Strategic Assessment of Sampling Resources

Report

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Executive Summary

The U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS) leverages robust sampling projects to verify the safety of products regulated by the Agency. In fiscal year (FY) 2018, the year this evaluation began, the Agency collected over 120,000 samples for laboratory microbiological and chemical residue analysis through these projects. FSIS reported over 2,000,000 different analytes from these results and collected and analyzed almost 4,000 samples for further examination of veterinary diseases.

As a science-based agency, FSIS uses data to inform decision making and drive continuous improvement of processes. To maximize the efficiency, effectiveness, and value of these sampling projects, the Agency undertook a systematic evaluation to fully account for and prioritize resources. The Strategic Assessment of Sampling Resources (SASR) evaluation team (or SASR workgroup) within FSIS was formed to design and conduct this evaluation. The SASR Workgroup incorporated broad, cross-cutting participation from multiple program areas, including the Agency's pathogen and chemical residue workgroups. FSIS supplemented its expertise with contracted work to conduct and develop portions of this strategic evaluation. The evaluation was conducted from September 2017 to May 2019. The assessment compiles information from a variety of different sources, including Public Health Information System (PHIS) sampling data, Agency reports, FSIS notices and directives, and relevant *Federal Register* notices, among other sources.

The underlying premise guiding the SASR workgroup through the evaluation was that FSIS sampling only fulfills its purpose when the data it generates is used by the Agency. Relying on that guiding principle, the SASR workgroup developed a framework to assess whether data generated under each of the Agency's sampling projects are analyzed, and if the results of those analyses are factored into the Agency's decision-making.

The workgroup developed a multiphase approach, with the sixth and final phase earmarked for future development:

- Phase 1: identify and describe all current sampling projects and the reason behind each.
- Phase 2: develop weighted categories and criteria to use for scoring and ranking the potential benefits of each project.
- Phase 3: determine whether each sampling project, as implemented, could satisfy the stated policy objective or its intended purpose.
- Phase 4: assess whether data from ongoing sampling projects is being used by the Agency as originally intended.
- Phase 5: conduct a cost assessment across all sampling projects.
- Phase 6 (future phase): conduct a semi-quantitative evaluation, based on work from Phases 1-5, to provide rankings for current and future sampling projects

This report details the outcomes and results of Phases 1-5 and includes a master table of broad sampling programs and initiatives. More detailed results from individual projects are provided in Appendix G: Details of Costs Associated with Sampling Projects.

Based on the results, the SASR workgroup identified nine major findings and made recommendations to address them, including some related to internal FSIS workgroups. These recommendations will increase the Agency's efficiency and improve allocation of resources. These findings and associated recommendations can be separated into 2 major categories: Process-Oriented and Statistically-Oriented.

Process Findings and Recommendations

1. *Process Improvement Findings*

   A. The Sampling Coordination Committee (SCC) is underutilized. The SCC was formed to centralize responsibility for the organizational aspects of sampling project development and maintenance. However, the SCC could be better incorporated into the management review process for the various pathogen and chemical residue workgroups. Also, the current SCC *Annual Sampling Plan Change Request Form* could be improved upon by collecting additional information —potential project benefits; statistical sampling needs and plans; and how the Agency will analyze and use the data—to assess proposed sampling projects.

   SASR Actions: The workgroup reviewed the SCC form and developed tools to address deficiencies.

   Recommendations:

   1.1: The SCC should revise the current *Annual Sampling Plan Change Request Form* to incorporate the following:

   a) the benefit questions established by this evaluation (page 22);
   b) a question to determine whether the information can be obtained by updating an existing sampling project (page 37);
   c) more detailed statistical documentation regarding the number of samples required and sample allocation methodology (page 33); and
   d) a schedule for routine evaluation—with a formal analysis plan— for each sampling project to determine whether the results of the project are being used to inform FSIS policy (page 37).

   1.2: New sampling project sponsors and the SCC should ensure that a sampling project's design has been optimized. Further, they should ensure that the information gained from the sampling will be used before any decision to institute a sampling project, and consider the overall costs associated with the sampling plan (page 41).

   B. FSIS laboratories do not have a centralized and robust cost projection tracking system for all laboratory related costs.

   Recommendation:

   1.3: FSIS should utilize Office of Public Health Science (OPHS) resource subject matter experts to create and continuously refine a repository that projects and track resource requirements by lab and project (page 40).

2. *Sampling Project Sunsetting Finding*

   A. The Agency does not have a consistent, formal process to assess when a project or portions of a project should "sunset".

   Recommendation:

   2.1: FSIS should review existing exploratory/baseline sampling and make determinations to either discontinue sampling or incorporate the exploratory portion of the sampling into a routine sampling project (page 37).

   2.2: For projects developed after these recommendations are implemented, the Agency should ensure there is a specified sunset date for each project (page 37).

3. *Sampling Project Inventory Finding*
   A. **There is no single, comprehensive inventory of sampling projects that includes how they are designed and why they are initiated and sustained.** In 2011, the Agency created a complete inventory of sampling projects, but it has not been updated since the original 2011 sampling plan[1].
   SASR Actions: The workgroup created a detailed inventory of all ongoing sampling projects that includes the name of each project, the policy objective or intended purpose, and how the individual sample results and aggregate data are being used to inform Agency policy decisions.
   Recommendation:
   3.1: The SCC should annually review the inventory through the routine development of the Annual Sampling Plan and propose if the inventory should be internally or publicly available (page 15).

4. *Implementation of Weighted Criteria Finding*
   A. **The semi-quantitative approach, developed by the SASR workgroup, is an appropriate and useful method to evaluate the benefits of each sampling program.**
   SASR Actions: The workgroup developed weighted criteria and ranked sampling projects to ensure that overall Agency needs are considered when deciding when to initiate and sunset sampling programs.
   Recommendations:
   4.1: All sampling projects that ranked below 0.30 on the benefit score (**see Table 1: Summary of Sampling Projects Ranked by Unweighted and Weighted Score**) should be evaluated by the various Data Coordination Committee (DCC) pathogen/chemical workgroups. Results of the evaluation should be reviewed through the Enterprise Governance process. Based on the findings presented, continuation of any project below 0.3 should be explicitly endorsed by the Enterprise Steering Board (ESB) (page 22).
   4.2: Moving forward, the sampling project proposers and SCC should adopt the weighted benefits criteria from this report to evaluate the potential benefits of proposed new or revised sampling projects (page 22).
   4.3: The sampling project proposers and SCC should also ensure that a sampling project's design has been optimized, consider how the information from the sampling will be used by the Agency, and consider the overall costs associated with the sampling plan (page 41).

5. *Outreach and Communication Finding*
   A. **Finding: SASR workgroup recommendations will change processes for sampling projects and could cause confusion during implementation.**
   Recommendation:
   5.1: The SASR workgroup will coordinate with Office of Public Affairs and Consumer Education (OPACE) to communicate findings and recommendations to FSIS employees, including a description of the new process and tools that will be available. This new information should be placed on the new SCC Sampling Change Request Form (see Recommendation 3a), currently located on the SCC SharePoint site, to be accessible for applicable parties.

[1] Report on the Food Safety and Inspection Services' Microbiological and Residue Sampling Projects. 2011. https://www.fsis.usda.gov/wps/wcm/connect/0816b926-c7ee-4c24-9222-34ac674ec047/FSIS_Sampling_Projects_Report.pdf?MOD=AJPERES

Statistical-Oriented Findings and Recommendations

6. *Alignment of Statistical and Policy Goals Finding*
   - **A. Agency sampling projects have differing levels of utility and cost-effectiveness,** and some sampling projects could be optimized by altering the number of samples collected and analyzed.
     SASR Actions: The workgroup collaborated with MITRE to develop a tool that provides a variety of statistically-based calculations as a *starting point* for optimizing the number of samples that should be collected and analyzed for each sampling project.
     Recommendations:
     6.1: When a request is submitted for a new or revised sampling project, the submitter should evaluate the project to optimize sample allocation. To meet this recommendation, the workgroups should (page 33):
     a) Using the tool as a ***starting point,*** determine the appropriate number of samples to analyze to ensure that any intended benefits (e.g. maximum margin of error, upper bound claims, or comparison of rates) can be realized given the statistical limitations of its design.
     b) Determine the minimum number of samples required to meet ***Agency policy goals*** (e.g., establishment categorization).
     c) Determine the number of samples required to realize both the statistical and policy benefits annually, and document and include it in the workgroup submission to the FSIS Annual Sampling Plan.

7. *Sampling for Products with Very Low Pathogen Rates Finding*
   - **A. For domestic sampling projects with very low positive rates it is not feasible to collect and analyze enough samples** to produce reliable estimates.
     SASR Actions: The workgroup used the MITRE tool 'upper bound estimator' to develop a table to help guide decision making.
     Recommendation:
     7.1: FSIS should consider the statistical claims that can be made based on the number of samples collected and analyzed [if no positive samples are detected] (page 34).
     7.2: FSIS should clearly document the reasoning and the potential statistical claims that are associated with each sampling project (page 34).

8. *Prevalence Estimation Finding*
   - **A. FSIS has not established clear and consistent standards for when sampling data can be used to estimate national prevalence.** The ability to estimate pathogen prevalence in establishments is not solely a matter of the number of samples that are included in the analysis. The margin of error around the estimate decreases as the number of samples increases.
     SASR Actions: The workgroup reviewed FSIS documentation (reports, analyses) regarding prevalence estimation to identify aspects for improvement.
     Recommendation:
     8.1: FSIS should develop clear standards for determining whether a prevalence estimate can be calculated for each FSIS in plant sampling projects, including identifying whether there is a maximum margin of error for calling an estimate a "prevalence." (page 34)
     8.2: For all projects, FSIS should clearly document the reasons a prevalence estimate can or cannot be calculated (page 34).

9. *Sampling Project Specific Results Findings*

A. Sampling of imports at reinspection serves different purposes and has different statistical design challenges than domestic sampling. To obtain a statistically representative sample, significantly more import samples would need to be taken, the PHIS import module would require a rework and requiring additional work with international stakeholders.

Recommendation:

9.1: FSIS should conduct a separate evaluation of import sampling to maximize the benefits it provides to the Agency (page **34**).

B. The egg product workgroup evaluated the sampling model and suggested an updated methodology. However, at the time this evaluation was conducted, the Agency had not yet made a final decision on whether and how to modify egg product sampling.

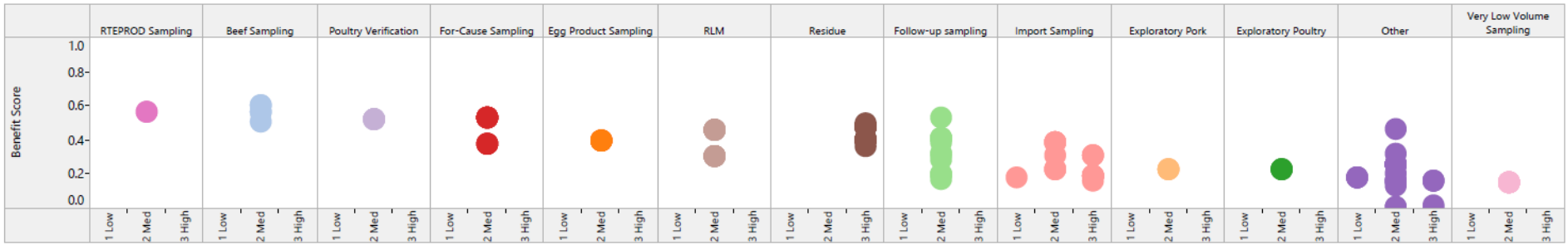
Recommendation:

9.2: FSIS should complete review of the egg product sampling proposal and implement any changes by FY 2020 (page **34**).

MASTER TABLE

The SASR workgroup evaluated each sampling project using the criteria and categorized costs of the project. The costs have been categorized into low, medium and high categories to simplify the cost/benefit ratio by grouping. Detailed results of that evaluation are provided in Appendix H. The master table below provides an overall summary of the results of the evaluation of the sampling programs that were evaluated. It provides both a graphical and tabular representation of the benefit score and cost per sample for the sampling projects rolled up to their unifying groupings.

	RTEPROD Sampling	Beef Sampling	Poultry Verification	For-Cause Sampling	Egg Product Sampling	RLM	Follow-up sampling	Residue	Import Sampling	Exploratory Pork	Exploratory Poultry	Other	Very Low Volume Sampling
Projects	2	5	5	15	7	12	13	34	21	3	4	26	10
Benefit Score	0.60	0.60	0.53	0.50	0.43	0.40	0.34	0.38	0.27	0.23	0.23	0.16	0.15
$ Category	2	2	2	2	2	2	2	3	3	2	2	2	2
Samples	14,800	18,375	24,000		1,600	5,064	0	10,850	13,760	4,497	780	8,000	2,560



- For each of the grey rows (i.e. Projects and Samples), the darker the color the higher the value. On the blue row (Benefits score), the darker the color, the higher the benefit score, while on green row ($ Category) row, the darker the color, the lower the average cost per sample to run the projects. Different color schemes are used to improve readability between the rows and between the points in the scatter plots.
- The values in the Projects row indicate the number of projects included in the grouping.
- The $ Category is the average cost of sampling for all projects within the grouping.
- The Samples row contains the combined number of samples for the projects that were allocated in the FY 2019 Annual Sampling Plan.
- The top scatter plot relates the average benefit score to the average total cost per sample rolled up to the grouping level. The size of the points in the top scatter plot represent the cumulative number of samples for that grouping. The larger the point, the more samples are included in that grouping. Not all project names are listed on the scatter plot.
- The bottom scatter plot relates the cost per sample to the benefit score for that sampling project.
- The points on the bottom scatter plot represent the individual projects. Note: there may be overlap with several projects in the grouping as projects may have identical benefits scores and cost per sample, resulting in fewer points represented.

Introduction

In 2016, the Food Safety and Inspection Service (FSIS) formed the Evaluation Working Group (EWG), which reports to the Enterprise Steering Board (ESB), to provide a more formal mechanism to prioritize, coordinate, integrate, and collaborate on FSIS evaluation activities. In 2017, the EWG developed and began work on a prioritized list of all potential evaluations that could be conducted by the Agency. One of these priorities was a strategic evaluation of all FSIS sampling projects, which included developing evaluation criteria. This effort included a retrospective evaluation of existing projects and development of a framework and tools to prospectively evaluate new sampling projects. To design and conduct this evaluation, a Strategic Assessment of Sampling Resources (SASR) evaluation team was formed.

This evaluation is consistent with FSIS' fiscal year (FY) 2017-2021 Strategic Plan, which has a specific objective under Goal 1 of strengthening sampling projects. This report summarizes the approach and methods used, as well as results, findings, and recommendations from the evaluation.

Background

FSIS conducts robust sampling projects for the products it regulates, with laboratory testing of samples conducted by FSIS field service laboratories. FSIS sampling is an important component of how FSIS verifies that establishments have addressed food safety hazards and are producing safe, unadulterated, and properly labeled product.

In general, for this document, broad FSIS sampling efforts related to a chemical residue or specific pathogen, such as *Salmonella*, is referred to as a "sampling program," whereas an individual sampling effort, such as HC_CH_COM01 for *Salmonella*, is referred to as a "sampling project".

FSIS collects samples at domestic, federally-inspected establishments, in commerce (for example, at retail establishments), and at FSIS-regulated import houses (i-Houses). FSIS also collects samples as part of outbreak investigations and in response to consumer complaints. Samples are collected and sent to one of FSIS' laboratories, which conduct microbiological analysis, chemical residue analysis, or other analyses, such as pathology or speciation. In addition, FSIS inspectors conduct many chemical residue screening tests in the establishment, such as Kidney Inhibition Swab (KIS) tests. However, this evaluation focuses on samples from projects that are analyzed in FSIS laboratories; in-establishment screening tests are not evaluated here.

For microbiological sampling, FSIS currently performs analyses for *Salmonella*, *Campylobacter*, *Listeria monocytogenes (Lm),* Indicator Organisms, *E. coli* O157:H7 and non O157 Shiga toxin-producing *Escherichia coli* (STEC) for various products including raw beef, poultry, pork, and *Siluriformes,* as well as ready-to-eat (RTE) products. For a detailed description of most of FSIS' sampling projects, please see the Agency's 2011 Report on the Food Safety and Inspection Service's Microbiological and Residue Sampling Projects.

