UNITED STATES
National Residue Program for Meat, Poultry, and Egg Products

FY 2019 RESIDUE SAMPLE RESULTS

United States Department of Agriculture
Food Safety and Inspection Service
Office of Public Health Science

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Preface

The 2019 National Residue Program Data publication (the 'Red Book'), explains the Food Safety and Inspection Service (FSIS) chemical residue sampling plans and presents National Residue Program (NRP) testing results by fiscal year. [For those reading this electronically, this document has been commonly known as the "Red Book" because the covers of the previously printed versions were red.] In addition, the following appendices are included for the convenience of the reader: Appendix I, NRP Positive Non-Violative and Positive Violative Residue Samples Results; Appendix II, Number of Samples Required to Detect Violations with Predefined Probabilities; Appendix III, FY 2019 List of Chemical Residues by Class/Method.

Acknowledgements

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Contacts and Comments

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Acronyms

AMDUCA – Animal Medicinal Drug Use Clarification Act
CSI – Consumer Safety Inspector
DW – FSIS Data Warehouse
EPA – Environmental Protection Agency
FDA – Food and Drug Administration
FSIS – Food Safety and Inspection Service
FY – Fiscal Year
HACCP – Hazard Analysis and Critical Control Point
IPP – inspection program personnel
KIS™ Test – Kidney Inhibition Swab Test
MRM – Multi-Residue Method
ND – non-detect
NRP – National Residue Program
OPHS – Office of Public Health Science
PHIS – Public Health Information System
PHV – Public Health Veterinarian
PPB – parts per billion
PPM – parts per million
RVT- Residue Violator Tracking
SAT – Surveillance Advisory Team

Executive Summary

An essential aspect of food safety efforts in meat, poultry, and egg products is the monitoring and control of chemical residues that may result from the use of animal drugs and pesticides, or from incidents involving environmental contaminants. The U.S. National Residue Program (NRP) for Meat, Poultry, and Egg Products is an interagency program designed to identify, prioritize, and test for chemical residues and contaminants in meat, poultry, and egg products. The U.S. Department of Agriculture's (USDA), Food Safety and Inspection Service (FSIS) publishes the NRP Data (traditionally known as the Red Book) each year to summarize the results of testing meat, poultry, and egg products for chemical residues and contaminants of public health concern.

This 2019 summary report highlights FSIS residue test results from domestic inspection and import reinspection sampling plans. In FY 2019 (October 2018 through September 2019), ten analytical methods were used by FSIS to detect approximately 250 different veterinary drugs, pesticides and environmental contaminants. Key observations from the report include:

Domestic Sampling Plan

- **Scheduled Sampling Plan**

Scheduled sampling is the sampling of specified slaughter subclasses at the time of slaughter, after a carcass has passed ante-mortem inspection. In FY 2019, 7,767 samples were analyzed under the scheduled sampling plan (7,312 from U.S. Federal establishments and 455 from U.S. State inspected establishments). Of the 7,767 samples, 21 chemical residue violations were found. In comparison to previous Domestic Scheduled Sampling (FY 2016- 2018), the number of samples collected has remained the same, but the violation rate (below 0.4%) has been declining since 2016. In FY 2019, the residue were: piperonyl butoxide (2), moxidectin (2), carbadox (3), florfenicol (2), atrazine (2), metolachlor (3), and one each for doramectin, salbutamol, ceftiofur, clothianidin, heptachloraobenzene, and tetracycline.

In FY 2019, FSIS sampled and analyzed egg products and did not find any violation. Overall, the violation rate for the domestic scheduled sampling plan has remained below 0.40% for the last four years. In the cattle class, there was a significant ($p<0.05$) decline in violation rate for heifers. All swine violations reported in FY 2019 were from violative residues of carbadox in roaster swine. For species considered minor class, such as lamb/sheep and goats, the changes in violations were not significant.

- **Inspector-Generated Sampling Plan**

FSIS inspectors conduct inspector-generated sampling when they suspect that animals may have violative levels of chemical residues. In FY 2019, of the 174,308 Kidney Inhibition Swab (KIS™) tests conducted on suspect animals by FSIS, 3,569 samples were submitted to FSIS field laboratories for further analysis and of these, 606 chemical residue violations were reported in 523 samples (multiple residue violations may be found in the same samples). In comparison to previous NRP results (FY 2016 - 2019), the number of samples screened has remained the same (approximately 174,000 samples screened/year), but the violation rate (which has remained below 0.4%) has declined significantly ($p<0.0001$) since 2016. The predominant violative residues in the inspector-generated samples were ceftiofur (179), penicillin (141), and sulfadimethoxine (59), which account for 30%, 23%, and 9.7% of total violative residues, respectively.

Dairy cows (71%) and bob veal (14%) account for 85% of the violations reported under the inspector-generated sampling plan.

- Dairy cow percent violation rates (number of sample screened/violation rate) using the KIS™ test has decreased significantly in FY 2019. Of the 2,294 dairy cow samples analyzed at FSIS labs, desfuroylceftiofur (the primary metabolite of ceftiofur) and penicillin account for 6.8% and 4.9% of the violations reported, respectively.
- Bob veal percent violation rates has also decreased between FY 2018-2019. In FY 2019, of the 247 bob veal samples analyzed at FSIS labs, neomycin accounts for greater than 10% of the violations reported.
- In FY 2019, FSIS inspection program personnel (IPP) performed a total of 20,360 KIS™ tests in swine slaughter class (market swine, sows, roaster swine, boar swine, and feral swine), resulting in only 8 violative samples (0.03%).

Import Reinspection Sampling Plan

Imported meat, poultry, and egg products are sampled through the point-of-entry Import Reinspection Sampling Plan, a chemical residue monitoring program conducted to verify whether foreign inspection systems in exporting countries are equivalent to U.S. standards. A total of 3,501 samples were analyzed under this program in FY 2019, of which seven samples were violative. Those violative samples originated from the following countries: Costa Rica (1), Netherlands (1), Mexico (2), and Vietnam (3).

Distribution of Metal Testing Results by Animal Slaughter Class (Appendix I)

As part of its food safety mission, FSIS routinely evaluates meat and poultry products for 18 different metals. Because none of these metals have established U.S. regulatory levels in these products, tested carcasses are not held and no regulatory actions are taken with respect to individual carcasses in response to metals test results. FSIS actively monitors and reviews metals results to evaluate whether additional actions are necessary. Appendix 1, summarizes the metals testing results for meat and poultry samples collected in FY 2019. In FY 2019, FSIS performed 28,371 metal analyses in more than 1,600 samples. Overall, these data indicate levels of metals in FSIS-regulated product, on average, are relatively low and are not likely to cause a human health concern.

Introduction

The U.S. National Residue Program (NRP) for Meat, Poultry, and Egg Products – administered by the U.S. Department of Agriculture's (USDA), Food Safety and Inspection Service (FSIS) – is an interagency program designed to identify, rank, and analyze for chemical contaminants in meat, poultry, and egg products. FSIS publishes the NRP Residue Sampling Plans (traditionally known as the Blue Book) each year to provide information on the process used to select and prioritize the sampling of meat, poultry, and egg products for chemical contaminants of public health concern.

Background

An essential aspect of food safety efforts in meat, poultry, and egg products is the control of residues that may result from the use of animal drugs and pesticides, or from incidents involving environmental contaminants. The United States has a complex residue control system, with rigorous processes for approval, sampling, testing, and enforcement.

FSIS administers this regulatory program under the Federal Meat Inspection Act (FMIA) (21 U.S.C. 601 et seq.), the Poultry Products Inspection Act (PPIA) (21 U.S.C. 453 et seq.), and the Egg Products Inspection Act (EPIA) (21 U.S.C. 1031 et seq.). The NRP supports the FSIS mission of protecting the health and welfare of the American public by preventing the distribution into commerce of domestic and imported meat, poultry and egg products that are adulterated because they contain violative residues.

The NRP requires the cooperation and collaboration of several agencies for its successful design and implementation. FSIS, the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA), are the primary Federal agencies managing this program. The FDA, under the Federal Food, Drug, and Cosmetic Act (FFDCA), establishes tolerances for veterinary drugs and action levels for food additives and environmental contaminants. The EPA, under the FFDCA and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) establishes tolerances for registered pesticides. Title 21 and Title 40 of the Code of Federal Regulations (CFR) includes tolerance levels established by FDA and EPA, respectively.

The Surveillance Advisory Team (SAT) - which includes representatives from USDA's FSIS, Agricultural Research Service (ARS), and Agricultural Marketing Service (AMS); the Department of Health and Human Services' (HHS) FDA and Centers for Disease Control and Prevention (CDC); and EPA - meets annually to evaluate chemical compounds for inclusion in the NRP scheduled sampling plans. The SAT consists of experts in veterinary medicine, toxicology, chemistry, and public health who provide professional advice, as well as information on veterinary drug and pesticide use in animal husbandry. SAT discussions are used to decide which compounds represent a public health concern and warrant inclusion in the NRP scheduled sampling plans. In addition, the SAT may propose, based on professional judgment and reliable field information, the initiation of exploratory assessments for directed sampling on a production class or region of the country. These agencies work together to create the annual sampling plan, based on the following: prior NRP findings of chemical residues in meat (including Siluriformes), poultry, and egg products; FDA veterinary drug inventories obtained during on-farm visits and investigations; and pesticides and environmental contaminants of current importance to EPA (see Appendix I for a description of the statistical analysis to determine the number of samples required to detect a given number of expected violations).

The range of chemical compounds evaluated for inclusion in the NRP is comprehensive in scope. It includes approved and unapproved pharmaceutical drugs and pesticides, and environmental contaminants known or suspected to be present in food animals in the United States and in countries exporting products to the United States. The NRP is designed to: (1) provide a structured process for identifying and evaluating chemical compounds intentionally and unintentionally present in food animals; (2) analyze

chemical compounds of concern; (3) collect, analyze, and report results; and (4) identify the need for appropriate regulatory follow-up subsequent to the identification of violative levels of chemical residues.

Actions Taken on Violations

A violation occurs when an FSIS laboratory detects a chemical compound at a level in excess of an established tolerance or action level, as well as if the residue detected has no established tolerance. Once the laboratory analysis is complete, FSIS enters the detailed residue violation information into the Residue Violator Tracking (RVT) system, an FSIS/FDA interagency database. For violative samples, IPP are notified via the Public Health Information System (PHIS), an FSIS database designed to collect, consolidate and analyzed data in order to improve public health, and provide establishment with analytical results. IPP document noncompliance at the establishment through a noncompliance report and verify that the establishment takes required corrective actions in response to the violation. Under best practices, the establishment should also notify the producer that an animal from that business has been identified as having a residue violation. In addition, FSIS shares relevant information regarding violative residue samples with EPA and FDA, where the latter Agency has on-farm jurisdiction. FDA and cooperating State agencies investigate producers linked to residue violations and, if conditions leading to residue violations are not corrected, can take legal action.

To notify the public and the industry of repeated residue violations by the same producer, FSIS posts a weekly Residue Repeat Violators List on its Web site that identifies producers with more than one violation in a rolling 12-month period. In addition, this list provides helpful information to AMS School Lunch Program processors and producers that want to avoid violative levels of residues; serves as a deterrent for violators; and enables FSIS and FDA to better target resources. It is important to note that because FSIS updates the Residue Repeat Violators List weekly, FDA may not have investigated each violation at the time of publication.

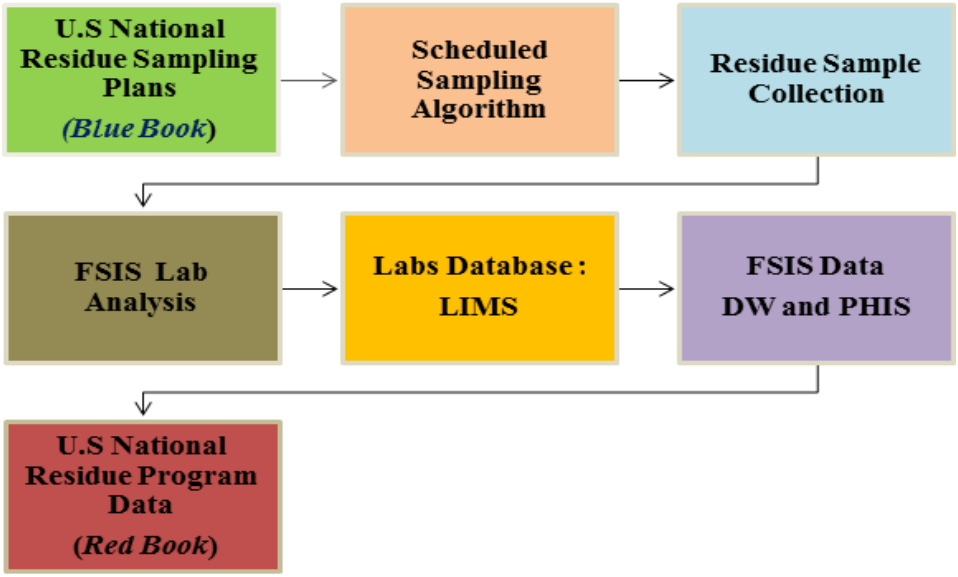
FSIS Laboratory Analytical Methods

Minimizing food safety hazards from farm-to-fork protects consumers from the public health risks associated with chemical contaminants in food. In 1996, FSIS published the "Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems" final rule (61 FR 38806). Title 9 of the Code of Federal Regulations, Part 417 (9 CFR 417) requires FSIS-inspected slaughter and processing establishments to identify all food safety hazards (including animal drug, pesticide and environmental contaminant residues) reasonably likely to occur before, during, and after the food animal or product enters the slaughter establishment. The regulation also requires establishments to identify preventive measures to control these hazards. FSIS can take regulatory action against establishments that do not have an effective chemical residue control program in place.

With ever greater public concern about the risks of chemical contaminants, regulatory agencies such as FSIS, EPA and FDA focus on continually strengthening the identification, prioritization, and testing for chemical hazards in regulated commodities. To achieve this goal, FSIS uses multi-residue methods for the detection, identification, quantification, and confirmation of veterinary drug, pesticide, and environmental contaminant residues (see APPENDIX III). The veterinary drug, pesticide and environmental contaminant multi-residue methods screen and confirm over 80, 100 and 17 analytes, respectively.

The FSIS Chemistry Laboratory Guidebook lists and describes the analytical methods, analytical processes, and performance characteristics used. One key performance element is the Minimum Level of Applicability (MLA). FSIS defines an MLA as the lowest level at which a method has been successfully validated for a residue in a given matrix. It is also the lowest level at which a laboratory analyst is expected to maintain ongoing proficiency in the method.

Figure 1. This figure illustrates the steps of the NRP. The NRP begins with interagency development of a sampling program plan (Blue Book) and ends by developing a report summarizing the collection and analysis of samples and the results of analysis (Red Book).



Overview of the Sampling Plans

The 2019 NRP was implemented for the U. S. Government fiscal year from October 1, 2018 to September 30, 2019 and focused on chemical residues in samples of domestic meat, poultry, and egg products collected at Federal and State inspected establishments and samples of imported meat, poultry, and egg products collected during FSIS re-inspection at import inspection establishments. All samples were tested in FSIS laboratories. FSIS Directive 10,800.1 and FSIS Directive 9900.6 provide further details on sampling collection procedures for domestic and imported products.

Domestic Sampling Plan

1. Tier 1

The Tier 1 sampling plan is the scheduled, or "directed" sampling of specified slaughter subclasses at the time of slaughter, after they have passed ante-mortem inspection. Within the subclass, inspectors randomly select carcasses for sampling. The number of samples scheduled each year is based on the probability of detecting at least one violation (APPENDIX II). Sampling tasks are assigned each month through PHIS. The sampling task provides information to the FSIS IPP on when to collect the sample (collection window) and which production class to sample. The establishment holds, or controls livestock carcasses selected for testing pending the results of analysis. For residue testing of poultry, Siluriformes, or egg products, the IPP recommends but does not require that the establishment holds product pending the analysis results.

