# USDA Food Safety and Inspection Service
# Annual Sampling Summary Report
Fiscal Year 2019

United States Department of Agriculture
Food Safety and Inspection Service

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# Introduction

The U.S. Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS) inspects meat, poultry, and egg products to ensure that the food produced is safe, wholesome, and properly labeled. Verification activities serve to protect the public from foodborne hazards. A key FSIS inspection verification activity is the sampling of product for microbiological contaminants or chemical residues.

Each year, FSIS establishes sampling priorities and goals through its annual sampling plan. FSIS utilizes the agency's Strategic Plan goals, outcomes, objectives, and measures – as well as specific items of focus in the agency's Annual Plan – to develop its Annual Sampling Plan. The Annual Sampling Plan identifies changes planned for the fiscal year to FSIS' various sampling programs and describes the agency's overall strategy for directing its sampling resources. In addition, the Annual Sampling Plan aligns goals and measures described in FSIS' Strategic and Annual Plan with sampling activities and results.

This report, the FY19 Annual Sampling Summary Report, summarizes the activities and provides an overview of results for the products the agency inspected during fiscal year (FY) 2019 (October 1, 2018 – September 30, 2019).

FSIS routinely evaluates sampling data, posts these data to the FSIS website, including establishment specific datasets, and shares data through quarterly letters directly with regulated establishments. These data include FSIS pathogen verification data, FSIS National Residue Program data, and import and export data. The results of these assessments are used in a variety of ways, including monitoring effectiveness, overall sanitation, and food safety systems, informing agency policy making, estimating public health impact, and advising strategic and performance planning.

## Background

The agency historically used the Annual Sampling Plan to detail sampling results and related activities from the previous years in addition to reporting the planned sampling allocations and activities for the current year. Effective FY 2019, FSIS began reporting only the prospective current year planned information in the annual sampling plan and developed this report to provide the retrospective information.

FSIS analyzes sampling data and calculates either percent positive or prevalence. Percent positive is percentage of samples of a specific FSIS-regulated product with a specific pathogen detected by sampling. Prevalence is the estimated proportion, nationally, of a specific FSIS-regulated product with a specific pathogen. More information on the definitions for percent positive, volume-weighted percent positive, and prevalence can be found on the FSIS website sampling results data dictionary.

## Summary of Sampling

FSIS continued to focus on its mission of protecting public health and preventing foodborne illness in several different ways. In FY 2019, FSIS concluded a comprehensive internal evaluation of all sampling projects called the Strategic Assessment of Sampling Resources (SASR). During this evaluation, FSIS developed several new tools to help optimize the benefits provided by each sampling project.

FSIS looked for other areas to improve their sampling programs and implemented the following:

- Microbiological Sampling Programs
    - A revised methodology for assessing whether establishments meet applicable *Salmonella* performance against the current performance standards for poultry products.
    - The implementation of a new *Salmonella* categorization methodology in response to public comments.
    - Calculating and publishing new estimates of the prevalence of *Salmonella* in pork products.
    - New collaborative work with USDA's Agricultural Research Service to determine the presence of non-O157 Shiga toxin-producing *Escherichia coli* (STEC) in pork products.
    - The development of a new sampling plan for raw pork products to be implemented in FY 2020.
    - Publishing new performance standards for *Campylobacter* in not ready-to-eat (RTE) comminuted chicken and turkey.

- National Residue Program
    - Modernization of the FSIS residue annual sampling plan (formerly known as the Blue Book).
    - Updated residue methodology.

- Redefined the sampling of lamb and mature sheep.
- Implemented liquid and dry egg products surveillance for pesticide residues.

FSIS collaborated with U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Food and Drug Administration (FDA) to meet the agency's goal to improve coordination of federal food safety efforts and address cross-cutting priorities for food safety data. In coordination with the CDC, FSIS began using whole genome sequencing (WGS) as the primary characterization tool for *Salmonella*, *Campylobacter*, and *E. coli* in meat and poultry.

## Beef Products

FSIS collects samples from federally inspected establishments and retail firms to verify products are not adulterated. These samples are scheduled monthly by randomly selecting establishments from the current population that produce eligible products. The frequency of sampling at any establishment is based on the volume of eligible products. FSIS samples all raw beef products for *Escherichia coli* (*E. coli*) O157:H7 and *Salmonella* in raw beef product samples; in addition, a subset of raw beef products are sampled for non-O157 STEC (**Table 1**).

FSIS also collects raw beef follow-up samples that are scheduled in response to a positive finding from an initial routine verification sample positive, as well as for traceback to supplier establishments (**Table 1**). The follow-up sample may or may not be from the same location as where the initial positive sample was collected (i.e., trace back to the supplier). Follow-up samples are a tool FSIS uses to verify whether the establishment has made effective corrective action in response to the initial positive detected through routine FSIS verification testing.

For more information on source materials sampled, the sample project summary, sample method, and product sampled, see the FSIS Directive 10,010.1 Informational Dashboard and select the appropriate sample code for more information.