FSIS' Sampling Coordination Committee (SCC) was established in 2016 to provide a forum through which sampling strategies and program recommendations are discussed prior to being presented, via the Data Coordination Committee (DCC), to the Executive Governance Boards and the Management Council for official authorization to implement or modify sampling programs. The SCC has the authority to identify and review sampling matters and to make recommendations for sampling actions that support the mission of FSIS. The SCC maintains a Sampling Plan Change Request Form, which was developed to

ensure that all pertinent questions were addressed before approving a sampling project. The Form also serves as a permanent record of changes to sampling projects; approved forms are stored on the SCC SharePoint site. When recommending changes to the collective Agency sampling program via the FSIS Annual Sampling Plan or individual sampling projects, the SCC considers the sampling standardization, organization resource commitments, sampling portfolio management, overlap and interagency process interaction.

Purpose of Evaluation

Historically, each FSIS sampling project has been designed independently, with unique purposes and goals. Sampling projects are resource intensive and, therefore, FSIS determined that an overall evaluation of FSIS' sampling projects was necessary to maximize the efficiency, effectiveness and value of those projects. The purpose of this evaluation, therefore, was 1) to develop a method to evaluate FSIS' ongoing and future sampling programs; and 2) use that method to assess the allocation of FSIS' sampling resources across the different sampling projects to ensure that the Agency is strategically utilizing sampling resources.

Design and Structure of the Evaluation

Given this is a novel, holistic assessment of the Agency's sampling projects, the SASR workgroup first needed to develop a framework—that is, an approach and method—for conducting the evaluation. An early consensus among workgroup members was that an underlying premise of this evaluation is that FSIS sampling is only useful if the data generated are used by the Agency. Thus, the workgroup sought to develop a framework that included an assessment of whether data generated under the Agency's sampling projects are analyzed, and whether the results of the analysis are factored into the Agency's decision-making.

With that in mind, the workgroup developed the framework—through an iterative process that included multiple consultations with FSIS subject matter experts (SMEs) and executives from across the Agency—and identified the necessary pieces of information to properly assess the Agency's sampling efforts. That framework consists of the following five phases, organized according to different aspects of the evaluation:

- Need: A robust inventory of all sampling projects.
    - Phase 1: Describe current sampling projects.
- Need: A systematic, equitable way to assess the relative strengths and weaknesses of each sampling project based on the information that a sampling project can provide to the Agency, and the importance of that information.
    - Phase 2: Develop weighted criteria against which to evaluate sampling projects
- Need: A way to determine whether the number of samples collected and analyzed for each sampling project achieves the stated Agency goal of the project.
    - Phase 3: Assess whether each sampling project, as implemented, can provide the intended information/benefits
- Need: A systematic, equitable way to assess whether the results from each sampling project are being analyzed, and whether those results are used to inform FSIS policy decisions.
    - Phase 4: For on-going sampling projects, determine whether FSIS has used the results for Agency decisions
- Need: A systematic, equitable way to assess the relative costs of each sampling project.
    - Phase 5: Assessment of costs across sampling projects

Scope

This evaluation included all active routine and inspector-generated sampling projects, as well as follow-up/for-cause sampling the Agency performs and analyses in its laboratory (e.g. follow-up sampling in response to a prior positive sampling result). Special Programs and Outbreak sampling projects were excluded as they are non-routine and not continuously running projects. In establishment screening KIS tests, which are conducted by in-plant personnel, were also not included in this evaluation.

Data

This analysis utilized a listing of all current sampling projects from the FSIS Public Health Information System (PHIS), descriptions from *Federal Register Notices*, FSIS Directives and Notices that indicate why each sampling project was initiated, information collected from SMEs on how FSIS used aggregate analyses from each sampling project, and cost information supplied by FSIS laboratory management, Office of Field Operations (OFO), budget staff, and economists.

Participants

The SASR workgroup includes staff from a broad cross-section of the agency, including the Office of the Chief Financial Officer (OCFO), Office of International Coordination (OIC), Office of Field Operations (OFO), Office of Investigation, Enforcement, and Audit (OIEA), Office of Planning, Analysis and Risk Management (OPARM), Office of Policy and Program Development (OPPD), and the Office of Public Health Science (OPHS).

The SASR workgroup reached out to FSIS SMEs to help describe and assess individual sampling projects, provide cost estimates, and help select appropriate statistics for evaluating whether a sampling project is designed in a way to meet Agency and policy goals. Participants predominantly acted through one or more of the workgroups, or as SMEs on various topics, as identified below:

- Pathogen and Chemical Residue Workgroups (PWG; includes commodities and residues)
    - *Salmonella* and *Campylobacter* Coordination Group (SCCG)
    - Ready-to-Eat (RTE) Workgroup
    - Shiga toxin-producing *Escherichia coli* (STEC) Workgroup
    - Egg Products
    - Residues
- OCFO Budget Analysts
- Laboratory personnel
- FSIS statisticians
- FSIS economists
- MITRE Consultants

A full Participant List is presented in Appendix A: Evaluation Participants.

Phase 1: Describe Current Sampling Projects

Approach and Methodology

In Phase 1, the SASR workgroup compiled a complete list of all existing FSIS sampling projects captured in PHIS and the Laboratory Information Management System (LIMS). Included in this data compilation was the project code, project name, and the purpose of sampling. To understand the purpose of each sampling project, the workgroup and SMEs reviewed historic Annual Sampling Plans, Annual Sampling Catalog, all relevant *Federal Register Notices* (FRNs), FSIS Directives and Notices related to Agency sampling, as well as other relevant FSIS Notices and Directives, internal FSIS documents, including the SCC Sampling Plan Change Request Form, and external sources to identify rationale for initiating each sampling project.

Analysis

The SASR workgroup conducted a side by side evaluation with the Annual Sampling Plan to determine whether the plan provided enough information to serve as a full inventory.

Results

Complete results for all current sampling projects, including the project code, the name of the sampling project, and the purpose of the sampling as described, when available, in the FRN or FSIS Directive or Notice announcing its initiation, are included in Appendix B: Description of Ongoing Sampling Projects. For some sampling projects, FSIS uses a different project code for samples of the same product-pathogen pair that are sent to different laboratories for analysis. For the purposes of summarizing the data in this report, and to avoid double-counting, when there were different project codes for the same product-pathogen pair being sent to different laboratories, those project codes were assessed together and are only counted once.

The side by side comparison of the Annual Sampling Plan with the inventory that was created during this phase identified several gaps, including that the sampling plan covered a more limited scope of projects and there were no details concerning the historic policy background for initiating all sampling programs.

Recommendations

The SCC should annually review the inventory through the routine development of the Annual Sampling Plan and propose if the inventory should be internally or publicly available.

Phase 2: Develop Weighted Criteria against which to Evaluate Sampling Projects

Approach and Methodology

In Phase 2, the SASR workgroup developed categories and criteria to use for a qualitative evaluation of the potential benefits of each sampling project. Evaluation of each of the 157 sampling projects identified in Phase 1 is based on the extent to which the project contributes to the Agency's mission and goals. An Excel spreadsheet was created to track scoring. This qualitative evaluation included the following four steps:

1. Establish the criteria;
2. Assign each sampling program a score of either one or zero, according to whether it could or could not potentially provide the information, or benefit, for the given criteria;
3. Determine criteria weights using within-Agency expert elicitation and rank ordering; and
4. Compute project total score as the weighted sum of the benefit scores.

Analysis

Establish the Criteria

To determine the potential benefits of any given sampling project, the SASR workgroup identified four broad categories of ways that the Agency uses data from its sampling projects in decision-making: 1) to assess individual establishments or countries; 2) to conduct investigations; 3) to modernize regulations; and 4) to track Agency progress.

The workgroup then created a series of criteria, in the form of questions, under each of the four categories, for a total of 18 questions to gather information on what benefits could potentially come from the different sampling projects (see Box 1 for the 18 criteria questions). For each sampling project, the questions could be asked to determine whether data from the sampling project could provide the given benefit. If it could, a score of one would be entered into an Excel spreadsheet; if it could not, a score of zero would be entered into an Excel spreadsheet. The SASR workgroup met several times to discuss the scores for each of the projects and through these robust discussions came to a consensus over which values were appropriate for the given project/question. The scores for each question—zero or one—could then be summed for each sampling project to provide an overall rating or 'score' for the sampling project. That overall score reflects the amount of information, or potential benefits, that each sampling project provides to FSIS for its decisions.

As a means of peer review, the SASR workgroup had SMEs peer review the criteria and test their applicability by evaluating two different FSIS sampling projects—the STEC sampling projects and pathology sampling projects. The peer review was to ensure that the criteria were adequate and would be applicable to FSIS' sampling projects. The questions were refined based on feedback received. Additional SMEs were then enlisted to evaluate all ongoing FSIS sampling projects against those refined criteria.

Box 1: Criteria for Determining the Potential Benefits for Individual Sampling Projects

1. **Assess Individual Establishments or Countries**
   a. Food Safety Related:
      i. Is the sampling project testing for an adulterant that is likely to occur, including residues with tolerances?
      ii. Are the sampling results used to direct a Food Safety Assessment for an establishment or supplier?
      iii. Do the sampling results indicate whether an establishment is meeting FSIS' performance standards, such as *Salmonella* performance standards for poultry?
      iv. Does the sampling project contribute to other surveillance, verification or follow-up activities at specific establishments, in commerce facilities or countries?
      v. Does the sampling project test for food defense-related threat agents?
   b. Non-Food Safety Related:
      i. Do the sampling results provide inspection personnel information on animal diseases that are diseases for which a carcass would be condemned?
      ii. Does the sampling project identify misbranding, such as a non-compliance related to economic adulteration?
5. **Conduct Investigations**
   a. Is the sampling project conducted to investigate an outbreak to link contamination in FSIS-regulated regulated products to clinical illnesses?
   b. Is the sampling project conducted for follow-up investigations in special circumstances other than outbreak investigations?
6. **Modernize Agency Policies and Regulations**
   a. Are the sampling results being analyzed to inform the development of FSIS regulations or policies?
   b. Are the sampling results used to determine the hazard or risk of an emerging pathogen, chemical or other agent in an FSIS-regulated product?
   c. Do the sampling results provide information about a hazard (microbial or chemical) in a new or different product?
7. **Track Agency Progress, Conduct National Surveillance, and Establish/Support Priorities**
   a. Does FSIS use the results of the sampling project to track its progress in advancing Agency's the Agency towards a specific performance measure from its Strategic or Annual Plan?
   b. Is the sampling project conducted to provide information, at the national level, on the prevalence of antimicrobial anti-microbial resistance?
   c. Do the results provide information on the presence of bacterial types or strains that typically are associated with human illnesses?
   d. Does the sampling project provide information, at the national level, on the prevalence or percent positive of a microbe, chemical or other agent of concern?
   e. Is the sampling project conducted to support data collection efforts for another agency, or as a requirement of an MOU?
   f. Do the sampling results provide inspection personnel information on animal diseases that are diseases for which FSIS conducts surveillance from an animal health perspective?

Determine Criteria Weights

As an initial assessment, all criteria were given the same weight, such that each time the SMEs indicated that a sampling project, as it was designed at the time of the assessment, could potentially provide the specific information described in the criterion question, it was given a score of one. The overall score for potential benefits for each sampling project was then calculated by summing the number of positive "yes" responses across all criteria questions.

However, after review of the overall scores and discussion amongst the SASR workgroup, as well as with FSIS SMEs and executives, the consensus of the SASR workgroup was that all potential benefits, or information, are not equally important to the Agency. For example, information on the presence of an adulterant is considered more important—or of greater benefit—than information for a Memorandum of Understanding (MOU). Therefore, the workgroup attached weights to the benefits questions.

To do so, the SASR workgroup polled its members as well as Agency SMEs to determine the value they would attach to each benefit question, ranking them in order of importance from highest (1) to lowest (18). Next, the workgroup reviewed the results of its polling and developed a consensus ranking for each benefit criteria. MITRE then explored different methods to convert the rankings to weights. (See **Appendix C: ROC Method** for more information on the ROC method.) The rank-order centroid (ROC) method was selected because it provided more differentiation among the criterions than other methods examined. The ROC methodology uses a standard competitive ranking process; that is, in the case of a tie, the ranking would skip (e.g., 1, 1, 3 …) to preserve the same ranking scale across program areas. The final criteria ranking is computed from the median program area response.

As a final review, FSIS SMEs examined the overall weighted scores for the different sampling projects to assess whether the rankings based on those scores reflected the importance of the sampling data to FSIS' mission. Minor changes were made in the weighting to better align the scores with FSIS' mission. The result of the weighting and minor adjustments was that the final scores and rankings based on those scores more accurately reflected the relative benefits each sampling project provides.

Results

Rank and Weight Criteria

The ROC weight, using the standard competitive ranking process, is shown in **Error! Reference source not found.**. The final weighting for each criteria question is listed in the far-right column, and the number for the criteria (from Box 1) are listed from highest to lowest weighting. As can be seen in Figure 1, Criteria 1.a.i, which is whether the sampling programs tests for adulterants, is clearly ranked as the Agency's top priority and has the highest weight. As discussed above, the rank corresponds to the value assigned to each question (on a scale of 1-18) based workgroup and Agency's consensus.

Criteria	Rank	Rank Order Centroid	
		ROC Weight (Initial)	ROC Weight (Avg Ties)
1.a.i	1.0	0.180	0.180
4.a	3.0	0.129	0.121
2.a	3.0	0.112	0.121
1.a.iii	3.5	0.095	0.095
4.c	5.0	0.081	0.076
3.a	5.0	0.071	0.076
4.d	6.0	0.061	0.061
1.a.ii	7.5	0.052	0.049
1.b.i	7.5	0.045	0.049
4.b	9.0	0.039	0.036
1.a.iv	9.0	0.033	0.036
3.b	11.0	0.027	0.027
2.b	11.5	0.023	0.021
3.c	11.5	0.018	0.021
1.a.v	12.0	0.014	0.014
1.b.ii	13.0	0.010	0.010
4.f	17.0	0.006	0.006
4.e	17.5	0.003	0.003

1. Assess Individual Establishments ...
2. Conduct Investigations
3. Modernize Agency Policies...
4. Track Agency Progress ...

Figure 1. Criteria Ranking and Weights. The criteria numbers correspond to the criteria in Box 1 and are color-coded for the category of potential benefits from the information: blue, to assess individual establishments or countries; yellow, to conduct investigations; green, to modernize Agency policies; and gold, to track Agency progress.

Score Projects Across Criteria and Compute Total Scores

SMEs reviewed each of the sampling projects and assigned the criteria a score of 1 if met by the sampling project or 0 if the criteria were not met; that is, whether the sampling project data could provide the Agency with the stated information. The total score is computed as the weighted sum of the criteria scores, or:

$$TotalScore = \sum_{j=1}^{18} w_j \times Score_j,$$

where W_j is the criteria weight and $Score_j$ is the criteria score. In other words, for each sampling project, the responses (1 or 0) for each question are multiplied by the weight for that question, and then added together to get the overall weighted score for the sampling project. The different sampling projects could then be ranked according to those weighted scores, which represent the relative potential benefits of the different sampling projects. Detailed findings on the potential benefits of ongoing sampling projects, including raw data from SME evaluation of all existing sampling projects, are included in Appendix D: Detailed Findings on the Potential Benefits of Ongoing Sampling Projects.

