able to detect many metabolites, impurities, and alteration products of pesticides, as well as selected industrial chemicals. 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. SRMs are sometimes needed to analyze pesticides that are not

adequately extracted or detected using standard MRMs or to target specific pesticide/commodity combinations.

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 FDA TDS program. The TDS is distinct from FDA's regulatory pesticide residue monitoring program. The TDS monitors levels of pesticide chemicals in foods representing the totality of the American diet. Data from the TDS are used to calculate exposures to pesticides from the U.S. diet.

Regulatory monitoring determines pesticide chemical residues primarily in raw commodities, but the TDS monitors foods prepared table-ready for consumption. Therefore, depending on the TDS food, the sample may be washed, peeled, and/or cooked before analysis, simulating typical consumer handling. In addition to being analyzed for pesticide chemical residues, TDS foods also are selectively analyzed for toxic and nutrient elements, industrial chemicals, and other chemical contaminants.

Another distinction from FDA's pesticide residue monitoring program is that TDS foods are analyzed at levels 10-100 times lower than the regulatory monitoring program. TDS residue levels as low as 0.1 parts per billion (ppb) are reported routinely.

TDS foods are collected for sampling as "market baskets," with each market basket comprising samples of about 266 different foods that represent the average U.S. consumer's diet, bought from the same retail venues from which consumers buy them. Each year, the market baskets are collected from four different regions of the country, from three different cities in each of those regions. For each region, samples from the three cities are combined to form a single composite prior to analysis.

Analytical results and additional information about the history and design of the TDS can be found on FDA's TDS website.[6] The Agency is in the process of updating the website with additional TDS data.

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 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. 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 2017 FDA pesticide residue monitoring program in accordance with the threefold design of the program, i.e., the regulatory pesticide monitoring program, focused sampling surveys, and the TDS program. Additionally, the report examines data to evaluate import products that may warrant special attention.

In FY 2017, FDA analyzed 6,504 samples under the regulatory monitoring program, of which 6,069 were human foods and 435 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.

Regulatory Monitoring of Human Foods

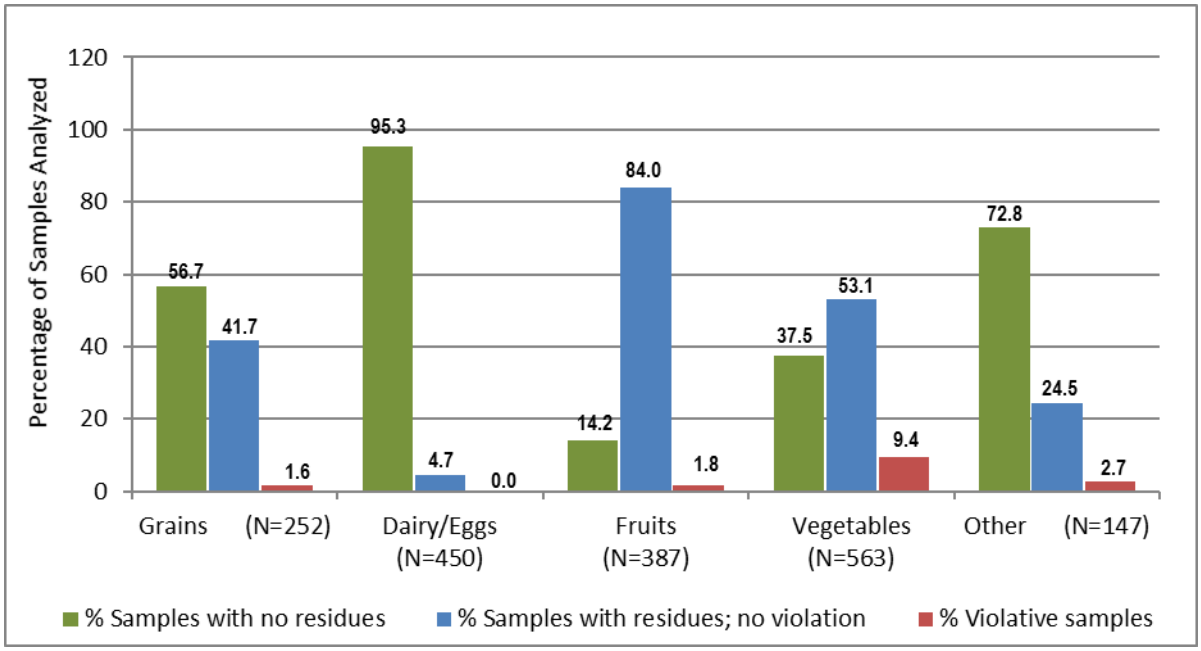
The 6,069 human foods analyzed in FY 2017 include results from two focused sampling assignments: 550 samples were analyzed for the "Domestically Produced Animal-Derived Foods" assignment and 246 samples were analyzed for the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment. Results of each 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 2017, 1,799 were domestic samples and 4,270 were import samples. Results for the domestic samples are tabulated in Appendix B, "Analysis of Domestic Human Foods by Commodity Group in FY 2017," and results for the import samples are tabulated in Appendix C, "Analysis of Import Human Foods by Commodity Group in FY 2017." 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 1,799 domestic samples analyzed in FY 2017, 96.2% were in compliance and 52.5% had no detectable residues (Appendix B). Samples collected under the domestic commodity groups "Fruits" and "Vegetables" accounted for the majority (52.8%) of domestic samples.

Figure 1. Results of Domestic Samples by Commodity Group

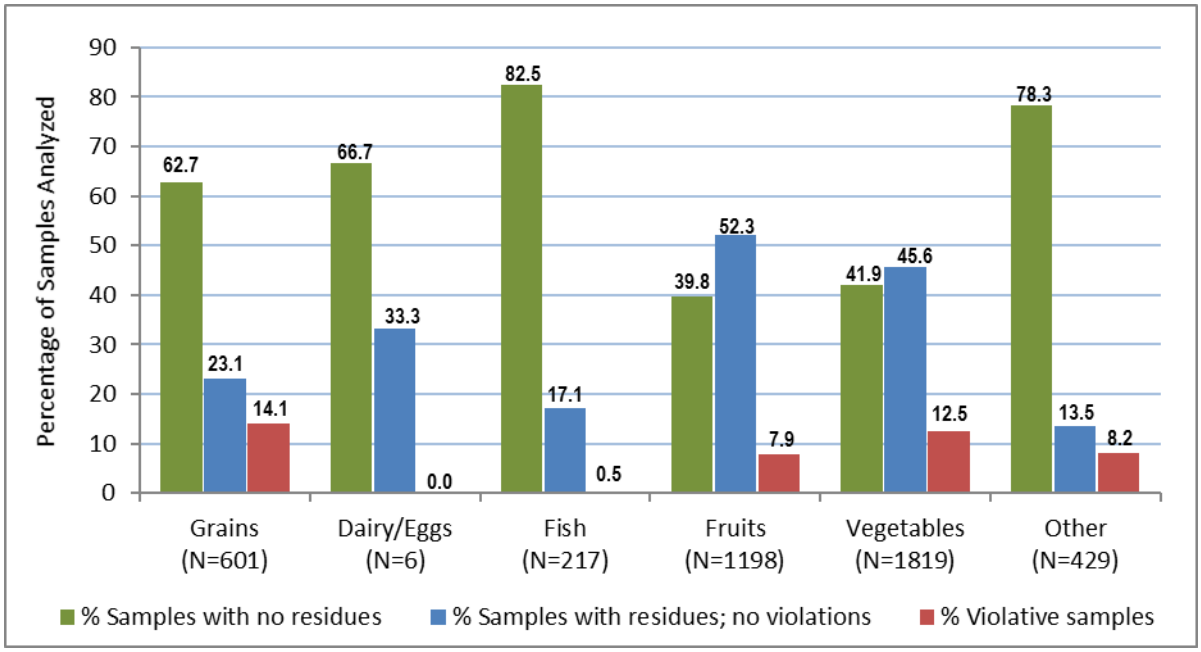


N = Number of samples analyzed for commodity group

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 56.7% of the 252 samples analyzed and 4 samples (1.6%) contained violative residues. In the milk/dairy products/eggs commodity group, 95.3% of the 450 samples analyzed contained no pesticide residues and none were violative. In the fruits commodity group, 387 samples were analyzed; 14.2% contained no residues and 7 samples (1.8%) contained violative residues. For the vegetables commodity group, no residues were found in 37.5% of the 563 samples analyzed and 53 (9.4%) contained violative residues. In the commodity group of other food products, no residues were found in 72.8% of the 147 samples analyzed and only 4 (2.7%) samples contained violative residues.

Of the 4,270 import samples analyzed in FY 2017, 89.6% were in compliance and 50.0% had no detectable residues (Appendix C). Fruits and vegetables accounted for the majority (70.7%) of import samples.