**Table 1. FSIS' Raw Beef Verification Sampling**

FSIS has five verification sampling codes and corresponding follow-up sampling codes.

| Raw Beef Sampling Verification Code | Sample Project Description | Corresponding Follow-Up Sampling Code |
|---|---|---|
| MT43 | Raw ground beef | MT53 or MT44[/1/] |
| MT60 | Beef manufacturing trimmings produced from cattle slaughtered onsite | MT53 |
| MT64 | Raw ground beef components other than trim, produced from cattle slaughtered onsite | MT53 |
| MT65 | Bench trim produced from cattle not slaughtered onsite | MT52 or MT53 |
| MT05 | Raw ground beef in retail | MT06 |

[/1/] FSIS also conducts MT44T follow-up sampling for positive samples not from FSIS verification sampling (e.g., traceback related to recalls or from state testing results).

In FY 2019, there were a sufficient number of MT43 and MT60 samples to estimate the prevalence of STEC. The calculated *E. coli* O157:H7 prevalence (MT60) in FY 2018 was 0.15% and was 0.05% in FY 2019. The calculated non-O157 STEC prevalence (MT60) in FY 2018 was 0.25% and was 0.51% in FY 2019.

*Salmonella* analysis is performed on all raw beef samples. *Salmonella* prevalence in raw ground beef from FSIS inspected establishments was 3.36% in FY 2018 and 2.25% in FY 2019, and *Salmonella* prevalence in beef manufactured trimmings was 1.85% in FY 2018 and 1.44% in FY 2019. The number of samples allocated each year to other raw beef sampling projects does not allow FSIS to estimate prevalence; instead, those values are reported as percentage positive (**Table 2**).

Follow-up samples are assigned based on detection of STEC or *Salmonella* through routine testing. The elevated levels of STEC and *Salmonella*, when compared to routine projects, is not unusual. The results are used by FSIS to support compliance determinations and enforcement actions, when necessary (**Table 3**). Effective February 4, 2019, FSIS started using a harmonized laboratory method for detection of both *E. coli* O157:H7 and non-O157 STEC in the first screen step. This method has been documented in the Microbiology Laboratory Guidebook, and stakeholders were informed of this through both a *Federal Register* Notice (84 FR 57688) and a February 1, 2019 *Constituent Update*. This change affected MT60 and all follow-up sampling codes.

**Table 2. FY 2019 Summary of FSIS' Beef Verification Sampling Programs**

FY 2019 results for FSIS' five verification sampling codes for detecting *Escherichia coli* O157:H7 and/or non-O157 STEC (including O23, O45, O103, O111, O121, and O145) and *Salmonella* in raw beef product samples.

| Product Name and Project Code | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Type of Calculation /1/ | Prevalence or Percent Positive Calculation |
|---|---|---|---|---|---|---|
| Raw Ground Beef MT43 | *E. coli* O157:H7 | 1,211 | 10,683 | 8 | Prevalence | <0.01% |
| | *Salmonella* spp. | 1,211 | 10,683 | 162 | Prevalence | 2.25% |
| Beef Manufacturing Trim MT60 | *E. coli* O157:H7 | 489 | 4,077 | 5 | Prevalence | 0.05% |
| | non-O157 STEC | 477 | 3,983 | 34 | Prevalence | 0.51% |
| | *Salmonella* spp. | 489 | 4,076 | 75 | Prevalence | 1.44% |
| Raw Ground Beef Components other than Trim MT64 | *E. coli* O157:H7 | 150 | 1,212 | 2 | Percent Positive | 0.17% |
| | *Salmonella* spp. | 150 | 1,213 | 75 | Percent Positive | 6.18% |
| Bench Trim MT65 | *E. coli* O157:H7 | 466 | 1,350 | 1 | Percent Positive | 0.07% |
| | *Salmonella* spp. | 466 | 1,349 | 10 | Percent Positive | 0.74% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Raw Ground Beef In Retail MT05 | *E. coli* O157:H7 | 531[/2/] | 531 | 1 | Percent Positive | 0.19% |
| | *Salmonella* spp. | 531[/2/] | 531 | 10 | Percent Positive | 1.88% |

[/1/] Percent positive is 100*(the total number of positive samples divided by the total number of tested samples). Prevalence is a calculated percentage that takes into account establishment production volumes and the volume of contaminated product. See the sampling results data dictionary on the FSIS website for a detailed description of prevalence.

[/2/] MT05 ground beef samples are collected from retail firms.