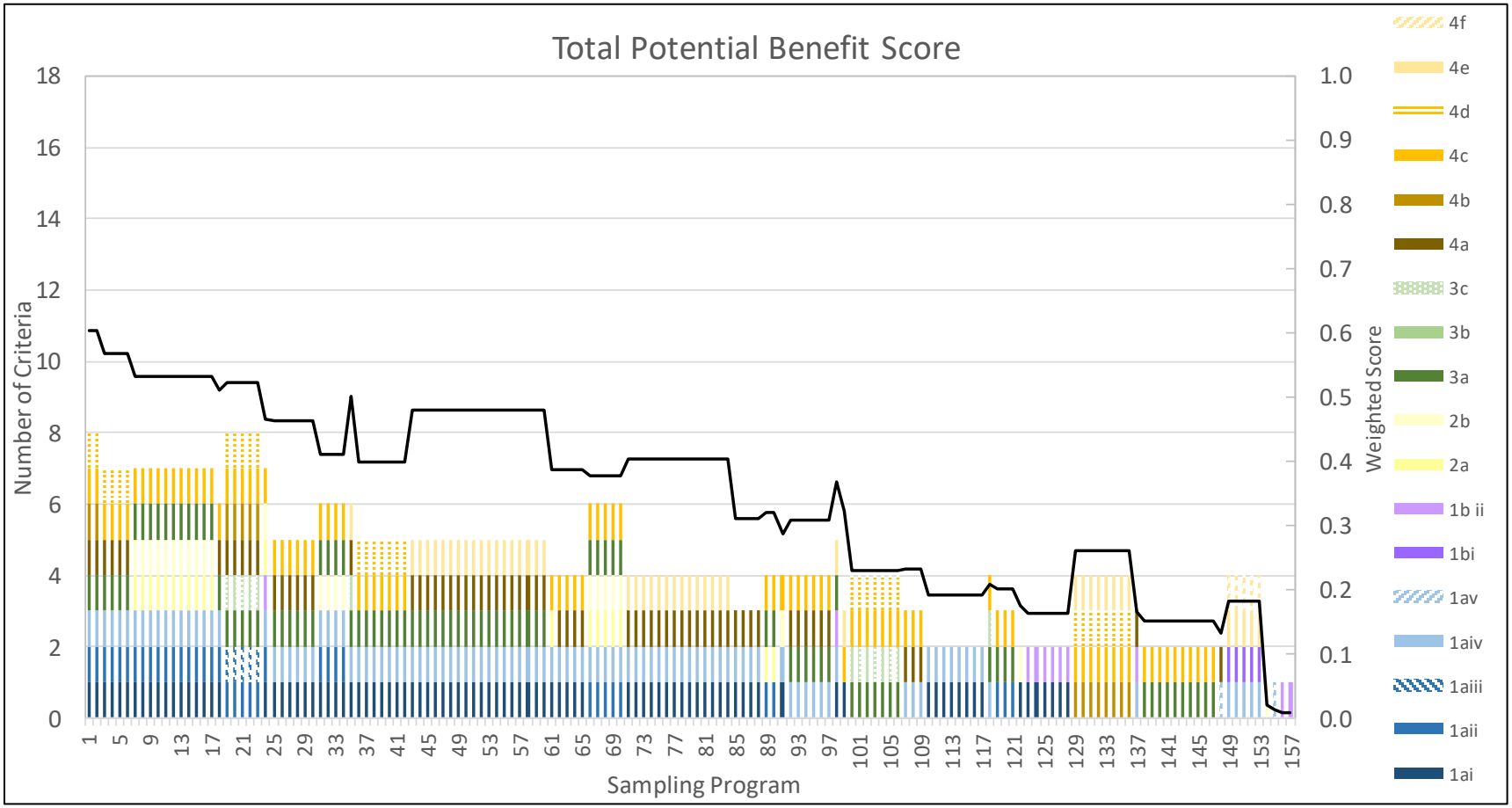
Table 1 presents the results of the scoring, ranking and weighting of each sampling project in order of its weighted score, from highest to lowest. The effect of the weighting is shown in Table 1, where the rank according to the weighted score for a given project is higher than the unweighted ranking (e.g., NRP 43, Order 43). This effect is more pronounced in Figure 2, which shows the unweighted and weighted scores

for each sampling project from highest to lowest weighted score. There are several sampling projects that have four criteria identified as being applicable, but the weighted score varies—and the black line diverges—depending on which criteria are scored with a one. For instance, a score of 1 was given to both the NARMS sampling projects and the State residue testing projects for four questions (shown as multicolored bars in Figure 2, ranges are Sampling Program 129-136 and 79-87 respectively). However, when the weighted value for each individual question was applied (shown as a black line in Figure 2), the overall weighted score for NARMS decreased, while the overall weighted score for the State residue sampling projects increased. A more drastic example of how the weighting affected final ranking is demonstrated by the final weighted score for the pathology sampling projects, which decreased from fulfilling four criteria, to having an overall score of less than 1. These examples highlight the benefits of utilizing a weighted scoring approach versus an unweighted approach.

Table 1: Summary of Sampling Projects Ranked by Unweighted and Weighted Score

Order	Project Name	Potential Benefit Score		Order	Project Name	Potential Benefit Score		Order	Project Name	Potential Benefit Score		Order	Project Name	Potential Benefit Score	
		Unweighted	Weighted			Unweighted	Weighted			Unweighted	Weighted			Unweighted	Weighted
1	MT43	8	0.60	41	EM36	5	0.40	81	NRP_ST_S	4	0.40	121	F_TU_COM01	3	0.20
2	MT60	8	0.60	42	EM37	5	0.40	82	NRP_SW_S	4	0.40	122	FAMR01	2	0.18
3	MT64	7	0.57	43	KIS	5	0.48	83	NRP_YC_S	4	0.40	123	AMR01	2	0.16
4	MT65	7	0.57	44	NRP_BC	5	0.48	84	NRP_YT_S	4	0.40	124	EXP_LV_ABX	2	0.16
5	RTEPROD_RAND	7	0.57	45	NRP_BS	5	0.48	85	IMPABNCONT	3	0.31	125	EXP_LV_HORM	2	0.16
6	RTEPROD_RISK	7	0.57	46	NRP_BV	5	0.48	86	IMPAMRBEEF	3	0.31	126	EXP_LV_SOY	2	0.16
7	INTCONT_LM_E	7	0.53	47	NRP_DC	5	0.48	87	IMPFISH_CH_E	3	0.31	127	FOODCHEM	2	0.16
8	INTCONT_LM_M	7	0.53	48	NRP_FFV	5	0.48	88	IMPFISH_CH_W	3	0.31	128	UNKSUB	2	0.16
9	INTCONT_LM_W	7	0.53	49	NRP_GO	5	0.48	89	F_CH_CARC01	4	0.32	129	NARMS_BC	4	0.26
10	INTCONT_SA_E	7	0.53	50	NRP_HC	5	0.48	90	F_TU_CARC01	4	0.32	130	NARMS_DC	4	0.26
11	INTCONT_SA_M	7	0.53	51	NRP_HF	5	0.48	91	FLISTERIA	4	0.29	131	NARMS_HF	4	0.26
12	INTPROD_LM_E	7	0.53	52	NRP_MS	5	0.48	92	RLMENVC_EL	4	0.31	132	NARMS_MS	4	0.26
13	INTPROD_LM_M	7	0.53	53	NRP_NFFV	5	0.48	93	RLMENVC_MWL	4	0.31	133	NARMS_ST	4	0.26
14	INTPROD_LM_W	7	0.53	54	NRP_OBT	5	0.48	94	RLMENVC_WL	4	0.31	134	NARMS_SW	4	0.26
15	INTPROD_SA_E	7	0.53	55	NRP_RS	5	0.48	95	RLMENVR_EL	4	0.31	135	NARMS_YC	4	0.26
16	INTPROD_SA_M	7	0.53	56	NRP_SH	5	0.48	96	RLMENVR_MWL	4	0.31	136	NARMS_YT	4	0.26
17	MT44T	7	0.53	57	NRP_ST	5	0.48	97	RLMENVR_WL	4	0.31	137	IMPSPECIESID	3	0.16
18	MT05	6	0.51	58	NRP_SW	5	0.48	98	RES_FI	5	0.37	138	LO_CH_CARC01	2	0.15
19	HC_CH_CARC01	8	0.52	59	NRP_YC	5	0.48	99	AMS_PROD_RTE	3	0.32	139	LO_CH_COM01	2	0.15
20	HC_CH_COM01	8	0.52	60	NRP_YT	5	0.48	100	EXP_CH_MSK01	4	0.23	140	LO_CH_MSK01	2	0.15
21	HC_CPT_LBW01	8	0.52	61	FRTESALMONEL	4	0.39	101	EXP_CPT_OT01	4	0.23	141	LO_CPT_LBW01	2	0.15
22	HC_TU_CARC01	8	0.52	62	EGGIMP	4	0.39	102	EXP_CPT_QH01	4	0.23	142	LO_CPT_OT01	2	0.15
23	HC_TU_COM01	8	0.52	63	IMVRTE	4	0.39	103	EXP_PK_COM02	4	0.23	143	LO_CPT_QH01	2	0.15
24	COMPLIAN	7	0.46	64	MT08	4	0.39	104	EXP_PK_ICT02	4	0.23	144	LO_TU_CARC01	2	0.15
25	RLMCONT_EL	5	0.46	65	MT51	4	0.39	105	EXP_PK_NCT02	4	0.23	145	LO_TU_COM01	2	0.15
26	RLMCONT_MWL	5	0.46	66	INTENV_LM_E	6	0.38	106	EXP_TU_MSK01	4	0.23	146	RE_CH_CARC01	2	0.15
27	RLMCONT_WL	5	0.46	67	INTENV_LM_M	6	0.38	107	IMP_PORK	3	0.23	147	LO_TU_MSK01	2	0.15
28	RLMPRODC_EL	5	0.46	68	INTENV_LM_W	6	0.38	108	IMP_POULTRY	3	0.23	148	FDS05	2	0.13
29	RLMPRODC_MWL	5	0.46	69	INTENV_SA_E	6	0.38	109	IMPFISH_MI	3	0.23	149	IMPPATH	4	0.18
30	RLMPRODC_WL	5	0.46	70	INTENV_SA_M	6	0.38	110	IMPHORMONES	2	0.19	150	PATH_LIVESTK	4	0.18
31	MT06	6	0.41	71	CG_RES_EL	4	0.40	111	IMPMETALS	2	0.19	151	PATH_OTHER	4	0.18
32	MT44	6	0.41	72	CG_RES_MWL	4	0.40	112	IMPPESTICIDE	2	0.19	152	PATH_POULTRY	4	0.18
33	MT52	6	0.41	73	CG_RES_WL	4	0.40	113	IMPRESEGG	2	0.19	153	PATH_PRODUCT	4	0.18
34	MT53	6	0.41	74	CG_SHOW_MWL	4	0.40	114	IMPRESFR_EL	2	0.19	154	ABNCONT	1	0.02
35	NRP_FS	6	0.50	75	CG_SHOW_WL	4	0.40	115	IMPRESFR_WL	2	0.19	155	FDS01	1	0.01
36	EM31	5	0.40	76	NRP_BC_S	4	0.40	116	IMPRESPR_EL	2	0.19	156	EXP_LV_NUTR	1	0.01
37	EM32	5	0.40	77	NRP_BV_S	4	0.40	117	IMPRESPR_ML	2	0.19	157	SPECID	1	0.01
38	EM33	5	0.40	78	NRP_DC_S	4	0.40	118	EXP_FI_MIC01	4	0.21				
39	EM34	5	0.40	79	NRP_HF_S	4	0.40	119	F_CPT_LBW01	3	0.20				
40	EM35	5	0.40	80	NRP_MS_S	4	0.40	120	F_CU_COM01	3	0.20				

Figure 2. Unweighted and Weighted Scores



By design, and consistent with FSIS' mission, sampling projects related to adulterant testing ranked the highest in this analysis. Specifically, the for-cause sampling projects for *Lm* in RTE products and food contact surfaces were ranked the highest, followed by the follow-up and risk-based *E. coli* O157:H7 and other adulterant Shiga Toxin *E. coli* (STEC) sampling projects for raw ground beef. The Agency's Pathogen Reduction/Hazard Analysis and Critical Control Point (PR/HACCP) verification sampling projects (for *Salmonella* and *Campylobacter* in poultry carcasses) were ranked just below the projects that address adulterants, indicating that the weighting of the sampling projects successfully aligned with the Agency's purpose and mission.

The lowest scoring sampling projects were the only projects with an affirmative response to any of the following questions: test for food defense-related threat agents (Question 1av), provide inspection program personnel (IPP) with information on animal diseases that are diseases for which a carcass would be condemned (Question 1bi), determine the hazard or risk of an emerging pathogen, chemical, or other agent in an FSIS-regulated product (Question 3b), provide IPP information on animal diseases for which FSIS conducts surveillance from an animal health perspective (Question 4f).

In general, the sampling projects with the highest scores are those that directly align with the Agency's current priorities (identifying adulterants, reducing pathogen positive rates). FSIS' exploratory microbiological and chemical residue sampling projects generally received mid-level rankings, reflecting the importance the Agency puts on those projects.

As can be seen in Table 1 and Figure 2, the ranked, weighted scores are well spread among the sampling projects, with weighted scores ranging from 0.01 to 0.68. About 38% of the sampling projects scored below 0.3, indicating those provide limited information to the Agency for decisions. It is important to note, however, that this ranking only considers one phase of the evaluation of a sampling project— the potential benefits. Other aspects are examined in the other phases of this evaluation—Phase 3, whether the sampling project is actually providing those benefits, Phase 4, whether the data are being used, and Phase 5, what the associated costs are for running sampling projects. These other aspects also need to be considered when evaluating sampling programs. In addition, there are instances in which other external considerations, such as international trade, other ramifications, and practicality should be taken into account when evaluating sampling projects, and those considerations are not included in this ranking of potential benefits. Therefore, neither the raw nor the weighted score should be deterministic for sampling programs; that is, a sampling program should not be eliminated solely because it has a low weighted score.

Recommendations

- FSIS should reexamine projects with a weighted-benefit ranking below 0.3 to determine whether improvements could be made to strengthen the value of those projects or whether the project should be discontinued. The reexamination should take into account the information obtained in other phases of this evaluation, as well as other external considerations.
- Moving forward, the criteria and weighting for the potential benefits (Box 1) should be included in requests for new sampling projects or modifications to existing projects.

Phase 3: Assess Whether Each Sampling Project, as Implemented, Can Provide the Intended Information and Benefits

Approach and Methodology

After evaluating the potential benefits of each sampling project through the qualitative criteria scoring in Phase 2, the SASR workgroup assessed whether the identified benefits are likely to be realized from implementation of the project (Phase 3). This phase is important because, regardless of the potential benefits, if a sampling project is not designed and implemented correctly, those benefits will not be realized. This Phase 3 analysis only applies to routine, algorithm-based sampling projects like Raw Ground Beef, Young Chicken Carcasses, and Ready-to-Eat (RTE) products. It does not apply to collector generated, follow-up sampling or retail projects; such sampling programs are not statistically designed and, therefore, cannot be evaluated on a statistical basis. Importantly, that means they cannot be used to estimate national trends, prevalence or other such metrics.

The workgroup, in conjunction with Agency statisticians and analysts, developed a series of questions to help determine whether a sampling project's design, or, in the case of sampling projects undergoing Agency consideration, planned design, is adequate to provide the information sought. The SASR workgroup used several central tenets in reviewing the design of sampling projects. First, the number of samples allocated for each project should be as small as possible while still providing the necessary analytical information. Although collecting more samples produces more accurate estimates of pathogen rates and of establishment-specific and industry-wide performance, there can be diminishing returns to collecting large numbers of samples. FSIS must balance the need for accurate estimates with effective use of funds, IPP inspection activities, and cost to industry (from destructive sampling).

There are two major factors that drive the required number of samples for FSIS sampling projects: 1) policy goals and 2) the statistical validity to draw conclusions related to those policy goals. Examples of statistical concerns are producing national estimates (e.g., prevalence) and monitoring progress towards Agency goals (e.g., *Salmonella* pathogen reduction in Chicken Carcasses). Examples of policy concerns include categorizing establishments (e.g., *Salmonella* in Chicken Carcasses) and specific requirements based on a public health concern.

Box 2 contains a summary of common statistical terms used throughout the text below for ease of understanding.

Box 2: Overview of Statistical Terms

Confidence Interval: A range of values for a particular estimated parameter (i.e. pathogen rate), for which, at some level of confidence, the real value of the parameter is included. FSIS generally uses 95% confidence intervals for estimated pathogen rates (prevalence, or percent positive). Example Statement: The 95% confidence interval for the prevalence of *Salmonella* in Beef Manufacturing Trim was 1.1% to 3.78%.

Margin of error: A measure of an estimate's precision. As the MOE decreases, number of samples required must increase.

Significance level (α): The significance level is the probability of deeming the new project successful at reducing pathogen levels when in fact it is not successful.

- Subtracting the significance level from one (1-α) yields the confidence level of the interval.
- For a 95% confidence interval, set the significance level to 0.05.
- This is a Type I error in statistical contexts.
- Smaller values of α require larger number of samples.

Power: The power of a test is its ability to detect a change in prevalence that indeed has occurred because of the new project.

  - A common value for power is 0.80, or 80%.
  - A larger number of samples provides more power.

FSIS Pathogen Rate Estimation

FSIS publicly posts pathogen rate estimates for multiple sampling projects[2,3]. There are three different estimates produced: percent positive[4], volume-weighted percent positive, and prevalence. On the webpage, FSIS defines the three estimates as follows:

- Percent positive (PP): The percentage of samples of a specific FSIS-regulated product with a specific pathogen. These calculations may vary significantly from the actual prevalence of the population, but FSIS cannot make a more precise calculation with the data currently available.
- Volume-weighted percent positive (VWPP): The VWPP for a specific product-pathogen pair is calculated by combining the production volumes (production volume can be defined as the amount (weight or numbers of head) of product produced per year) for establishments with their sampling results. This provides a more accurate estimation than a percent positive, but the data do not meet the statistical requirements to make a prevalence estimate. VWPP is more public health focused than PP, in that weighting results by volume reflects exposure of the public to specific pathogens.