Figure 2. Results of Import Samples by Commodity Group



N = Number of samples analyzed for commodity group

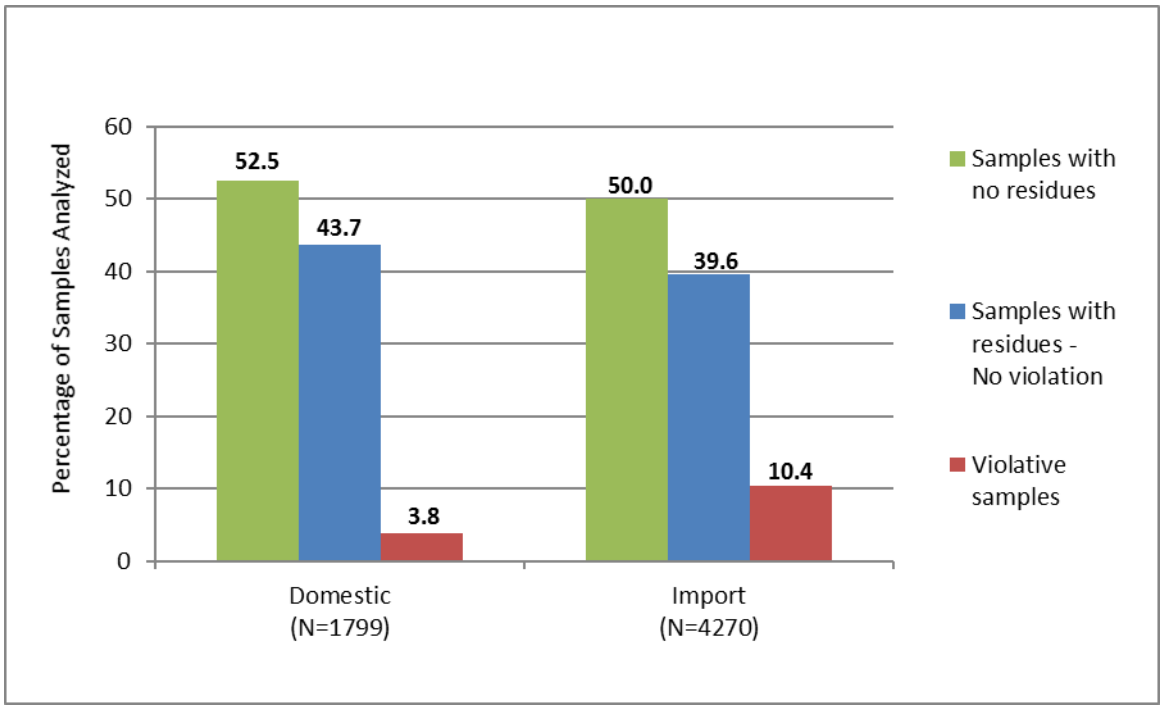
Figure 2 summarizes the number of samples analyzed and the residue findings in import samples by commodity groups. In the import grains and grain products commodity group, 62.7% of the 601 samples analyzed had no detectable residues, and 85 (14.1%) contained violative residues. Rice comprises most of the violations in this commodity group; 78 (91.8%) of the 85 violations were rice and rice products. For the import milk/dairy products/eggs commodity group, no residues were found in 4 (66.7%) of the 6 samples and none had violative residues. For the import fish/shellfish/other aquatic products commodity group, no residues were found in 179 (82.5%) of the 217 samples analyzed, and one sample (0.5%) was found to contain violative residues. For the import fruit commodity group, no residues were detected in 478 (39.8%) of 1,198 samples analyzed and 95 (7.9%) had violative residues. Of the 1,819 import vegetable commodity group samples analyzed, 763 (41.9%) had no residues detected and 227 (12.5%) had violative residues. In the commodity group of other import food products, consisting largely of nuts, seeds, oils, honey, candy, beverages, spices, multi-ingredient products, and dietary supplements, 336 (78.3%) of the 429 samples analyzed had no residues detected, while 35 (8.2%) of the samples had violative residues.

Overall Results for Domestic and Import Human Food Samples

In total, 1,799 domestic and 4,270 import human food samples were collected and analyzed for the pesticides listed in Appendix A. No residues were found in 52.5% of domestic samples and 50.0% of import samples (Figure 3). Violative residues were found in 3.8% of the domestic samples and 10.4% of the import samples. The violation rate for domestic samples was slightly higher in FY 2017 than in recent years; for FY 2012-2016 the violation rate ranged from 0.9-2.8%. The increase in FY 2017 is primarily due to the

higher violation rate of the vegetable commodities group resulting from leafy vegetables such as cilantro (48.3%), kale (25.8%), and leaf lettuce (14.8 %) that were targeted for increased sampling. The import violation rate is consistent with FY 2012-2016, i.e., 9.4-12.6 % for import samples.

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



For several commodity groups, the violation rate was higher for import samples. For example, 14.1% of import grain samples were violative; however, only 1.6% of the domestic grain samples was violative. Similarly, 7.9% of the import fruit samples were violative compared with 1.8% of the domestic fruit samples; and 12.5% of import vegetable samples were violative, whereas 9.4% of domestic samples were violative. In the commodity group of other food products, the violation rate was 8.2% for import samples compared with 2.7% for domestic samples.

Of the 68 domestic violative samples, 64 contained pesticide chemical residues that have no EPA tolerance, i.e., "no-tolerance" violations and 13 contained pesticide chemical residues that exceeded an EPA tolerance, i.e., "over-tolerance" violations. Nine samples had both no-tolerance and over-tolerance violations for different pesticides contained in the same sample.

Of the 443 import violative samples, 427 had no-tolerance violations and 71 had over-tolerance violations; 55 samples had both no-tolerance and over-tolerance violations for different pesticides contained in the same sample.

Geographic Coverage

Domestic: A total of 1,799 domestic samples were collected from 48 states and Puerto Rico. Table 1 lists the number of domestic samples from each state and territory, in descending order.

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

State/Territory	Samples (N)	State/Territory	Samples (N)
California	288	Virginia	17
Texas	131	Utah	16
Washington	110	North Dakota	14
New York	106	New Mexico	12
Kansas	97	Nebraska	12
Wisconsin	81	Alabama	10
Illinois	79	Vermont	10
Ohio	75	Iowa	10
Michigan	73	Arkansas	9
Minnesota	64	Idaho	9
Oregon	61	West Virginia	9
New Jersey	53	Montana	8
Colorado	51	Mississippi	7
Pennsylvania	50	Connecticut	7
Massachusetts	47	North Carolina	7
Missouri	42	Oklahoma	6
Tennessee	29	Delaware	5
Georgia	27	Wyoming	4
Maryland	24	Puerto Rico	4
Kentucky	22	New Hampshire	3
Maine	22	Rhode Island	3
Louisiana	21	Arizona	2
Indiana	20	South Dakota	2
Florida	20	Nevada	1
South Carolina	19		

No domestic samples were collected from the states of Alaska, Hawaii, or the District of Columbia.

Imports: A total of 4,270 import samples were collected representing food shipments from 100 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 the countries/economies of origin that had fewer than ten samples collected.

Table 2. Import Samples Collected and Analyzed per Country of Origin for Countries with Ten or More Samples Collected

Country/Economy	Samples (N)	Country/Economy	Samples (N)
Mexico	1538	Indonesia	23
China	519	Argentina	21
India	304	Russia	21
Canada	295	Costa Rica	19
Thailand	118	United Kingdom	19
Italy	116	Saudi Arabia	18
Chile	105	Japan	16
Turkey	102	Lebanon	16
Guatemala	99	Germany	15
Vietnam	94	Iran	15
Peru	79	Philippines	15
Ecuador	45	El Salvador	14
Korea, Republic Of (South)	44	Bolivia	13
Spain	44	Taiwan	13
United States	41	Afghanistan	12
Pakistan	38	Colombia	12
Dominican Republic	36	Honduras	12
Greece	32	Israel	12
Netherlands	29	Serbia	12
Poland	27	Bangladesh	11
Belgium	25	United Arab Emirates	11
Egypt	25	Burma (Myanmar)	10
France	23		

*Import goods purchased while in U.S. commerce.

Table 2a. Countries from Which Fewer Than Ten Samples Were Collected and Analyzed

Countries/Economies		
Algeria	Haiti	Paraguay
Armenia	Hungary	Portugal
Australia	Iraq	Romania
Austria	Ireland	Sierra Leone
Belize	Ivory Coast	South Africa
Benin	Jamaica	Sri Lanka
Bosnia-Hercegovina	Kazakhstan	Sweden
Brazil	Lithuania	Switzerland
Bulgaria	Madagascar	Syrian Arab Republic
Burkina Faso	Malaysia	Tanzania
Cambodia	Moldova	Togo
Cameroon	Montenegro	Tunisia
Croatia	Morocco	Ukraine
Czech Republic	Mozambique	Uruguay
Denmark	New Zealand	Uzbekistan
Estonia	Nicaragua	Venezuela
Ethiopia	Nigeria	Yemen
Ghana	Panama	Zambia
Grenada		

Pesticides Found

In FY 2017, FDA pesticide methods could detect the 761 pesticides and industrial chemicals listed in Appendix A. Of these chemicals, residues of 221 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. Six pesticide chemical residues that had not been previously detected in the FDA regulatory pesticide monitoring program are flagged with an asterisk.