**Table 3. FY 2019 Summary of FSIS' Beef Follow-Up Sampling Programs**

FY 2019 follow-up testing results in raw beef product samples in response to samples positive for either *E. coli* O157:H7 or non-O157 STEC in the verification sampling projects are shown.

| Product Name and Project Code[/1/] | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Percent Positive Calculation |
|---|---|---|---|---|---|
| Raw Ground Beef MT44 | *E. coli* O157:H7 | 3 | 31 | 0 | 0.00% |
| | *Salmonella* spp. | 3 | 32 | 0 | 0.00% |
| Trim and Components MT52 | *E. coli* O157:H7 | 2 | 61 | 1 | 1.64% |
| | non-O157 STEC | 2 | 43 | 0 | 0.00% |
| | *Salmonella* spp. | 2 | 61 | 3 | 4.92% |
| Beef Manufacturing Trim MT53 | *E. coli* O157:H7 | 43 | 515 | 2 | 0.39% |
| | non-O157 STEC | 41 | 469 | 7 | 1.49% |
| | *Salmonella* spp. | 43 | 515 | 20 | 3.88% |
| Follow-up Testing to an *E. coli* Positive (Trim or Ground Beef) MT44T[/2/] | *E. coli* O157:H7 | 9 | 31 | 0 | 0.00% |
| | non-O157 STEC | 9 | 31 | 0 | 0.00% |
| | *Salmonella* spp. | 9 | 31 | 0 | 0.00% |

[/1/] No MT06 samples were collected in FY 2019.

[/2/]Traceback not at slaughter establishments and dependent on positive findings from other *E. coli* O157:H7 or non-O157 STEC sampling projects.

## Pork Products

FSIS began exploratory sampling of raw pork products in May 2015 to test for pathogens of public health concern, as well as for indicator organisms (January 26, 2015, 80 FR 3940). Using the results of these exploratory sampling programs, FSIS narrowed its focus to products more likely to be contaminated with *Salmonella*. In October 2019, FSIS announced increased sampling of raw pork products. Raw comminuted pork products are sampled under the project code HC_PK_COM01 and raw intact and raw non-intact pork products are sampled under the project code HC_PK_CUT01 (FSIS Notice 41-19).

FSIS Notice 41-19 indicated FSIS schedules five (5) samples per month for eligible establishments producing >6,000 pounds per day of comminuted product and eligible establishments producing >50,000 pounds per day of pork cuts (intact and non-intact). Sampling is focused on larger establishments because they produce the most product and have the highest *Salmonella* levels. Establishments producing 1,001 to 6,000 pounds of comminuted pork products or 1,001 to 50,000 pounds of pork cuts are randomly selected for sampling tasks.

FSIS announced the FY 2019 results of the exploratory raw pork sampling program, as well as next steps, in an October 4, 2019 *Constituent Update* (**Table 4**).

**Table 4. FY 2019 Results for FSIS' Exploratory Raw Pork Sampling Program**

FY 2019 exploratory sampling results for detecting *E. coli* (O157:H7 and non-O157 STEC) and *Salmonella* in raw pork product samples are shown.

| Product Name and Project Code | *Pathogen* | Number of Establishments sampled | Number of Samples Analyzed | Number Positive | Percent Positive Calculation |
|---|---|---|---|---|---|
| Intact Cuts EXP_PK_ICT02 | *E. coli* O157:H7 | 32 | 493 | 0 | 0.00% |
| | non-O157 STEC | 32 | 494 | 0 | 0.00% |
| | *Salmonella* spp. | 125 | 1,345 | 137 | 10.19% |
| Non-intact Cuts EXP_PK_NCT02 | *E. coli* O157:H7 | 15 | 362 | 0 | 0.00% |
| | non-O157 STEC | 15 | 361 | 0 | 0.00% |
| | *Salmonella* spp. | 43 | 1,154 | 86 | 7.45% |
| Comminuted EXP_PK_COM02 | *E. coli* O157:H7 | 42 | 677 | 0 | 0.00% |
| | non-O157 STEC | 42 | 678 | 3 | 0.44% |
| | *Salmonella* spp. | 140 | 1,667 | 363 | 21.78% |

## Siluriformes Products

In FY 2019, FSIS collected exploratory samples in raw Siluriformes fish products that will inform the next steps for food safety verification through routine sampling in the future.

**Table 5. FY 2019 Siluriformes Sampling Results**

FY 2019 exploratory sampling results for FSIS raw Siluriformes product sampling are shown.

| Product Name and Project Code | *Pathogen* | Number of Establishments sampled | Number of Samples Analyzed | Number Positive | Percent Positive Calculation |
|---|---|---|---|---|---|
| Raw Siluriformes EXP_FI_MIC01 | *Salmonella* | 73 | 608 | 21 | 3.45% |

## Poultry Products

In federally inspected slaughter and processing establishments, FSIS analyzes young chicken and turkey carcasses, comminuted chicken and turkey, and chicken parts samples for *Salmonella* and *Campylobacter* (**Table 6**).

FSIS concluded the exploratory sampling for religious exempt and very low volume poultry slaughter establishments in FY 2019, as announced in the August 2, 2019 *Constituent Update*. FSIS increased sampling across several verification projects, including poultry carcass and parts sampling, to maximize the categorization of eligible establishments relative to the FSIS *Salmonella* performance standards. This change in sampling task assignments was announced in the July 26, 2019 *Constituent Update*.

Notably, *Campylobacter* results in **Table 6** were derived from the enrichment method. The transition from direct plating to the more sensitive enrichment method was announced in the August 27, 2018 *Constituent Update*.