[2] https://www.fsis.usda.gov/wps/portal/fsis/topics/data-collection-and-reports/microbiology/sampling-project-results

[3] Use of FSIS Regulatory Verification Sampling to Generate Prevalence Estimates, April 2012 https://www.fsis.usda.gov/wps/wcm/connect/56b2ccbd-ad57-4311-b6df-289822d28115/Prevalence_Estimates_Report.pdf?MOD=AJPERES

[4] FSIS uses a logit transformation when producing 95% confidence intervals for pathogen rates. This transformation removes the possibility of a confidence interval overlapping 0% or 100%, by making the confidence interval "unbalanced." For ease of discussion, this document does not utilize this transformation.

- Prevalence: The estimated proportion, nationally, of a specific FSIS-regulated product with a specific pathogen.

FSIS definitions of these estimates vary slightly among publications at different points in time; for example, there are small differences between the current definitions and those referenced in the 2015 methodology paper.[1]

Footnote 2 from the publicly posted spreadsheets is applied to Processed Egg and Ready-to-Eat estimates, which are listed as volume weighted percent positive, "/2/. These calculations are made using the same calculation as prevalence. FSIS is not labeling these calculations prevalence because the data may not meet the statistical criteria for prevalence. If FSIS determines that the data do meet the statistical criteria, the label will be updated." The criteria that must be met to call an estimate a "prevalence" are outlined in the Prevalence estimate report. If an estimate does not meet the criteria for estimating prevalence, for transparency, the specific criteria that are lacking should be documented.

The FSIS definition of a prevalence estimate suggests there is a minimum number of samples required for labeling an FSIS estimate as "prevalence" versus "volume weighted percent positive" or for not calculating a prevalence. However, no explicit standard is set, or referenced in any of the documentation.

A direct effect of increasing the number of samples is to reduce the margin of error for a given estimate. The number of samples required to have a margin of error less than a pre-determined acceptable limit depends on the pathogen rate for the specific product/pathogen pairing in a sampling project. Rather than set a strict sample size limit, the SASR workgroup decided to base the calculations for the number of samples required on reaching a designated standard for the margin of error—see Table 2.

It is important to remember, however, that FSIS sampling projects often serve not only to estimate national prevalence, but also to assess an individual establishment's control of pathogens. Therefore, determinations about the number of samples to collect should be based not only on the number needed to estimate prevalence in the overall industry, but also on the number of samples needed to monitor individual establishments.

Table 2: Designated Standards for the Maximum Margin of Error Calculations by Pathogen Rate

Pathogen Rate	Maximum Margin of Error
Greater than 50%	+/- 5%
From 1% to 50%	+/- 1%
< 1%	+/- the expected Pathogen Rate

Statistical Determination of Sample Size

FSIS worked closely with MITRE to develop an Excel-based calculator tool to determine the required number of FSIS in-plant samples. The tool allows users to produce *preliminary* estimates of the number of samples required for three common situations:

- A confidence interval for a single proportion (e.g., prevalence) to within a specified margin of error
- An upper bound on the probability of a positive test result (e.g., adulterant monitoring)
- The difference between two proportions (e.g., impact of an industry standard on prevalence of a non-adulterant pathogen)

It should be stressed that this tool is only the first step in determining the number of samples needed to accomplish the goals of each sampling project. Other analyses should be incorporated into the evaluation, such as needs for

[1] FSIS Estimation of Pathogen Rates in the Population Represented by the Samples Collected in Each Sampling Project for Fiscal Year 2015 www.fsis.usda.gov/wps/wcm/connect/56b2ccbd-ad57-4311-b6df-289822d28115/Prevalence_Estimates_Report.pdf?MOD=AJPERES

stratification (e.g., by establishment) or other statistical measures; policy requirements; public health concerns; and technical, resource-based, and other limitations that could influence the final number of samples.

The design of the preliminary calculation for the number of samples required is purposely simple. The calculation estimates the largest number of samples required for a given set of parameters. Use of some complex statistical designs (stratification) or variance calculations (jackknife method) will produce confidence intervals with smaller margins of error for similar numbers of samples. However, for preliminary estimates and general planning purposes, the tool will provide useful estimates for the number of samples required to meet FSIS goals.

Confidence interval estimates

Confidence interval estimates are useful for establishing a range of plausible values around an estimated prevalence value. Three input values are needed to use the tool to determine the required number of samples for a pathogen rate estimate:

1. An estimate of the true prevalence of a pathogen in FSIS in-plant sampling
    a. This input may be based on current data, previous studies, or similar studies.
2. Maximum Margin of Error Estimate (MOE)
    a. If, for example, prevalence must be estimated to within +/-0.10, or 10%, then 0.10 is the maximum MOE.
3. Significance Level
    a. FSIS generally uses an Alpha of 0.05 for confidence intervals.

Table 3 provides sample size estimates for a given pathogen rate and desired margin of error. More samples are required to produce a smaller MOE. For example, if the pathogen rate is 40%, 1,476 samples are needed for a MOE of +/- 2.5%. This means that with 95% confidence the pathogen rate observed fell between 37.5-42.5%. Whereas, 9,220 samples are required to reduce the MOE to +/- 1% (39% - 41%).

Table 3: Tool to estimate the number of samples required for a given pathogen rate and a set maximum margin of error, assuming a 95% confidence interval.

Pathogen Rate	**Number of Samples Required for Different Maximum Margins of Error (+/- % range), Alpha=0.05**							
	10%	5%	2.5%	1%	0.5%	0.1%	0.05%	0.01%
40%	93	369	1,476	9,220	36,879	921,951	3,687,801	92,195,012
30%	81	323	1,291	8,068	32,269	806,707	3,226,826	80,670,636

20%	62	246	984	6,147	24,586	614,634	2,458,534	61,463,342
10%	35	139	554	3,458	13,830	345,732	1,382,926	34,573,130
5%		73	292	1,825	7,299	182,470	729,878	18,246,930
1%			61	381	1,522	38,031	152,122	3,803,045
0.50%				192	765	19,112	76,446	1,911,126
0.10%					154	3,838	15,351	383,762
0.01%						385	1,537	38,411

Upper bound estimates

Upper bound estimates provide comparatively less information than interval estimates, but they also require smaller numbers of samples. Upper bound estimates are based on the idea that for any given sample size, if no positive test results are observed, then pathogen rate does not exceed some upper bound with known confidence. Two input values are needed to use the tool to determine the required number of samples for an upper bound estimate:

1. The upper bound of the pathogen rate.
    a. If there are no positive test results, this is the value the pathogen rate does not exceed.
2. Significance Level
    a. The Upper Bound estimates do not have a standard Alpha value. This differs from the Alpha=.05 standard for confidence intervals.

The following is an example of estimating the number of samples required for an upper bound estimate. Assume that FSIS will take no action as long as the overall prevalence of a non-adulterant pathogen remains at or below some acceptable level, say 0.25, or 25%. The number of samples FSIS must collect so that, if there are no positive test results for that pathogen, the agency can be 95% confident that the pathogen's prevalence does not exceed 25% is 11. The 'price' of the small number of samples is confidence that the prevalence of the non-adulterant pathogen is somewhere at or below 25% if no positive results are detected. If two of the samples were positive, the estimated pathogen rate would be 18.18%, with a margin of error larger than 18.18%. The benefits for using the upper bound estimates to determine the number of samples required are found when the pathogen rate is very low.

The tool allows the user to easily compare sampling requirements for interval estimates and upper bound estimates.

Table 4: Upper bound number of samples required calculations by pathogen rate and confidence.

Pathogen Rate	Number of Samples Required for Different Alphas (confidence intervals)							
	0.1	**0.05**	**0.025**	**0.01**	**0.005**	**0.001**	**0.0005**	**0.0001**
3%	76	99	122	152	174	227	250	303
2%	114	149	183	228	263	342	377	456
1%	230	299	368	459	528	688	757	917
0.50%	460	598	736	919	1,058	1,379	1,517	1,838

0.25%	920	1,197	1,474	1,840	2,117	2,760	3,037	3,680
0.10%	2,302	2,995	3,688	4,603	5,296	6,905	7,598	9,206
0.05%	4,605	5,990	7,376	9,209	10,594	13,813	15,199	18,417
0.01%	23,025	29,956	36,887	46,050	52,981	69,075	76,006	92,099

Table 4 provides upper bound sample size estimates for a given pathogen rate by varying confidence intervals. As an example of table interpretation, if FSIS analyzed 4,603 samples without finding any positives for the given pathogen, the Agency could be 99% confident that the pathogen rate does not exceed 0.10%. Basing the sample size on the upper bound number of samples requirement does not preclude the Agency from estimating the pathogen rate and producing a confidence interval. The resulting confidence interval will be wider than if the number of samples were set to optimize the interval, but with far fewer samples collected. For example, if the rate for the non-adulterant pathogen were actually 0.01%, 38,411 (see Table 3) samples would be required to reduce the margin of error to +/- .01%, but the 95% confidence interval from 4,603 samples would have a margin of error of +/- .029%.

Difference between two proportions test

Instead of monitoring occurrence of pathogen in FSIS testing with an interval or upper bound estimate, some projects may be designed with the goal of lowering pathogen prevalence in FSIS in-plant testing from current levels to meet targets. In this case, it is important to be able to establish a plausible correlation between the new project and the new prevalence level by testing for the difference between two proportions.[5] The goal of this test is to allow FSIS to state the pathogen rate was reduced by a desired percentage due to industry's response to some action by FSIS.

The following four input values are needed to use the tool to determine the number of samples required to show the difference between two proportions:

1. An estimate of the true, initial prevalence of a pathogen in FSIS in-plant testing (starting proportion)
    - This input may be based on current data, previous studies, or similar studies.
2. A second proportion that is an estimate of the true, new pathogen rate in FSIS in-plant testing
    - The pathogen rate expected because of a new project or action.
    - The difference between the first and second proportion is known as the minimum clinically relevant difference.
    - The tool assumes that a project must lower the pathogen rate to the value of the second proportion to be considered successful.
3. The significance level (α) of the test.
4. The power (1-β) of the test.[6]
    - If the new project is a success, it is important that we collect enough data to verify that.

If a project is being designed to reduce pathogen positive rates (Rate), to detect the difference, FSIS would compare the rates from two different time periods. Thus, the total number of samples required would be the number of samples needed to determine Rate 1 plus the number of samples needed to determine the Rate 2. For example, FSIS would need to collect 1,091 samples per rate (2,182 total) to be able to detect a change in pathogen rate from 25% to 20% with 80% power and 95% confidence.

Analysis

[5] Testing for the difference between two proportions is a more general case of assessing the impact of a new standard. Assessing the impact of a new standard is covered in the next section of this document.

[6] The quantity β is the false negative rate of the test. It is analogous to α, commonly referred to as significance, which is the false positive rate of the test.

The workgroup conducted focus groups with key members of each sampling workgroup to walk through each sampling project and, using the number of samples estimator tool developed by MITRE, assess whether enough samples were collected to determine, with statistical confidence, that the stated purpose of the project was achieved. For example, for sampling projects that were designed to assess pathogen prevalence in FSIS in-plant testing, is FSIS collecting enough samples to produce a 95% confidence interval with an acceptable margin of error?

Results

The discussion of results is organized into domestic sampling and import sampling. Domestic sampling is conducted to verify HACCP in producing establishments, while imports sampling is conducted as one part of the international equivalence process.

Domestic Sampling

Estimation of the pathogen prevalence in FSIS in-plant testing is important for several sampling projects, such as the poultry verification projects for carcasses, parts, and comminuted products. For pathogen-product pairs that have existing performance standards, such as *Salmonella* in chicken carcasses where the standard seeks a 25% reduction in illness, the number of samples estimated by the difference between two proportions test provides sound statistical results for planning purposes.

Most FSIS sampling projects do not require strict adherence to the maximum margin of error requirements for estimation of pathogen prevalence to be useful to the Agency. For projects that seek to estimate pathogen rate where the current pathogen rates are exceedingly low, such as the current pathogen rate of 0.01% for *E. coli* O157:H7 in raw ground beef, estimating the pathogen rate with an ideal margin of error requires far more samples to be collected and analyzed than the Agency has the resources to perform.

However, many sampling projects could utilize the Upper Bound estimate to guide sample size decisions. At the establishment level, no adulterants are permitted, and because of FSIS and industry efforts, the number of positive tests for adulterants is very low. It is conceivable that no positive results may be found over a given fiscal year. When this occurs, FSIS is limited in the statements that it can make regarding the data because no confidence interval can be calculated without at least 1 positive and 1 negative observation. However, if 4,603 samples were taken, FSIS could state with 99% confidence that the percent positive did not exceed 0.1%. If 9,209 samples were taken, FSIS could state with 99% confidence that the percent positive did not exceed 0.05%.

As discussed earlier, FSIS does not have a standard for the maximum margin of error of a confidence interval for an estimate of a pathogen rate, particularly for a prevalence estimate. For purposes of this analysis, the workgroup used the parameters identified in Table 5.

Table 5: Parameters for a standard maximum margin of error of a confidence interval for an estimate of a pathogen rate

Pathogen Rate	Maximum Margin of Error
Greater than 50%	+/- 5%
From 1% to 50%	+/- 1%
< 1%	+/- the expected Pathogen Rate

For ease of reference, a portion of Table 4, Upper Bound Sample Size Calculations is reproduced in Table 6.

Table 6: Subset of Table 4 (Upper bound sample size calculations by pathogen rate and confidence)

Pathogen Rate	Alpha				
	0.1	0.05	0.025	0.01	0.005
0.50%	460	598	736	919	1,058
0.25%	920	1,197	1,474	1,840	2,117
0.10%	2,302	2,995	3,688	4,603	5,296
0.05%	4,605	5,990	7,376	9,209	10,594
0.01%	23,025	29,956	36,887	46,050	52,981

The workgroup reviewed current sample size allocations for a select group of FSIS sampling projects and the associated pathogen rate estimates and performed some sample size calculations based on that data. The sample size calculations shown below are based on simple statistical concepts. As such, they are meant to be a starting point for determining appropriate sample sizes. There are many reasons the sample size may be more or less than the number suggested by the calculations (policy, advanced statistical techniques, etc.). Additional information is located in Appendix E: Required Number of Samples Estimates for Published Pathogen Rates.

Overview of Sample Size Estimations for Select Sampling Projects

- Risk-Based Sampling of Raw Ground Beef or Veal Products – *E. coli* O157:H7 & *Salmonella* (MT43)
  - For FY 2019, FSIS allocated 11,500 samples for MT43.
  - FSIS estimates the prevalence of *E. coli* O157:H7 in FSIS in-plant testing under MT43 to be around 0.01%.
    - 38,411 samples would be required to produce a confidence interval with a margin of error of 0.01% and an estimate of 0.01%.
    - If all 11,500 samples were negative in FY 2019, FSIS could state with 99.5% confidence the *E. coli* O157:H7 rate did not exceed 0.05%.
  - FSIS estimates the prevalence of *Salmonella* in FSIS in-plant testing under MT43 to be around 3.89%.
    - 1,437 samples would be required to produce a confidence interval with a margin of error of 1% and an estimate of 3.89%.
    - Two sets of 5,484 samples would be required (for example: 5,484 samples in FY18 and 5,484 samples in FY19) to be able to show a 25% reduction in *Salmonella* from 3.89% to 2.92% with 95% confidence and 80% power.

- Sampling of Bench Trim for further use in ANY raw, non-intact beef products (MT65)
  - For FY 2019, FSIS allocated 1,500 samples for MT65.
  - FSIS estimates the prevalence of *E. coli* O157:H7 in FSIS in-plant testing under MT65 to be almost 0%. FSIS did not find a positive sample in calendar year 2018.
    - At least one positive sample is required to produce a confidence interval.
    - 38,411 samples would be required to produce a confidence interval with a margin of error of 0.01% and an estimate of 0.01%.
    - If all 1,500 samples were negative in FY 2019, FSIS could state with 97.5% confidence the *E. coli* O157:H7 rate did not exceed 0.25%.
  - FSIS estimates the prevalence of *Salmonella* in FSIS in-plant testing under MT65 to be around a 0.66%.
    - 696 samples would be required to produce a confidence interval with a margin of error of 0.66% and an estimate of 0.66%.
    - Two sets of 35,356 samples would be required (for example: 35,356 samples in FY18 and 35,356 samples in FY19) to be able to show a 25% reduction in *Salmonella* from 0.66% to 0.5% with 95% confidence and 80% power.