Table 3. Pesticides Found in Human Foods in FY 2017 Listed in Order of Frequency

Pesticide (No. samples detected)		
Imidacloprid (470)	Boscalid (438)	Azoxystrobin (348)
Carbendazim° (299)	Pyraclostrobin (293)	Fludioxonil (279)
Chlorpyrifos (265)	Thiamethoxam (257)	Tebuconazole (253)
Chlorantraniliprole (239)	Thiabendazole (227)	Acetamiprid (206)
Cypermethrin (203)	Malathion (191)	Bifenthrin (184)
Cyprodinil (179)	Lambda-cyhalothrin (177)	Propiconazole (171)
Flonicamid (160)	Myclobutanil (159)	Chlorothalonil (154)
Clothianidin (145)	Pyrimethanil (137)	Permethrin (136)
Propamocarb (129)	Metalaxyl (127)	Piperonyl butoxide (125)
Difenoconazole (124)	Buprofezin (115)	Spinetoram (109)
Thiophanate-methyl (107)	Tricyclazole (105)	Imazalil (100)
Dimethoate (94)	Trifloxystrobin (91)	Methamidophos (90)
Spinosad (89)	Dimethomorph (82)	Captan (79)
Methoxyfenozide (79)	Fenhexamid (77)	Fenpropathrin (77)
Bifenazate (74)	Iprodione (72)	Isoprothiolane (69)
Acephate (68)	Fluopicolide (67)	DCPA (66)
Fluxapyroxad (66)	Mandipropamid (66)	Linuron (64)
Flubendiamide (60)	Spiromesifen (59)	Ethoxyquin (55)
Carbaryl (54)	Cyflumetofen (53)	Cyfluthrin (53)
Fenamidone (49)	Fenpyroximate, e- (49)	Fluopyram (49)
Flupyradifurone (49)	Spirotetramat (49)	Thiacloprid (49)
Methomyl (48)	Hexythiazox (46)	Dinotefuran (45)
Indoxacarb (44)	Phosmet (44)	Chlorfenapyr (41)
Chlorpropham (41)	Diazinon (38)	Quinoxyfen (38)
Fenbuconazole (37)	Spirodiclofen (37)	Triazophos (37)
Famoxadone (36)	Glyphosate (36)	DDT (34)
Pyriproxyfen (33)	Cyromazine (31)	Novaluron (30)
Ametoctradin (29)	Profenofos (29)	Diflubenzuron (27)
Pirimiphos methyl (25)	Sulfoxaflor (25)	Diphenylamine (24)
Prometryn (24)	BAM (22)	Dichlorvos (22)
Penthiopyrad (22)	Deltamethrin (19)	Propargite (19)
Abamectin (18)	Fipronil (18)	Flutriafol (18)
Monocrotophos (18)	Cyazofamid (17)	Dicloran (17)

Pesticide (No. samples detected)		
Etoxazole (17)	Fenbutatin oxide (17)	Clopyralid (16)
Pendimethalin (16)	Triflumizole (16)	Procymidone (15)
Pymetrozine (15)	Triadimenol (14)	Ethion (13)
Hexaconazole (13)	Dieldrin (12)	Phenylphenol, o- (12)
Pyridaben (12)	Etofenprox (11)	Fenvalerate (11)
Chlorpyrifos methyl (10)	Cyantraniliprole (10)	Kresoxim-methyl (10)
Dodine (9)	Endosulfan (9)	Prochloraz (9)
Carbofuran (8)	Flusilazole (8)	Metrafenone (8)
Metribuzin (8)	Quintozene (7)	Tetraconazole (7)
Atrazine (6)	Cymoxanil (6)	Diafenthiuron (5)
Dicofol (5)	Fluoxastrobin (5)	Pronamide (5)
Coumaphos (4)	Diuron (4)	Epoxiconazole (4)
Fenpropimorph (4)	Fluridone (4)	Isoprocarb (4)
Lufenuron (4)	Metaflumizone (4)	Methoprene (4)
MGK 264 (4)	Paclobutrazol (4)	Phorate (4)
Tebufenozide (4)	Triadimefon (4)	2,4-D (3)
Acibenzolar-S-methyl (3)	Dicamba (3)	Esfenvalerate (3)
Ethoprop (3)	Fenpropidin* (3)	Folpet (3)
Glufosinate (3)	Quinclorac (3)	Thifluzamide* (3)
Ametryn (2)	BHC (2)	Bromopropylate (2)
Chlordane (2)	Cycloate (2)	Emamectin benzoate (2)
Ethirimol (2)	Fenitrothion (2)	Fenobucarb (2)
Fenuron (2)	Flufenoxuron (2)	Formetanate HCl (2)
Methidathion (2)	Oxadixyl (2)	Oxamyl (2)
Parathion methyl (2)	Penconazole (2)	Phosalone (2)
Picoxystrobin (2)	Propoxur (2)	Spiroxamine (2)
Tebufenpyrad (2)	Tetramethrin (2)	Triclopyr (2)
2,6-DIPN (1)	4-CPA (1)	Acetochlor (1)
Azinphos-methyl (1)	Benalaxyl (1)	Chlorfluazuron (1)
Clethodim (1)	Clofentezine (1)	Cyflufenamid (1)
Cyproconazole (1)	Dichlobenil (1)	Dichlofluanid (1)
Diethofencarb (1)	Diniconazole (1)	EPN (1)
Fenamiphos (1)	Fenthion (1)	Fluquinconazole (1)
Flutolanil (1)	Heptachlor (1)	Isocarbophos (1)

Pesticide (No. samples detected)		
Isofetamid (1)	Metaldehyde (1)	Metconazole (1)
Methoxychlor (1)	Metolachlor (1)	Nicotine (1)
Nuarimol (1)	Oxadiazon (1)	Oxathiapiprolin* (1)
Oxpoconazole* (1)	Oxyfluorfen (1)	Phoxim (1)
Pirimicarb (1)	Proquinazid* (1)	Quinalphos (1)
Resmethrin (1)	Sedaxane* (1)	Tetradifon (1)
Trifluralin (1)	Zoxamide (1)	

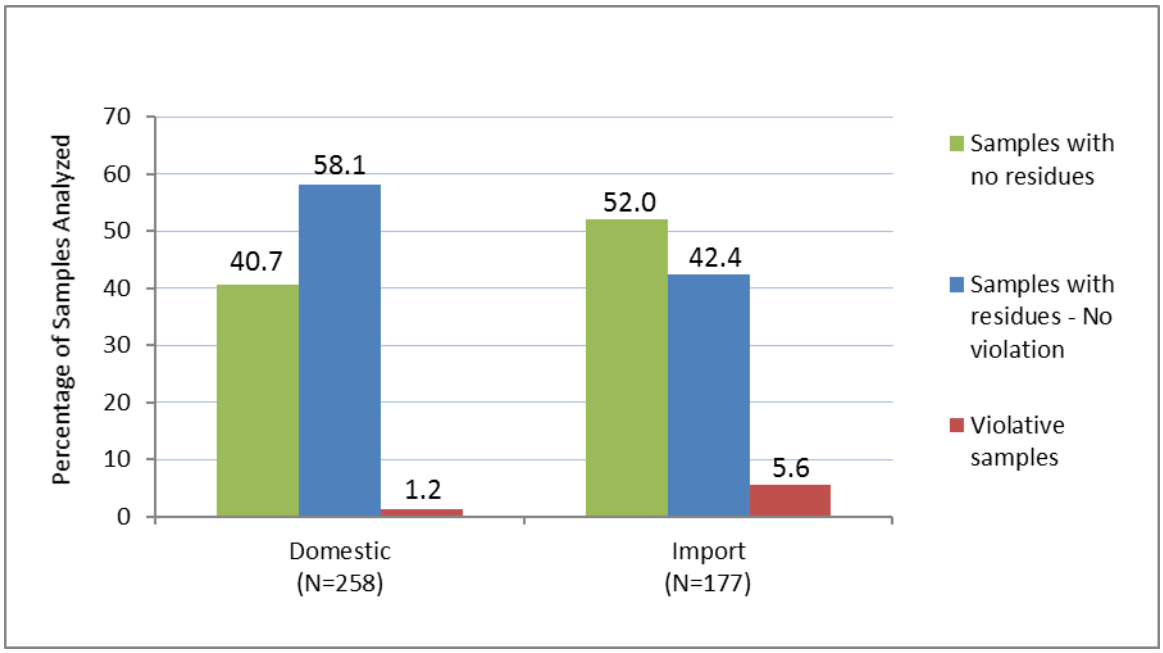
°Carbendazim is both a fungicide and a degradant of thiophanate methyl; it was reported under the category of thiophanate methyl in the 2015 and 2016 pesticide residue monitoring reports.

*Pesticide not found previously in FDA regulatory pesticide residue monitoring program.

Regulatory Monitoring of Animal Foods

In FY 2017, FDA analyzed 435 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 vs. Import Animal Food Samples



Of the 435 animal food samples, 258 samples were domestic, and 177 samples were imports. No residues were found in 105 (40.7%) of the 258 domestic samples, and 1.2% (3 samples) were violative. Of the 177 import samples, 92 (52.0%) contained no residues and 5.6% (10 samples) were violative.