Tier 1 sampling results also can be used to identify producers or other entities marketing animals with violative levels of residues. Thus, the Tier 1 sampling plan not only gathers information, but also assists in deterring practices that lead to violative residues.

In FY 2019, the Tier 1 sampling plan included collection and testing of samples from the following production classes: bob veal, beef cows, dairy cows, egg products, goats, market swine, sows, Siluriformes fish, steers/ heifers, young chickens, and young turkeys. These production classes represent 95 percent of domestic meat and poultry consumption.

2. Tier 2

a. Inspector-Generated Sampling

IPP can conduct inspector-generated sampling when it is suspected that animals may have violative levels of chemical residues. Currently, such sampling targets individual suspect animals, suspect populations of animals, and/or animals condemned for specific pathologies listed in FSIS Directive 10,800.1 (i.e., animal with disease signs and symptoms, producer history, or as a follow-up to results from random scheduled sampling). When Public Health Veterinarians (PHVs) detect evidence of a disease that may have been treated or suspect the administration of a veterinary drug, they retain the carcass and analyze samples using an in-plant method - the KIS™ test[1] - to screen for the presence of chemical residues. If the in-plant test is negative for veterinary drug residues included in the screen, the carcass is released to the establishment. If there are screen positive results, samples are sent to FSIS laboratory testing and the carcass is held pending results. Based on violative laboratory results, the PHV condemns carcasses and/or parts of animals.

i. Sampling of Individual Suspect Animals

Under the direction of the PHV, IPP conduct a KIS™ test on any carcass that, based on herd history or ante-mortem or post-mortem inspection findings, may contain a violative drug

[1] The KIS™ test is an antibiotic detection test for kidney tissue. Its principle of detection is microbial inhibition. Bacteria, cultured in agar with purple pH indicator media and kidney extract, generate acid that produces a yellow color. In the presence of antibiotic, the bacterial growth is inhibited and the test remains blue/purple.

residue. IPP follow instructions in FSIS Directive 10,800.1, relative to circumstances warranting a KIS ™ test and for performing KIS™ tests and documenting the task in PHIS. The PHV selects a carcass for sampling based on the criteria outlined in FSIS Directive 10,800.1. Usually, the sample is screened in the plant by the IPP and the screen-result verified when necessary by a PHV. Other samples are sent directly to the FSIS laboratory for analysis. For example, if the IPP suspects the misuse of a veterinary drug in an animal, she/he can perform the relevant in-plant screening analysis. If the result of a screening analysis is positive, the carcass is held (if it is not already condemned for other pathology or conditions that would make it unfit for human consumption), and the liver, kidney, and muscle samples from the carcass are then sent to an FSIS laboratory for analysis. If IPP suspect that there is misuse of drugs that cannot be detected by the KIS™ test, the samples are sent directly to the laboratory for appropriate analysis. These samples are reported under the **Collector-Generated** program.

ii. Sampling of Suspect Animal Populations

a. KIS™ Testing of Bob Veal Calves

Bob veal calf carcasses for KIS™ testing are selected from healthy appearing calves, as determined by the IPP or PHV, during ante-mortem inspection. Sampling is directed by the FSIS regulation 9 CFR 310.21 and FSIS Directive 10,800.1.

b. Sampling of Show Animals

Show animals, such as cattle, hogs, sheep, and goats presented for inspection, from a single fair or livestock show are selected for the KIS™ test whenever an establishment presents show animals for slaughter. When show animals appear otherwise healthy, the PHV selects animals at random from the entire lot of show animals for testing at the frequency specified in FSIS Directive 10,800.1. When show animals appear unhealthy or are suspected of having antibiotic residues (e.g., injection sites, evidence of a disease process), IPP tags the animals as "U.S. Suspect" and perform a KIS™ test.

iii. Sampling of Animals from State-Inspected Slaughter Establishments

Inspectors from State inspected establishments that operate under inspection systems "at least equal to" the Federal requirements collect and submit samples of kidney, liver and muscle from animals suspected of having violative residues directly to the FSIS laboratory.

b. Targeted Sampling

FSIS implements targeted sampling plans, also known as exploratory assessments, in response to information obtained by FDA and EPA and provided to FSIS about misuse of animal drugs and/or exposure to environmental chemicals, as well as in response to Tier 1 analytical results. The duration of these sampling plans varies based on the situation. FSIS may conduct studies to determine the frequency and concentration at which some residues like trace metals and industrial components are present in animals. These sampling plans could be designed to distinguish components of meat, poultry and egg products in which residue problems exist, to measure the extent of problems, and to evaluate the impact of actions taken to reduce the occurrence of residues in the food animal population.

For this targeted sampling, the sampling tasks are assigned through PHIS. The sampling task provides instructions to the IPP on when to collect the sample (collection window) and from which slaughter production class to collect the sample. The establishment holds, or controls livestock carcasses selected for testing pending the test results. For residue testing of poultry, Siluriformes, or egg products, the IPP recommends but does not require the establishment establishments hold or control the product pending the test results.

In FY 2019, targeted sampling included sheep, bull, roaster swine, formula-fed veal, non-formula fed veal, and heavy calves from randomly selected Federal establishments (please refer to FY 2019 Blue Book for further details).

3. Tier 3

The Tier 3 sampling plan is similar in structure to the targeted sampling / exploratory assessment program in Tier 2, with the exception that Tier 3 encompasses targeted testing at a herd or flock level. A targeted testing program designed for livestock or flocks originating from the same farm or geographic region may be necessary on occasion to determine the level of exposure to a chemical or chemicals. For instance, producers may administer some veterinary drugs to a herd or a flock (for example, growth promotants or antibiotics given in the feed) in a way that involves misuse. In addition, livestock and birds may be exposed unintentionally to an environmental contaminant. Tier 3 provides a vehicle for obtaining information that will support future policy development within the NRP.

In FY 2019, The NRP consisted of Tier 3 sampling of feral swine samples for pesticides (please refer to FY 2019 Blue Book for details on sampling plan.

Import Reinspection Sampling Plan

Imported meat (including Siluriformes fish), poultry, and egg products are sampled through the port-of-entry Import Reinspection Sampling Plan, a chemical residue monitoring program conducted to verify the equivalence of inspection systems in exporting countries to the U.S. standards. All imported products are subject to reinspection and one or more types of inspection (TOI) are conducted on every lot[2] of product before it enters the United States. FSIS Directive 9900.6 provides instructions to IPP on collecting laboratory sampling and testing of imported meat, poultry, and egg products. Chemical residue sampling is included in the reinspection of imported products. There are three levels of chemical residue reinspection for imported products that include:

- normal sampling: random sampling from a lot;
- increased sampling: above-normal sampling resulting from an Agency management decision; and
- intensified sampling: additional samples taken when a previous sample for a TOI that failed to meet U.S. requirements.

The data obtained from laboratory analyses are entered into PHIS, an FSIS database designed to generate reinspection assignments, receive and store results, and compile histories for the performance of foreign establishments certified by the central competent authority in the exporting country.

The import reinspection sampling program is structured using the same Tier 1 and Tier 2 (targeted) criteria used to develop the domestic plan.

Additionally, for intensified import sampling, the lot must be retained pending laboratory results.

[2] An import lot is a group of products defined statistically and/or scientifically by production segments and certified from one country and one establishment. A lot consists entirely of the same species, process category, and product standard of identity (sub-category). A single lot can contain shipping cartons with varying sizes of immediate containers.

Summary of Domestic Sampling and Testing Program

This section summarizes the results from the FY 2019 Domestic Scheduled Sampling Plan. The results are associated with specific animal class. All data reported in the following tables were extracted from the FSIS Data Warehouse and PHIS databases.

Table 1 summarizes the number of domestic samples analyzed, by animal class, in the scheduled sampling program (including State samples).

Table 2 presents a summary of the results—specifically the number of non-detect samples, the number of non-violative positive samples, and the number of violative samples—in the domestic scheduled sample program.

Table 3 summarizes the number of residue analytes in the domestic scheduled sampling program for each chemical method by animal class.

Table 4 summarizes the number of residue analytes in the domestic scheduled sampling program.

Table 5 summarizes the number and types (i.e., specific compound) of violations in the domestic scheduled sampling program violation results by animal class.

Figure 2 - 9 presents detailed summary of the results—specifically violation rates for each animal class and comparison from previous NRP (FY 2016 – 2018) in the domestic scheduled sampling program. Fisher's exact test was used to analyze the relationship between quantitative variables. The hypothesis tests developed in this study considers a significance of 5%, and the null hypothesis was rejected when the p-value was less than or equal to 0.05 (* – significant difference, $p < 0.05$; ** – highly significant difference, $p < 0.005$; ***– very highly significant difference, $p < 0.0005$).

Table 1. FY 2019 Number of Domestic Residue Samples Analyzed by Animal Class

Animal Category	Animal Class	Domestic Scheduled Sampling		
		FY 2019 Planned Numbers*	Tier 1 & Tier 2 U.S. Federal Establishments	Tier 1 U.S. State Establishments
Bovine	Beef Cows	800	754	54
	Bob Veal	400	391	--
	Bulls	100	87	--
	Dairy Cows	800	758	50
	Formula-Fed Veal	75	56	--
	Heavy Calves	75	64	--
	Heifers	400	442	74
	Non-Formula-Fed Veal	75	64	--
	Steers	400	397	103
Porcine	Feral Swine	100	99	--
	Market Swine	800	725	98
	Roaster Swine	300	396	--
	Sows	800	679	52
Poultry	Young Chickens	800	716	17
	Young Turkeys	800	640	7
Minor Species	Goats	300	282	--
	Lambs/Sheep	150	161	--
	Siluriformes Fish	650	582	--
	Egg Products	400	19	--
	Total	**8,225**	**7,312**	**455**

Note: * Planned FY 2019 Domestic Scheduled Sampling numbers (refer to FY 2019 Blue Book for details on sampling plan)
Data Source: FSIS Data Warehouse and PHIS databases.

Table 2. FY 2019 Domestic Scheduled Samples Analyzed by Animal Class

Animal Category	Animal Class	Number of Non-Detect Samples	Number of Non-Violative Positives Samples	Number of Violative Samples	Total Samples
Bovine	Beef Cows	799	6	3	808
	Bob Veal	387	3	1	391
	Bulls	87	--	--	87
	Dairy Cows	802	3	3	808
	Formula Fed Veal	56	--	--	56
	Heavy Calves	64	--	--	64
	Heifers	513	3	--	516
	Non- Formula Fed Veal	63	--	1	64
	Steers	497	2	1	500
Porcine	Feral Swine	98	--	1	99
	Market Swine	822	1	--	823
	Roaster Swine	391	2	3	396
	Sows	729	2	--	731
Poultry	Young Chickens	732	1	--	733
	Young Turkeys	647	--	--	647
Minor Species	Goats	281	--	1	282
	Sheep	157	2	2	161
	Siluriformes Fish	567	10	5	582
	Egg Products	19	--	--	19
	Total	**7,711**	**35**	**21**	**7,767**

Note: The results include Tier 1 and Tier 2 "targeted" animal classes.
Data Source: FSIS Data Warehouse and PHIS databases.

Table 3. FY 2019 Domestic Scheduled Samples - Number of Samples (Carcasses) Analyzed per Chemical Method per Animal Class

Animal Class	(# Samples Collected)	Number of Samples Analyzed per Chemical Method								
		Aminoglycosides	Avermectins	βeta-Agonists	Carbadox	Dyes	Metals	MRM*	Nitrofurans	Pesticides
Beef Cows	**808**	806	419	386	--	--	148	808	--	386
Bob Veal	**391**	388	211	178	--	--	135	391	--	177
Bulls	**87**	86	49	37	--	--	3	87	--	36
Dairy Cows	**808**	805	415	389	--	--	141	808	--	388
Formula-Fed Veal	**56**	56	31	25	--	--	--	56	--	6
Heavy Calves	**64**	64	36	28	--	--	4	64	--	7
Heifers	**516**	515	284	231	--	--	148	516	--	229
Non- Formula Fed Veal	**64**	64	42	22	--	--	2	64	--	3
Steers	**500**	498	275	222	--	--	152	500	--	221
Feral Swine	**99**	--	--	--	--	--	--	--	--	99
Market Swine	**823**	819	410	407	--	--	151	823	--	407
Roaster Swine	**396**	--	--	--	396	--	--	--	--	--
Sows	**731**	728	402	326	--	--	142	731	--	326
Young Chickens	**733**	732	--	--	--	--	201	732	365	365
Young Turkeys	**647**	646	--	--	--	--	181	647	319	320
Goats	**282**	281	151	--	--	--	--	282	--	131
Lambs/Sheep	**161**	160	83	--	--	--	--	161	--	77
Siluriformes Fish	**582**	--	--	--	--	257	258	582	313	314
Egg Products	**19**	--	--	--	--	--	--	--	--	19
Total	**7,767**	**6,648**	**2,808**	**2,251**	**396**	**257**	**1,666**	**7,252**	**997**	**3,510**

Note: *Multi-Residue Method includes the following drug class: analgesics, anthelmintic, beta-lactams, fluoroquinolones, macrolides, nitroimidazoles, phenicols, sulfonamides, tetracyclines, and tranquilizers.
Data Source: FSIS Data Warehouse and PHIS databases.

Table 4. FY 2019 Domestic Scheduled Samples - Number of Chemical Analytes per Animal Class

Animal Class	(# Samples Collected)	Number of Chemical Analytes per Chemical Method									
		Aminoglycosides	Avermectins	βeta-Agonists	Carbadox	Dyes	Metals	MRM*	Nitrofurans	Pesticides	Total
Beef Cows	808	7,254	1,676	680	--	--	2,613	65,778	--	32,511	**110,512**
Bob Veal	391	3,492	844	322	--	--	2,374	31,809	--	14,633	**53,474**
Bulls	87	774	196	77	--	--	51	7,078	--	3,021	**11,197**
Dairy Cows	808	7,281	1,660	705	--	--	2,487	66,126	--	32,403	**110,662**
Formula-Fed Veal	56	504	124	49	--	--	--	4,579	--	521	**5,777**
Heavy Calves	64	576	144	52	--	--	72	5,233	--	605	**6,682**
Heifers	516	4,635	1,136	429	--	--	2,608	42,079	--	18,884	**69,771**
Non- Formula Fed Veal	64	576	168	38	--	--	35	5,262	--	259	**6,338**
Steers	500	4,482	1,100	401	--	--	2,684	40,821	--	18,476	**67,964**
Feral Swine	99	--	--	--	--	--	--	--	--	8,096	**8,096**
Market Swine	823	7,371	1,636	719	--	--	2,670	72,252	--	34,288	**118,936**
Roaster Swine	396	--	--	--	396	--	--	--	--	--	**396**
Sows	731	6,552	1,607	582	--	--	2,517	64,336	--	27,091	**102,685**
Young Chickens	733	6,588	--	--	--	--	3,539	60,224	1,460	30,546	**102,357**
Young Turkeys	647	5,814	--	--	--	--	3,181	53,245	1,276	26,626	**90,147**
Goats	282	2,529	599	--	--	--	--	22,910	--	10,969	**37,007**
Lambs/Sheep	161	1,440	332	--	--	--	--	12,610	--	6,175	**20,557**
Siluriformes Fish	582	--	--	--	--	1,024	4,523	50,749	1,268	24,733	**82,297**
Egg Products	19	--	--	--	--	--	--	--	--	1,302	**1,302**
Total	**7,767**	**59,868**	**11,222**	**4,054**	**396**	**1,024**	**29,354**	**605,091**	**4,004**	**291,139**	**1,006,152**

Note: Multiple analytes may be associated with the same sample. Not all samples are analyzed using all chemical methods.
*Multi-Residue Method includes the following drug class: analgesics, anthelmintic, beta-lactams, fluoroquinolones, macrolides, nitroimidazoles, phenicols, sulfonamides, tetracyclines, and tranquilizers.
Data Source: FSIS Data Warehouse and PHIS databases.