- Sampling of Processed Egg Products (EM31-EM37)
  - For FY 2019, FSIS allocated 1,600 samples for all EM31-EM37.
  - FSIS estimates the volume weighted percent positive of *Lm* in EM31-EM37 products to be almost 0%. FSIS did not find a positive sample in calendar year 2018.
    - At least one positive sample is required to produce a confidence interval.
    - 38,411 samples would be required to produce a confidence interval with a margin of error of 0.01% and an estimate of 0.01%.
    - If all 1,600 samples were negative in FY 2019, FSIS could state with 97.5% confidence that the *Lm* rate did not exceed 0.25%.
  - FSIS estimates the prevalence of *Salmonella* in EM31-EM37 products to be around a 0.01%.
    - 38,411 samples would be required to produce a confidence interval with a margin of error of 0.01% and an estimate of 0.01%.
    - If all 1,600 samples were negative in FY 2019, FSIS could state with 97.5% confidence that the *Salmonella* rate did not exceed 0.25%.

- HACCP Verification for Young Chicken Carcasses (HC_CH_CARC01)
  - For FY 2019, FSIS allocated 9,000 samples for HC_CH_CARC01.
  - FSIS estimates the prevalence of *Salmonella* in young chicken carcasses to be around a 4.25%.
    - 1,564 samples would be required to produce a confidence interval with a margin of error of 1% and an estimate of 4.25%.
    - 2,735 samples required for both sets of data to be able to show a 25% reduction (the stated Healthy People 2020 goal) in *Salmonella* from 7.5% to 5.63% with 95% confidence and 80% power.
  - FSIS estimates the prevalence of *Campylobacter* in young chicken carcasses to be around a 29.5%.
    - 7,990 samples would be required to produce a confidence interval with a margin of error of 1% and an estimate of 29.5%.
    - 549 samples would be required for both sets of data to be able to show a 25% reduction in *Campylobacter* from 29.5% to 22.13% with 95% confidence and 80% power.

- Sampling for Ground and Other Comminuted Turkey (not Mech. Separated) (HC_TU_COM01)
  - For FY 2019, FSIS allocated 1,500 samples for HC_TU_COM01.
  - FSIS estimates the prevalence of *Salmonella* in comminuted turkey products to be around a 25.41%.
    - 7,281 samples would be required to produce a confidence interval with a margin of error of 1% and an estimate of 25.41%.
    - 631 samples would be required for both sets of data to be able to show a 25% reduction (the stated Healthy People 2020 goal) in *Salmonella* from 19.9% to 14% with 95% confidence and 80% power.
  - FSIS estimates the prevalence of *Campylobacter* in comminuted turkey products to be around a 2.71%.
    - 1,013 samples would be required to produce a confidence interval with a margin of error of 1% and an estimate of 2.71%.
    - 7,914 samples would be required for both sets of data to be able to show a 25% reduction in *Campylobacter* from 2.71% to 2.03% with 95% confidence and 80% power.

The number of samples required for almost all of FSIS' domestic sampling projects can be justified by the underlying statistical requirements. There are instances, particularly for the adulterant testing projects, where there may be an opportunity to reduce sampling allocations, but the policy requirements of those projects and the implications of reducing sampling must be considered before committing to any reduction.

It should be noted the National Residue Program (NRP) already utilizes the upper bound sample size calculations for determining the number of samples required for the various NRP sampling projects.

Import Sampling

All imported shipments of meat, poultry, and egg products that enter the United States are presented to FSIS for re-inspection. Point-of-entry re-inspection, including sampling, is one element of a three-part approach FSIS uses to evaluate and verify the on-going equivalence of an exporting country's food safety inspection system. FSIS checks every imported shipment for eligibility, certification, transportation damage, proper labeling, carton count, and general condition.

FSIS import re-inspection sampling uses PHIS to allocate types of inspections by country, process category, product category, product group and species. PHIS provides the ability to increase or decrease re-inspection of products by country or establishment using three levels of inspection: Normal, Increased, and Intensified. For normal sampling, FSIS collects and analyzes samples for pathogens, species identification, and drug and chemical residues at set intervals. Import re-inspection is performance-based in that failed types of inspections trigger additional like inspections on subsequent lots received from those foreign establishments – known as intensified level of re-inspection. The decision to increase the level of inspection above normal is an agency/management decision.

While the import sampling plan is modeled after the domestic sampling project, there are major differences in implementation. Domestic establishments operate and produce products eligible for sampling at predictable intervals and quantities. As such, it is possible to assign sampling tasks in a routine fashion and have confidence in the number of samples collected. Import sampling is dependent on establishments in foreign countries exporting product to the United States. In addition, domestic sampling is conducted to evaluate PR/HACCP in FSIS-regulated establishments.

Import sampling is only one segment of a three-part process to continually evaluate and verify the equivalency of an exporting country's food safety inspection system. It is supplemental to the sampling programs that the foreign country conducts; to be deemed equivalent, the foreign country's sampling program would already have been determined to have been equivalent. Import sampling is not designed to evaluate the equivalence of the foreign country. For a specific country product pair, there may be only a handful of lots shipped each year. Therefore, it is not possible to collect enough samples of a particular product for most importing countries to make any sound statistical determinations about any pathogen or residue.

Imported lots are refused entry if the shipment fails to meet U.S. requirements. For shipments refused entry for reasons significant to Public Health, such as an adulterant being detected upon re-inspection, FSIS:

1. Notifies the foreign central competent authority (CCA) and requests an investigation, a root cause analysis, and an assessment of corrective actions as verified by the foreign CCA;
2. Evaluates the response as part of assessing the foreign country's on-going equivalence; and
3. Uses the information to plan future audits performed as part of on-going equivalence verification.

For shipments that fail a lab sampling type of inspection, samples of all subsequent lots of like product and country and foreign establishment are collected until a specified number of negative results are received. For adulterants, the chance of a positive is likely to be so low that the intensification in sampling rate will act as a deterrence. The minimum number of intensified samples following a pathogen positive is 15. If all were negative, then FSIS could conclude, with 95% confidence, the pathogen rate for the product/country/processing establishment during intensified sampling did not exceed 19%.

For products that yield non-regulatory results, such as a *Salmonella* positive in raw chicken parts, FSIS does not reject the product. FSIS does not make any statistical determinations regarding the product, the performance of the foreign establishment, or the country's equivalence based on import sampling. To obtain a statistically based sample, significantly more import samples would need to be collected, the PHIS import module would require a rework and, most likely, a significant amount of work with international stakeholders would be necessary.

Recommendations

General Recommendations

- Pathogen workgroups should evaluate new and ongoing sampling projects to optimize sample allocation. To meet this overarching recommendation, the workgroups should take the following steps:
    - Using the tool as a *starting point,* the workgroups should determine the appropriate number of samples to analyze to ensure that any statistical benefits (e.g. maximum margin of error, upper bound claims, or comparison of rates) can be realized.
    - The workgroups should also determine the minimum number of samples required to meet policy goals (e.g. number of samples needed for establishment categorization).
    - The number of samples required to realize the statistical and policy benefits should be determined annually, be documented and included in the workgroup submission to the FSIS Annual Sampling Plan.
- The workgroup developed a series of questions that can be used to determine whether a sampling project's design is adequate to realize the potential benefits for which the sampling project is being initiated or conducted. Those questions are presented in Box 2. The workgroup recommends these questions be incorporated into the Sampling Plan Change Request Form.
- FSIS should consider the statistical claims that can be made based on the number of samples collected and analyzed when determining the required number of samples for each sampling project.
- FSIS should more clearly document the reasoning for the required number of samples and the potential statistical claims that are associated with each sampling project.
- FSIS should develop standards for determining whether a prevalence estimate based on FSIS in-plant sampling can be calculated for each sampling project, including identifying whether there is a maximum margin of error for calling an estimate a "prevalence."
- For all projects, FSIS should clearly document the reasons a prevalence estimate based on FSIS in-plant sampling can or cannot be calculated.

Sampling Project Specific Recommendations

- The egg product workgroup has evaluated the sampling model and has suggested updated methodology. The Agency has not made a final decision. FSIS should complete review of the proposal and implement any changes by FY 2020.
- Import sampling, as currently conducted by FSIS, cannot be used to make any statistical claims. To obtain a statistically based sample, significantly more samples would need to be taken, the PHIS import module would require a rework, and, most likely a significant amount of work with international stakeholders would be necessary. FSIS should evaluate import sampling to maximize benefit to the Agency.

Other Recommendations

- FSIS sampling programs use different methods for determining production volume categories of establishments. FSIS should develop a standard method for determining production volume categories for establishments.

Box 3: Questions to Help Consider whether Sampling Project Designs are Adequate

What background is available to help inform the design?

- How will the Agency use the data? That is, what is the intent of the sampling? (Please use list of potential benefits discussed in Box 1.)
- Is there any evidence that the pathogen or chemical is in the product or is this an exploratory sampling project?
- If there is evidence, is it known at what frequency the analyte is present?
- What evidence is there that there is an overall risk?
- Are there existing data to help inform the sampling design?
- Has there been a risk assessment or other analysis conducted to support the design?
- What is the severity of the outcome?
- How concerned do we need to be if there are positives?
- Can you 'piggy-back' on another sampling project?

What are the characteristics of the samples being collected and the analysis?

- Is the sample a rinsate, grab sample, or some other type of sample?
- What is the volume of product that will be evaluated and how was that determined?
- What does that volume of product represent?
- What is the level of detection at that volume?
- What is the sensitivity and specificity of the test method?

Are you trying to assess individual establishments or countries?

- Do you need to differentiate between different classes/sizes of establishments?
- Do you need to differentiate between different countries?
- Do you need to evaluate individual establishments?
- Is there a minimum number of samples you want from each establishment?
- Is there a maximum number of samples that you can collect from each establishment?

Are you trying to look at national rate or trends?

- Are you looking to determine the baseline level of a hazard/compound in a specific product? If so, why?
- What percent positive do you want to be able to detect with confidence, or at what percent positive are you concerned? (Note: this gets to what percent positive we are trying to estimate, which informs the number of samples for a given level of confidence.)
- How confident do you need to be in your conclusions from this sampling project? General trend? Detect a 50% change? Detect a 10% change?
- Are you looking for a threshold above which you think something is likely to occur or is there a minimal analyte level below which you don't care?

What number of samples (i.e., what sampling size) needs to be collected for the desired purpose?

- What is the best estimate of the national pathogen rate?
- Are you looking to produce a national pathogen rate estimate?
  - <u>YES</u>
    - What is the maximum margin of error acceptable for the estimate?
    - Are you looking to compare multiple time periods, if so, what amount of change are you looking to measure?
  - <u>NO</u>
    - What is the highest pathogen rate you are willing to accept the pathogen rate does not exceed if there are no positive sampling results?
    - What level of certainty do you want that the pathogen rate does not exceed that level?
- If there is a targeted number of samples for each establishment, how many samples are required to reach those targets?

Phase 4: For On-Going Sampling Projects, Determine Whether FSIS Has Used the Results for Agency Decisions

Approach and Methodology

In Phase 4, the SASR workgroup conducted a survey of SMEs, as well as the pathogen and chemical residue workgroups, to identify what decisions, or in some cases, types of decisions the Agency has made based on the results of the sampling projects. The purpose of this compilation was to better elucidate the ways in which FSIS has used the data it has collected. All sampling projects were developed with a purpose in mind, but whether they achieved that purpose and have been used to help shape Agency decision-making required further evaluation.

Examples of decisions the Agency makes using results from sampling projects include responding to residue violations with enforcement actions, using data on microbial trends to drive policy decisions, and using import sample results in future evaluations of a country's equivalence.

Analysis

Included in this compilation are the Project Code, Project Name, Description of How Data are Used in Agency Decisions, the number of samples planned in the FSIS FY 2018 Annual Sampling Plan, the number of samples analyzed in the FY 2018 Annual Plan, and the number of samples planned for the FSIS FY 2019 Annual Sampling Plan.

Results

The results of this compilation are presented in **Appendix E:** Required Number of Samples Estimates for Published Pathogen Rates

FSIS posts pathogen rates for select sampling projects quarterly. Reported estimates are either prevalence, volume-weighted percent positive, or straight percent positive. This appendix uses values from CY2018 published values because it has the most current pathogen rates to demonstrate the number of samples required for confidence interval estimates and to determine a difference between two proportions.

The number of samples required to meet the maximum margin of error for the estimated pathogen rate is based off the requirement discussed in Phase 3 on **Table 5: Parameters for a standard maximum margin of error of a confidence interval for an estimate of a pathogen rate** .

The number of required samples for these projects tends to be much higher than the number of samples allocated in the Annual Sampling Plan. In a few instances, the number of samples required is much lower. The projects where the required number of samples is considerably lower than the Annual Sampling Plan are highlighted.

The number of samples required for each proportion is calculated from either the current estimated pathogen rate, or from the actual FSIS documentation. For current estimated rates, the goal listed is a 25% pathogen (the stated Healthy People 2020 goal) rate reduction. For projects with specific goals, the number of samples required is based on the target pathogen rate, not the current estimated pathogen rate.

Table E1: Estimated Number of Samples Required for Projects with Published Pathogen Rates

Work-group	Project	Pathogen	FY 2019 Annual Sampling Plan	Interval Estimates				Difference Between Tw	
				Estimated Pathogen Rate CY 2018	Max Margin of Error	Significance Level (alpha)	Required # of Samples	Initial Pathogen Rate	Target Pathogen Rate
SCCG	HC_CH_CARC01	*Salmonella*	*9,000*	4.49%[1]	1%	0.05	1,791	7.50%	5.63%
		Campylobacter		13.03%[3]	1%	0.05	4,354		
	HC_CH_LBW01	*Salmonella*	*9,000*	12.99%[1]	1%	0.05	4,342	28%	18%
		Campylobacter		15.40%[3]	1%	0.05	5,005		
	HC_CH_COM01	*Salmonella*	*2,500*	38.32%[1]	1%	0.05	9,080	49%	34%
		Campylobacter		7.96%[3]	1%	0.05	2,815		
	HC_TU_CARC01	*Salmonella*	*2,000*	0.53%[1]	0.53%	0.05	721	1.70%	1.275%
		Campylobacter		0.51%[3]	0.51%	0.05	750		
	HC_TU_COM01	*Salmonella*	*1,500*	23.21%[1]	1%	0.05	6,847	19.90%	14%
		Campylobacter		2.53%[3]	1%	0.05	948	1.20%	1.0%
	EXP_CH_MSK01	*Salmonella*	*150*	80.95%[3]	5%	0.05	237	80.95%	60.71%
		Campylobacter		62.50%[3]	5%	0.05	361	62.50%	46.88%
	EXP_TU_MSK01	*Salmonella*	*150*	48.48%[3]	1%	0.05	9,595	48.48%	36.36%
		Campylobacter		9.09%[3]	1%	0.05	3,175	9.09%	6.82%
	EXP_CPT_QH01	*Salmonella*	*120*	15.60%[3]	1%	0.05	5,058	15.60%	11.70%
		Campylobacter		20%[3]	1%	0.05	6,147	20%	15%
	EXP_CPT_OT01	*Salmonella*	*360*	54.15%[3]	5%	0.05	382	54.15%	40.62%
STEC	MT43	*E. coli* O157:H7	*11,500*	0.01%[1]	0.01%	0.05	38,411		
		Salmonella		3.36%[1]	1.00%	0.05	1,248	3.36%	2.52%
	MT60	*E. coli* O157:H7	*3,750*	0.15%[1]	0.15%	0.05	2,558		
		non-O157 STEC		0.25%[1]	0.25%	0.05	1,533		
		Salmonella		1.86%[1]	1.00%	0.05	702	1.86%	1.39%
	MT64	*E. coli* O157:H7	*1,050*	0.17%[3]	0.24%	0.05	2,256		
		Salmonella		7.11%[3]	1.00%	0.05	2,538	7.11%	5.33%
	MT65	*E. coli* O157:H7	*1,500*	0.00%[3]	--%	0.05	--		
		Salmonella		0.58%[3]	0.58%	0.05	659	0.58%	0.44%
Pork	EXP_PK_ICT02	*Salmonella*	*1,521*	10.57%[3]	1.00%	0.05	3,632	10.57%	7.93%
	EXP_PK_NCT02	*Salmonella*	*1,272*	7.15%[3]	1.00%	0.05	2,551	7.15%	5.37%
	EXP_PK_COM02	*Salmonella*	*1,704*	20.88%[3]	1.00%	0.05	6,347	20.88%	15.66%
Egg Products	EM	*Salmonella*	*1,600*	0.00%[2]	--%	0.05	--		
		L. monocytogenes		0.00%[2]	--%	0.05	--		
RTE	RTEPROD_RAND	*Salmonella*	*7,400*	0.01%[2]	0.01%	0.05	38,411		
		L. monocytogenes		0.10%[2]	0.10%	0.05	3,838		
	RTEPROD_RISK	*Salmonella*	*7,400*	0.02%[2]	0.02%	0.05	19,204		
		L. monocytogenes		0.01%[2]	0.01%	0.05	38,411		

1 – Prevalence 2 – Volume Weighted Percent Positive 3 – Percent Positive 4 – Number of samples required to detect the difference officially stated by FSIS

Appendix F: Summary, by sampling project, of analyses conducted using results from each project. In general, results from most of FSIS' current sampling projects are used to make regulatory decisions, such as enforcement actions, or to inform Agency policy decisions.