The violation rate of 1.2% for domestic animal foods in FY 2017 is consistent with FY 2012-2016; i.e., 0.8 – 2.3%. The violation rate of 5.6% for import animal foods is slightly higher than FYs 2012-2016; i.e., 1.9 - 4.8%. As with human foods, the violation rates of import animal foods are higher than those of domestic animal foods.

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

Table 4. Summary of Animal Foods Analyzed for Pesticides

Commodity Type	Samples Analyzed N	Without Residues N (%)†	Violative Samples N (%)†
Totals – All Samples	**435**	**197 (45.3)**	**13 (3.0)**
Whole and Ground Grains/Seeds	137	97 (70.8)	1 (0.7)
Mixed Livestock Food Rations	86	8 (9.3)	3 (3.5)
Medicated Livestock Food Rations	33	6 (18.2)	0 (0)
Plant Byproducts	70	34 (48.6)	5 (7.1)
Hay and Silage	5	1 (20.0)	0 (0)
Animal Byproducts	7	4 (57.1)	0 (0)
Pet Food/Treats	57	20 (35.1)	0 (0)
Other Animal Food Ingredients	40	27 (67.5)	4 (10.0)

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

Commodities commonly used to feed livestock that produce food for human consumption comprised 76.1% of the samples analyzed, i.e., Whole and Ground Grains/Seeds, Mixed Livestock Food Rations, Medicated Livestock Food Rations, Plant Byproducts, and Hay and Silage. Of these 331 samples, nine violations (2.7%) were found. The Plant Byproducts category had the highest violation rate, i.e., 5 of 70 samples analyzed (7.1%) were violative, all five were ingredients for pet foods.

All animal foods were analyzed for 730 different chemicals using the FDA pesticide MRMs (Appendix A). In FY 2017, residues of 80 different pesticides were found in the 435 animal food samples analyzed. They are listed in Table 5 in descending order of frequency of detection along with the number of samples in which they were found.

For all samples, ethoxyquin, malathion and piperonyl butoxide were the most frequently found pesticide chemicals. Ethoxyquin, an approved food additive for specific uses as a chemical preservative in animal foods[7], was found in 28.5% (124 samples) of the commodities analyzed. The residue levels of all samples were well below the food additive approved use level of 150 ppm, with the exception of two violative samples, vitamin supplements intended for further mixing into animal foods. Malathion was found in 23.0% (100 samples) of the samples; none were violative. Piperonyl butoxide was found in 10.6% (46 samples) of the samples analyzed. Piperonyl butoxide is exempted from tolerances when used as a synergist with pesticides on growing crops.

Table 5. Pesticides Found in Animal Foods in FY 2017 Listed in Order of Frequency

Pesticide (No. Samples Detected)		
Ethoxyquin (124)	Malathion (100)	Piperonyl butoxide (46)
Diflubenzuron (15)	Azoxystrobin (14)	Chlorpyrifos (14)
Chlorpyrifos methyl (13)	Methoprene (13)	Chlorpropham (10)
Propiconazole (10)	Thiabendazole (10)	MGK 264 (9)
Tebuconazole (8)	Pirimiphos methyl (6)	Boscalid (5)
Pyrimethanil (5)	Dichlorvos (4)	Fluopicolide (4)
Lambda-cyhalothrin (4)	Metalaxyl (4)	Permethrin (4)
Cyfluthrin (3)	Cypermethrin (3)	DEF (3)
Deltamethrin (3)	Dinotefuran (3)	Imidacloprid (3)
Carbendazim (2)	Chlorantraniliprole (2)	Cyprodinil (2)
Difenoconazole (2)	Dimethoate (2)	Dimethomorph (2)
Fenbutatin oxide (2)	Flonicamid (2)	Fludioxonil (2)
Imazalil (2)	Isoprothiolane (2)	Mandipropamid (2)
Phenylphenol, o- (2)	Pyraclostrobin (2)	Thiamethoxam (2)
Thiophanate-methyl (2)	Tricyclazole (2)	Abamectin (1)
Acetamiprid (1)	Ametryn (1)	Atrazine (1)
Benzovindiflupyr (1)	Buprofezin (1)	Clothianidin (1)
Cyproconazole (1)	Cyromazine (1)	DDT (1)
Diazinon (1)	Dicloran (1)	Diuron (1)
Epoxiconazole (1)	Fenhexamid (1)	Fenoxanil (1)
Flupyradifurone (1)	Fluridone (1)	Flusilazole (1)
Flutriafol (1)	Hexythiazox (1)	Methamidophos (1)
Metolachlor (1)	Metrafenone (1)	Myclobutanil (1)
Nicotine (1)	Novaluron (1)	Oxyfluorfen (1)
Prochloraz (1)	Pronamide (1)	Propamocarb (1)
Propargite (1)	Quintozene (1)	Spinosad (1)
Tetraconazole (1)	Trifloxystrobin (1)	

Focused Sampling

In FY 2017, FDA conducted pesticide analyses for two field assignments. The first assignment conducted in FY 2017 was the "Domestically Produced Animal-Derived Foods"[†] (Animal-Derived Foods) assignment for which selected animal-derived foods were analyzed for pesticides and other chemical contaminants. The second assignment conducted in FY 2017 was the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment. The samples collected and analyzed for the Herbicides assignment represent the second year of the two-year assignment that began in FY 2016. For this assignment, two SRMs were used to analyze (1) glyphosate and glufosinate (glyphosate SRM) and (2) 28 selected acid herbicides (acid herbicides SRM) in selected commodities.

Animal-Derived Foods Assignment

In 2017, FDA completed the collection and analysis of 550 samples for the Animal-Derived Foods assignment, consisting of 268 whole milk, 160 shell eggs, 97 honey, and 25 game meat samples. Results are listed in Table 6a.

Table 6a. Pesticides Found in Samples Analyzed for the Animal-Derived Foods Assignment

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)
Total	**550**	**508 (92.4)**	**2 (0.4)**
Milk	268	268 (100)	0
Eggs	160	140 (87.5)	0
Honey	97	75 (77.3)	2 (2.1)
Bison	4	No residues found in 25 game meat samples	
Elk	7		
Rabbit	7		
Venison	7		

No pesticide chemical residues were found in any of the domestic game meat samples analyzed, and no violative residues were found in the domestic milk or eggs. Residues of seven pesticide chemicals were found in domestic honey, mostly at trace levels. Of those, piperonyl butoxide is exempted from tolerances when used as a synergist with pesticides on growing crops. The remaining six pesticides/degradants 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. Two honey samples

[†] Previously referred to as the "EU Audit" assignment.

were found violative because they contained low levels (< 0.1 ppm) of flonicamid and propargite above trace levels.

Herbicides Assignment

In the first part of the assignment, the glyphosate SRM was used to analyze glyphosate and glufosinate in four commodities: grain corn, soybeans, milk, and eggs. Glyphosate and glufosinate are broad-spectrum herbicides used to control weeds, including for crops that have been genetically engineered for glyphosate and glufosinate resistance, e.g., corn and soybeans. Corn and soybeans were analyzed because glyphosate and glufosinate are widely used in the U.S. to treat these crops. Milk and eggs were analyzed because they are consumed by infants and small children; and, they are produced by cows and chickens that may consume corn and soybeans. Assignment results from analyses using the glyphosate SRM are listed in Table 6b.

Table 6b. Results for the Analysis of Selected Foods Using Glyphosate SRM

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Glyphosate Residues Detected N (%)	Glufosinate Residues Detected N (%)
Totals	**119**	**84 (70.6)**	**0**	**35 (29.4)**	**3 (2.5)**
Corn	39	32 (82.1)	0	7 (17.9)	0 (0)
Soybeans	70	42 (60.0)	0	28 (40.0)	3 (4.3)
Milk	8	8 (100)	0	No residues found in milk and eggs	
Eggs	2	2 (100)	0		

*All glyphosate and glufosinate residues were below tolerances.

A total of 119 different samples were collected and analyzed, consisting of 39 corn, 70 soybean, 8 milk, and 2 egg samples. None of the 119 samples contained violative levels of glyphosate or glufosinate. No glyphosate or glufosinate residues were found in milk and egg samples, and no residues were found in 82.1% of the corn samples and 60.0% of the soybean samples.

In the second part of the Herbicides assignment, the acid herbicides SRM was implemented to analyze 28 acid herbicides in specific food commodities; see Appendix A for the complete list of acid herbicides included in the method.

Six grain commodities (corn, soybean, barley, rice, wheat, and oats) were selected for the assignment because of the use of acid herbicides on grain crops. Eight different root crops were also chosen for the assignment because acid herbicides are sometimes used to defoliate root crops prior to harvesting. Assignment results from analyses using the acid herbicides SRM are listed in Table 6c.