Table 5. FY 2019 Domestic Scheduled Sampling Violations by Animal Class

No. of Samples	Animal Class	Tissue	Compound	Concentration	Units	Tolerance Level Value	Authority (CFR Citation)
1	Beef Cow	Liver	Doramectin	144.5	PPB	100	21 CFR 556.225
2	Beef Cow	Kidney	Desfuroylceftiofur	0.528	PPM	0.4	21 CFR 556.113
3	Beef Cow	Muscle	Salbutamol	*	PPM	0	Not Approved
4	Bob Veal	Liver	Florfenicol	3.42	PPM	0	21 CFR 556.283
		Muscle	Florfenicol	543.46	PPM	0	21 CFR 556.283
5	Dairy Cow	Kidney	Gentamycin Sulfate	*	*	--	Not Approved
6	Dairy Cow	Muscle	Meloxicam	*	*	--	Not Approved
7	Dairy Cow	Muscle	Tetracycline	3.4	PPM	2	21 CFR 556.720
8	Feral Swine	Muscle	Clothianidin	*	*	--	40 CFR 180.586
9	Goat	Muscle	Moxidectin	35.5	*	--	20 CFR 556.426
10	Mature Sheep	Muscle	Moxidectin	85.3	PPB	50	21 CFR 556.426
11	Mature Sheep	Muscle	Piperonyl Butoxide	0.2189	PPM	0.1	40 CFR 180.127
12	Non Formula-fed Veal	Muscle	Florfenicol	0.62	PPM	0	21 CFR 556.283
		Liver	Florfenicol	8.98	PPM	0	21 CFR 556.283
13	Roaster Swine	Liver	Carbadox	207.22	PPB	30	21 CFR 556.100
14	Roaster Swine	Liver	Carbadox	375.8	PPB	30	21 CFR 556.100
15	Roaster Swine	Liver	Carbadox	40.8	PPB	30	21 CFR 556.100
16	Siluriformes (Catfish)	Muscle	Atrazine and Metabolites	*	*	--	40 CFR 180.220
17	Siluriformes (Catfish)	Muscle	HCB	*	*	--	CPG Sec. 575.100
18	Siluriformes (Catfish)	Muscle	Atrazine and Metabolites	*	*	--	40 CFR 180.220
			Metolachlor	*	*	--	40 CFR 180.368
19	Siluriformes (Catfish)	Muscle	Metolachlor	*	*	--	41 CFR 180.368
20	Siluriformes (Catfish)	Muscle	Metolachlor	*	*	--	42 CFR 180.368
21	Steer	Muscle	Piperonyl Butoxide	0.1512	PPM	0.1	40 CFR 180.127

Notes: *Violative residue results were residue were detected but not quantified.
Not Approved- Residue detected is not approved for the animal class.
Data Source: FSIS Data Warehouse and PHIS databases.
PPM – parts per million (mg/kg) PPB – parts per billion (µg/kg)

Summary of Domestic Scheduled Sampling Program Violation Rates

This section summarizes the results from the FY 2016-2019 Domestic Scheduled Sampling Plan. All data reported in the following figures were extracted from the FSIS Data Warehouse and PHIS databases.

Figure 2. FY 2016 - 2019 Domestic Scheduled Sampling Collection Numbers

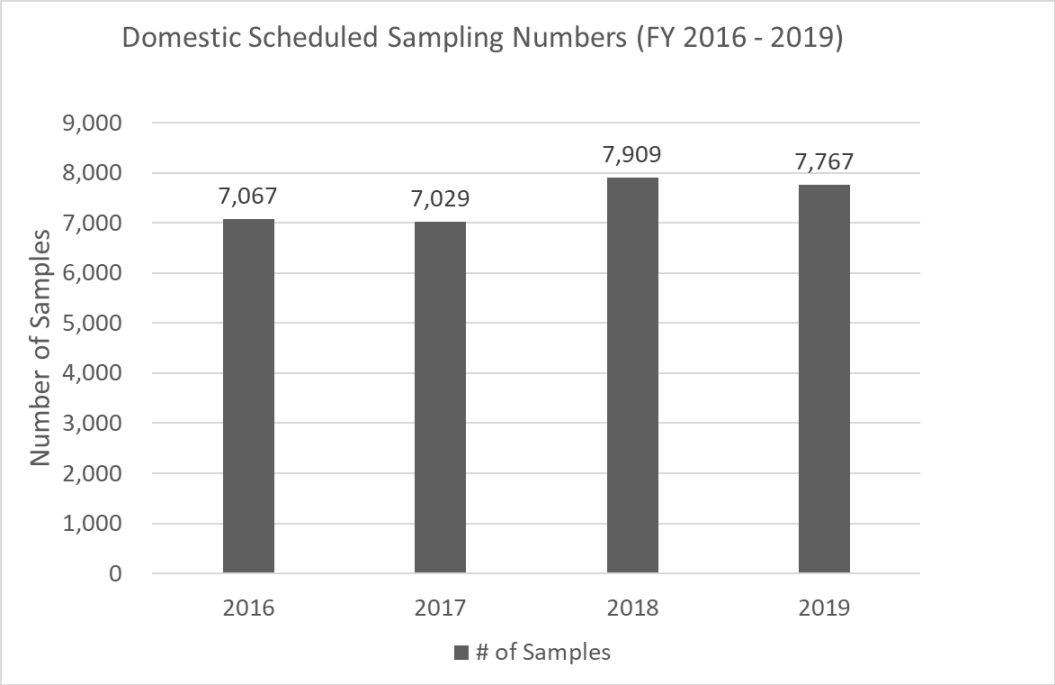


Figure 2 compares the domestic scheduled sampling collection numbers for the past four years of the NRP (FY 2016 – 2019).

Figure 3. FY 2016 - 2019 Domestic Scheduled Sampling Violation Rate

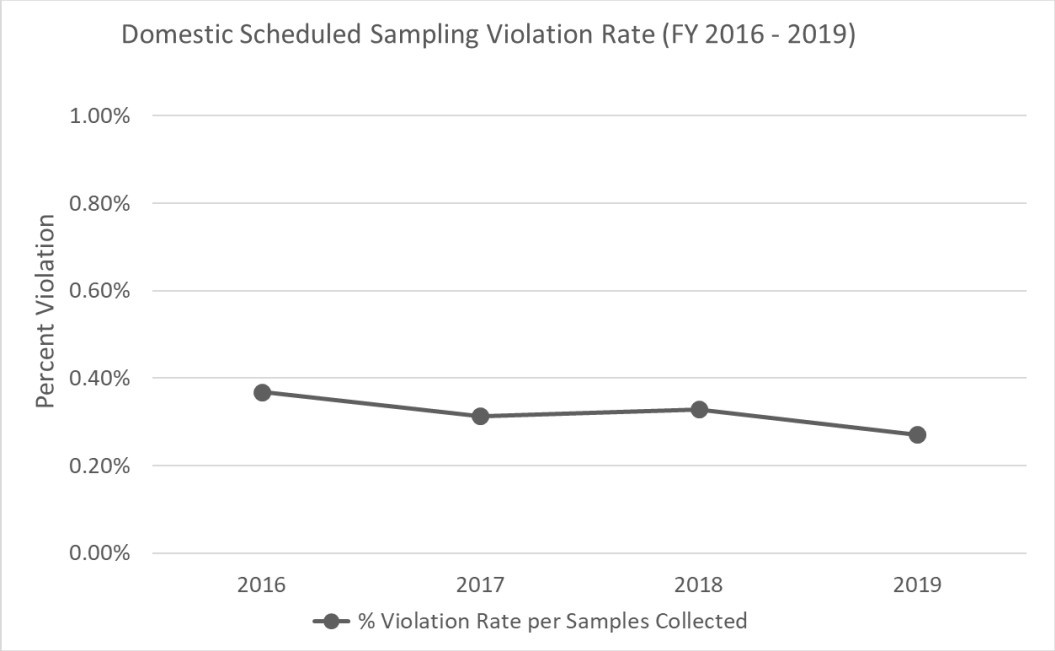


Figure 3 compares the domestic scheduled sampling violation rate. Overall, the violation rate has remained below 0.40% for the last four years. There was no significant change ($p>0.05$) in the FY 2019 violation rates in comparison to previous years.

Figure 4. FY 2019 Domestic Scheduled Sampling Collection Numbers per Cattle Class

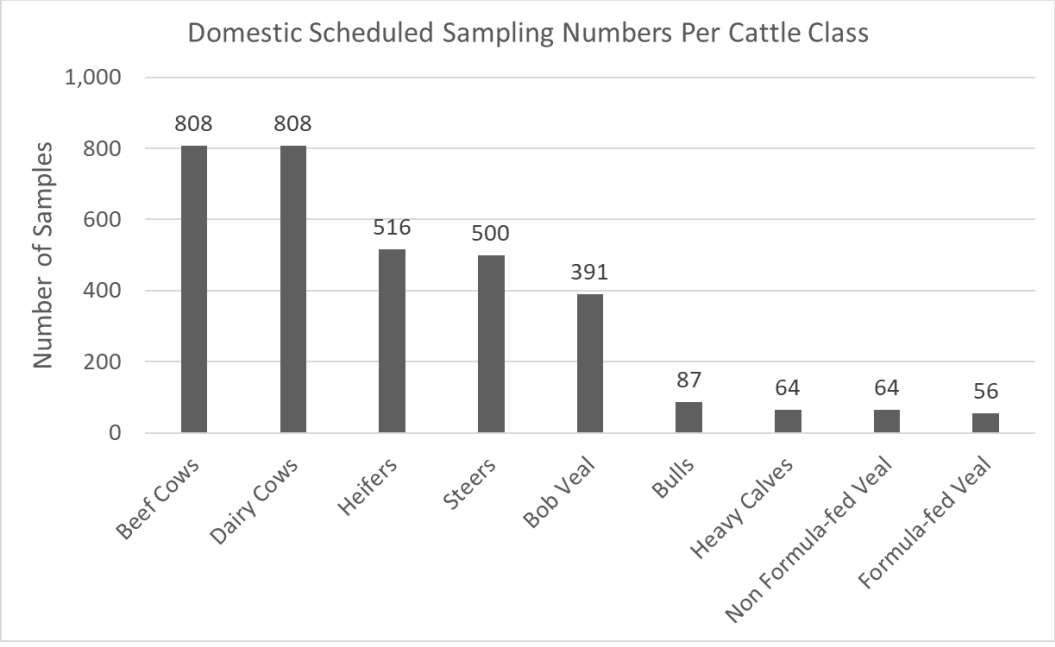


Figure 4 compares domestic scheduled sampling collection numbers for the cattle class analyzed in FY 2019.

Figure 5. FY 2016 - 2019 Domestic Scheduled Sampling Percent Violation Rate per Cattle Class

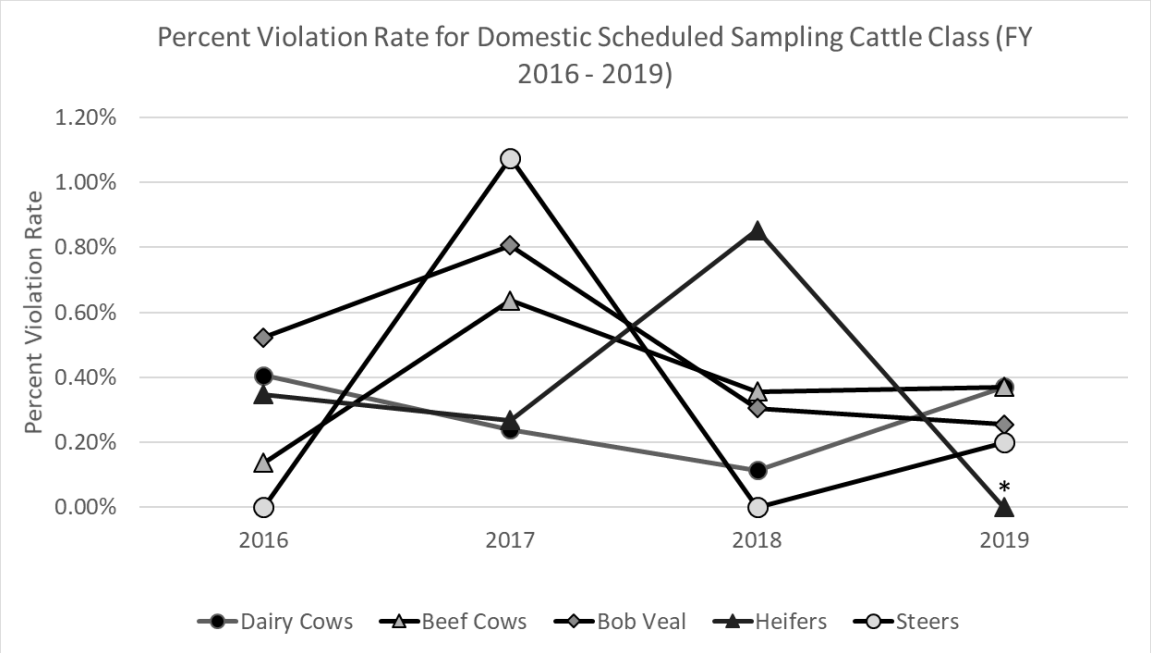


Figure 5 compares the domestic scheduled sampling violation rate of the major cattle class, for the past four years of the NRP (FY 2016 – 2019). There was a significant decrease in heifer violation ($p<0.05$) between FY 2018-2019. No significant changes were observed in other slaughter classes.

Figure 6. FY 2019 Domestic Scheduled Sampling Collection Numbers per Swine Class

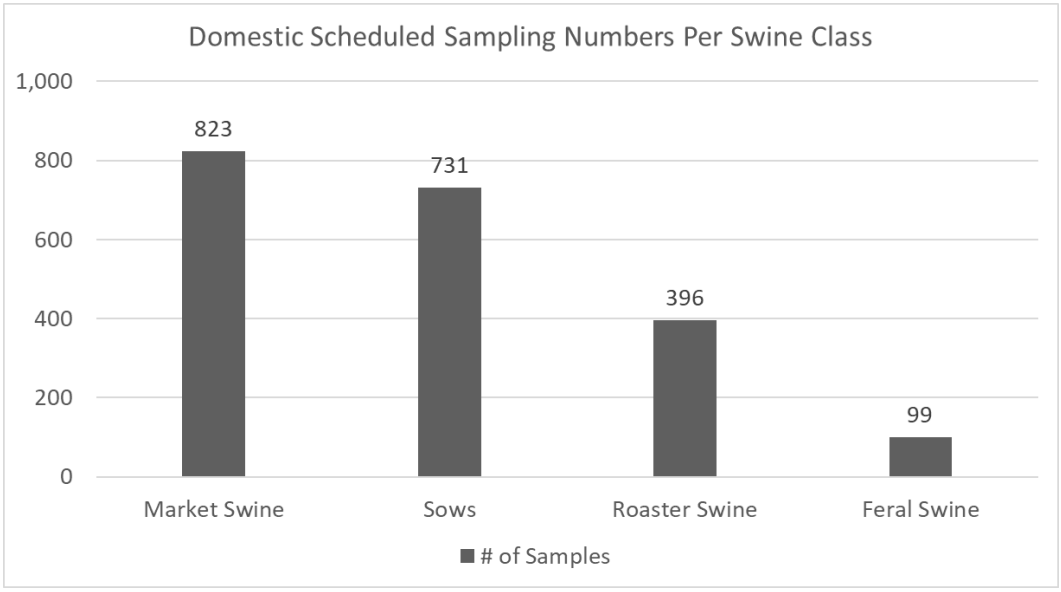


Figure 6 compares domestic scheduled sampling violation numbers for swine analyzed in FY 2019.