**Table 6. FY 2019 Sampling Result Summary For FSIS' Raw Poultry Sampling Programs**

FY 2019 sampling results for detecting *Salmonella* and *Campylobacter* in raw poultry product samples are shown. Follow-up samples from previous positives are not included in the calculations.

| Product Name and Project Code | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Type of Calculation | Prevalence or Percent Positive Calculation |
|---|---|---|---|---|---|---|
| Chicken Whole Carcasses /3/ HC_CH_CARC01 | *Salmonella* spp. | 207 | 8,985 | 415 | Prevalence | 3.62% |
| | *Campylobacter* spp. /4/ | 207 | 8,961 | 1895 | Percent Positive | 21.15% |
| | *Salmonella* spp. | 63 | 89 | 6 | Percent Positive | 6.74% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Chicken Quarter or Half Carcasses /3/ EXP_CPT_QH01 /1/ | *Campylobacter* spp. /4/ | 63 | 87 | 29 | Percent Positive | 33.33% |
| Chicken Parts - Legs, Breasts, Wings /3/ HC_CPT_LBW01 | *Salmonella* spp. | 478 | 9,393 | 859 | Prevalence | 8.77% |
| | *Campylobacter* spp. /4/ | 478 | 9,374 | 1650 | Percent Positive | 17.60% |
| Other Raw Chicken Parts /3/ /5/ EXP_CPT_OT01 /1,6/ | *Salmonella* spp. | 93 | 286 | 145 | Percent Positive | 50.70% |
| | *Campylobacter* spp. | | | | | |
| Comminuted Chicken HC_CH_COM01 | *Salmonella* spp. | 73 | 2,027 | 509 | Prevalence | 27.64% |
| | *Campylobacter* spp. /4/ | 73 | 2,016 | 103 | Percent Positive | 5.11% |
| Mechanically Separated Chicken EXP_CH_MSK01 /1/ | *Salmonella* spp. | 29 | 118 | 89 | Percent Positive | 75.42% |
| | *Campylobacter* spp. /4/ | 29 | 116 | 79 | Percent Positive | 68.10% |
| Turkey Whole Carcasses /2/ HC_TU_CARC01 | *Salmonella* spp. | 46 | 1,841 | 12 | Prevalence | 0.38% |
| | *Campylobacter* spp. /4/ | 46 | 1,842 | 29 | Percent Positive | 1.57% |
| Comminuted Turkey HC_TU_COM01 | *Salmonella* spp. | 56 | 1,490 | 290 | Prevalence | 21.63% |
| | *Campylobacter* spp. /4/ | 56 | 1,477 | 41 | Percent Positive | 2.78% |
| Mechanically Separated Turkey EXP_TU_MSK01 /1/ | *Salmonella* spp. | 16 | 102 | 48 | Percent Positive | 47.06% |
| | *Campylobacter* spp. /4/ | 16 | 102 | 31 | Percent Positive | 30.39% |

/1/ Exploratory sampling projects.
/2/ This sampling project uses sponge sampling.
/3/ This sampling project uses a product rinse.
/4/ *Campylobacter* results are of samples analyzed using the enrichment method. FSIS began analyzing raw poultry samples using the enrichment method on August 27, 2018.
/5/ Only *Salmonella* results are reported for Raw Chicken - Other Parts.
/6/ *Campylobacter* results from the EXP_CPT_OT01 sampling project are generated using the direct plating method instead of the enrichment method because there is a limited sample collection volume.

**Table 7. FY 2020 Follow-Up Sampling Result Summary For FSIS' Raw Poultry Sampling Programs**

FY 2020 follow-up sampling results for detecting *Salmonella* and *Campylobacter* in raw poultry product samples are shown. FSIS *Salmonella* follow-up sampling results provide a snapshot of a specific

establishment's performance based on intensified sample collection after the establishment implemented corrective actions. For this reason, the aggregated set of data reflects FSIS' efforts to implement follow-up samples but does not provide overall information about performance without additional context.

| Product Name and Project Code | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Type of Calculation | Percent Positive Calculation |
|---|---|---|---|---|---|---|
| Chicken Whole Carcasses /3/ F_CH_CARC01 | *Salmonella* spp. | 29 | 552 | 68 | Percent Positive | 12.32% |
| Chicken Parts - Legs, Breasts, Wings /3/ F_CPT_LBW01 | *Salmonella* spp. | 80 | 1327 | 194 | Percent Positive | 14.62% |
| Comminuted Chicken F_CH_COM01 | *Salmonella* spp. | 12 | 169 | 51 | Percent Positive | 30.18% |
| Turkey Whole Carcasses /2/ F_TU_CARC01 | *Salmonella* spp. | 0 | 0 | 0 | Percent Positive | -- |
| Comminuted Turkey F_TU_COM01 | *Salmonella* spp. | 13 | 199 | 47 | Percent Positive | 23.62% |

## Ready-to-Eat (RTE) Products

FSIS conducts microbiological testing of post-lethality exposed (PLE) and not PLE-exposed RTE meat, poultry, and egg products for *Lm* and *Salmonella* in domestically produced RTE and egg products. *Lm* and *Salmonella* are adulterants in RTE products. Under various RTE sampling programs, FSIS collects RTE product samples and swab samples. More information can be found on the FSIS website: RTE Meat and Poultry Products Microbiological Sampling Programs.