Table 6c. Results for the Analysis of Selected Foods Using the Acid Herbicides SRM

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)
Totals	**228**	**203 (89.0)**	**0**
Corn	51	50 (98.0)	0
Soybeans	78	77 (98.7)	0
Barley	24	16 (66.7)	0
Rice	9	5 (55.6)	0
Wheat	6	5 (83.3)	0
Oats	4	1 (25.0)	0
Peanuts	2	1 (50.0)	0
Beets	8	5 (62.5)	0
Turnips	21	18 (85.7)	0
Carrots	2	No residues found	
Radishes	2		
Potatoes	6		
Sweet potatoes	12		
Sugar beet	3		

No acid herbicide residues were found in 203 (89.0%) of the 228 samples collected and analyzed for the assignment in FY 2017. None of the samples contained violative levels of acid herbicides.

Among the six different grain products analyzed, corn and soybeans contained the lowest percentage of residues; 2.0% of corn and 1.3% of the soybean samples. For the root crops, no residues were found in carrots, radishes, potatoes, sweet potatoes, or sugar beets. No residues were found in 85.7% of turnips, 62.5% of beets, and 50.0% of peanut samples.

Of the 28 different acid herbicides included within the scope of the acid herbicide method, six (clopyralid, 2,4-D, quinclorac, dicamba, 4-CPA, and triclopyr) were found in the commodities tested. Clopyralid was the most frequently reported acid herbicide; it was found in 16 samples in six commodities; corn, barley, wheat, oats, turnips and beets. 2,4-D was found in three samples (soybeans, oats and peanuts). Of the nine rice samples analyzed, quinclorac residues were found in 3 and triclopyr residues were found in two. Dicamba was found in three samples (soybeans, barley and oats). 4-CPA was found in a peanut sample, as a degradation product of 2,4-D.

In summary, in FY 2017 FDA concluded the Herbicides assignment that began in FY 2016. Over the two-year period, a total of 879 samples of corn (313), soy (337), milk (121) and eggs (108) were analyzed for glyphosate and glufosinate using the glyphosate SRM, and 1119 samples of selected grains and root crops were analyzed for 28 acid

herbicides using the acid herbicide SRM. Residues of glyphosate or glufosinate were not found in any egg or milk samples. Glyphosate and/or glufosinate residues were found in 59.5% of the corn and soy grain samples, but none exceeded the established tolerances. Acid herbicide residues were found in 11.8% of the samples analyzed using the acid herbicide SRM. Only one of the acid herbicide residues found was violative (in FY 2016); a residue of 2,4-D was found at 0.127 ppm, exceeding the soybean tolerance of 0.02 ppm.

Total Diet Study

In FY 2017, FDA analyzed four market baskets in the TDS program consisting of 266 different food items per market basket: 1064 samples were analyzed altogether. Residues of 157 different pesticides were found in the TDS foods. Most were found at very low levels; the residue levels in 87% of the samples were below 0.01 ppm, and about 2% were above 0.1 ppm.

Table 7 lists the most frequently found pesticide residues (i.e., residues found in at least 2% of the samples) in TDS foods, the total number of findings, and the occurrence as a percentage of all 1064 items analyzed in FY 2017. The most frequently observed pesticide chemical residues are consistent with those reported in FY 2016.

Table 7. Frequency of Occurrence of Pesticide Residues in the Total Diet Study

Pesticide[1]	**Samples N (%)[2]**	**Mean <Max>[3] (ppm)**
Boscalid	332 (31.2)	0.0003 <0.303>
Imidacloprid	262 (24.6)	0.0008 <0.095>
Azoxystrobin	235 (22.1)	0.0004 <0.250>
Bifenthrin	226 (21.2)	0.0004 <0.068>
Piperonyl butoxide	212 (19.9)	0.0007 <0.030>
DDT	162 (15.2)	0.0002 <0.0081>
Chlorantraniliprole	157 (14.8)	0.0004 <0.120>
Clothianidin	139 (13.1)	0.0005 <0.018>
Thiamethoxam	139 (13.1)	0.0005 <0.032>
Malathion	138 (13.0)	0.0021 <0.106>
Acetamiprid	125 (11.7)	0.0006 <0.086>
Difenoconazole	125 (11.7)	0.0004 <0.040>
Fluxapyroxad	125 (11.7)	0.0003 <0.079>
Tebuconazole	123 (11.6)	0.0007 <0.346>
Metalaxyl	108 (10.2)	0.0003 <0.013>
Thiabendazole	102 (9.6)	0.0015 <0.424>
Pyraclostrobin	96 (9.0)	0.0004 <0.075>
Methoxyfenozide	95 (8.9)	0.0011 <0.125>
Novaluron	91 (8.6)	0.0004 <0.037>
Chlorpropham	90 (8.5)	0.0011 <4.70>
Pyrimethanil	83 (7.8)	0.0012 <2.01>
Fludioxonil	76 (7.1)	0.0009 <1.16>
Chlorpyrifos methyl	75 (7.0)	0.0007 <0.025>

Pesticide[1]	**Samples N (%)[2]**	**Mean <Max>[3] (ppm)**
Carbendazim[4]	74 (7.0)	0.0013 <0.040>
Fluopyram	73 (6.9)	0.0004 <0.012>
Propamocarb	68 (6.4)	0.0007 <0.623>
Captan	64 (6.0)	0.0064 <0.855>
Deltamethrin	63 (5.9)	0.0017 <0.124>
Chlorpyrifos	61 (5.7)	0.0004 <0.057>
Flubendiamide	54 (5.1)	0.0023 <0.062>
Penthiopyrad	53 (5.0)	0.0004 <0.088>
Myclobutanil	52 (4.9)	0.0006 <0.070>
Carbaryl	50 (4.7)	0.0003 <0.062>
Buprofezin	49 (4.6)	0.0003 <0.250>
Permethrin	49 (4.6)	0.0025 <6.80>
Fluopicolide	46 (4.3)	0.0004 <1.08>
Cyprodinil	45 (4.2)	0.0014 <0.309>
Trifloxystrobin	42 (3.9)	0.0003 <0.021>
Propiconazole	42 (3.9)	0.0011 <0.227>
Spinosad	41 (3.9)	0.001 <0.032>
Bifenazate	40 (3.8)	0.0005 <0.150>
Lambda-cyhalothrin	40 (3.8)	0.0019 <0.058>
Dimethomorph	36 (3.4)	0.0004 <0.200>
Phenylphenol, o-	35 (3.3)	0.0015 <0.080>
Quinoxyfen	31 (2.9)	0.0004 <0.017>
Clopyralid[5]	30 (2.8)	0.0184 <0.181>
Diflubenzuron	29 (2.7)	0.0004 <0.005>
Hexythiazox	28 (2.6)	0.0003 <0.018>
2,4-D[5]	28 (2.6)	0.0031 <0.028>
Spinetoram	28 (2.6)	0.001 <0.035>
Dimethoate	27 (2.5)	0.0003 <0.0048>
Imazalil	27 (2.5)	0.001 <0.347>
Flonicamid	27 (2.5)	0.0013 <0.647>
Metolachlor	26 (2.4)	0.0002 <0.0008>
Linuron	26 (2.4)	0.0007 <0.022>
Dinotefuran	26 (2.4)	0.0019 <0.057>

Pesticide[1]	**Samples N (%)**[2]	**Mean (ppm)**	**<Max>**[3]
Mandipropamid	26 (2.4)	0.001	<1.22>
Fenhexamid	25 (2.3)	0.0021	<0.220>
Imazamox	23 (2.2)	0.0003	<0.006>
Spirotetramat	23 (2.2)	0.0006	<0.038>
BAM[6]	23 (2.2)	0.0006	<0.025>
Fenpyroximate, e-	22 (2.1)	0.0016	<0.072>
DCPA	22 (2.1)	0.0005	<0.017>

[1] Isomers, metabolites, and related compounds are included with the 'parent' pesticide.

[2] Based on analysis of 1,064 total items.

[3] Harmonic mean of all positive residue levels; maximum residue level.

[4] Carbendazim is both a fungicide and a degradant of thiophanate methyl.

[5] Reflects overall incidence; i.e., based on analysis of all samples, though only 64 selected foods per market basket (256 items total) were analyzed for acid herbicides. (Samples not analyzed are counted as negative for the residues of acid herbicides.)

[6] 2,6-Dichlorobenzamide is a degradant of both fluopicolide and dichlobenil.

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 available intelligence. Historically, the violation rate for import foods is higher than for domestic foods; results from FY 2017 continue that trend. The violation rate for import foods (10.4%) was over 2.5 times higher than the rate for domestic foods (3.8%). The majority of the violations for import commodities are no-tolerance violations, and about 80 % of them are < 0.1 ppm. Examination of the FY 2017 pesticide data from the analysis of imported human foods indicates that the commodities listed in Table 8 may warrant targeted sampling in the future.

The following criteria were applied to the FY 2017 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 8 lists the import commodities analyzed in FY 2017 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 8 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 8, those same commodities might be extracted and reported separately. For example, Appendix C indicates FDA analyzed 330 import rice and rice products in FY 2017. Of those, 322 samples have been flagged as warranting special attention in Table 8. The other eight rice product samples have been excluded from Table 8 because they are highly processed products, e.g. rice flour and snacks.