Figure 7. FY 2016 - 2019 Domestic Scheduled Sampling Percent Violation Rate per Swine Class

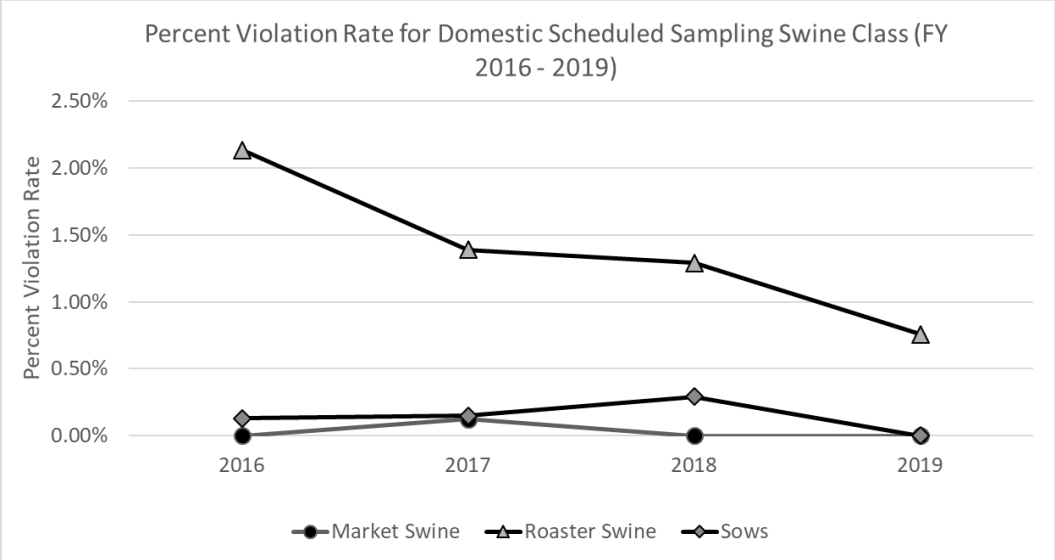


Figure 7 compares the domestic scheduled sampling violation rate of the swine slaughter class. No violations were reported in market swine and sows. While the violation rate for roaster swine is a downward trend, there was no significant difference ($p>0.05$) in the violation rate between FY 2018 to FY 2019.

Figure 8. FY 2019 Domestic Scheduled Sampling Collection Numbers per Minor Class

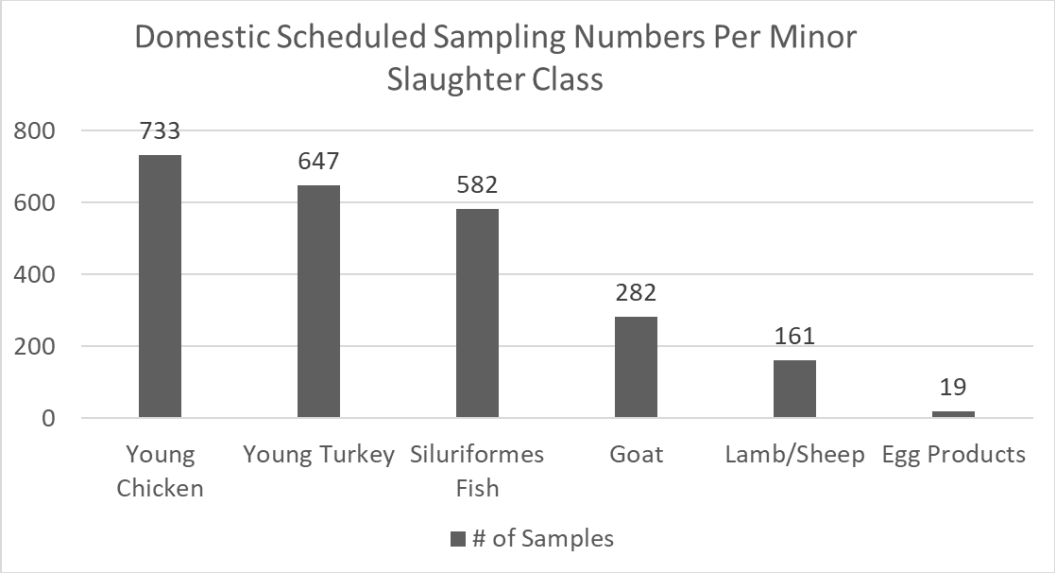


Figure 8 compares domestic scheduled sampling violation rates for minor animal classes analyzed in FY 2019.

Figure 9. FY 2016 - 2019 Domestic Scheduled Sampling Percent Violation Rate in Sheep and Goats

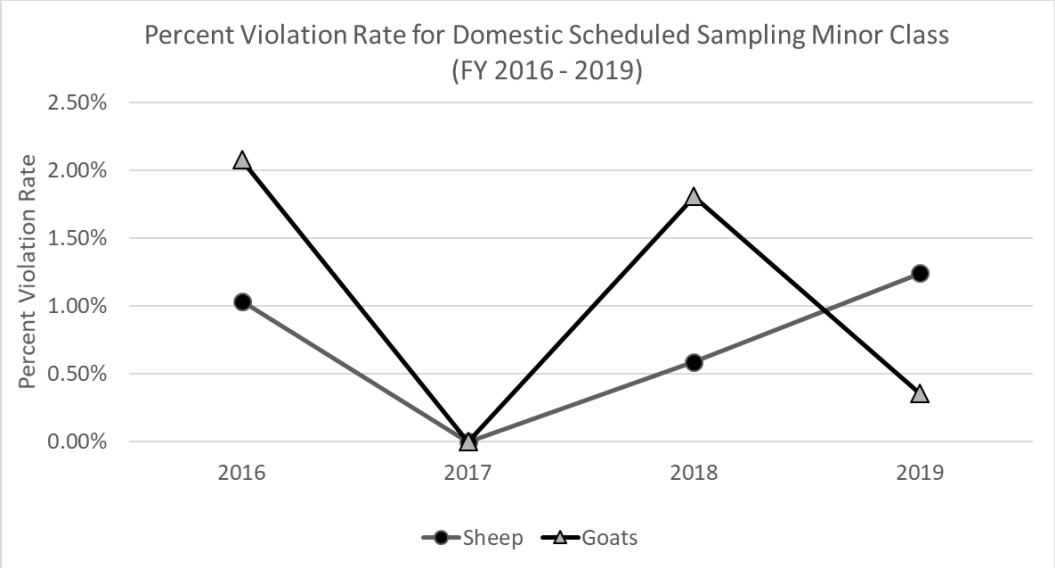


Figure 9 compares the domestic scheduled sampling violation rate of sheep and goats. There was no significant change in goats ($p>0.05$) and sheep ($p>0.05$), between FY 2018 and FY 2019.

Summary of Domestic Inspector-Generated Sampling Program

PHVs, and IPP under the guidance of a PHV, conduct inspector-generated residue sampling when an animal is suspected to have undergone drug treatment and may possibly contain violative levels of chemical residues. Carcasses are typically first screened using the KIS™ test. If KIS™ test kits are not available; the PHV submits the sample directly to the FSIS laboratory for testing. All data reported in the following tables and figures were extracted from the FSIS Data Warehouse and PHIS databases.

Table 6 summarizes the total number of in-plant screening tests performed using the KIS™ test and includes the number of in-plant screens with negative results; the number of carcasses sent to FSIS laboratory for confirmation; and the number of carcasses with violations for each animal class.

Table 7 summarizes the total number of carcasses suspected to have undergone drug treatment and were sent directly to FSIS laboratory for analysis, without the administration of a KIS™ Test.

Table 8 summarizes the results for specific chemical compounds that were detected **(violative**) within inspector-generated sampling projects across animal class.

Table 9 summarizes the results for specific chemical compounds that were detected **(violative**) within carcasses sent directly to FSIS laboratory for chemical analysis.

Table 10 summarizes the number of domestic scheduled samples and inspector-generated samples analyzed by animal class.

Figure 10– 20 present detailed summaries of FY 2019 domestic inspector-generated sampling program results—specifically violation rates for each animal class and comparison from previous NRP (FY 2016 – 2019). Fisher's exact test was used to analyze the relationship between quantitative variables. The hypothesis tests developed in this study considered a significance of 5%, and the null hypothesis was rejected when the p-value was less than or equal to 0.05 (* -significant difference, $p < 0.05$; ** – highly significant difference, $p < 0.005$; *** - highly significant difference, $p < 0.0005$).

Table 6. Summary of FY 2019 Tier 2 Inspector-Generated Sampling (KIS ™) Test and Confirmatory Tests

Animal Category	Animal Class	KIS ™ Test			
		Total Number of In-plant Carcasses	Number of In-plant Negative Carcasses	Number of Samples Analyzed in FSIS Labs*	Number of Samples with Confirmed Lab Violations
Bovine	Beef Cows	9,323	9,057	275	**24**
	Bison	1	1	0	**0**
	Bob Veal	30,709	30,462	247	**73**
	Bulls	1,335	1,293	44	**3**
	Dairy Cows	96,608	94,371	2,294	**371**
	Heavy Calves	225	206	19	**1**
	Formula-fed Veal	345	334	11	**0**
	Heifers	3,816	3,690	129	**10**
	Non Formula-fed Veal	255	208	43	**12**
	Steers	8,783	8,538	255	**18**
Porcine	Boar/Stag Swine	92	91	1	**0**
	Feral Swine	6	6	0	**0**
	Market Swine	15,116	14,951	166	**1**
	Roaster Swine	1,437	1,428	9	**1**
	Sows	3,709	3,654	56	**6**
Minor Species	Goats	672	666	8	**2**
	Mature Sheep	565	562	5	**0**
	Lambs	1,311	1,307	7	**1**
	Total	**174,308**	**170,825**	**3,569**	**523**

Note:* Number of carcasses include in-plant KIS™ screens positive and carcasses sent directly to the FSIS laboratory for chemical analysis.
Data Source: FSIS Data Warehouse and PHIS databases.

Table 7. FY 2019 Tier 2 Suspect Animal Samples sent Directly to FSIS Laboratory

Animal Category	Animal Class	Number of Non-Detect Samples	Number of Non-Violative Positives Samples	Number of Violative Samples	Total Samples
Bovine	Beef Cows	18	1	2	21
	Bob Veal	1	1	--	2
	Dairy Cows	33	3	2	38
	Heavy Calves	1	--	1	2
	Formula-fed Veal	1	--	--	1
	Heifers	4	--	1	5
	Non Formula-fed Veal	1	--	--	1
	Steers	52	2	--	54
Porcine	Market Swine	47	1	1	49
	Roaster Swine	1	--	--	1
	Sows	5	1	--	6
Poultry	Young Chicken	2	--	--	2
Minor Species	Goats	6	1	--	7
	Mature Sheep	1	--	--	1
	Lambs	11	1	--	12
	Total	**184**	**11**	**7**	**202**

Data Source: FSIS Data Warehouse and PHIS databases.

Table 8. FY 2019 Number of Residue Violations results in Inspector-Generated Sampling by Chemical Residue and Animal Class (*KIS™ Test Samples*)

Chemical Residue	Beef Cows	Bob Veal	Bulls	Dairy Cows	Goats	Heavy Calves	Heifers	Lambs	Market Swine	Non-Formula Fed Veal	Roaster Swine	Sows	Steers	Total
Ampicillin	--	--	--	22	--	--	--	--	--	--	--	--	--	**22**
Cefazolin	--	--	--	--	--	--	--	--	--	--	--	--	--	**1**
Ciprofloxacin	--	4	--	--	--	--	--	--	--	--	--	--	--	**4**
Desethylene Ciprofloxacin	--	1	--	--	--	--	--	--	--	--	--	--	--	**1**
Desfuroylceftiofur	8	5	2	157	--	--	3	--	--	--	--	--	4	**179**
Dihydrostreptomycin	--	2	--	2	--	--	--	--	--	--	--	--	--	**4**
Doxycycline	--	--	--	1	--	--	--	--	--	--	--	--	--	**1**
Enrofloxacin	--	4	--	--	--	--	--	--	--	--	--	--	--	**4**
Florfenicol	3	1	--	3	--	--	--	2	--	6	--	--	3	**18**
Flunixin	2	7	--	27	--	--	--	2	--	1	--	--	4	**43**
Gamithromycin	--	1	--	--	--	--	--	--	--	--	--	--	--	**1**
Gentamycin Sulfate	1	1	--	3	--	--	1	--	1	--	1	--	1	**9**
Ketoprofen	--	--	--	2	--	--	--	--	--	--	--	--	--	**2**
Meloxicam	1	2	--	9	--	--	--	--	--	--	--	--	--	**12**
Neomycin	--	30	--	1	--	--	--	--	--	2	--	--	--	**33**
Oxytetracycline	2	1	--	3	1	--	--	--	--	--	--	--	--	**7**
Penicillin	3	6	1	112	1	1	4	--	1	--	--	6	6	**141**
Ractopamine	--	--	--	--	--	--	--	--	--	--	--	--	1	**1**
Salbutamol	--	2	--	--	--	--	--	--	--	--	--	--	--	**2**
Sulfadimethoxine	3	7	--	47	--	--	1	--	--	--	--	--	1	**59**
Sulfadoxine	--	--	--	5	--	--		--	--	--	--	--	--	**5**
Sulfamethazine	3	1	--	10	--	--	3	--	--	--	--	--	1	**18**

Note: Multiple violative residues may be associated with a single carcass
Data Source: FSIS Data Warehouse and PHIS databases.

Chemical Residue	Beef Cows	Bob Veal	Bulls	Dairy Cows	Goats	Heavy Calves	Heifers	Lambs	Market Swine	Non-Formula Fed Veal	Roaster Swine	Sows	Steers	**Total**
Sulfamethoxazole	--	6	--	--	--	--	--	--	--	--	--	--	--	**6**
Tetracycline	--	1	--	2	--	--	--	--	--	--	--	--	--	**3**
Tildipirosin	--	1	--	--	--	--	--	--	--	--	--	--	--	**1**
Tilmicosin	3	4	--	5	--	2	--	--	--	7	--	--	4	**25**
Tylosin	--	4	--	--	--	--	--	--	--	--	--	--	--	**4**
Grand Total	**29**	**91**	**3**	**412**	**2**	**3**	**12**	**4**	**2**	**16**	**1**	**6**	**25**	**606**

Note: Multiple violative residues may be associated with a single carcass
Data Source: FSIS Data Warehouse and PHIS databases.

Table 9. FY 2019 Number of Residue Violations results in Suspect Animal Carcasses sent Directly to FSIS Laboratory by Chemical Residue and Animal Class (*Non- KIS™ tests Samples*)

Chemical residue	Beef Cows	Dairy Cows	Heavy Calves	Heifers	Market Swine	Total
Desfuroylceftiofur	--	2	--	1	--	**3**
Florfenicol	--	--	2	--	--	**2**
Flunixin	--	--	1	--	--	**1**
Piperonyl Butoxide	--	--	--	--	1	**1**
Sulfamethazine	1	--	--	--	--	**1**
Tilmicosin	2	--	--	--	--	**2**
Grand Total	**3**	**2**	**3**	**1**	**1**	**10**

Note: Multiple violative residues may be associated with a single carcass
Data Source: FSIS Data Warehouse and PHIS databases.