**Table 8: FY 2019 Ready-to-Eat Product Sampling Results by Project**

FY 2019 sampling results for all FSIS domestic RTE microbiological sampling programs are reported for *Listeria monocytogenes* (*Lm)* and *Salmonella* (if applicable).

| Product Name and Project Code | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Percent Positive Calculation |
|---|---|---|---|---|---|
| PLE and non-PLE products selected randomly RTEPROD_RAND | *Listeria monocytogenes* | 2,211 | 6,973 | 16 | 0.23% |
| | *Salmonella* spp. | 2,211 | 6,986 | 4 | 0.06% |
| PLE products selected by risk RTEPROD_RISK | *Listeria monocytogenes* | 1,688 | 7,558 | 14 | 0.19% |
| | *Salmonella* spp. | 1,689 | 7,571 | 3 | 0.04% |
| Intensified Verification Testing (IVT/for-cause) product INTCONT | *Listeria monocytogenes* | 53 | 1,016 | 6 | 0.59% |
| | *Salmonella* spp. | 6 | 55 | 0 | 0.00% |
| IVT non-food contact environmental INTENV | *Listeria monocytogenes* | 53 | 515 | 14 | 2.72% |
| | *Salmonella* spp. | 6 | 88 | 1 | 1.14% |
| IVT product INTPROD | *Listeria monocytogenes* | 53 | 489 | 5 | 1.02% |
| | *Salmonella* spp. | 6 | 55 | 0 | 0.00% |
| Routine risk-based *Lm* (R*Lm*) food contact surfaces RLMCONT | *Listeria monocytogenes* | 190 | 2,637 | 5 | 0.19% |
| R*Lm* non-food contact environmental (composite of 5-swabs) RLMENVC | *Listeria monocytogenes* | 190 | 267 | 25 | 9.36% |
| R*Lm* product (composite of five 25-gram products from same lot) RLMPRODC | *Listeria monocytogenes* | 190 | 264 | 2 | 0.76% |

**Table 9. RTE Egg Products FY 2019 Sampling Results by Project**

FY 2019 microbiological sampling of liquid and dried domestic pasteurized egg products regulated by FSIS are shown. More information can be found on the FSIS website: Quarterly Sampling Reports on Ready-to-eat Products and Egg Products.

| Product Name and Project Code | Pathogen | Number of Establishments Sampled | Number of Samples Analyzed | Number Positive | Percent Positive Calculation |
|---|---|---|---|---|---|
| Egg Whites EM31 | *Listeria monocytogenes* | 36 | 351 | 0 | 0.00% |
| | *Salmonella* spp. | 36 | 354 | 1 | 0.28% |
| Whole Egg or Yolks EM32 | *Listeria monocytogenes* | 45 | 433 | 0 | 0.00% |
| | *Salmonella* spp. | 45 | 442 | 1 | 0.23% |
| Whole Eggs with Added Yolks or Whole Egg Blends EM33 | *Listeria monocytogenes* | 26 | 235 | 0 | 0.00% |
| | *Salmonella* spp. | 26 | 241 | 0 | 0.00% |
| Whole Eggs or Yolks with > 2% salt or sugar added EM34 | *Listeria monocytogenes* | 40 | 345 | 2 | 0.58% |
| | *Salmonella* spp. | 40 | 348 | 0 | 0.00% |
| Dried Yellow Egg Products EM35 | *Listeria monocytogenes* | 16 | 139 | 0 | 0.00% |
| | *Salmonella* spp. | 16 | 139 | 0 | 0.00% |
| Dried Egg Whites EM36 | *Listeria monocytogenes* | 11 | 116 | 0 | 0.00% |
| | *Salmonella* spp. | 11 | 116 | 0 | 0.00% |
| Pan Dried Egg White EM37 | *Listeria monocytogenes* | 1 | 12 | 0 | 0.00% |
| | *Salmonella* spp. | 1 | 12 | 0 | 0.00% |

## National Residue Program

Information on the National Residue Program can be found on the FSIS website: Residue Chemistry.

### Domestic Scheduled Sampling Plan

Scheduled sampling is the sampling of specified slaughter subclasses at the time of slaughter after a carcass has passed antemortem inspection. Of the 7,767 samples analyzed by FSIS, (7,312 from federally regulated plants and 455 from State inspected plants), 21 chemical residue violations were found.

In comparison to previous years' domestic scheduled sampling (FY 2016 – FY 2019), 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 detected residue violations consisted of the following residues: 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 report any violations.

Overall, the violation rate for the domestic scheduled sampling plan has remained below 0.4% for the last 4 years. In the cattle class, there was a 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 increase in violation in sheep was not significant (**Table 10**).

**Table 10: FY 2019 Scheduled Residue Sampling Results Summary**

FY 2019 sampling results for FSIS chemical residue sampling are shown. FSIS inspectors collect muscle, kidney, and liver tissue from carcasses and parts for laboratory analysis. Annual totals are included in the figure below to provide complete information typically found in the National Residue Program (NRP) sampling plan. FSIS has harmonized and incorporated the NRP sampling plan into the FSIS Annual Sampling Plan and is no longer publishing them separately.