Table 8. Import Commodities That May Warrant Special Attention

Commodity[†]	Samples Analyzed	Violation Rate (%)
Apricots	23	13.0
Carrot	28	21.4
Celery	52	38.5
Cilantro	67	37.3
Dates	47	14.9
Eggplant	27	11.1
Figs	17	23.5
Ginger root	17	23.5
Lettuce, head	35	14.3
Lettuce, leaf	31	12.9

Commodity†	Samples Analyzed	Violation Rate (%)
Onions, leeks, scallions, shallots*	84	10.7
Papaya*	90	13.3
Peas*	65	16.9
Pepper, hot*	175	23.4
Persimmons	5	80.0
Pineapple	39	18.0
Prickly pear*	7	42.9
Radish	35	28.6
Raisins	17	29.4
Rice*	322	23.6
Spinach*	39	23.1
String beans*	63	15.9

† 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 2016 table of import commodities warranting special attention.

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5. Pesticide Analytical Manual, Volume I, 3rd Ed., 1999, Chapter 1, Section 105, https://www.fda.gov/media/74473/download.
6. FDA Total Diet Study, https://www.fda.gov/food/science-research-food/total-diet-study.
7. Code of Federal Regulations, Title 21 Parts 573.380 and 573.400, https://ecfr.io/Title-21/cfr573_main

Appendices

Appendix A lists the 761 pesticides and industrial chemicals analyzed using FDA methods in 2017, including 30 pesticides analyzed by the acid herbicides SRM and glyphosate SRM. In addition to these chemicals, FDA analytical procedures detect other metabolites and isomers associated with the pesticides listed below.

All residue findings are summarized in Appendices B (domestic) and C (import). In FY 2017, 110 different domestic food commodities and 598 different import 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

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 the 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, 40 subcategories are listed for the import samples in Appendix C, but only 16 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 2017

Pesticides		
2,3,4,6-tetrachlorophenol	2,4-D[1]	2,4-D sec-butyl ester
2,4-DB[1]	2,6-dimethylaniline	2,6-DIPN
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
Aminocarb	Aminopyralid[1]	Amisulbrom
Amitraz	Ancymidol	Anilazine
Anilofos	Aniten	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	Bentazone methyl	Benthiavalicarb-isopropyl
Benzovindiflupyr	Benzoximate	Benzoylprop ethyl
BHC	Bicyclopyrone	Bifenazate
Bifenox	Bifenthrin	Binapacryl
Biphenyl	Bistrifluron	Bitertanol
Bithionol	Bixafen	Boscalid
Bromacil	Bromfenvinphos ethyl	Bromfenvinphos methyl
Bromobutide	Bromocyclen	Bromophos
Bromophos-ethyl	Bromopropylate	Bromoxynil[1]
Bromoxynil octanoate	Bromuconazole	Bufencarb
Bupirimate	Buprofezin	Butachlor
Butafenacil	Butamifos	Butocarboxim

Pesticides		
Butoxycarboxim	Butralin	Butylate
Cadusafos	Cafenstrole	Captafol
Captan	Carbaryl	Carbendazim[5]
Carbetamide	Carbofuran	Carbophenothion
Carbosulfan	Carboxin	Carfentrazone ethyl ester
Carpropamid	Chloramben[1]	Chlorantraniliprole
Chlorbenside	Chlorbromuron	Chlorbufam
Chlordane	Chlordecone	Chlordimeform
Chlorethoxyfos	Chlorfenapyr	Chlorfenethol
Chlorfenprop-methyl	Chlorfenvinphos	Chlorfenvinphos methyl
Chlorfluazuron	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
Closantel	Clothianidin	Coumaphos
Crimidine	Crotoxyphos	Crufomate
Cumyluron	Cyanazine	Cyanofenphos
Cyanophos	Cyantraniliprole	Cyazofamid
Cyclafuramid	Cyclaniliprole	Cycloate
Cycloxydime	Cycluron	Cyenopyrafen
Cyflufenamid	Cyflumetofen	Cyfluthrin
Cyhalofop butyl ester	Cymiazole	Cymoxanil
Cypermethrin	Cyphenothrin	Cyprazine
Cyproconazole	Cyprodinil	Cyprofuram
Cyromazine	Cythioate	Daimuron
Dazomet	DCPA	DDT
DEET	DEF	Deltamethrin
Demeton	Desmedipham	Desmetryn
Diafenthiuron	Dialifor	Diallate
Diamidafos	Diazinon	Dicamba[1]

Pesticides		
Dicapthon	Dichlobenil	Dichlofenthion
Dichlofluanid	Dichlone	Dichlormid
Dichlorobenzene, 1,3-	Dichlorophen	Dichlorprop[1]
Dichlorvos	Diclobutrazol	Diclocymet
Diclofop[1]	Diclomezine	Dicloran
Dicofol	Dicrotophos	Dicyclanil
Dieldrin	Diethatyl-ethyl	Diethofencarb
Difenoconazole	Difenoxuron	Diflovidazin
Diflubenzuron	Diflufenican	Diflufenzopyr[1]
Diflumetorim	Dimefluthrin	Dimefox
Dimepiperate	Dimethachlone	Dimethachlor
Dimethametryn	Dimethenamid	Dimethipin
Dimethirimol	Dimethoate	Dimethomorph
Dimetilan	Dimoxystrobin	Diniconazole
Dinitramine	Dinocap	Dinoseb
Dinotefuran	Dinoterb	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
Ethoxyquin	Ethychlozate	Etobenzanid
Etofenprox	Etoxazole	Etridiazole
Etrimfos	Famoxadone	Famphur
Fenamidone	Fenamiphos	Fenarimol
Fenazaquin	Fenbuconazole	Fenbutatin oxide
Fenchlorazole-ethyl	Fenclorim	Fenfuram

Pesticides		
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	Flumetralin
Flumetsulam	Flumiclorac-pentyl	Flumioxazin
Flumorph	Fluometuron	Fluopicolide
Fluopyram	Fluoranthene	Fluorene
Fluorochloridone	Fluorodifen	Fluoroglycofen
Fluoroimide	Fluotrimazole	Fluoxastrobin
Flupyradifurone	Fluquinconazole	Flurenol n-butyl ester
Flurenol-methyl ester	Fluridone	Fluroxypyr[1]
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]	Halfenprox
Halofenozide	Haloxyfop[1]	Heptachlor
Heptenophos	Hexachlorobutadiene	Hexachlorophene
Hexaconazole	Hexaflumuron	Hexazinone
Hexythiazox	Hydramethylnon	Hydroprene
IBP	Imazalil	Imazamethabenz[1]
Imazamethabenz methyl	Imazamox[1]	Imazapic[1]

Pesticides		
Imazapyr[1]	Imazaquin[1]	Imazasulfuron
Imazethapyr[1]	Imibenconazole	Imidacloprid
Inabenfide	Indanofan	Indaziflam
Indoxacarb	Ioxynil	Ipconazole
Iprodione	Iprovalicarb	Isazofos
Isobenzan	Isocarbamid	Isocarbophos
Isodrin	Isofenphos	Isofetamid
Isomethiozin	Isoprocarb	Isopropalin
Isoprothiolane	Isoproturon	Isopyrazam
Isotianil	Isoxaben	Isoxadifen-ethyl
Isoxaflutole	Isoxathion	Ivermectin
Jodfenphos	Karbutilate	Kresoxim-methyl
Lactofen	Lambda-cyhalothrin	Lenacil
Leptophos	Lindane	Linuron
Lufenuron	Malathion	Maleic hydrazide
Mandestrobin	Mandipropamid	MCPA[1]
MCPA-butoxyethyl ester	MCPB[1]	Mecarbam
Mecoprop[1]	Mefenacet	Mefenpyr-diethyl
Mefluidide	Mepanipyrim	Mephosfolan
Mepronil	Meptyldinocap	Mesotrione
Metaflumizone	Metalaxyl	Metaldehyde
Metamitron	Metazachlor	Metconazole
Methabenzthiazuron	Methacrifos	Methamidophos
Methfuroxam	Methidathion	Methiocarb
Methomyl	Methoprene	Methoprotryne
Methoxychlor	Methoxyfenozide	Methyldymron
Metobromuron	Metolachlor	Metolcarb
Metominostrobin	Metoxuron	Metrafenone
Metribuzin	Metsulfuron methyl	Mevinphos
Mexacarbate	MGK 264	Mirex
Molinate	Monalide	Monocrotophos
Moxidectin	Myclobutanil	Naftalofos
Naled	Naphthalene	Naphthaleneacetamide
Naproanilide	Napropamide	Naptalam
Neburon	Nicotine	Nitenpyram