Table 10. Summary of FY 2019 Domestic Residue Samples Analyzed by Animal Class

Animal Category	Animal Class	Domestic Scheduled Sampling		Inspector-generated Sampling Tier 2 Suspect Animals	
		Tier 1 & Tier 2 U.S. Federal Establishments	Tier 1 U.S. State Establishments	KIS™ Test	Non- KIS™ Samples *
Bovine	Beef Cows	754	54	9,323	21
	Bison	--	--	1	--
	Bob Veal	391	--	30,709	2
	Bulls	87	--	1,335	--
	Dairy Cows	758	50	96,608	38
	Formula-Fed Veal	56	--	345	1
	Heavy Calves	64	--	225	2
	Heifers	442	74	3,816	5
	Non-Formula-Fed Veal	64		255	1
	Steers	397	103	8,783	54
Porcine	Boars/Stags	--	--	92	--
	Feral Swine	99	--	6	--
	Market Swine	725	98	15,116	49
	Roaster Swine	396		1,437	1
	Sows	679	52	3,709	6
Poultry	Young Chickens	716	17	--	2
	Young Turkeys	640	7	--	--
Minor Species	Goats	282	--	672	7
	Lambs/Sheep	161	--	1,876	13
	Siluriformes Fish	582	--	--	--
	Egg Products	19	--	--	--
	Total	**7,312**	**455**	**174,308**	**202**

Note: * 202 suspect animal Carcasses sent directly to FSIS Laboratory (**Non-KIS™ test)** were collected and directly sent to FSIS labs for analysis.
Data Source: FSIS Data Warehouse and PHIS databases.

Summary of Domestic Inspector-Generated Sampling Program Violation Rates

This section summarizes the results from the FY 2019 Domestic Inspector-generated Sampling Plan. The results are associated with specific animal class. All data reported in the following figures were extracted from the FSIS Data Warehouse and PHIS databases.

Figure 10. FY 2016 - 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate

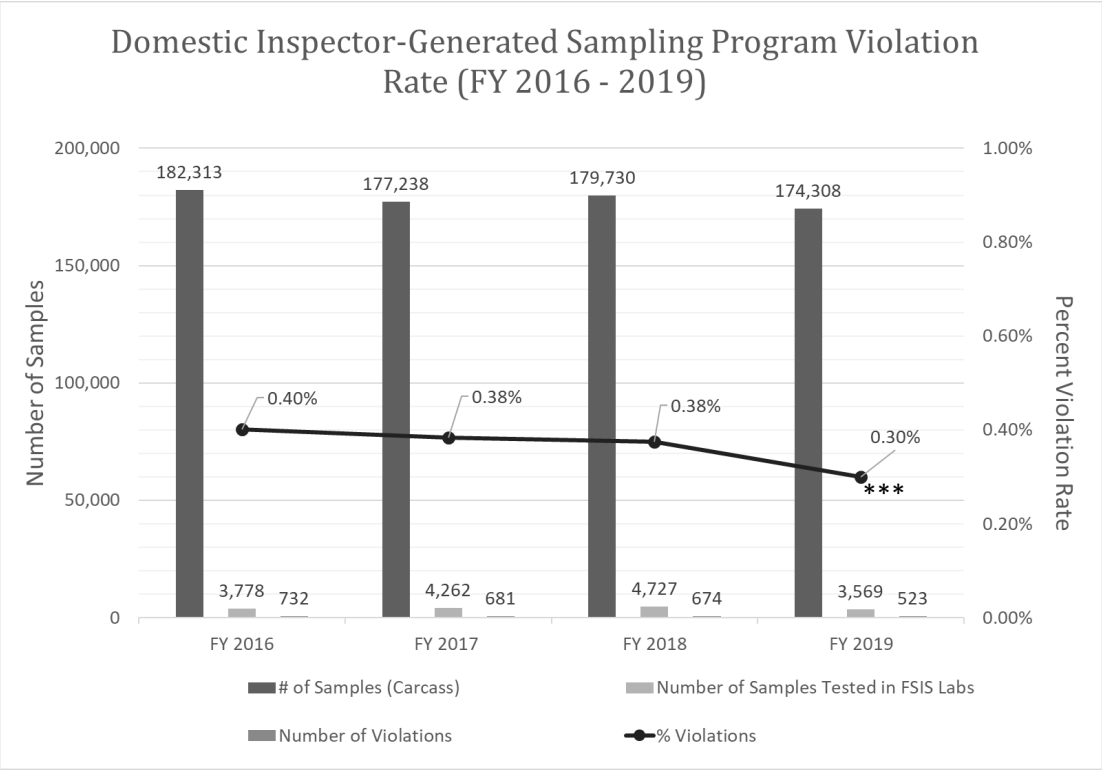


Figure 10 compares the domestic inspector-generated sampling program sample numbers (left axis) and percent violation rate (right axis) for the past four years (FY 2016 – 2019). Similar to the domestic scheduled sampling, the violation rate here (the number of KIS™ Test administrated/number of violations) have remained below 0.40%. There was a highly significant reduction ($p<0.0005$) in violation rate for FY 2019, when compared to FY 2018.

Figure 11. FY 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate per Animal Class (Cattle)

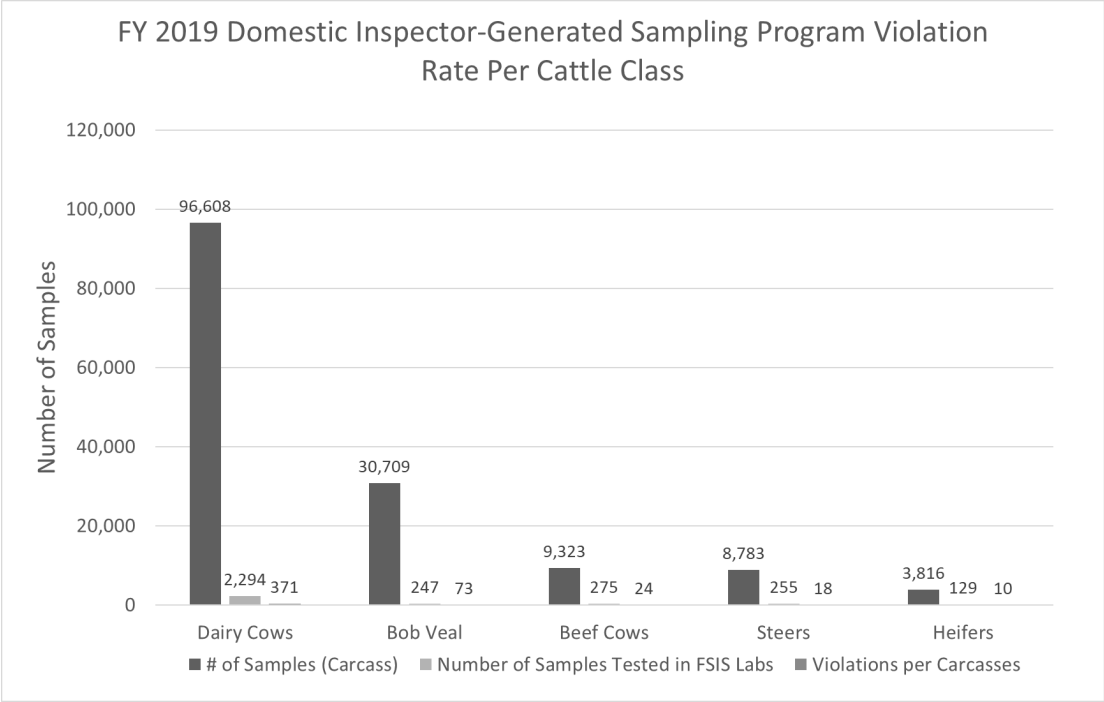


Figure 11 compares domestic inspector-generated sampling screening numbers and violation numbers for the cattle class, analyzed in FY 2019. Compared to the previous figure, dairy cows accounts for nearly 55% (96,608/174,308) of the KIS™ test performed and nearly 71% (371/523) of the violations reported in FY 2019.

Figure 12. FY 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate per Animal Class (Cattle) *continue*

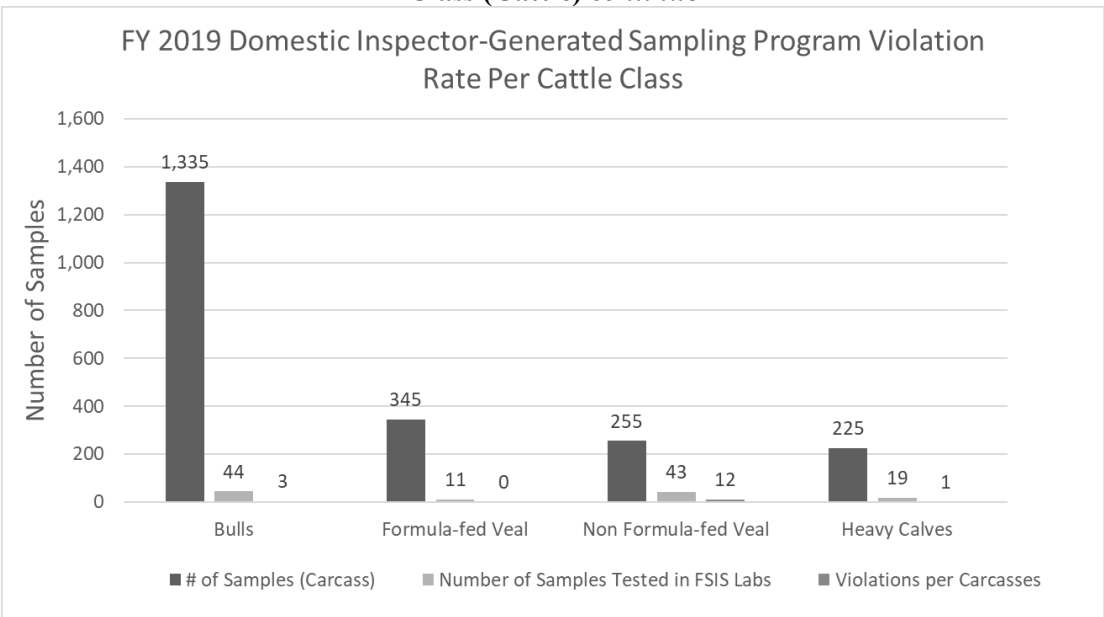


Figure 12 compares domestic inspector-generated sampling screening numbers and violation numbers for the remaining cattle class analyzed in FY 2019.

Figure 13. FY 2016 - 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate for Dairy Cows

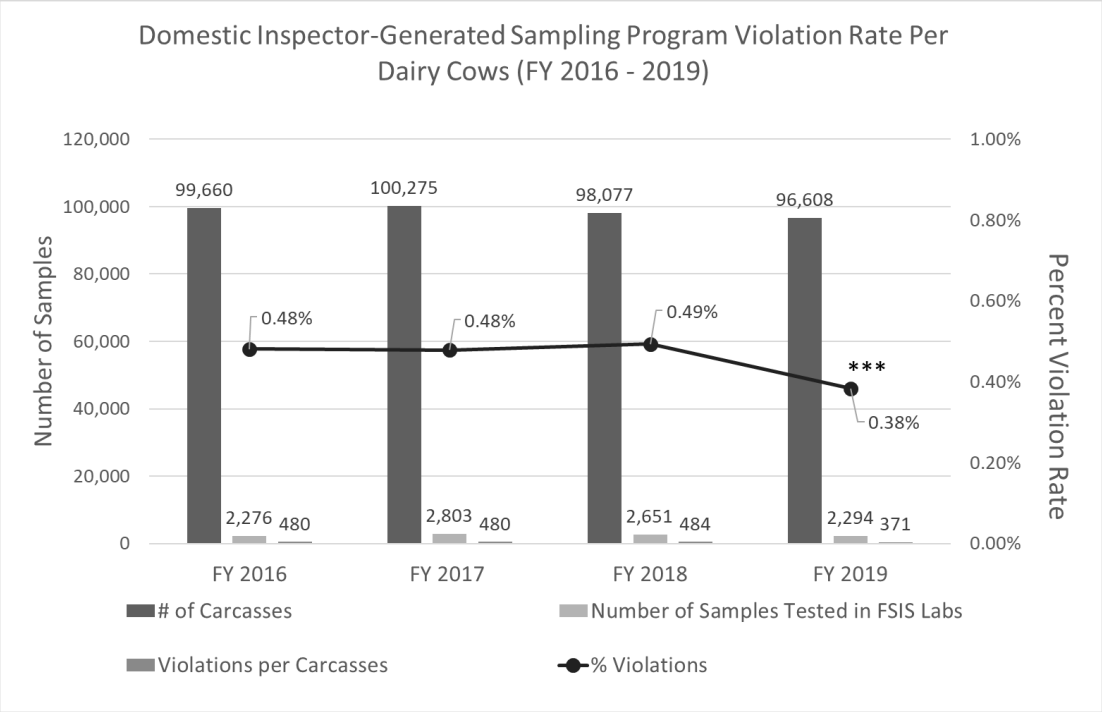


Figure 13 compares the dairy cow domestic inspector-generated sampling program sample numbers (left axis) and percent violation rate (right axis) for the past four years. Similar to the overall domestic inspector-generated sampling violation rate, there was a highly significant reduction ($p<0.005$) in violation rate for FY 2019 when compared to FY 2018.

Figure 14. FY 2016-2019 Domestic Inspector-Generated Sampling Top-Five Violative Residues (Percent Violative) in Dairy Cows

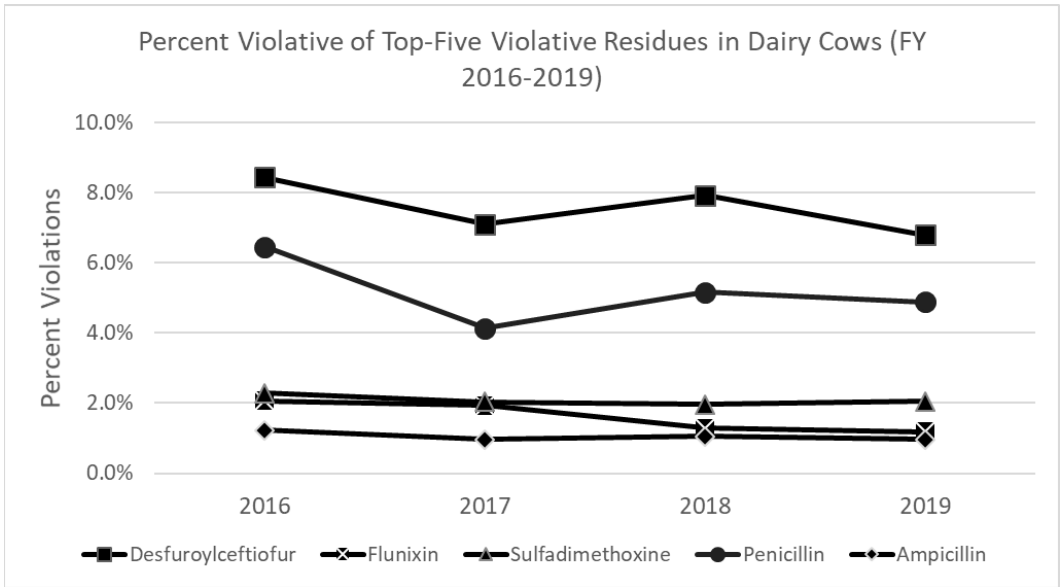


Figure 14 compares the percent violative rate of the top-five violative residues observed in dairy cows. In FY 2019, of the 2,294 dairy cow samples analyzed at FSIS labs, desfuroylceftiofur (the primary metabolite of ceftiofur) and penicillin accounts for 6.8% and 4.9% of the violations, respectively.