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

## Inspector-Generated Sampling Plan

FSIS inspectors conduct inspector-generated sampling when they suspect that animals presented for slaughter inspection may have violative levels of chemical residues. In FY 2019, 174,308 Kidney Inhibition Swab (KIS™) tests were conducted (**Table 11**). Of those, 3,569 samples were submitted to FSIS field laboratories for further analysis and 606 chemical residue violations were reported in 523 samples. Due to multiple analyses per sample submitted, multiple residue violations may be found in the same sample. 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%) accounted for 85% of the 606 violations reported under the inspector-generated sampling plan.

- In FY 2019, dairy cow percent violation rates (violations/number of samples screened) using the KIS™ test decreased significantly. Of the 2,294 dairy cow samples, desfuroylceftiofur (the primary metabolite of ceftiofur) and penicillin account for 6.8% and 4.9% of the violations reported, respectively.

- 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, IPP performed a total of 20,360 KIS™ tests in swine slaughter classes (market swine, sows, roaster swine, boar swine, and feral swine), resulting in only 8 violative samples (0.03%).

**Table 11. Summary of FY 2019 Inspector-Generated Sampling (KIS™) Test and Confirmatory Tests**

FY 2019 sampling results for FSIS inspector-generated KIS™ Residue Tests. Annual totals are included in the figure below to provide complete information typically found in the NRP sampling plan. FSIS has harmonized and incorporated the NRP sampling plan into the FSIS Annual Sampling Plan and is no longer publishing them separately.

| | | KIS™ Test | | | |
|---|---|---|---|---|---|
| **Animal Category** | **Animal Class** | **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 |
| **Other Species** | Goats | 672 | 666 | 8 | 2 |
| | Mature Sheep | 565 | 562 | 5 | 0 |
| | Lambs | 1,311 | 1,307 | 7 | 1 |
| **Annual Total** | | **174,308** | **170,825** | **3,569** | **523** |

## Imports Sampling

### Import Residue Sampling

Imported meat, poultry, and egg products are sampled through the point-of-entry Import Reinspection Sampling Plan, a chemical residue monitoring program, that is conducted to verify whether foreign inspection systems in exporting countries are equivalent to U.S. standards. A total of 3,501 product 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). The results are summarized in **Table 12**.

**Table 12. Summary of FY 2019 Residue Sampling of Imported Products**

FY 2019 import residue samples by inspection level, per exporting country and production type. The number of violations are given in parentheses. Annual totals are included in the figure below to provide complete information typically found in the National Residue Program (NRP) sampling plan. FSIS has harmonized and incorporated the NRP sampling plan into the FSIS Annual Sampling Plan and is no longer publishing them separately.

| Country | Number Samples by Inspection Level and Product Type (Violations) | | | | | |
|---|---|---|---|---|---|---|
| | Normal | | Increased[/1/] | Intensified[/2/] | | |
| | 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 (1) | -- | -- | -- | -- | **50 (1)** |
| Denmark | 22 | 2 | -- | -- | -- | **24** |
| Finland | 22 | -- | -- | -- | -- | **22** |
| France | 41 | 1 | -- | -- | -- | **42** |
| Germany | -- | 3 | -- | -- | -- | **3** |
| Honduras | 16 | -- | -- | -- | -- | **16** |
| Iceland | 2 | -- | -- | -- | -- | **2** |

| Country | Number Samples by Inspection Level and Product Type (Violations) | | | | | |
|---|---|---|---|---|---|---|
| | Normal | | Increased[/1/] | Intensified[/2/] | | |
| | Raw | Processed | Raw | Raw | Processed | Total |
| Ireland | 41 | -- | -- | -- | -- | **41** |
| Israel | -- | 21 | -- | -- | -- | **21** |
| Italy | -- | 11 | -- | -- | -- | **11** |
| Japan | 15 | -- | -- | -- | -- | **15** |
| Korea, Republic Of | -- | 1 | -- | -- | -- | **1** |
| Lithuania | -- | 11 | -- | -- | -- | **11** |
| Mexico | 101 (1) | 7 | 1 | 14 (1) | -- | **123 (2)** |
| Namibia | 20 | -- | 22 | -- | -- | **42** |
| Netherlands | 64 (1) | 5 | -- | 12 | -- | **81 (1)** |
| 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 (3) | -- | 12 | 64 | -- | **1,490 (3)** |
| **Annual Total** | **3,093 (6)** | **249** | **50** | **93 (1)** | **16** | **3,501 (7)** |

[/1/]Increased is a level of reinspection above the normal level that is directed by a FSIS management decision. Under increased reinspection, FSIS may hold, on a case-by-case basis, lots of imported meat, poultry, or egg products pending receipt of a laboratory analysis. If FSIS does not place the product on hold, the importer of record is still required to hold product tested for adulterants by FSIS and is not to allow such product to enter commerce unless and until negative results are received.