There are many ways in which FSIS' sampling projects achieve their intended goals, and information from those projects often trigger immediate actions by the Agency. For example, the identification of a product positive for an adulterant (*E. coli* O157:H7 or non-O157 STEC identified in a ground beef sample (MT43)) triggers a District Office notification through the FSIS Biological Information Transfer and E-Mail System (BITES). The result is put into the FSIS System Tracking *E. coli* O157:H7 – Positive Suppliers (STEPS), and the Agency decides whether a product retention, detention, or recall is necessary.[7] Similarly, for an establishment subject to the *Salmonella* pathogen reduction performance standards, results from a *Salmonella* sampling (e.g., in chicken carcasses (HC_CH_CARC01)) are used to determine whether or not an establishment has met the performance standard, and these results are also subject to a monthly public posting of the establishment's category status.[8]

However, this evaluation identified sampling projects from which results have not been used to inform FSIS policy. For example, for many of the existing exploratory sampling projects—such as the Agency's

[7] https://www.fsis.usda.gov/wps/wcm/connect/18fd8926-62dd-42c0-aa1c-8109e87f4170/Ecoli_FSIS_Actions.pdf?MOD=AJPERES

[8] https://www.fsis.usda.gov/wps/wcm/connect/ebf83112-4c3b-4650-8396-24cc8d38bf6c/10250.1.pdf?MOD=AJPERES

exploratory sampling for chicken parts (quarter and half carcasses; EXP_CPT_QH01*)—at the time of this evaluation, no formal analyses have been conducted with the data produced from the project and results have not been used to inform FSIS policies.

Project Level Evaluations and Improvements

Concurrently with this analysis, the *Salmonella* and *Campylobacter* Coordination Group (SCCG) undertook an evaluation of the very low volume, religious exempt, and mechanically separated poultry exploratory sampling projects. The evaluation was conducted with the spirit of the SASR recommendations and ultimately resulted in FSIS deciding to end the very-low volume and religious exempt projects. A decision for the mechanically separated poultry projects is pending the results of an establishment survey regarding product usage.

Recommendations

- The SCC should revise the current sampling request SCC form to include the following updates:
  - Include a schedule for routine evaluation (with a formal analysis plan) of each sampling project to determine whether the results of the project are being used to inform FSIS policy.
  - Include a question to prompt the requestor to evaluate whether the necessary information could be obtained by updating an existing sampling project.
- Review existing exploratory/baseline sampling and make determinations to either discontinue sampling or incorporate the exploratory portion of the sampling into a routine sampling project.
- For projects that will be developed after the other recommendations are in place, ensure that there is a sampling timeline that includes a specified sunset date for the project.

Phase 5: Assessment of Costs Across Sampling Projects

Approach and Methodology

In Phase 5, the SASR workgroup estimated the cost of each sampling project to compare the relative costs among the different sampling projects. The cost estimates include both an estimate of the FSIS field personnel costs for collecting the sample at an establishment or in-commerce, and the FSIS laboratory costs associated with analyzing the sample.

The workgroup consulted with OFO personnel to gather information on the cost of inspection personnel time for collecting samples. It was determined that the absolute time that it takes to collect and ship a sample varies greatly, both between the different types of samples that are collected, as well as from establishment to establishment, because of the different physical sizes and layouts of establishments. It should be noted that inspection personnel collect samples during their workday assignment in lieu of performing some other inspection activity identified in PHIS as having a lower priority.

Therefore, the workgroup categorized the time for different types of sample collection as long, medium, or short to differentiate the costs of collection of samples. The costs of shipping the samples was approximately the same, regardless of the type of sample and was not used in the relative cost estimates. FSIS OPHS laboratory personnel provided estimates of the cost of analyzing samples for different product–pathogen pairs.

The workgroup estimated the relative costs of the different sampling projects by estimating the cost per sample and multiplying that cost by the number of samples collected for that sampling project. The following types of costs were considered when estimating the cost per sample:

I. The cost of inspection personnel time for collecting the samples for the different projects,
II. Estimates of the costs of laboratory personnel time for conducting the analyses, and
III. Where possible, estimates of the costs of the equipment and reagents for each sample.

Analysis

Costs Associated with FSIS Field Personnel Collecting Samples

The time FSIS IPP spend collecting samples varies depending on a variety of issues, including the product or type of sample being collected, the sample collection method, the size of the establishment, and the data entry requirements in PHIS. For the purposes of this analysis the SASR workgroup used OFO's methodology for its workforce planning, as described below.

OFO aggregates its work measurement data into four groupings:

- Direct inspection time (i.e., actual observation or hand-on task time),
- Indirect inspection time (e.g., data entry, research, and analytical time),
- Internal travel time (i.e. inside the plant), and
- External travel time (i.e. outside the plant).

FSIS allocates 30 minutes direct time for conducting sampling tasks, except the N-60 sampling task, which is allotted 60 minutes. The N-60 sample collection method is used with the MT60 and MT65 project codes. The indirect time factored into the work assignment calculation by applying an indirect multiplier, therefore the task indirect time varied between establishments and work assignments.

This analysis does not include internal or external travel time.

Table 7: Indirect Inspection Time Estimates for Large Establishments

Work Measurement Grouping	All Sample Collection Methods*	N 60 Method
Direct Inspection Time	30 minutes	60 minutes
Indirect Inspection Time	54 minutes	108 minutes
Internal Travel Time	Not Included	Not Included
External Travel Time	Not Included	Not Included

*Except N60

Finally, to estimate the cost of collecting samples, the workgroup multiplied the time estimates by the base salary of a GS-10 step 1 full time employee with no locality pay, and included the standard multiplier from the OMB Circular A-76[9] for estimating benefits and administrative overhead of 36.25%. The FSIS employee hourly rate is an approximation because samples can be collected by FSIS employees ranging from grades GS-9 through GS-12 at any of the 10 steps within the grades and at locations throughout the country with various locality pay rates.

Costs Associated with FSIS Laboratories Analyzing Samples

A second aspect of the costs associated with FSIS sampling projects is the laboratory costs of analyzing the different types of samples. FSIS laboratory personnel provided estimates of the costs of different types of analyses performed by the FSIS labs. Cost estimates for a sampling project overall, however, were complicated by many factors, not the least of which was that total costs vary based on the number of positive samples that need further characterization, for example whole genome sequencing (WGS).

This cost estimate does not include the laboratory labor costs for conducting the analysis, and only includes the direct costs for sample screening and confirmatory testing. At the time of the evaluation there was not enough information regarding labor hours to include in the report. OPHS field laboratories do not have a robust cost tracking system to account for all laboratory related costs, such as costs associated with instrumentation.

Since positives can greatly increase the cost of a sampling project by requiring further confirmatory testing, the costs for confirmatory testing of positives and further characterization are added to the costs of screening the negatives, to obtain an overall cost for a sampling project. It should also be noted that the confirmatory testing costs vary by analyte, and the rates of positives can vary year-to-year and by project.

To determine an average cost for a microbiological sample, FSIS summed the direct costs for analyzing samples, such as collection supplies, shipping and storage costs, and screening tests. Then multiplied these summed costs by the total number of samples planned for the year. The average cost also includes additional costs for confirmatory testing or further characterization. The expected number of samples for these costs are derived from the estimated percent positive rate for that project and are estimated based on historical data.

[9] https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A76/a076.pdf

The direct testing costs and the confirmatory testing are summed and then divided by the total number of samples analyzed to obtain an overall average for each sampling project. This analysis was completed for all projects designed to test for *E. coli* O157:H7, other STEC, *Salmonella*, *Campylobacter*, and *Lm*. The NARMS costs were also included in the estimate for a microbiological sample. The current microbiology OPHS cost models did not include equipment costs as they were primarily focused on consumables. These costs were then summed across all projects and divided by the total number of samples analyzed to get a total average cost for a microbiological sample.

A similar methodology was used for estimating an overall average cost for chemical or drug residue testing for a single sample. Since the methods for these types of analyses are quite different than microbiological testing, they are estimated separately. Chemical and drug residue testing can also be conducted using a variety of methods and FSIS tests for a variety of compounds. Again, the costs were averaged across several different methods and compounds, including the Multi-Residue Method (MRM), pesticide method, and tests for sodium, speciation, fat content, and others. Reagent costs per sample were multiplied by the number of samples planned for each method. Costs for confirmatory testing were added based on the reagent costs per confirmatory sample and the historical percent positive rates. Costs for equipment maintenance contracts were also added. These costs were then divided by the total number of samples tested to obtain an average direct cost for chemical or drug residue testing. Similarly, this cost estimate does not include the laboratory labor costs for conducting the analysis, and only includes the direct costs for sample screening and confirmatory testing.

As with both the microbiology and chemistry cost estimates, a similar approach was used to create the pathology cost estimates. The difference between pathology and the other estimates is that FSIS only performs two types of pathology analysis, advanced meat recovery (AMR) and normal diagnostic analysis. These two cost estimates include the consumables necessary for analysis, as well as the cost to send supplies to the field to gather the samples. Labor costs are not included. Unlike the previous two estimates, the pathology costs were not averaged, since there are designated projects that can distinguish the specific type of analysis to be performed.

Results

A complete list by project of the cost assessment is provided in Appendix G: Details of Costs Associated with Sampling Projects. Table 8 summarizes the five-different analysis/collection combinations that were found.

Table 8: Summary of Cost by Laboratory Analysis and Sample Collection

Laboratory Analysis Type	Laboratory Costs per sample ($)	Sample Collection Minutes	Field Personnel Hourly Rate ($)	Field Personnel Costs per sample ($)	Total Cost Estimate per sample ($)
Microbiological	82.17	54	31.53	28.38	110.55
Microbiological (N60)	82.17	108		56.75	138.92
Chemical Residue	115.06	54		28.38	143.44
Pathology (Diagnostic)	30.38	54		28.38	58.76
Pathology (AMR)	96.41	54		28.38	124.75

Recommendations

- FSIS should utilize OPHS resource subject matter experts to create and continuously refine a repository to track resource requirements by lab and project.

- New sampling project sponsors and the SCC should ensure that:
    - a sampling project's design has been optimized,
    - how the information from the sampling project will be used by the Agency is considered,
    - and consider the overall costs associated with the sampling plan before the decision to institute the sampling project is made.

Appendix A: Evaluation Participants

Participation included a broad cross-section of the agency, including the Office of the Chief Financial Officer (OCFO), the Office of Planning, Analysis, and Risk Management (OPARM), the Office of Field Operations (OFO), the Office of Investigation, Enforcement, and Audit (OIEA), the Office of Policy and Program Development (OPPD), the Office of Public Health Science (OPHS), and the Office of International Coordination (OIC).

The workgroup reached out to subject matter experts (SMEs) to help describe and assess individual sampling projects, to provide cost estimates, and to help select appropriate statistics for evaluating whether a sampling project is designed in a way to meet the potential benefits. Participants predominantly acted through one or more of the working groups, or as SMEs on various topics, as identified below:

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Appendix B: Description of Ongoing Sampling Projects

Typically, when FSIS initiates a sampling project, the Agency states its purpose and description in the Federal Register notice announcing the project. Table B1 in this appendix provides those descriptions and cites the FSIS documents which contain either that description or the regulation that applies.

Table B1. Description of Ongoing Sampling Projects

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
ABNCONT	Abnormal Container[a]	Samples are collected ad hoc when inspection program personnel (IPP) observes an abnormal container being used (Thermal Processing).[b]
AMR01	Advanced Meat Recovery Product	Beef AMR product is defined as product containing central nervous tissue (CNS) or CNS-type tissues. AMR product is defined as not "beef;" it cannot be used as an ingredient of a "meat food product" (9 CFR 318.24). The AMR01 project is restricted to product produced from beef skull or vertebral column bones because these are the most likely products to contain CNS tissues or CNS-type tissue (Directive 7160.3). Note that FSIS has determined it is not necessary to establish a verification sampling project for SRM removal (72 FR 38711).
AMS_PROD_RTE	AMS RTE Canada EV Project - Product Collected by FSIS	In 2015, FSIS and AMS Export Verification (EV) Project designed this collaborative testing project to verify establishments' control of pathogens in closed-faced sandwiches produced under voluntary FSIS inspection that are intended for export to Canada (80 FR 67382).
CG_RES_EL; CG_RES_MWL; CG_RES_WL;	Collector Generated - Residue - Eastern Lab/ Midwestern Lab/ Western Lab	Established in 1967 (77 FR 39896), this annual sampling project was developed by FSIS, FDA, EPA, and ARS, AMS, and CDC based on investigations, veterinary drug inventories, and on-farm visits. The group creates a list of chemical compounds for testing and ranks them by public health risk and regulatory concern. Then the group considers FSIS lab capacity and analytical methods (77 FR 39895) to verify establishments' control of animal drug residues, pesticides, environmental contaminants, and any other chemical hazards in and on meat and poultry products. The National Residue Projects (NRP) also provides national data on chemical residue testing results to support risk assessment, enforcement, and educational activities (Directive 10,800.1).
CG_SHOW_MWL; CG_SHOW_WL	Collector Generated-Residues-Show Animals-Midwest Lab/Western Lab	Established in 1967 (77 FR 39896), this annual sampling project was developed by FSIS, FDA, EPA, and ARS, AMS, and CDC based on investigations, veterinary drug inventories, and on-farm visits. The group creates a list of chemical compounds for testing and ranks them by public health risk and regulatory concern. Then the group considers FSIS lab capacity and analytical methods (77 FR 39895) to verify establishments' control of animal drug residues, pesticides, environmental contaminants, and any other chemical hazards in and on meat and poultry products. The National Residue Projects (NRP) also provides national data on chemical residue testing results to support risk assessment, enforcement, and educational activities (Directive 10,800.1).
COMPLIAN	Investigative Sampling	Samples are collected for products in commerce that are suspected to be adulterated or misbranded (FSIS Directive 8010.1).
EGGIMP	Import-Egg Products-Salmonella and Lm	Sampling for imports of pasteurized liquid, frozen egg products, and dried egg products (Directive 9900.2).
EM31	Egg Product Sampling-Pasteurized-Egg Whites-Salmonella and Lm	The Egg Monitoring (EM) group of product codes tests egg products that must be pasteurized before they leave the official plant (21 U.S.C. §1034 and §1036).
EM32	Egg Product Sampling-Pasteurized-Whole Egg or Yolks - Salmonella and Lm	
EM33	Egg Product Sampling-Pasteurized-Whole Eggs with Added Yolks or Whole Egg Blends-Salmonella and Lm	
EM34	Egg Product Sampling-Pasteurized-Whole Eggs or Yolks with > 2% salt or sugar added-Salmonella and Lm	
EM35	Egg Product Sampling-Pasteurized-Dried Yellow Egg Products - Salmonella and Lm	
EM36	Egg Product Sampling-Pasteurized-Dried Egg Whites - Salmonella and Lm	
EM37	Egg Product Sampling-Pasteurized-Pan Dried Egg Whites - Salmonella and Lm	