Figure 15. FY 2016 - 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate for Bob Veal

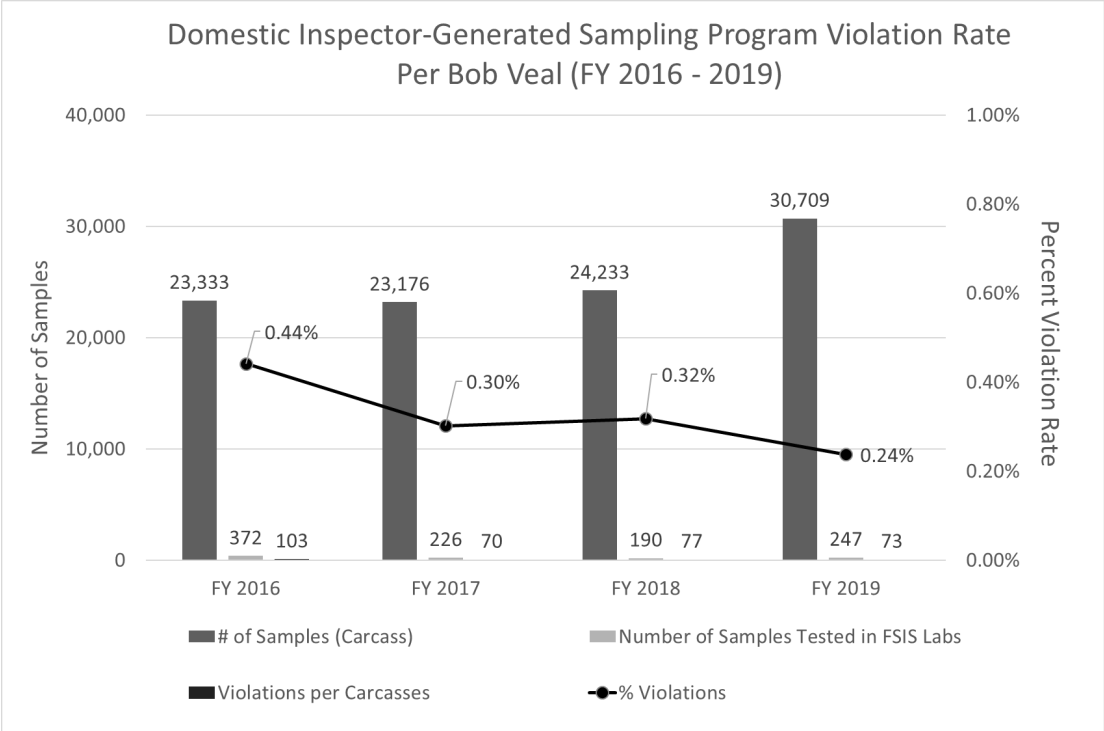


Figure 15 compares the bob veal domestic inspector-generated sampling program sample numbers (left axis) and percent violation rate (right axis) for the past four years. There was no significant change in bob veal violation rate ($p>0.05$), between FY 2018 and FY 2019.

Figure 16. FY 2016-2019 Domestic Inspector-Generated Sampling Top-Five Violative Residues (Percent Violative) in Bob Veal

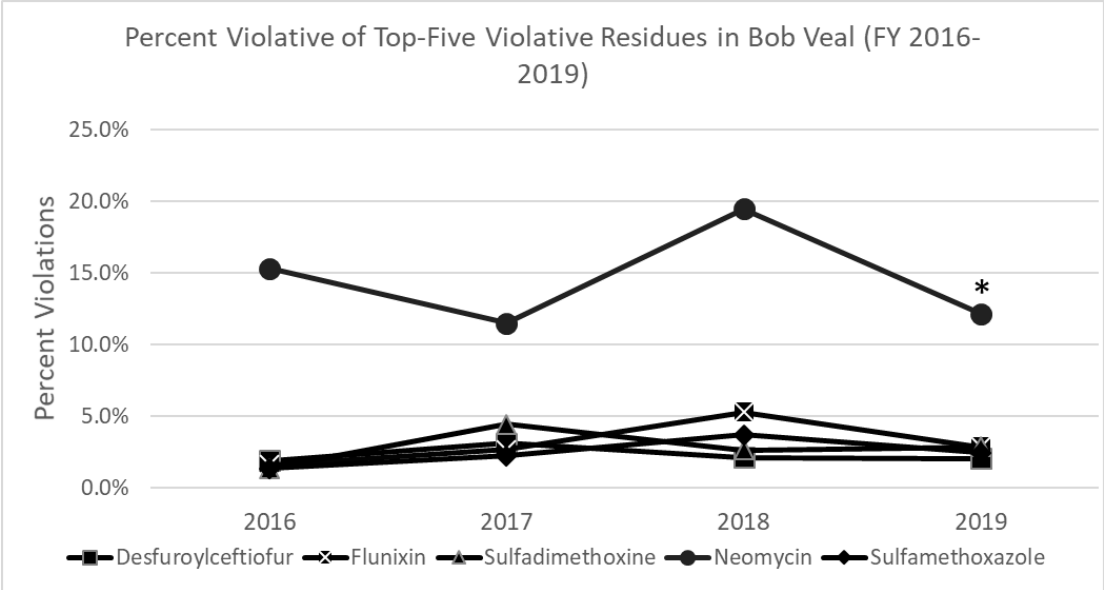


Figure 16 compares the percent violative rate of the top-five violative residues observed in bob veal. In FY 2019, of the 247 bob veal samples analyzed at FSIS labs, neomycin accounted for 12.1% of the violations. There was a significant decrease in the violation rate ($p<0.05$) between FY 2018-2019.

Figure 17. FY 2016 - 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate for Beef Cows

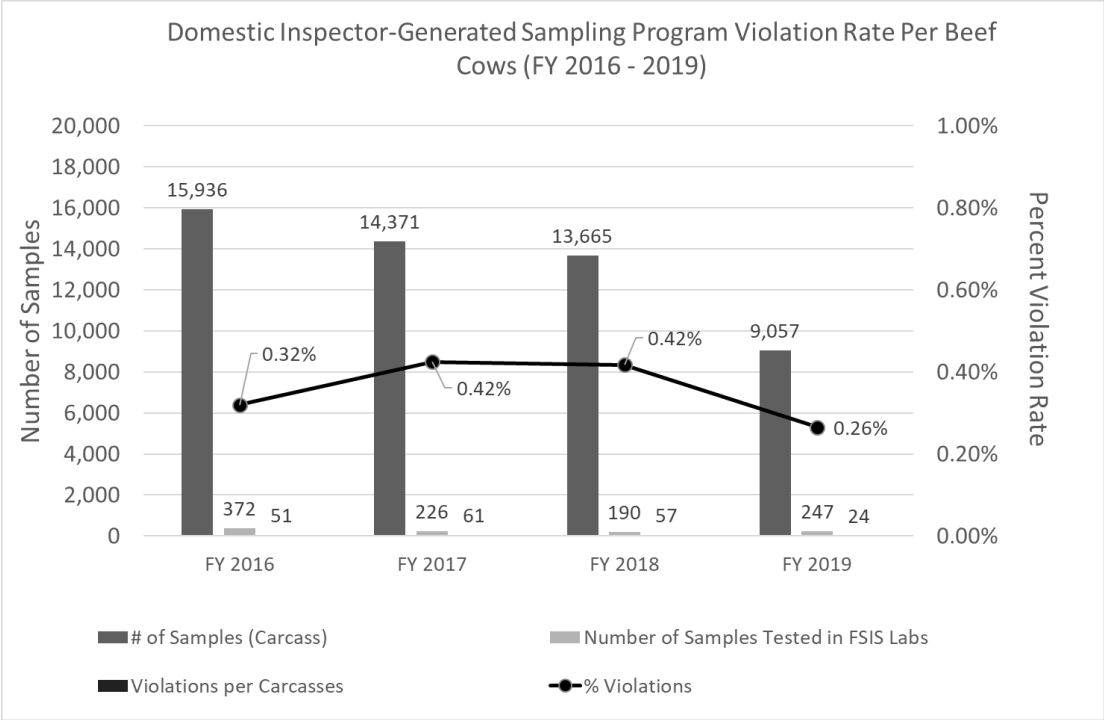


Figure 17 compares the beef cows domestic inspector-generated sampling program numbers (left axis) and percent violation rate (right axis) for the past four years. There was no significant change in beef cow violation rate ($p>0.05$), between FY 2018 and FY 2019.

Figure 18. FY 2016 - 2019 Domestic Inspector-Generated Sampling Top-Five Violative Residues (Percent Violative) in Beef Cows

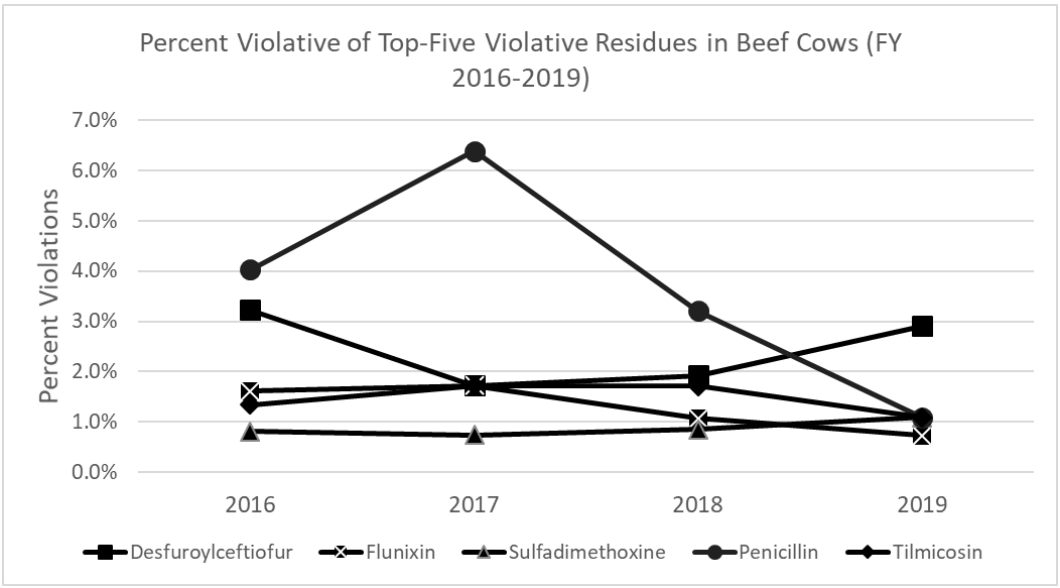


Figure 18 compares the percent violative rate of the top-five violative residues observed in beef cows. While the rate of penicillin has been steadily declining, the percent violation rate between FY 2018-2019 was not significant ($p>0.05$).

Figure 19. FY 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate per Animal Class (Swine)

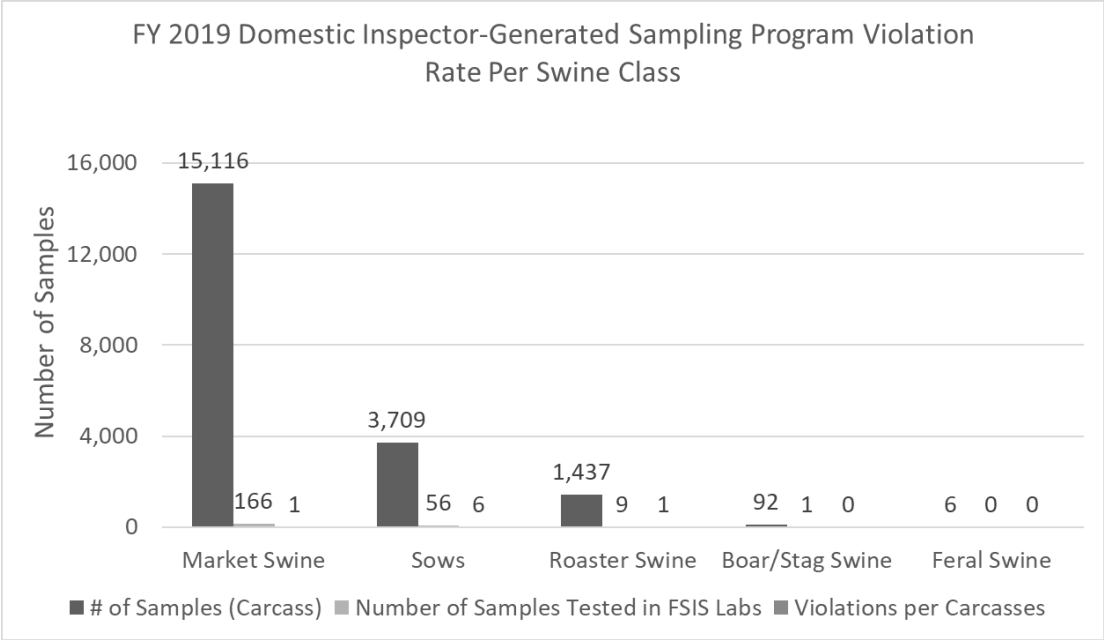


Figure 19 compares domestic inspector-generated sampling screening numbers and violation numbers for the swine class analyzed in FY 2019.

Figure 20. FY 2019 Domestic Inspector-Generated Sampling Screening/Violation Rate per Animal Class (Minor)

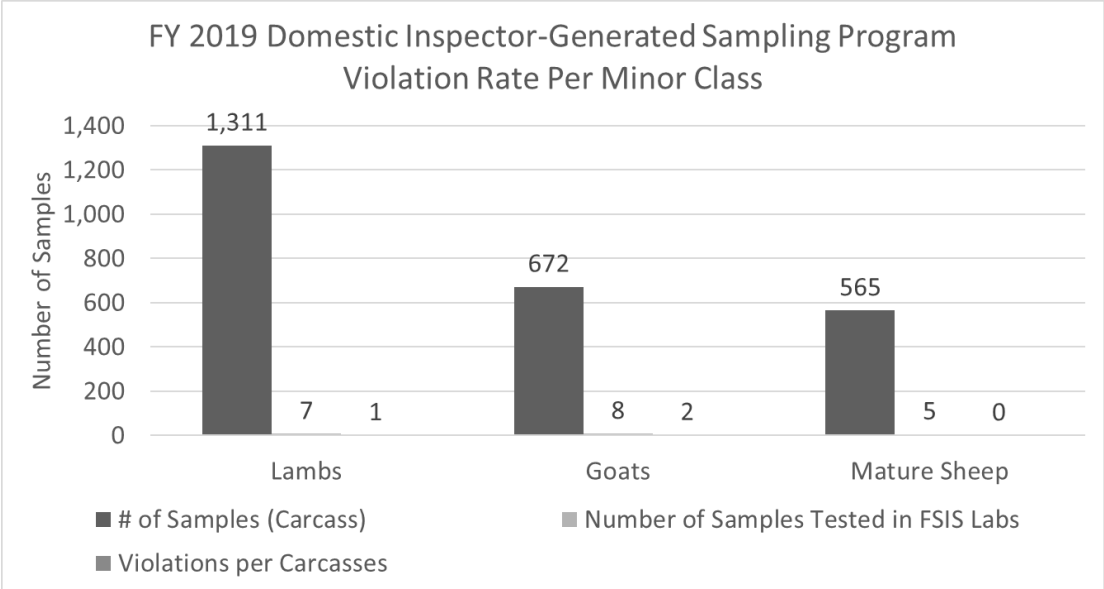


Figure 20 compares domestic inspector-generated sampling screening numbers and violation numbers for the minor class analyzed in FY 2019.

Import Residue Reinspection Sampling Program

This section summarizes the results from the FY 2019 Import Residue Reinspection Sampling Program. The results are associated with specific animal class. All data reported in the following tables were extracted from the FSIS Data Warehouse and PHIS databases.

Table 11 summarizes the number of import residue samples analyzed per chemical method by Production Class and Product Type.

Table 12 summarizes the number of import residue samples by inspection level, per exporting country and Production Type.

Table 13 summarizes the number of import residue samples analyzed, by exporting country and Production Type.

Table 14 summarizes number of samples and chemical residues under the import residue sample program, by exporting country.

Table 15 summarizes the number and types (i.e., specific compound) of violations in the import residue sampling program violation results by foreign country and animal class.