Pesticides		
Nitralin	Nitrapyrin	Nitrofen
Nitrothal-isopropyl	Norflurazon	Novaluron
Noviflumuron	Nuarimol	Octhilinone
Octyldiphenyl PO4	Ofurace	Orbencarb
Orysastrobin	Oryzalin	Ovex
Oxabetrinil	Oxadiazon	Oxadixyl
Oxamyl	Oxathiapiprolin	Oxpoconazole
Oxydemeton-methyl	Oxyfluorfen	Oxythioquinox
Paclobutrazol	Parathion	Parathion methyl
PCBs	Pebulate	Penconazole
Pencycuron	Pendimethalin	Penflufen
Pentachlorophenol[1]	Pentanochlor	Penthiopyrad
Permethrin	Perthane	Phenkapton
Phenmedipham	Phenothrin	Phenthoate
Phenylphenol, o-	Phorate	Phosalone
Phosfolan	Phosmet	Phosphamidon
Phoxim	Phthalide	Picloram[1]
Picolinafen	Picoxystrobin	Pindone
Pinoxaden	Piperalin	Piperonyl butoxide
Piperophos	Pirimicarb	Pirimiphos ethyl
Pirimiphos methyl	Plifenate	Potasan
Prallethrin	Pretilachlor	Probenazole
Prochloraz	Procymidone	Prodiamine
Profenofos	Profluralin	Prohydrojasmon
Promecarb	Prometon	Prometryn
Pronamide	Propachlor	Propamocarb
Propanil	Propaphos	Propargite
Propazine	Propetamphos	Propham
Propiconazole	Propisochlor	Propoxur
Propoxycarbazone	Proquinazid	Prosulfocarb
Prothioconazole	Prothiofos	Prothoate
Pymetrozine	Pyracarbolid	Pyraclofos
Pyraclostrobin	Pyraflufen ethyl	Pyrazon
Pyrazophos	Pyrazoxyfen	Pyrene
Pyrethrins	Pyribencarb	Pyributicarb

Pesticides		
Pyridaben	Pyridalyl	Pyridaphenthion
Pyridate	Pyrifenox	Pyrifluquinazon
Pyriftalid	Pyrimethanil	Pyrimidifen
Pyriminobac-methyl	Pyriofenone	Pyriproxyfen
Pyroquilon	Pyroxasulfone	Quinalphos
Quinclorac[1]	Quinoclamine	Quinoxyfen
Quintozene	Quizalofop[1]	Quizalofop ethyl
Rabenzazole	Resmethrin	Ronnel
Rotenone	Saflufenacil	Salithion
Schradan	Sebuthylazine	Secbumeton
Sedaxane	Sethoxydim	Siduron
Silafluofen	Silthiofam	Silvex
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	Tetraconazole
Tetradifon	Tetramethrin	Tetrasul
Thenylchor	Thiabendazole	Thiacloprid
Thiamethoxam	Thiazopyr	Thidiazuron
Thifluzamide	Thiobencarb	Thiocyclam
Thiodicarb	Thiofanox	Thiometon
Thionazin	Thiophanate-methyl	Thioquinox
Tiadinil	Tiocarbazil	Tolclofos methyl
Tolfenpyrad	Tolyfluanid	Tralkoxydim
Transfluthrin	Triadimefon	Triadimenol
Tri-allate	Triamiphos	Triapenthenol
Triazamate	Triazophos	Triazoxide

Pesticides		
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) PO4	Tris(chloropropyl) PO4	Triticonazole
Tycor	Uniconazole	Valifenalate
Vamidothion	Vernolate	Vinclozolin
XMC	Zoxamide	

[1]Acid herbicide included within the scope of the acid herbicides SRM.
[2]3,4-dichloroanaline is a metabolite of multiple pesticides.
[3]3,5-dichloranaline 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 and glufosinate are within scope of the glyphosate SRM.

Appendix B. Analysis of Domestic Human Foods by Commodity Group in FY 2017

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Totals - All Domestic Samples	**1799**	**945 (52.5)**	**68 (3.8)**	**13**	**64**
Grains and Grain Products					
Barley and barley products	24	14 (58.3)	2 (8.3)	0	2
Corn and corn products	71	41 (57.7)	0	0	0
Oats and oat products	10	9 (90.0)	0	0	0
Rice and rice products	24	16 (66.7)	0	0	0
Soybeans and soybean products	95	50 (52.6)	1 (1.1)	0	1
Wheat and wheat products	28	13 (46.4)	1 (3.6)	1	0
Group Subtotal	**252**	**143 (56.7)**	**4 (1.6)**	**1**	**3**
Milk/Dairy Products/Eggs					
Eggs	162	141 (87.0)	0	0	0
Milk, cream and cheese products	288	288 (100)	0	0	0
Group Subtotal	**450**	**429 (95.3)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Group Subtotal	**0**	**0**	**0**	**0**	**0**
Fruits					
Apple fruit/juice	42	5 (11.9)	0	0	0
Blackberry fruit/juice	29	11 (37.9)	2 (6.9)	0	2
Blueberry fruit/juice	1	0	0	0	0
Cantaloupe	2	1 (50.0)	0	0	0
Cherry fruit/juice	32	0	0	0	0
Grape fruit/juice, raisins	31	2 (6.5)	0	0	0
Grapefruit fruit/juice	16	2 (12.5)	0	0	0
Lemon fruit/juice	22	1 (4.5)	0	0	0
Nectarine fruit/juice	27	1 (3.7)	0	0	0
Orange fruit/juice	22	3 (13.6)	1 (4.5)	0	1
Peach fruit/juice	30	0	0	0	0
Pear fruit/juice	29	2 (6.9)	0	0	0
Plum fruit/juice, prunes	31	5 (16.1)	3 (9.7)	0	3
Raspberry fruit/juice	16	4 (25.0)	0	0	0
Strawberries	38	3 (7.9)	1 (2.6)	1	0

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Other fruits/fruit products	19	15 (78.9)	0	0	0
Group Subtotal	**387**	**55 (14.2)**	**7 (1.8)**	**1**	**6**
Vegetables					
Broccoli	22	11 (50.0)	0	0	0
Cauliflower	1	0	0	0	0
Celery	30	4 (13.3)	2 (6.7)	0	2
Cilantro	29	3 (10.3)	14 (48.3)	1	14
Collards	1	0	1 (100)	0	1
Corn	4	4 (100)	0	0	0
Cucumbers	15	1 (6.7)	0	0	0
Eggplant	19	11 (57.9)	0	0	0
Kale	31	2 (6.5)	8 (25.8)	3	6
Lettuce, head	18	2 (11.1)	0	0	0
Lettuce, leaf	27	8 (29.6)	4 (14.8)	0	4
Mushrooms and truffles	16	13 (81.2)	0	0	0
Okra	12	5 (41.7)	3 (25.0)	2	3
Onions/leeks/scallions/shallots	14	12 (85.7)	0	0	0
Peas (green/snow/sugar/sweet)	11	2 (18.2)	1 (9.1)	0	1
Peppers, hot	22	10 (45.5)	0	0	0
Peppers, sweet	23	7 (30.4)	0	0	0
Potatoes	17	5 (29.4)	0	0	0
Radishes	29	22 (75.9)	1 (3.4)	1	1
Red beets	5	3 (60.0)	0	0	0
Spinach	33	3 (9.1)	6 (18.2)	1	6
Squash	63	29 (46)	5 (7.9)	1	5
String beans (green/snap/pole/long)	28	10 (35.7)	5 (17.9)	2	5
Sweet potatoes	26	7 (26.9)	1 (3.8)	0	1
Tomatoes	28	15 (53.6)	0	0	0
Other bean and pea products	7	4 (57.1)	0	0	0
Other leaf and stem vegetables	2	0	0	0	0
Other root and tuber vegetables	18	13 (72.2)	1 (5.6)	0	1
Other vegetables/vegetable products	12	5 (41.7)	1 (8.3)	0	1
Group Subtotal	**563**	**211 (37.5)**	**53 (9.4)**	**11**	**51**

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Other Food Products					
Animal products/byproducts	25	25 (100)	0	0	0
Honey	98	76 (77.6)	2 (2.0)	0	2
Peanuts and peanut products	2	1 (50.0)	0	0	0
Refined oil	20	4 (20.0)	2 (10.0)	0	2
Miscellaneous foods	1	1 (100)	0	0	0
Other nuts and nut products	1	0	0	0	0
Group Subtotal	**147**	**107 (72.8)**	**4 (2.7)**	**0**	**4**

†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 2017

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Totals - All Import Samples	**4270**	**2135 (50.0)**	**443 (10.4)**	**71**	**427**
Grains and Grain Products					
Bakery products, doughs, crackers	13	9 (69.2)	0	0	0
Barley and barley products	51	39 (76.5)	1 (2.0)	0	1
Breakfast cereals	9	7 (77.8)	0	0	0
Corn and corn products	37	30 (81.1)	1 (2.7)	0	1
Macaroni and noodles	45	23 (51.1)	4 (8.9)	0	4
Oats and oat products	22	18 (81.8)	0	0	0
Rice and rice products	330	184 (55.8)	78 (23.6)	21	78
Soybeans and soybean products	6	5 (83.3)	0	0	0
Wheat and wheat products	65	42 (64.6)	1 (1.5)	0	1
Other grains and grain products	23	20 (87.0)	0	0	0
Group Subtotal	**601**	**377 (62.7)**	**85 (14.1)**	**21**	**85**
Milk/Dairy Products/Eggs					
Milk, cream and cheese products	6	4 (66.7)	0	0	0
Group Subtotal	**6**	**4 (66.7)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Aquaculture seafood	134	103 (76.9)	1 (0.7)	0	1
Fish and fish products	52	45 (86.5)	0	0	0
Shellfish and crustaceans	20	20 (100)	0	0	0
Other aquatic animals/products	11	11 (100)	0	0	0
Group Subtotal	**217**	**179 (82.5)**	**1 (0.5)**	**0**	**1**
Fruits					
Ackees, lychees, longans	4	1 (25)	3 (75)	1	3
Apple fruit/juice	59	17 (28.8)	1 (1.7)	0	1
Apricot fruit/juice	23	6 (26.1)	3 (13)	0	3
Avocado fruit/juice	54	22 (40.7)	0	0	0
Bananas, plantains	26	13 (50)	0	0	0
Bitter melon	1	1 (100)	0	0	0
Blackberry fruit/juice	32	7 (21.9)	3 (9.4)	0	3
Blueberry fruit/juice	35	12 (34.3)	0	0	0