[/2/]Intensified is a level of reinspection that is implemented automatically by the Public Health Information System (PHIS) when a Type of Inspection PHIS task is reported as "Fail." Under intensified reinspection, FSIS holds the sampled lot at the official import inspection establishment pending receipt of laboratory analysis. The sampled lot is not allowed to move off-site to be held.

## Imports Microbial Sampling

Lab sampling for imported product, through product or rinsate sample collection, depends on the number of shipments received by country and product.

**Table 13. Summary of FY 2019 Import Microbiology Sampling Results by Project**

FY 2019 microbiological sampling results for FSIS imported products by inspection level. The values summarize results over all countries and do not reflect the percent positive for individual countries. Additionally, no direct comparisons should be made to domestic sampling.

| Product Name and Project Code | Pathogen | Normal | | Increased[1] | | Intensified[2] | | Total Samples |
|---|---|---|---|---|---|---|---|---|
| | | Number of Samples Analyzed | Number Positive | Number of Samples Analyzed | Number Positive | Number of Samples Analyzed | Number Positive | |
| Imported Raw Beef Manufactured Trimmings or Components for use in Ground Beef or Beef Products MT51 | *E. coli* O157:H7 | 840 | 2 | 22 | 0 | 61 | 0 | 923 |
| | non-O157 STEC | 800 | 2 | 22 | 1 | 60 | 0 | 882 |
| | *Salmonella* spp. | 840 | 4 | 22 | 0 | 61 | 0 | 923 |
| Imported Raw Ground or Comminuted Beef or Veal Product MT08 | *E. coli* O157:H7 | 43 | 0 | -- | -- | -- | -- | 43 |
| | *Salmonella* spp. | 43 | 0 | -- | -- | -- | -- | 43 |
| Micro Pathogen Sampling of RTE Products IMVRTE | *Listeria monocytogenes* | 2,765 | 3 | 53 | 0 | 65 | 0 | 2,883 |
| | *Salmonella* spp. | 2,766 | 0 | 53 | 0 | 65 | 0 | 2,884 |
| Imported Egg Products EGGIMP | *Listeria monocytogenes* | 131 | 0 | -- | -- | -- | -- | 131 |
| | *Salmonella* spp. | 131 | 0 | -- | -- | -- | -- | 131 |
| Imported Raw and NRTE Poultry Products IMP_Poultry | *Salmonella* spp. | 687 | 137 | -- | -- | -- | -- | 687 |
| | *Campylobacter* | 686 | 70 | -- | -- | -- | -- | 686 |
| Imported Raw Pork Product IMP_Pork | *Salmonella* spp. | 338 | 8 | -- | -- | -- | -- | 338 |
| Imported *Siluriformes* Microbiology Sampling IMPFISH_MI | *Salmonella* spp. | 745 | 1 | -- | -- | -- | -- | 745 |

/1/Increased is a level of reinspection above the normal level that is directed by a FSIS management decision. Under increased reinspection, FSIS may hold, on a case-by-case basis, lots of imported meat, poultry, or egg products pending receipt of a laboratory analysis. If FSIS does not place the product on hold, the importer of record is still required to hold product tested for adulterants by FSIS and is not to allow such product to enter commerce unless and until negative results are received.

/2/Intensified is a level of reinspection that is implemented automatically by the Public Health Information System (PHIS) when a Type of Inspection PHIS task is reported as "Fail." Under intensified reinspection, FSIS holds the sampled lot at the official import inspection establishment pending receipt of laboratory analysis. The sampled lot is not allowed to move off-site to be held.

## Whole Genome Sequencing (WGS) Initiatives

FSIS engages with Federal partners to establish, advance, and implement the application of whole genome sequencing (WGS) data for regulatory purposes. FSIS: (1) works to ensure that WGS related projects align with the goals and objectives of the FSIS Strategic Plan and other policies and (2) disseminates information about the use of WGS data analyses to FSIS personnel and stakeholders.

FSIS laboratories performed WGS on all samples for all pathogens from FSIS-regulated products. In FY 2019, this equated to 15,240 sequences uploaded to National Center for Biotechnology Information (NCBI). In addition, FSIS implemented updated software for all pathogen bioinformatic analysis and modernized *Campylobacter* speciation via species determination through WGS.

In FY 2019, FSIS partnered with USDA Agricultural Research Service (ARS) to evaluate the utility of long-read sequencing technology to complement FSIS's current short-read approach. FSIS also collaborated with ARS and the Centers for Disease Control and Prevention (CDC) to capture emerging antimicrobial resistance genotypes of *Salmonella*.

FSIS initiated real-time WGS result reporting for *Lm* to help District Offices and field inspectors to evaluate multiple findings of *Lm* in the same establishment. Such findings can indicate *Lm* harborage or cross-contamination events.