Table 11. FY 2019 NRP Import Residue Samples - Number of Residue Samples Analyzed Per Chemical Method by Production Class and Product Type

Production Class and Type		Chemical Methods								
		Aminoglycosides	Antifungal Dyes	Avermectins	Beta Agonists	Metals	MRM	Nitrofurans	Pesticides	Sulfonamides
Beef	Raw	371	--	187	185	116	372	--	208	--
	Processed	--	--	77	--	11	--	--	--	61
Chicken	Raw	49	--	21	25	16	49	15	30	--
	Processed	--	--	--	--	7	--	--	--	2
Goat	Raw	107	--	69	39	--	108	--	64	--
Lamb	Raw	25	--	20	5	--	25	--	19	--
Mutton	Raw	11	--	10	1	--	11	--	6	--
Pork	Raw	273	--	125	148	49	273	--	174	--
	Processed	--	--	6	--	22	--	--	--	5
Turkey	Raw	27	--	11	12	8	27	6	15	--
	Processed	--	--	--	--	14	--	--	--	15
Veal	Raw	83	--	42	42	10	83	--	36	--
Siluriformes	Raw	--	785	--	--	782	782	780	770	--
Egg Products	Processed	--	--	--	--	--	--	--	45	--
Total		**946**	**785**	**568**	**457**	**1,035**	**1,730**	**801**	**1,367**	**83**

Data Source: FSIS Data Warehouse and PHIS databases.

Table 12. FY 2019 Number of Import Residue Samples Collected by Inspection Level, per Exporting Country and Production Type

Country	Inspection Level / Product Type					
	Normal		Increased*	Intensified		
	Raw	Processed	Raw	Raw	Processed	Total
Argentina	109	--	--	--	--	**109**
Australia	131	--	--	--	--	**131**
Brazil	48	125	--	3	11	**187**
Canada	416	57	--	--	--	**473**
Chile	122	--	1	--	--	**123**
China	75	--	--	--	--	**75**
Costa Rica	50	--	--	--	--	**50**
Denmark	22	2	--	--	--	**24**
Finland	22	--	--	--	--	**22**
France	41	1	--	--	--	**42**
Germany	--	3	--	--	--	**3**
Honduras	16	--	--	--	--	**16**
Iceland	2	--	--	--	--	**2**
Ireland	41	--	--	--	--	**41**
Israel	--	21	--	--	--	**21**
Italy	--	11	--	--	--	**11**
Japan	15	--	--	--	--	**15**
Korea, Republic Of	--	1	--	--	--	**1**
Lithuania	--	11	--	--	--	**11**
Mexico	101	7	1	14	--	**123**
Namibia	20	--	22	--	--	**42**
Netherlands	64	5	--	12	--	**81**
New Zealand	203	1	--	--	--	**204**
Nicaragua	22	--	--	--	--	**22**
Northern Ireland	34	--	--	--	--	**34**
Poland	19	2	--	--	--	**21**
Spain	20	--	--	--	--	**20**
United Kingdom	39	--	--	--	--	**39**
Uruguay	47	2	14	--	5	**68**
Vietnam	1,414	--	12	64	--	**1,490**
Total	**3,093**	**249**	**50**	**93**	**16**	**3,501**

Note: * During FY 2019 there were no countries with "increased" sampling for processed products
Data Source: FSIS Data Warehouse and PHIS databases.

Table 13. FY 2019 Number of Import Residue Samples Analyzed by Exporting Country and Production Type

Country	Production Type														
	Beef		Chicken		Egg Products	Goat	Lamb	Mutton	Pork		*Siluriformes*	Turkey		Veal	
	Raw	Processed	Raw	Processed	Processed	Raw	Raw	Raw	Raw	Processed	Raw	Raw	Processed	Raw	Total
Argentina	109	--	--	--	--	--	--	--	--	--	--	--	--	--	**109**
Australia	76	--	--	--	--	22	11	12	--	--	--	--	--	10	**131**
Brazil	--	136	--	--	--	--	--	--	51	--	--	--	--	--	**187**
Canada	196	--	51	6	40		4		113	8	--	29	3	23	**473**
Chile	--	--	42	--	--	--	9	1	51	--	--	20	--	--	**123**
China	--	--	--	--	--	--	--	--	--	--	75	--	--	--	**75**
Costa Rica	50	--	--	--	--	--	--	--	--	--	--	--	--	--	**50**
Denmark	--	--	--	--	--	--	--	--	22	2	--	--	--	--	**24**
Finland	--	--	--	--	--	--	--	--	22	--	--	--	--	--	**22**
France	--	--	--	--	--	--	--	--	--	1	--	--	--	41	**42**
Germany	--	--	--	--	--	--	--	--	--	3	--	--	--	--	**3**
Honduras	16	--	--	--	--	--	--	--	--	--	--	--	--	--	**16**
Iceland	--	--	--	--	--	--	2	--	--	--	--	--	--	--	**2**
Ireland	20	--	--	--	--	--	--	--	21	--	--	--	--	--	**41**
Israel	--	--	--	1	--	--	--	--	--	--	--	--	20	--	**21**
Italy	--	--	--	--	--	--	--	--	--	11	--	--	--	--	**11**
Japan	15	--	--	--	--	--	--	--	--	--	--	--	--	--	**15**
Korea, Republic Of	--	--	--	1	--	--	--	--	--	--	--	--	--	--	**1**
Lithuania	--	5	--	--	--	--	--	--	--	6	--	--	--	--	**11**
Mexico	45	--	--	1	--	24	1		46	--	--	--	6	--	**123**
Namibia	42	--	--	--	--	--	--	--	--	--	--	--	--	--	**42**
Netherlands		--	--	--	5	--	--	--	47	--	--	--	--	29	**81**
New Zealand	40	1	--	--	--	126	8	4	--	--	--	--	--	25	**204**
Nicaragua	22	--	--	--	--	--	--	--	--	--	--	--	--	--	**22**
Northern Ireland	--	--	--	--	--	--	--	--	34	--	--	--	--	--	**34**
Poland	--	--	--	--	--	--	--	--	19	2	--	--	--	--	**21**

Country	Production Type														
	Beef		Chicken		Egg Products	Goat	Lamb	Mutton	Pork		*Siluriformes*	Turkey		Veal	
	Raw	Processed	Raw	Processed	Processed	Raw	Raw	Raw	Raw	Processed	Raw	Raw	Processed	Raw	Total
Spain	--	--	--	--	--	--	--	--	20	--	--	--	--	--	**20**
United Kingdom	--	--	--	--	--	--	--	--	39	--	--	--	--	--	**39**
Uruguay	52	7	--	--	--	--	9	--	--	--	--	--	--	--	**68**
Vietnam	--	--	--	--	--	--	--	--	--	--	1,490	--	--	--	**1,490**
Total	**683**	**149**	**93**	**9**	**45**	**172**	**44**	**17**	**485**	**33**	**1,565**	**49**	**29**	**128**	**3,501**

Data Source: FSIS Data Warehouse and PHIS databases.

Table 14. FY 2019 Number of Samples and Chemical Residues Detected under the Import Residue Sample Program by Exporting Country

Country	Number of Samples	Samples with Detected Non-Violative	Samples with Residue Detected Violative
Argentina	109	--	--
Australia	131	--	--
Brazil	187	11	--
Canada	473	4	--
Chile	123	--	--
China	75	1	--
Costa Rica	50	--	1
Denmark	24	--	--
Finland	22	--	--
France	42	--	--
Germany	3	--	--
Honduras	16	--	--
Iceland	2	--	--
Ireland	41	--	--
Israel	21	--	--
Italy	11	--	--
Japan	15	--	--
Korea, Republic Of	1	--	--
Lithuania	11	--	--
Mexico	123	--	2
Namibia	42	--	--
Netherlands	81	--	1
New Zealand	204	--	--
Nicaragua	22	1	--
Northern Ireland	34	--	--
Poland	21	--	--
Spain	20	--	--
United Kingdom	39	--	--
Uruguay	68	--	--
Vietnam	1,490	2	3
Total	**3,501**	**19**	**7**

Data Source: FSIS Data Warehouse and PHIS databases.

Table 15. FY 2019 Import Residue Sampling Violations by Foreign Country/Animal Class

No. of Samples	Country	Animal Class	Compound	Concentrations	Units	Tolerance Level Value	Authority (CFR Citations)
1	Costa Rica	Beef	Dihydrostreptomycin	1.1	PPM	0.5	21 CFR 556.200
2	Mexico	Goat	Ivermectin	68.5	PPB	0	21 CFR 556.344
3	Mexico	Goat	Dihydrostreptomycin	*	*	0	21 CFR 556.200
4	Netherlands	Pork	2-Amino-Flubendazole	*	*	0	Not Approved
5	Vietnam	*Siluriformes* (Catfish)	Crystal Violet	*	*	*	Not Approved
6	Vietnam	*Siluriformes* (Catfish)	Fipronil	*	*	*	Not Approved
7	Vietnam	*Siluriformes* (Catfish)	Fipronil sulfide	*	*	*	Not Approved

Note: * Violative residue results were residue were detected but not quantified.
Not Approved - Residue detected is not approved for the animal class.
Data Source: FSIS Data Warehouse and PHIS databases.

Appendix I

Distribution of Metal Testing Results by Animal Slaughter Class

Elements	Minimum Level of Applicability (MLA) (ppm)*	Animal	Number of Samples	Samples with Detections	Percent Detections	Min (ppm)	Max (ppm)
Aluminum	24.0	Beef Cows	134				
		Bob Veal	123				
		Bulls	2				
		Dairy Cows	134				
		Heavy Calves	4				
		Heifers	136				
		Siluriformes Fish	244				
		Market Swine	146				
		Non Formula-fed Veal	2				
		Sows	134				
		Steers	140				
		Young Chickens	191				
		Young Turkeys	171				
		Total	**1,561**	**0**	**0.0%**		
Arsenic	0.10	Beef Cows	147				
		Bob Veal	130				
		Bulls	3				
		Dairy Cows	141				
		Heavy Calves	4				
		Heifers	147				
		Siluriformes Fish	245	13	5.3%	0.11	0.25
		Market Swine	151				
		Non Formula-fed Veal	2				
		Sows	140				
		Steers	151				
		Young Chickens	199				
		Young Turkeys	178				
		Total	**1,638**	**13**	**0.8%**		
Barium	3.60	Beef Cows	147				
		Bob Veal	133				
		Bulls	3				
		Dairy Cows	142				
		Heavy Calves	4				
		Heifers	148				
		Siluriformes Fish	255				
		Market Swine	150				
		Non Formula-fed Veal	2				
		Sows	142				
		Steers	151				
		Young Chickens	195				
		Young Turkeys	176				
		Total	**1,648**	**0**	**0.0%**		
Boron		Beef Cows	147				
		Bob Veal	133				
		Bulls	3				
		Dairy Cows	135	2	1.5%	5.04	8.29
		Heavy Calves	4				
		Heifers	144				

Elements	Minimum Level of Applicability (MLA) (ppm)*	Animal		Number of Samples	Samples with Detections	Percent Detections	Min (ppm)	Max (ppm)
		Siluriformes Fish		252	1	0.4%	5.76	5.76
	4.80	Market Swine		146				
		Non Formula-fed Veal		2				
		Sows		137				
		Steers		149	1	0.7%	5.09	5.09
		Young Chickens		195	3	1.5%	6.02	6.12
		Young Turkeys		177	2	1.1%	5.12	6.54
			Total	**1,624**	**9**	**0.6%**		
		Beef Cows		147				
		Bob Veal		135				
		Bulls		3				
		Dairy Cows		142				
		Heavy Calves		4				
		Heifers		148				
		Siluriformes Fish		252				
Cadmium	0.01	Market Swine		151				
		Non Formula-fed Veal		2				
		Sows		141				
		Steers		152				
		Young Chickens		201				
		Young Turkeys		181				
			Total	**1,659**	**0**	**0.0%**		
		Beef Cows		146				
		Bob Veal		134				
		Bulls		3				
		Dairy Cows		139				
		Heavy Calves		4				
		Heifers		144				
		Siluriformes Fish		257				
Chromium	3.60	Market Swine		147				
		Non Formula-fed Veal		2				
		Sows		140				
		Steers		147				
		Young Chickens		200				
		Young Turkeys		180				
			Total	**1,643**	**0**	**0.0%**		
		Beef Cows		148				
		Bob Veal		133				
		Bulls		3				
		Dairy Cows		141				
		Heavy Calves		4				
		Heifers		147				
		Siluriformes Fish		255				
Cobalt	0.025	Market Swine		149				
		Non Formula-fed Veal		2				
		Sows		142				
		Steers		150				
		Young Chickens		199				
		Young Turkeys		176				
			Total	**1,649**	**0**	**0.0%**		
		Beef Cows		145				
		Bob Veal		130				
Copper		Bulls		3				
		Dairy Cows		140				

Elements	Minimum Level of Applicability (MLA) (ppm)*	Animal	Number of Samples	Samples with Detections	Percent Detections	Min (ppm)	Max (ppm)
		Heavy Calves	4				
		Heifers	144	1	0.7%	3.53	3.53
		Siluriformes Fish	253				
	3.00	Market Swine	148				
		Non Formula-fed Veal	2				
		Sows	140				
		Steers	145				
		Young Chickens	197				
		Young Turkeys	178				
		Total	**1,629**	**1**	**0.1%**		
		Beef Cows	148	68	45.9%	30.01	56.89
		Bob Veal	134	3	2.2%	31.14	33.87
		Bulls	3	2	66.7%	33.17	34.80
		Dairy Cows	141	92	65.2%	30.02	66.48
		Heavy Calves	4				
		Heifer	148	80	54.1%	30.08	45.84
		Siluriformes Fish	250	1	0.4%	31.24	31.24
Iron	30.0	Market Swine	148				
		Non Formula-fed Veal	2				
		Sows	140	2	1.4%	34.25	34.47
		Steers	152	79	52.0%	30.17	40.22
		Young Chickens	199				
		Young Turkeys	181				
		Total	**1,650**	**327**	**19.8%**		
		Beef Cows	138				
		Bob Veal	129				
		Bulls	2				
		Dairy Cows	130				
		Heavy Calves	4				
		Heifers	139				
		Siluriformes Fish	243	1	0.4%	0.09	0.09
Lead	0.025	Market Swine	145	1	0.7%	0.18	0.18
		Non Formula-fed Veal	2				
		Sows	134	1	0.7%	0.16	0.16
		Steers	142				
		Young Chickens	190	1	0.5%	0.03	0.03
		Young Turkeys	171				
		Total	**1,569**	**4**	**0.3%**		
		Beef Cows	147	8	5.4%	0.21	0.28
		Bob Veal	132				
		Bulls	3				
		Dairy Cow	141	3	2.1%	0.21	0.26
		Heavy Calves	4	1	25.0%	0.21	0.21
		Heifers	147	39	26.5%	0.20	0.32
		Siluriformes Fish	252	16	6.3%	0.20	1.29
Manganese	0.20	Market Swine	149	3	2.0%	0.20	0.29
		Non Formula-fed Veal	2				
		Sows	142				
		Steers	148	51	34.5%	0.20	0.28
		Young Chickens	195				
		Young Turkeys	174				
		Total	**1,636**	**121**	**7.4%**		