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Breadfruit, jackfruit	2	2 (100)	0	0	0
Cherry fruit/juice	26	8 (30.8)	2 (7.7)	0	2
Cranberry fruit/juice	3	3 (100)	0	0	0
Date fruit/juice	47	36 (76.6)	7 (14.9)	2	6
Fig fruit/juice	17	12 (70.6)	4 (23.5)	1	3
Grape fruit/juice, raisins	44	15 (34.1)	5 (11.4)	0	5
Grapefruit fruit/juice	7	0	1 (14.3)	0	1
Guava fruit/juice	5	3 (60)	0	0	0
Fruit jams, jellies, preserves, syrups, toppings	15	12 (80)	0	0	0
Kiwi fruit/juice	2	1 (50)	0	0	0
Lemon fruit/juice	17	4 (23.5)	1 (5.9)	1	0
Lime fruit/juice	55	14 (25.5)	4 (7.3)	1	3
Mango fruit/juice	90	57 (63.3)	8 (8.9)	0	8
Nectarine fruit/juice	24	0	1 (4.2)	0	1
Olives	50	45 (90)	1 (2)	1	0
Orange fruit/juice	48	33 (68.8)	3 (6.2)	0	3
Papaya fruit/juice	91	4 (4.4)	13 (14.3)	0	13
Peach fruit/juice	55	14 (25.5)	2 (3.6)	0	2
Pear fruit/juice	52	21 (40.4)	0	0	0
Pineapple fruit/juice	40	22 (55)	7 (17.5)	0	7
Plum fruit/juice, prunes	19	7 (36.8)	1 (5.3)	1	0
Pomegranate fruit/juice	1	1 (100)	0	0	0
Prickly pear fruit/juice	7	3 (42.9)	3 (42.9)	0	3
Raspberry fruit/juice	23	7 (30.4)	0	0	0
Strawberry fruit/juice	113	12 (10.6)	7 (6.2)	0	7
Watermelon	34	12 (35.3)	2 (5.9)	1	2
Other berry fruit/juice	11	8 (72.7)	1 (9.1)	0	1
Other citrus fruit/juice	3	2 (66.7)	1 (33.3)	0	1
Other fruits and fruit products	39	24 (61.5)	7 (17.9)	3	7
Other melons/vine fruit/juice	3	1 (33.3)	0	0	0
Other pome/core fruit/juice	3	2 (66.7)	0	0	0
Other sub-tropical fruit/juice	18	13 (72.2)	4 (22.2)	0	4
Group Subtotal	**1198**	**477 (39.8)**	**95 (7.9)**	**12**	**89**

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Vegetables					
Artichokes	5	5 (100)	0	0	0
Asparagus	23	17 (73.9)	1 (4.3)	0	1
Bamboo shoots	4	4 (100)	0	0	0
Bok choy and Chinese cabbage	3	0	1 (33.3)	0	1
Broccoli	41	22 (53.7)	2 (4.9)	0	2
Brussels sprouts	31	5 (16.1)	1 (3.2)	0	1
Cabbage	34	15 (44.1)	1 (2.9)	0	1
Carrots	29	16 (55.2)	6 (20.7)	0	6
Cassava	7	7 (100)	0	0	0
Cauliflower	31	29 (93.5)	0	0	0
Celery	52	8 (15.4)	20 (38.5)	2	20
Choyote (Chayote)	3	3 (100)	0	0	0
Cilantro	67	9 (13.4)	25 (37.3)	4	22
Collards	3	0	0	0	0
Corn	6	6 (100)	0	0	0
Cucumbers	66	13 (19.7)	6 (9.1)	2	5
Eggplant	31	8 (25.8)	5 (16.1)	0	5
Garbanzo beans	18	13 (72.2)	0	0	0
Garlic	5	5 (100)	0	0	0
Ginger	17	13 (76.5)	4 (23.5)	1	3
Kale	61	8 (13.1)	5 (8.2)	2	3
Kidney beans	7	3 (42.9)	0	0	0
Lettuce, head	35	11 (31.4)	5 (14.3)	1	4
Lettuce, leaf	31	2 (6.5)	4 (12.9)	2	4
Mung beans	13	10 (76.9)	1 (7.7)	0	1
Mushrooms/truffles/fungi	112	93 (83)	10 (8.9)	0	10
Okra	14	8 (57.1)	2 (14.3)	0	2
Onions/leeks/scallions/shallots	84	39 (46.4)	9 (10.7)	0	9
Peas (green/snow/sugar/sweet)	65	13 (20)	11 (16.9)	1	11
Peppers, hot	175	38 (21.7)	41 (23.4)	0	41
Peppers, sweet	67	21 (31.3)	2 (3)	0	2
Potatoes	34	4 (11.8)	1 (2.9)	0	1

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Pumpkins	2	2 (100)	0	0	0
Radishes	35	12 (34.3)	10 (28.6)	7	9
Red beets	11	9 (81.8)	0	0	0
Soybeans	18	15 (83.3)	0	0	0
Spinach	39	14 (35.9)	9 (23.1)	1	9
Squash	118	56 (47.5)	3 (2.5)	0	3
String beans (green/snap/pole/long)	64	23 (35.9)	10 (15.6)	5	10
Sweet potatoes	25	24 (96)	1 (4)	0	1
Taro/dasheen	2	2 (100)	0	0	0
Tomatoes/tomatillos	124	24 (19.4)	4 (3.2)	0	4
Turnips	12	9 (75)	1 (8.3)	0	1
Vegetable juice/drinks	9	8 (88.9)	1 (11.1)	0	1
Vegetables, breaded, or with sauce	7	3 (42.9)	0	0	0
Vegetables, other, or mixed	50	30 (60)	7 (14)	0	7
Other bean/pea vegetables/products	52	36 (69.2)	1 (1.9)	0	1
Other cucurbit vegetables	5	5 (100)	0	0	0
Other leaf and stem vegetables	55	31 (56.4)	15 (27.3)	4	15
Other root and tuber vegetables	17	11 (64.7)	2 (11.8)	0	2
Group Subtotal	**1819**	**762 (41.9)**	**227 (12.5)**	**32**	**218**
Other Food Products					
Animal products and byproducts	1	1 (100)	0	0	0
Baby foods/formula	2	1 (50)	0	0	0
Beverages and beverage bases	9	4 (44.4)	2 (22.2)	0	2
Candy, confections, chocolate, cocoa products	5	5 (100)	0	0	0
Coconut and coconut products	14	14 (100)	0	0	0
Condiments and dressings	12	4 (33.3)	4 (33.3)	0	4
Dietary supplement, botanical/herbal	23	11 (47.8)	7 (30.4)	1	7
Dietary supplement, other	8	6 (75)	0	0	0
Food additives, colors, flavorings, extracts	4	3 (75)	1 (25)	0	1
Food sweeteners, not honey	9	9 (100)	0	0	0
Honey and honey products	59	54 (91.5)	1 (1.7)	0	1
Multi-ingredient foods (dinners, sauces, specialties)	12	7 (58.3)	2 (16.7)	0	2
Nuts, almonds	3	2 (66.7)	0	0	0

Commodity Group	Samples Analyzed (N)	Without Residues N (%)†	Violative Samples* N (%)†	Over Tolerance Violations (N)	No Tolerance Violations (N)
Nuts, cashews	25	22 (88)	1 (4)	0	1
Nuts, other nuts and nut products	23	21 (91.3)	0	0	0
Nuts, peanuts and peanut products	4	3 (75)	0	0	0
Nuts, pecans	15	14 (93.3)	0	0	0
Oil, olive	64	53 (82.8)	5 (7.8)	0	5
Oil, vegetable	13	11 (84.6)	0	0	0
Oil, vegetable, seed stock	1	1 (100)	0	0	0
Seeds, edible and seed products	63	58 (92.1)	2 (3.2)	1	2
Spices	38	18 (47.4)	6 (15.8)	3	5
Tea	3	1 (33.3)	2 (66.7)	1	2
Tea, botanical/herbal, other	2	2 (100)	0	0	0
Other food products	17	11 (64.7)	2 (11.8)	0	2
Group Subtotal	**429**	**336 (78.3)**	**35 (8.2)**	**6**	**34**

†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.