## NARMS

The National Antimicrobial Resistance Monitoring System (NARMS) is an interagency, collaborative partnership with state and local public health departments, the U.S. Food and Drug Administration (FDA), the CDC, and the U.S. Department of Agriculture (USDA). This national public health surveillance system tracks changes in antimicrobial susceptibility of select foodborne enteric bacteria found in ill people (CDC), retail meats (FDA), and food animals (USDA-FSIS). The NARMS program at USDA focuses on two sampling points—samples collected from intestinal (cecal) content and carcass or food commodity samples. Food animals cecal content samples are taken from young chickens, young turkeys, dairy cattle, beef cattle, market hogs, and sows and analyzed for pathogens, including *Salmonella* and *Campylobacter*, and the bacterial indicators *Escherichia coli (E. coli)* and *Enterococcus*.

In FY 2019, there were 6,206 NARMS cecal content samples analyzed with 9,122 total bacterial isolates recovered, as summarized in **Table 14.** All the isolates were further characterized for antimicrobial resistance/susceptibility. All 1,636 *Salmonella* and 2,664 *Campylobacter* isolates, 1,023 of the 2,466 *E. coli*, and 653 of the 2,296 *Enterococcus* recovered isolates were subject to WGS (**Table 14**).

**Table 14. Summary of FY 2019 NARMS Cecal Sampling Program**

FY 2019 NARMS samples analyzed, isolates recovered, and further characterized.

| Sampling Code | Samples Analyzed | Total Isolates Retrieved | Further Characteristics Analysis | Isolates Characterized | | | |
|---|---|---|---|---|---|---|---|
| | | | | *Salmonella* | *Campylobacter* | *E. coli* | *Enterococcus* |
| Young Chicken NARMS_YC | 856 | 1635 | WGS | 427 | 540 | 148 | 106 |
| | | | AST | 430 | 548 | 323 | 326 |
| Young Turkey NARMS_YT | 434 | 718 | WGS | 66 | 215 | 131 | 62 |
| | | | AST | 66 | 216 | 218 | 214 |
| Dairy Cow NARMS_DC | 1264 | 1656 | WGS | 261 | 487 | 145 | 102 |
| | | | AST | 261 | 483 | 451 | 445 |
| Beef Cow NARMS_BC | 510 | 524 | WGS | 52 | 109 | 67 | 49 |
| | | | AST | 52 | 111 | 182 | 177 |
| Steer NARMS_ST | 1203 | 1647 | WGS | 120 | 628 | 190 | 110 |
| | | | AST | 120 | 627 | 483 | 402 |
| Heifer NARMS_HF | 640 | 863 | WGS | 61 | 323 | 92 | 64 |
| | | | AST | 62 | 328 | 250 | 216 |
| Market Swine NARMS_MS | 1026 | 1610 | WGS | 475 | 286 | 199 | 124 |
| | | | AST | 480 | 288 | 434 | 402 |
| Sow NARMS_SW | 273 | 469 | WGS | 165 | 63 | 51 | 36 |
| | | | AST | 165 | 63 | 125 | 114 |

The total numbers of isolates as well as whole genome sequencing (WGS) and antimicrobial susceptibility testing (AST) isolates do not match because:

- The "Total Isolates Retrieved" column reflects the number of isolates logged from positive ceca samples regardless of isolate characterization progress and the "Isolates Characterized" columns reflect isolate numbers that have been completed and authorized and so do not include isolates where testing is still in progress.
- The WGS and AST numbers are not the same due to delay in WGS which is an outcome of reagent delays (e.g., *Campylobacter*)
- These numbers will change as WGS work continues and WGS-based *Campylobacter* speciation is used.

### Other Sampling

FSIS conducts other sampling programs and special projects, in addition to microbiological and chemical residue sampling, in response to investigations or other rapidly evolving events to protect consumers and ensure food safety. These projects may include:

- Advanced meat recovery (AMR) sampling to verify that industry is preventing beef spinal cord material from entering the food supply and being misrepresented as meat;
- Foodborne illness and outbreak sampling in response to potential illness outbreaks;
- Label verification sampling to identify mislabeling, economic fraud, and adulteration of meat, poultry, and egg products;
- Species identification sampling to verify species claims of meat, poultry, and egg products;
- Food chemistry sampling to identify economic fraud or other chemical hazards.
- Compliance testing to evaluate products in commerce that are suspected to be adulterated or misbranded;
- Pathology testing to identify diseases, parasites, and related conditions in response to in-plant public health veterinarian findings from meat and poultry carcasses and parts; and
- Abnormal container testing when inspection program personnel observe abnormal containers of thermally processed products.

Results for these other sampling projects are not detailed in this report because the types of results for each project are unique to that project. Additionally, some of the results from these projects are used in ongoing investigations and cannot be publicly posted. The actual number of samples analyzed for each of these projects is included in the Annual Sampling Plan.

## Conclusion

In FY 2019, FSIS conducted meat, poultry, and egg products sampling verification to ensure that the food produced is safe, wholesome, and properly labeled to protect the public from foodborne hazards. As a science-based agency, FSIS uses data to inform decision making and drive continuous improvement of processes. FSIS evaluates these sampling data and shares the data, including analyses, on the FSIS website. Data sharing and transparency are critical steps to ensure public awareness of the food safety measures implemented.