Elements	Minimum Level of Applicability (MLA) (ppm)*	Animal		Number of Samples	Samples with Detections	Percent Detections	Min (ppm)	Max (ppm)
Molybdenum	0.05	Beef Cows		148	3	2.0%	0.05	0.07
		Bob Veal		135				
		Bulls		3				
		Dairy Cows		142	2	1.4%	0.06	0.08
		Heavy Calves		4				
		Heifers		148				
		Siluriformes Fish		257				
		Market Swine		151				
		Non Formula-fed Veal		2				
		Sows		142				
		Steers		152				
		Young Chickens		201	19	9.5%	0.05	0.12
		Young Turkeys		181				
			Total	**1,666**	**24**	**1.4%**		
Nickel	6.0	Beef Cows		143				
		Bob Veal		134				
		Bulls		3				
		Dairy Cows		138				
		Heavy Calves		4				
		Heifers		143				
		Siluriformes Fish		250				
		Market Swine		145				
		Non Formula-fed Veal		1				
		Sows		141				
		Steers		149				
		Young Chickens		198				
		Young Turkeys		174				
			Total	**1,623**	**0**	**0.0%**		
Selenium	0.50	Beef Cows		143				
		Bob Veal		127				
		Bulls		2				
		Dairy Cows		136				
		Heavy Calves		4				
		Heifer		139	1	0.7%	0.80	0.80
		Siluriformes Fish		245	6	2.4%	0.50	1.24
		Market Swine		146	4	2.7%	0.50	0.70
		Non Formula-fed Veal		2				
		Sows		136	3	2.2%	0.55	0.67
		Steers		151				
		Young Chickens		188	1	0.5%	0.60	0.60
		Young Turkeys		171				
			Total	**1,590**	**15**	**0.9%**		
Strontium	3.0	Beef Cows		146				
		Bob Veal		132				
		Bulls		3				
		Dairy Cows		139				
		Heavy Calves		4				
		Heifers		146				
		Siluriformes Fish		257	5	1.9%	3.47	68.37
		Market Swine		150				
		Non Formula-fed Veal		2				
		Sows		141				
		Steers		151				

Elements	Minimum Level of Applicability (MLA) (ppm)*	Animal		Number of Samples	Samples with Detections	Percent Detections	Min (ppm)	Max (ppm)
		Young Chickens		200				
		Young Turkeys		178				
			Total	**1,649**	**5**	**0.3%**		
		Beef Cows		146				
		Bob Veal		131				
		Bulls		3				
		Dairy Cows		140				
		Heavy Calves		4				
		Heifers		147				
		Siluriformes Fish		247				
Thallium	0.05	Market Swine		149				
		Non Formula-fed Veal		2				
		Sows		141				
		Steers		151				
		Young Chickens		193				
		Young Turkeys		176				
			Total	**1,630**	**0**	**0.0%**		
		Beef Cows		145				
		Bob Veal		134				
		Bulls		3				
		Dairy Cows		141				
		Heavy Calves		4				
		Heifers		145				
		Siluriformes Fish		256				
Vanadium	3.6	Market Swine		149				
		Non Formula-fed Veal		2				
		Sows		142				
		Steers		151				
		Young Chickens		198				
		Young Turkeys		177				
			Total	**1,647**	**0**	**0.0%**		
		Beef Cows		148	131	88.5%	30.52	87.07
		Bob Veal		135	66	48.9%	30.05	44.86
		Bulls		3	3	100.0%	45.76	56.45
		Dairy Cows		142	131	92.3%	30.19	91.13
		Heavy Calves		4	4	100.0%	32.95	37.58
		Heifers		148	133	89.9%	30.75	68.37
		Siluriformes Fish		253	1	0.4%	43.76	43.76
Zinc	30.0	Market Swine		150	25	16.7%	30.14	52.36
		Non Formula-fed Veal		2	1	50.0%	42.91	42.91
		Sows		142	57	40.1%	30.08	62.88
		Steers		152	141	92.8%	30.12	76.22
		Young Chickens		200				
		Young Turkeys		181	1	0.6%	31.78	31.78
		Total		**1,660**	**694**	**41.8%**		
		Grand Total		**29,371**	**1,213**	**4.1%**		

Note: * The MLA is the minimum level at which a method has been successfully validated for a residue in a given matrix. For quantitative methods, it is also the minimum level at which regulatory results may be reported.
No tolerance level was been set for metal contaminants in FSIS-regulated food products.

Appendix II

NRP Non-Violative Positive and Violative Residue Samples Results

In addition to the publication of the FY 2019 NRP samples results, FSIS posts the details of each positive non-violative, and positive violative residue result associated with the NRP sampling program in a spreadsheet format on the FSIS website at:

https://www.fsis.usda.gov/wps/portal/fsis/topics/data-collection-and-reports/chemistry/red-books/red-book

This spreadsheet includes detailed information regarding samples collected and analyzed by FSIS under both the "scheduled" sampling and the "inspector-generated" sampling programs. FSIS plans to update this spreadsheet on an ongoing basis so as to increase program transparency for all stakeholders. The spreadsheet includes the following data fields: sample collection and reviewed date, the project code, the animal class, tissue type, chemical residue name, concentration values, sample results (whether positive non-violative or postive violative), chemcial concentration values (if any) and the CFR reference for each chemical listed.

Appendix III

Number of Samples Required to Detect Violations with Predefined Probabilities

Scheduled sampling is conducted to provide some assurance that FSIS would detect a violation that affects a given percentage of the sample population.

Prior to FY 2012, FSIS tested 230 or 300 samples from each production class/residue compound class pairing to obtain results that were statistically meaningful. The testing sample sizes of 230 or 300 ensured FSIS a 90 percent or 95 percent probability, respectively, of detecting at least one chemical residue violation if the violation rate is equal to or greater than one percent in the population being sampled. Starting in FY 2012, as stated in its residue sampling plan, FSIS increased the sample size selected/tested to about 800 samples for each of the nine major production class tested under Tier 1.

Table A-1 provides the calculated number of samples required to ensure detection of at least one violation that affects a given percentage of the sampled population. Statistically, for a binomial distribution with sample size "n" and violation rate "v" (in decimal), if v is the true violation rate in the population and n is the number of samples, the probability, p, of finding at least one violation among the n samples (assuming random sampling) is $p = 1 - (1 - v)^n$

For example, if the true violation rate is 1% the probability of detecting at least one violation with sample sizes of 230,300,390,460, and 800 are 90%, 95%, 98%, 99%, and 99.97% respectively.

In the table below the probability of detecting at least one violation with a sample size of 800 is italicized and bolded.

Table A-1: Number of Samples Required to Detect Violations with Predefined Probabilities FY 2019 NRP

Percentage % Violative in the population (v)	Number of samples required to detect at least one violation in (n) samples with a probability (p)				
	0.90	0.95	0.98	0.99	0.9997
	Sample Size required "n"				
10	22	29	37	44	77
5	45	59	76	90	158
1	230	300	389	459	***807***
0.57	403	525	684	***806***	1,419
0.50	460	598	***780***	919	1,618
0.37	620	***808***	1,055	1,242	2,188
0.29	***793***	1,032	1,347	1,586	2,793
0.10	2,302	2,995	3,910	4,603	8,108

The procedure to calculate the required sample size needed is as follows:

$p = 1 - (1 - v)^n$ ← Probability of detecting at least one violation in n sample of binomial distribution with violation rate v

$1 - p = (1 - v)^n$ ← Subtract one from both side of the equation. This gives the probability of detecting No violations in n samples

$\log(1 - p) = \log(1 - v)^n$ ← Apply logarithmic function to both side of the equation

$\log(1 - p) = n * \log(1 - v)$ ← A logarithmic function property

$n = \frac{\log(1 - p)}{\log(1 - v)}$ ← Sample size based on violation rate (v) and probability of detecting (p)

Appendix IV

List of Chemical Residues by Class/Method

I. Veterinary Drugs

For FY 2019 sampling, FSIS used the following methods to test for veterinary drugs: the multi-residue method, the aminoglycoside method, the hormones method, the beta-agonist method, the avermectin method, the nitrofuran method, and the carbadox method. The detailed lists veterinary drug analytes tested for in each of those methods are listed below.

Multi-residue method

2-Aminosulfone Albendazole	DCCD	Gamithromycin	Oxytetracycline	Sulfamethoxypyridazine
2-Amino-Flubendazole	Desethylene Ciprofloxacin	Haloperidol	Penicillin G	Sulfanitran
2-Quinoxaline Carboxylic Acid (QCA)	Diclofenac	Ipronidazole	Phenylbutazone	Sulfapyridine
Abamectin	Dicloxacillin	Ipronidazole - OH	Pirlimycin	Sulfaquinoxaline
Acepromazine	Difloxacin	Ketamine	Prednisone	Sulfathiazole
Albendazole	Dimetridazole	Ketoprofen	Ractopamine	Tetracycline
Amoxicillin	Dimetridazole - OH	Levamisole	Ronidazole	Thiabendazole
Ampicillin	Dipyrone	Lincomycin	Salbutamol	Tildipirosin
Azaperone	Doramectin	Melengestrol Acetate	Sarafloxacin	Tilmicosin
Butorphanol	Doxycycline	Meloxicam	Selamectin	Tolfenamic Acid
Carazolol	Emamectin Benzoate	Metronidazole	Sulfachloropyridazine	Tulathromycin A
Cefazolin	Enrofloxacin	– Metronidazole-OH	Sulfadiazine	Tylosin
Chloramphenicol	Eprinomectin	Morantel tartrate	Sulfadimethoxine	Tyvalosin
Chlortetracycline	Erythromycin A	Moxidectin	Sulfadoxine	Virginiamycin
Cimaterol	Fenbendazole	Nafcillin	Sulfaethoxypyridazine	Xylazine
Ciprofloxacin	Fenbendazole sulphone	Norfloxacin	Sulfamerazine	β-Zearalanol
Clindamycin	Florfenicol	Orbifloxacin	Sulfamethazine	
Cloxacillin	Flubendazole	Oxacillin	Sulfamethizole	
Danofloxacin	Flunixin	Oxyphenylbutazone	Sulfamethoxazole	

Aminoglycoside Method

Amikacin	Gentamicin	Neomycin
Apramycin	Hygromycin B	Spectinomycin
Dihydrostreptomycin	Kanamycin	Streptomycin

Hormones Method

Megestrol	Melengestrol Acetate	Hexestrol	Zeranol

βeta-Agonists Method

Cimaterol	Ractopamine	Zilpaterol
Clenbuterol	Salbutamol	

Avermectin Method

Abamectin	Doramectin	Ivermectin	Moxidectin

Nitrofuran Method

3-Amino-2-oxazolidinone (AOZ)	1-Aminohydantoin (AHD)	Semicarbazide (SEM)
3-Amino-5-morpholinomethyl-2-oxazolidinone (AMOZ)		

Carbadox Method

Quinoxaline-2-carboxylic acid

II. Pesticides and environmental contaminants

For FY 2019 sampling, FSIS used the following methods to test for pesticides and environmental contaminants: the pesticide method and the metals method. The detailed lists of pesticides and environmental contaminant analytes tested for in each of those methods are listed below.

a. *Pesticide Method*

1-Naphthol	Coumaphos O	Fluroxypyr-1-Methylhepyl-Ester	Pentachlorobenzene (PCB)
3-Hydroxycarbofuran	Coumaphos S	Fluvalinate	Permethrin (cis&trans)
Acephate	DDD o,p’	Heptachlor	Piperonyl butoxide
Acetamiprid	DDD p,p’ + DDT, o,p'	Heptachlor epoxide (cis+ trans) or (B+A)	Pirimiphos methyl
Alachlor	DDE o,p’	Hexachlorobenzene (HCB)	Prallethrin
Aldicarb	DDE p,p’	Hexazinone	Profenofos
Aldicarb sulfone	DDT p,p’	Hexythiazox	Pronamide
Aldicarb sulfoxide	Deethylatrazine	Imazalil	Propachlor
Aldrin	Diazinon	Imidacloprid	Propanil
Atrazine	Dichlorvos (DDVP)	Indoxacarb	Propetamphos
Azinphos methyl	Dieldrin	Lindane (BHC gamma)	Propiconazole
Azoxystrobin	Difenoconazole	Linuron	Pyraclostrobin
Benoxacor	Diflubenzuron	Malathion	Pyrethrin I
Bifenthrin	Dimethoate	Metalaxyl	Pyrethrin II
Boscalid	Diuron	Methamidophos	Pyridaben
Buprofezin	Endosulfan I	Methomyl	Pyriproxyfen
Carbaryl	Endosulfan II	Methoxyfenozide	Resmethrin (cis&trans)
Carbofuran	Endosulfan sulfate	Metolachlor	Simazine
Carfentrazone ethyl	Ethion	Metribuzin	Sulprofos
Chlordane cis	Ethion monoxon	MGK-264 (isomers 1 & 2)	Tebufenozide
Chlordane trans	Ethofumesate	Myclobutanil	Tefluthrin
Chloroneb	Fenoxaprop ethyl	Nonachlor cis	Tetrachlorvinphos
Chlorothalonil	Fenpropathrin	Nonachlor trans	Tetraconazole
Chlorpropham	Fipronil	Norflurazon	Thiabendazole
Chlorpyrifos	Fipronil desulfinyl	Omethoate	Thiamethoxam
Chlorpyrifos methyl	Fipronil sulfide	Oxychlordane	Thiobencarb
Clothianidin	Fluridone	Pentachloroaniline (PCA)	Trifloxystrobin
1-Naphthol	Coumaphos O	Fluroxypyr-1-Methylhepyl-Ester	Pentachlorobenzene (PCB)
3-Hydroxycarbofuran	Coumaphos S	Fluvalinate	Permethrin (cis&trans)
Acephate	DDD o,p’	Heptachlor	Piperonyl butoxide
Acetamiprid	DDD p,p’ + DDT, o,p'	Heptachlor epoxide (cis+ trans) or (B+A)	Pirimiphos methyl
Alachlor	DDE o,p’	Hexachlorobenzene (HCB)	Prallethrin

Aldicarb	DDE p,p'	Hexazinone	Profenofos
Aldicarb sulfone	DDT p,p'	Hexythiazox	Pronamide
Aldicarb sulfoxide	Deethylatrazine	Imazalil	Propachlor
Aldrin	Diazinon	Imidacloprid	Propanil
Atrazine	Dichlorvos (DDVP)	Indoxacarb	Propetamphos
Azinphos methyl	Dieldrin	Lindane (BHC gamma)	Propiconazole
Azoxystrobin	Difenoconazole	Linuron	Pyraclostrobin
Benoxacor	Diflubenzuron	Malathion	Pyrethrin I
Bifenthrin	Dimethoate	Metalaxyl	Pyrethrin II
Boscalid	Diuron	Methamidophos	Pyridaben
Buprofezin	Endosulfan I	Methomyl	Pyriproxyfen
Carbaryl	Endosulfan II	Methoxyfenozide	Resmethrin (cis&trans)
Carbofuran	Endosulfan sulfate	Metolachlor	Simazine
Carfentrazone ethyl	Ethion	Metribuzin	Sulprofos
Chlordane cis	Ethion monoxon	MGK-264 (isomers 1 & 2)	Tebufenozide
Chlordane trans	Ethofumesate	Myclobutanil	Tefluthrin
Chloroneb	Fenoxaprop ethyl	Nonachlor cis	Tetrachlorvinphos
Chlorothalonil	Fenpropathrin	Nonachlor trans	Tetraconazole
Chlorpropham	Fipronil	Norflurazon	Thiabendazole
Chlorpyrifos	Fipronil desulfinyl	Omethoate	Thiamethoxam
Chlorpyrifos methyl	Fipronil sulfide	Oxychlordane	Thiobencarb
Clothianidin	Fluridone	Pentachloroaniline (PCA)	Trifloxystrobin

b. *Metals Method*

Aluminum (Al)	Copper (Cu)	Selenium (Se)
Barium (Ba)	Iron (Fe)	Strontium (Sr)
Boron (B)	Lead (Pb)	Thallium (Tl)
Cadmium (Cd)	Manganese (Mn)	Vanadium (V)
Chromium (Cr)	Molybdenum (Mo)	Zinc (Zn)
Cobalt (Co)	Nickel (Ni)	