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
EXP_CH_MSK01	Exploratory Sampling for Mechanically Separated Chicken	Exploratory sampling project whose goal is to determine the prevalence of *Salmonella* in comminuted poultry to develop performance standards for these products (77 FR 72686).
EXP_CPT_OT01	Exploratory Sampling for Chicken Parts - Other Parts	Sampling of other raw chicken parts to gain additional information about the prevalence and the microbiological characteristics of *Salmonella* and *Campylobacter* in those products (80 FR 3940).
EXP_CPT_QH01	Exploratory Sampling for Chicken Parts - Quarter and Half Carcasses	Sampling of quarter and half raw chicken carcasses to gain additional information on the prevalence and the microbiological characteristics of *Salmonella* and *Campylobacter* in those products (80 FR 3940).
EXP_FI_MIC01	Domestic Siluriformes Sampling for Microbiology	In 2015, FSIS announced (80 FR 79231) it would conduct sampling and testing of *Siluriformes* fish and fish products for *Salmonella* (76 FR 10439).
EXP_LV_ABX	Label Verification – Antibiotic Free	Label verification for antibiotic free claims for products eligible for sampling under the raw chicken parts project codes, HC_CPT_LBW01 and HC_CPT_QH01 (75 FR 82148). Label verification as described in FSIS Notice 26-18.
EXP_LV_HORM	Label Verification – Hormone Free	Label verification for hormone free claims eligible for raw ground beef products that are eligible for *Escherichia coli* O157:H7 testing (75 FR 82148). Label verification as described in FSIS Notice 26-18.
EXP_LV_NUTR	Label Verification for Nutrient Content - Raw Ground Beef	Label verification for nutrient content in raw ground beef samples that are eligible for *E. coli* O157:H7 testing (75 FR 82148). Label verification as described in FSIS Notice 26-18.
EXP_LV_SOY	Label Verification – Allergens	Sampling of ready-to-eat (RTE) products that are eligible for sampling under the RTEPROD_RAND project code (Directive 10,240.4)
EXP_PK_COM02	Baseline Sampling for Pork - Comminuted (Ground, Mechanically Separated, and Other Comminuted)	Exploratory sampling of raw pork products for pathogens of public health concern as well as for indicator organisms (80 FR 3940).
EXP_PK_ICT02	Baseline Sampling for Pork - Intact cuts	
EXP_PK_NCT02	Baseline Sampling for Pork - Non-Intact Cuts	
EXP_TU_MSK01	Exploratory Sampling for Mechanically Separated Turkey	Sampling to determine the prevalence of *Salmonella* in comminuted poultry and to develop performance standards for these products (77 FR 72686).
F_CH_CARC01	Follow-up sampling of Chicken Carcasses	Follow-up testing, where applicable, of chicken carcass samples after positives for *Salmonella* and *Campylobacter* (80 FR 3948).
F_CH_COM01	Follow-up sampling of Comminuted Chicken	Follow-up testing, where applicable, of comminuted chicken products after positives for *Salmonella* and *Campylobacter* (81 FR 7285)
F_CPT_LBW01	Follow-up sampling of Chicken Parts – Legs, Breasts and Wings	Follow-up testing, where applicable, of chicken part samples – legs, breasts, and wings, after positives for *Salmonella* and *Campylobacter* (81 FR 7285)
F_TU_CARC01	Follow-up sampling of Turkey Carcasses	Follow-up testing, where applicable, of turkey carcass samples after positives for *Salmonella* and *Campylobacter* (80 FR 3948).
F_TU_COM01	Follow-up sampling of Comminuted Turkey	Follow-up testing, where applicable, of comminuted turkey products after positives for *Salmonella* and *Campylobacter* (81 FR 7285)
FAMR01	Follow-up Sampling to Advanced Meat Recovery Positive	FAMR01 is follow-up testing of positive AMR01 samples.
FDS01	Food Defense Sampling - Meals Ready-to-Eat	Directive 5420.1
FDS05	Food Defense Sampling- Inauguration Testing	Directive 5420.1
FLISTERIA	Import-Follow-up to Listeria Monocytogenes Positive	Follow-up sampling for the FSIS risk-based verification testing project to assess the effectiveness of RTE operations in controlling L. monocytogenes (69 FR 34221) of imported RTE products after positives for L. monocytogenes.
FOODCHEM	Collector-Generated Food Chemistry Samples	Collector-generated samples for food chemistry analyses (Directive 10,630.1)
FRTESALMONEL	Import-Follow-up to Salmonella Positive in RTE Product	Follow up testing of imported ready-to-eat (RTE) meat, poultry, and egg products after positives for Salmonella.
HC_CH_CARC01/ HC_TU_CARC01	HACCP Verification for Young Chicken Carcasses/Turkey Carcasses	HC_CH_CARC01/ HC_TU_CARC01 is verification sampling used to confirm performance standards for *Salmonella* and *Campylobacter* in young chicken and turkey carcasses (75 FR 27288; Note: 9 CFR 381.94(b) amended 79 FR 49566), as well as to estimate national prevalence.

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
HC_CH_COM01/ HC_TU_COM01	Sampling for Ground and Other Comminuted Chicken/Turkey (not Mechanically Separated)	Verification sampling used to confirm performance standards for *Salmonella* and *Campylobacter* in ground and other communicated chicken and turkey products (not Mechanically separated) as well as to estimate national prevalence (80 FR 3944).
HC_CPT_LBW01	Sampling for Chicken Parts – Legs, Breasts, and Wings	Sampling of leg, breast and wing chicken parts to gain additional information on the prevalence and the microbiological characteristics of *Salmonella* and *Campylobacter* in those products (80 FR 3940).
IMP_PORK	Imported Raw Pork Product Sampling	Sampling raw intact and non-intact pork products for *Salmonella* species (FSIS Notice 93-16).
IMP_POULTRY	Import Sampling of Raw and NRTE Poultry Products	Sampling of imported poultry carcasses, imported raw chicken parts, and imported NRTE comminuted chicken and turkey for *Salmonella* and *Campylobacter* (80 FR 3940).
IMPABNCONT	Import-Abnormal Container	Samples are collected ad hoc when inspection program personnel (IPP) observes an abnormal container being used for an imported product (Thermal Processing).[b]
IMPAMRBEEF	Import - AMR Product - Beef	Random sampling of meat products as they enter the United States as part of the equivalency determination for foreign countries, for BSE/SRMs (72 FR 38719).
IMPFISH_CH_E; IMPFISH_CH_W	Import Siluriformes Chemistry Sampling - Eastern Laboratory/Western Laboratory	Residue sampling of imported Siluriformes fish, like FSIS does for imported meat products, to ensure the safety of imported catfish products (80 FR 79231).
IMPFISH_MI	Import Siluriformes Microbiology Sampling	(Residue sampling of imported Siluriformes fish, like FSIS does for imported meat products, to ensure the safety of imported catfish products (80 FR 79231). Sampling for Siluriformes currently only includes analysis of *Salmonella* under this project.
IMPMETALS	National Residue Plan - Import Sampling - Metals - Eastern Lab	Established 1967 (77 FR 39896), the annual sampling plan is developed by FSIS, FDA, EPA, and ARS, AMS, and CDC based on investigations, veterinary drug inventories, and on-farm visits. The group creates a list of chemical compounds for testing and ranks them by public health risk and regulatory concern. Then the group considers FSIS lab capacity and analytical methods (77 FR 39895) to verify establishments control animal drug residues, pesticides, environmental contaminants, and any other chemical hazards in and on meat and poultry products. The NRP also provides national data on chemical residue testing results to support risk assessment, enforcement, and educational activities (Directive 10,800.1).
IMPPESTICIDE	National Residue Plan - Import Sampling - Pesticides - Western Lab	Established in 1967 (77 FR 39896), the annual sampling project is developed by FSIS, FDA, EPA, and ARS, AMS, and CDC based on investigations, veterinary drug inventories, and on-farm visits. The group creates a list of chemical compounds for testing and ranks them public health risk and regulatory concern. The group then considers FSIS lab capacity and analytical methods (77 FR 39895) to verify establishments control animal drug residues, pesticides, environmental contaminants, and any other chemical hazards in and on meat and poultry products. The National Residue Program (NRP) also provides national data on chemical residue testing results to support risk assessment, enforcement, and educational activities (Directive 10,800.1).
IMPRESEGG	Import Residue Sampling - Egg Products	
IMPRESFR_EL; IMPRESFR_WL	National Residue Plan - Import Sampling - Fresh Product	
IMPRESPR_EL; IMPRESPR_MWL	National Residue Plan - Import Sampling - Processed Products	
IMPSPECIESID	Import-Species Identification	Verification of the species claim on imported products. (Directive 9900.6)
IMVRTE	Import-Micro Pathogen Sampling of RTE Products	IMVRTE is a risk-based verification testing project to assess the effectiveness of RTE operations in controlling L. monocytogenes (2004; 69 FR 34221). Generally, FSIS expects to collect, for L. monocytogenes testing, just one sample unit of RTE product from a production lot at an establishment selected for sampling.
INTCONT_LM_E; INTCONT_LM_M; INTCONT_LM_W	For-Cause Sampling- RTE Food Contact Surface-Listeria	This is for-cause sampling on RTE product and environmental samples. Risk-based verification testing project assesses the effectiveness of RTE operations in controlling L. monocytogenes (2004; 69 FR 34221). FSIS expects to collect food contact surface samples and environmental samples mainly from operations that have a history of problems associated with the proper control for *L. monocytogenes* or *Salmonella* depending on the project.
INTCONT_SA_E; INTCONT_SA_M	For-Cause Sampling- RTE Food Contact Surface-Salmonella	
INTENV_LM_E; INTENV_LM_M; INTENV_LM_W	For-Cause Sampling- Non-Food Surface-Listeria	
INTENV_SA_E; INTENV_SA_M	For-Cause Sampling- Non-Food Surface-Salmonella	
INTPROD_LM_E; INTPROD_LM_M; INTPROD_LM_W	For-Cause Sampling- RTE Product-Listeria	
INTPROD_SA_E; INTPROD_SA_M	For-Cause Sampling-RTE Product-Salmonella	
KIS	KIS - Samples from In-plant Testing	KIS (Kidney Inhibition Swab) sampling is intended for inspector-generated residue testing. FSIS laboratories use multi-residue screening methods on tissue samples submitted from positive KIS tests (Directive 10800.1)

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
LO_CH_CARC01	Very Low Volume Sampling for Chicken Carcasses	FSIS collects samples from eligible products 3–4 times per year from eligible establishments (80 FR 3946). Establishments are eligible for this project if they have been exempted from *Salmonella* verification testing if they produce less than 1,000 pounds per day of product.
LO_CH_COM01	Very Low Volume Sampling for Ground and Other Comminuted Chicken (not Mechanically Separated)	
LO_CH_MSK01	Very Low Volume Sampling for Mechanically Separated Chicken	
LO_CPT_LBW01	Very Low Volume Sampling for Raw Chicken Parts - Legs, Breast, Wings	
LO_CPT_OT01	Very Low Volume Sampling for Raw Chicken Parts - Other Parts	
LO_CPT_QH01	Very Low Volume Sampling for Chicken Parts - Quarters/Halves	
LO_TU_CARC01	Very Low Volume Sampling for Turkey Carcasses	
LO_TU_COM01	Very Low Volume Sampling for Ground and Other Comminuted Turkey (not Mechanically Separated)	
LO_TU_MSK01	Very Low Volume Sampling for Mechanically Separated Turkey	
MT05	Raw Ground Beef or Veal Sampling - Retail	FSIS currently samples and tests various raw ground beef products (including veal products) for E. coli O157:H7 (1999; 64 FR 2804). The project sampling is done at inspected establishments and retail stores (2014; 79 FR 32436) and are co-analyzed for Salmonella.
MT06	Raw Ground Beef or Veal Sampling - Retail - Follow-up	Based on suspected cause of *E. coli* O157:H7 contamination and the establishment's corrective action, FSIS determines the appropriate number of follow-up samples to collect and (2002; 67 FR 62333). (For Salmonella, see MT05 above)
MT08	Import-Sampling of Raw Ground or Comminuted Beef or Veal Product	FSIS currently samples and tests various raw ground beef products (including veal products) for E. coli O157:H7 (1999; 64 FR 2804). The project sampling is done at inspected establishments and retail stores. (For Salmonella, see MT05 above)
MT43	Risk-based Sampling of Raw Ground Beef or Veal Products - E. coli O157:H7 & Salmonella	FSIS currently samples and tests various raw ground beef products (including veal products) for E. coli O157:H7 (1999; 64 FR 2804). The project sampling is done at inspected establishments and retail stores. (For Salmonella, see MT05 above)
MT44	Follow-up Risk-based Sampling of Positive Raw Ground Beef or Veal Sample -E. coli O157:H7/Salmonella	Based on suspected cause of E. coli O157:H7 contamination and the establishment's corrective action, FSIS will determine the appropriate number of follow-up samples to collect and test (2002; 67 FR 62333). (For Salmonella, see MT05 above)
MT44T	Follow-up E. coli Sampling of Raw Ground Beef, Trimmings or Components (Traceback)	FSIS uses this sampling project to conduct verification activities at establishments that supply intact product to grinding establishments when the Agency determines that a supplier may be responsible for E. coli O157:H7-positive ground product (67 FR 62332). FSIS determines the number of follow-up samples to collect and test based on the suspected cause of *E. coli* O157:H7 contamination and the establishment's corrective action. FSIS conducts verification tests on trim when the Agency finds ground product at a grinder that receives product from outside sources positive for E. coli O157:H7 and can identify the supplier. (For Salmonella, see MT05 above)
MT51	Import-Raw Beef Manufactured Trimmings or Components for use in Ground Beef or Beef Products	FSIS uses this project to test trimmings, other source materials for imported non-intact product, and carcasses and parts that will be processed into non-intact product based on the observation that one of the best ways to control the risk of *E. coli* O157:H7 contamination is to test products while they are still intact (67 FR 62332). FSIS uses this project to test the effectiveness of these controls. (For *Salmonella*, see MT05 above)
MT52	Follow-up Sampling of Suppliers of Raw Ground Beef Trim or Components	FSIS uses this sampling project to conduct verification activities at establishments that supply intact product to grinding establishments when the Agency determines that a supplier may be responsible for E. coli O157:H7-positive ground product (2002, 67 FR 62332) FSIS conducts verification tests on trim when the Agency finds ground product at a grinder that receives product from outside sources positive for E. coli O157:H7 and FSIS can identify the supplier. (For Salmonella, see MT05 above)

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
MT53	Follow-up Sampling of Beef Mfg. Trim or Other Raw Ground Beef or Beef Patty Components	FSIS uses this sampling project to conduct verification activities at establishments that supply intact product to grinding establishments when the Agency determines that a supplier may be responsible for E. coli O157:H7-positive ground product (67 FR 62332). FSIS conducts verification tests on trim when the Agency finds ground product at a grinder that receives product from outside sources positive for E. coli O157:H7 and FSIS can identify the supplier. (For Salmonella, see MT05 above)
MT60	Sampling of Beef Manufacturing Trimmings	FSIS uses this project to testing trimmings, other source materials for non-intact product, and carcasses and parts that will be processed into non-intact product based on the observation that one of the best ways to control the risk of *E. coli* O157:H7 contamination is to test products while they are still intact. FSIS testing would be used to verify the effectiveness of these controls. (67 FR 62332) FSIS also conducts routine verification testing for six non-O157 Shiga toxin-producing *E.* coli (STEC), in addition to E. coli O157:H7, in raw beef manufacturing trimmings beginning June 4, 2012. (For *Salmonella*, see MT05 above)
MT64	Sampling of Raw Ground Beef or Beef Patty Components (other than trim)	FSIS uses this project to test trimmings, other source materials for non-intact product, and carcasses and parts that will be processed into non-intact product based on the observation that one of the best ways to control the risk of *E. coli* O157:H7 contamination is to test products while they are still intact. FSIS testing would be used to verify the effectiveness of these controls. (For *Salmonella*, see MT05 above) (67 FR 62332)
MT65	Sampling of Bench Trim for further use in ANY raw, non-intact beef products	FSIS uses this project to test trimmings, other source materials for non-intact product, and carcasses and parts that will be processed into non-intact product based on the observation that one of the best ways to control the risk of *E. coli* O157:H7 contamination is to test products while they are still intact. FSIS testing would be used to verify the effectiveness of these controls. (For *Salmonella*, see MT05 above) (67 FR 62332)
NARMS_BC	NARMS-Sampling-Beef Cows	The NARMS sampling projects are part of a national public health surveillance system that tracks antimicrobial susceptibility among enteric bacteria from humans, retail meats, and food animals (Directive 10,100.1). The projects were established in 1996 as a partnership between the FDA, CDC, and FSIS to better understand the emergence, persistence, and spread of antimicrobial resistance among foodborne bacteria. Samples are analyzed for *Salmonella*, *Campylobacter*, generic *E. coli*, and *Enterococcus*, and antimicrobial susceptibility testing is conducted on isolates obtained from these samples.
NARMS_DC	NARMS- Sampling-Dairy Cows (Paired with RESNARMS_DC)	
NARMS_HF	NARMS- Sampling-Heifers	
NARMS_MS	NARMS- Sampling-Market Swine	
NARMS_ST	NARMS- Sampling-Steers	
NARMS_SW	NARMS- Sampling-Sows	
NARMS_YC	NARMS- Sampling-Young Chickens (Paired with RESNARMS_YC)	
NARMS_YT	NARMS- Sampling-Young Turkeys	
NRP_BC	National Residue Project Sampling - Beef Cows	Established 1967 (77 FR 39896), the National Residue Sampling Projects are annual sampling projects developed by FSIS, FDA, EPA, and ARS, AMS, and CDC based on investigations, veterinary drug inventories, and on-farm visits. The group creates a list of chemical compounds for testing and ranks them public health risk and regulatory concern. The group then considers FSIS lab capacity and analytical methods (77 FR 39895) to verify establishments control animal drug residues, pesticides, environmental contaminants, and any other chemical hazards in and on meat and poultry products. The NRP also provides national data on chemical residue testing results to support risk assessment, enforcement, and educational activities (Directive 10,800.1).
NRP_BC_S	National Residue Project - Beef Cows - State	
NRP_BS	National Residue Project Sampling - Bull/Stag	
NRP_BV	National Residue Project Sampling - Bob Veal	
NRP_BV_S	National Residue Project - Bob Veal - State	
NRP_DC	National Residue Project Sampling - Dairy Cows	
NRP_DC_S	National Residue Project - Dairy Cows - State	
NRP_FFV	National Residue Project Sampling - Formula-Fed Veal	
NRP_FS	National Residue Project Sampling – Feral Swine	
NRP_GO	National Residue Project Sampling - Goats	
NRP_HC	National Residue Project Sampling - Heavy Calf	
NRP_HF	National Residue Project Sampling - Heifers	
NRP_HF_S	National Residue Project - Heifers - State	

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
NRP_MS	National Residue Project Sampling - Market Swine	
NRP_MS_S	National Residue Project - Market Swine - State	
NRP_NFFV	National Residue Project Sampling - Non-Formula-Fed Veal	
NRP_OBT	National Residue Project - Old Breeder Turkeys	
NRP_RS	National Residue Sampling Project - Roaster Swine	
NRP_SH	National Residue Project Sampling - Sheep	
NRP_ST	National Residue Project Sampling - Steers	
NRP_ST_S	National Residue Project - Steers - State	
NRP_SW	National Residue Project Sampling - Sows	
NRP_SW_S	National Residue Project - Sows - State	
NRP_YC	National Residue Project Sampling - Young Chickens	
NRP_YC_S	National Residue Project - Young Chickens - State	
NRP_YT	National Residue Project Sampling - Young Turkeys	
NRP_YT_S	National Residue Project - Young Turkeys - State	
PATH_LIVESTK	Samples for Histopathological Examination - Livestock	Ad hoc samples are collected when a PHV determines that submitting a pathology sample for laboratory analysis is needed.
PATH_OTHER	Samples for Histopathological Examination - Other (non-meat)	
PATH_POULTRY	Samples for Histopathological Examination - Poultry	
PATH_PRODUCT	Samples for Histopathological Examination - Product	
RE_CH_CARC01	Religious Exempt Sampling for Chicken Carcasses	FSIS collects samples from eligible products 3–4 times per year from eligible establishments (80 FR 3946). Establishments are eligible for this project if they have been exempted from *Salmonella* verification testing because of a religious exemption (approximately 95 establishments).
RES_FI	Domestic Siluriformes Testing for Residue and Speciation	In 2015, FSIS announced (80 FR 79231) it would conduct sampling and testing of Siluriformes fish and fish products for species and residues to ensure that product is not adulterated or misbranded. FSIS has developed a testing project that currently includes the capacity to test for malachite green, nitrofurans, veterinary drug residues, gentian violet, metals and pesticides (76 FR 10439).
RLMCONT_EL; RLMCONT_MWL; RLMCONT_WL	Risk-based Verification-Midwest Lab-RTE-Food Contact Surface Sample-Listeria	These projects conduct risk-based verification testing to assess the effectiveness of RTE operations in controlling L. monocytogenes (69 FR 34221). The projects collect food contact surface samples and environmental samples mainly from operations that have a history of problems associated with the proper control for L. monocytogenes.
RLMENVC_EL; RLMENVC_MWL; RLMENVC_WL	Risk-based Verification-Eastern Lab - RTE - Non-Food Contact Surface Sample-Listeria	
RLMENVR_EL; RLMENVR_MWL; RLMENVR_WL	Risk-based Verification-Eastern Lab-RTE-Non-Food Contact Brine Sample	
RLMPRODC_EL; RLMPRODC_MWL; RLMPRODC_WL	Risk-based Verification-Eastern Lab - RTE - Listeria - Product Sample (Composite)	
RTEPROD_RAND	RTEPROD Sampling - Random RTE Products	This sampling project conducts risk-based verification testing to assess the effectiveness of RTE operations in controlling *L. monocytogenes* (69 FR 34221). The agency plans to conduct testing at modulated frequencies, considering all relevant factors, including the alternative employed to address L. monocytogenes, production volume by type of RTE product produced, and the establishment's compliance history.
RTEPROD_RISK	RTEPROD Sampling - Risk-based RTE Products	

Project Code	Sampling Project Name	Purpose and Description of Sampling Project (from Federal Register Notice Unless Otherwise Indicated)
SPECID	Species Identification Sampling	Verification of the species claim on domestic products.
UNKSUB	Samples for Identification of Unknown Substance	Collector-generated samples primarily for ad hoc identification of extraneous materials (Directive 10,230.2)

[a] Sampling project name is not from PHIS.

[b] Sampling purpose is not from original Federal Register Notice.

Abbreviations: EL, Eastern Laboratory; MWL, Midwestern Laboratory; PHIS, Public Health Information System; WL, Western Laboratory.

Appendix C: ROC Method

The workgroup used the Rank Order Centroid (ROC) method to weight the criteria after the subject matter experts had ranked the criteria. The ROC weights are computed using the following formula:

$$w_j(ROC) = \frac{1}{n}\sum_{k=j}^{n}\frac{1}{r_k}$$

Where W_j is the weight of the j^{th} item, n is the number of items, and $1/r_k$ is the reciprocal of the ranks from j through n. Figure provides an example of converting rankings to weights for five items ranked 1 to 5. In the example, the weight of the item ranked third out of five would be calculated as $w_3(ROC) = \frac{1}{5}\sum_{k=3}^{5}\frac{I}{r_k} = \frac{1}{5}\left(\frac{1}{3}+\frac{1}{4}+\frac{1}{5}\right) = .16.$

Rank	Sum reciprocals $\sum_{k=j}^{n}\frac{1}{r_k}$		Split the sum into 5 equal parts to get the ROC (green bar)	ROC Weight
1	Ranks 1 to 5	= (1 +1/2 + 1/3 + 1/4 + 1/5)	$w_j(ROC) = \frac{1}{n}\sum_{k=j}^{n}\frac{1}{r_k}$	0.46
2	Ranks 2 to 5	= (1/2 + 1/3 + 1/4 + 1/5)		0.26
3	Ranks 3 to 5	= (1/3 + 1/4 + 1/5)		0.16
4	Ranks 4 to 5	= (1/4 + 1/5)		0.09
5	Rank 5	= 1/5		0.04

Figure C1. Rank Order Centroid Example with 5 Ranked Items

The occurrence of scoring ties and the variation in responses resulted in a non-linear ranking of the criteria. To accommodate the uneven ranking, $\frac{1}{n}$ is replaced in the ROC formula by the sum of the reciprocal sums $\frac{1}{\left(\sum_{j=1}^{n}\left(\sum_{k=j}^{n}\frac{I}{r_k}\right)\right)}$. The weights for tie rankings are then averaged to compute the final ROC weight.

Appendix D: Detailed Findings on the Potential Benefits of Ongoing Sampling Projects

This appendix presents the detailed scores for the potential benefits that the subject matter experts (SMEs) provided for each of FSIS' sampling projects. These scores were developed based on the criteria the workgroup developed for this evaluation (see Box 2 of the main body of this report).

Table D1 presents the full, raw scoring provided by the SMEs for each question or criteria, with the sampling projects listed by rank. Sampling projects for which the criteria apply (that is, that were scored a one) are indicated by a bar which is color coded as follows: category 1 criteria (e.g., 1ai) are blue, category 2 criteria are yellow, category 3 criteria are green, and category 4 criteria are gold when the criteria apply to the project. The second last column shows the total number of criteria that apply to the sampling project, and the dark green bars provide a visual representation of that number. The last column shows the overall weighted score for each sampling project, which is represented by the gray bars.

Table D1: Detailed Responses to Benefits Questions including Weighted/Unweighted Scores by Project

Order	Project Name	Description of Sampling Project	1ai	1aii	1aiii	1aiv	1av	1bi	1b ii	2a	2b	3a	3b	3c	4a	4b	4c	4d	4e	4f	Total	Wt Score
1	MT43	Risk-based Sampling of Raw Ground Beef or Veal Products - E.coli C	1	1		1						1			1	1	1	1			8	0.60
2	MT60	Sampling of Beef Manufacturing Trimmings	1	1		1						1			1	1	1	1			8	0.60
3	MT64	Sampling of Raw Ground Beef or Beef Patty Components (other tha	1	1		1						1			1		1	1			7	0.57
4	MT65	Sampling of Bench Trim for further use in ANY raw, non-intact beef	1	1		1						1			1		1	1			7	0.57
5	RTEPROD_RAND	RTEPROD Sampling - Random RTE Products	1	1		1						1			1		1	1			7	0.57
6	RTEPROD_RISK	RTEPROD Sampling - Risk-based RTE Products	1	1		1						1			1		1	1			7	0.57
7	INTCONT_LM_E	For-Cause Sampling-Eastern Lab-RTE Food Contact Surface-Listeria	1	1		1				1	1	1					1				7	0.53
8	INTCONT_LM_M	For-Cause Sampling-Midwest Lab-RTE Food Contact Surface-Listeri	1	1		1				1	1	1					1				7	0.53
9	INTCONT_LM_W	For-Cause Sampling-Western Lab-RTE Food Contact Surface-Listeri	1	1		1				1	1	1					1				7	0.53
10	INTCONT_SA_E	For-Cause Sampling-Eastern Lab-RTE Food Contact Surface-Salmone	1	1		1				1	1	1					1				7	0.53
11	INTCONT_SA_M	For-Cause Sampling-Midwest Lab-RTE Food Contact Surface-Salmo	1	1		1				1	1	1					1				7	0.53
12	INTPROD_LM_E	For-Cause Sampling-Eastern Lab-RTE Product-Listeria	1	1		1				1	1	1					1				7	0.53
13	INTPROD_LM_M	For-Cause Sampling-Midwest Lab-RTE Product-Listeria	1	1		1				1	1	1					1				7	0.53
14	INTPROD_LM_W	For-Cause Sampling-Western Lab-RTE Product-Listeria	1	1		1				1	1	1					1				7	0.53
15	INTPROD_SA_E	For-Cause Sampling-Eastern Lab-RTE Product-Salmonella	1	1		1				1	1	1					1				7	0.53
16	INTPROD_SA_M	For-Cause Sampling-Midwest Lab-RTE Product-Salmonella	1	1		1				1	1	1					1				7	0.53
17	MT44T	Follow-up E.coli Sampling of Raw Ground Beef, Trimmings or Comp	1	1		1				1	1	1					1				7	0.53
18	MT05	Raw Ground Beef or Veal Sampling - Retail	1	1		1						1			1		1				6	0.51
19	HC_CH_CARC01	HACCP Verification for Young Chicken Carcasses		1	1							1		1	1	1	1	1			8	0.52
20	HC_CH_COM01	Sampling for Ground and Other Comminuted Chicken (not Mechani		1	1							1		1	1	1	1	1			8	0.52
21	HC_CPT_LBW01	Sampling for Chicken Parts – Legs, Breasts, and Wings		1	1							1		1	1	1	1	1			8	0.52
22	HC_TU_CARC01	HACCP Verification for Young Turkey Carcasses		1	1							1		1	1	1	1	1			8	0.52
23	HC_TU_COM01	Sampling for Ground and Other Comminuted Turkey (not Mechanic		1	1							1		1	1	1	1	1			8	0.52
24	COMPLIAN	Investigative Sampling	1	1		1			1	1	1						1				7	0.46
25	RLMCONT_EL	Risk-based Verification-Eastern Lab - RTE - Food Contact Surface Sa	1			1						1			1		1				5	0.46
26	RLMCONT_MWL	Risk-based Verification-Midwest Lab-RTE-Food Contact Surface San	1			1						1			1		1				5	0.46
27	RLMCONT_WL	Risk-based Verification-Western Lab-Food Contact Surface Sample	1			1						1			1		1				5	0.46
28	RLMPRODC_EL	Risk-based Verification-Eastern Lab - RTE - Listeria - Product Sample	1			1						1			1		1				5	0.46
29	RLMPRODC_MWL	Risk-based Verification-Midwestern Lab - RTE - Listeria - Product Sa	1			1						1			1		1				5	0.46
30	RLMPRODC_WL	Risk-based Verification-Western Lab - RTE - Listeria - Product Samp	1			1						1			1		1				5	0.46
31	MT06	Raw Ground Beef or Veal Sampling - Retail - Follow-up	1	1		1					1	1					1				6	0.41
32	MT44	Follow-up Risk-based Sampling of Positive Raw Ground Beef or Vea	1	1		1					1	1					1				6	0.41
33	MT52	Follow-up Sampling of Suppliers of Raw Ground Beef Trim or Comp	1	1		1					1	1					1				6	0.41
34	MT53	Follow-up Sampling of Beef Mfg Trim or Other Raw Ground Beef or	1	1		1					1	1					1				6	0.41
35	NRP_FS	National Residue Program Sampling - Feral Swine	1			1						1		1	1				1		6	0.50
36	EM31	Egg Product Sampling-Pasteurized-Egg Whites-Salmonella and Lm	1			1						1					1	1			5	0.40
37	EM32	Egg Product Sampling-Pasteurized-Whole Egg or Yolks - Salmonella	1			1						1					1	1			5	0.40
38	EM33	Egg Product Sampling-Pasteurized-Whole Eggs with Added Yolks or	1			1						1					1	1			5	0.40
39	EM34	Egg Product Sampling-Pasteurized-Whole Eggs or Yolks with > 2% sa	1			1						1					1	1			5	0.40
40	EM35	Egg Product Sampling-Pasteurized-Dried Yellow Egg Products - Saln	1			1						1					1	1			5	0.40
41	EM36	Egg Product Sampling-Pasteurized-Dried Egg Whites - Salmonella a	1			1						1					1	1			5	0.40
42	EM37	Egg Product Sampling-Pasteurized-Pan Dried Egg Whites - Salmone	1			1						1					1	1			5	0.40
43	KIS	KIS - Samples from In-plant Testing	1			1						1			1				1		5	0.48
44	NRP_BC	National Residue Program Sampling - Beef Cows	1			1						1			1				1		5	0.48
45	NRP_BS	National Residue Program Sampling - Bull/Stag	1			1						1			1				1		5	0.48
46	NRP_BV	National Residue Program Sampling - Bob Veal	1			1						1			1				1		5	0.48
47	NRP_DC	National Residue Program Sampling - Dairy Cows	1			1						1			1				1		5	0.48
48	NRP_FFV	National Residue Program Sampling - Formula-Fed Veal	1			1						1			1				1		5	0.48
49	NRP_GO	National Residue Program Sampling - Goats	1			1						1			1				1		5	0.48
50	NRP_HC	National Residue Program Sampling - Heavy Calf	1			1						1			1				1		5	0.48
51	NRP_HF	National Residue Program Sampling - Heifers	1			1						1			1				1		5	0.48
52	NRP_MS	National Residue Program Sampling - Market Swine	1			1						1			1				1		5	0.48
53	NRP_NFFV	National Residue Program Sampling - Non Formula-Fed Veal	1			1						1			1				1		5	0.48
54	NRP_OBT	National Residue Program - Old Breeder Turkeys	1			1						1			1				1		5	0.48
55	NRP_RS	National Residue Sampling Program - Roaster Swine	1			1						1			1				1		5	0.48

Order	Project Name	Description of Sampling Project	1ai	1aii	1aiii	1aiv	1av	1bi	1b ii	2a	2b	3a	3b	3c	4a	4b	4c	4d	4e	4f	Total	Wt Score
56	NRP_SH	National Residue Program Sampling - Sheep	1			1						1			1				1		5	0.48
57	NRP_ST	National Residue Program Sampling - Steers	1			1						1			1				1		5	0.48
58	NRP_SW	National Residue Program Sampling - Sows	1			1						1			1				1		5	0.48
59	NRP_YC	National Residue Program Sampling - Young Chickens	1			1						1			1				1		5	0.48
60	NRP_YT	National Residue Program Sampling - Young Turkeys	1			1						1			1				1		5	0.48
61	FRTESALMONEL	Import-Follow-up to Salmonella Positive in RTE Product	1			1				1							1				4	0.39
62	EGGIMP	Import-Egg Products-Salmonella and Lm	1			1									1		1				4	0.39
63	IMVRTE	Import-Micro Pathogen Sampling of RTE Products	1			1									1		1				4	0.39
64	MT08	Import-Sampling of Raw Ground or Communited Beef or Veal Prod	1			1									1		1				4	0.39
65	MT51	Import-Raw Beef Manufactured Trimmings or Components for use	1			1									1		1				4	0.39
66	INTENV_LM_E	For-Cause Sampling-Eastern Lab-Non-Food Surface-Listeria		1		1				1	1	1					1				6	0.38
67	INTENV_LM_M	For-Cause Sampling-Midwest Lab-Non-Food Surface-Listeria		1		1				1	1	1					1				6	0.38
68	INTENV_LM_W	For-Cause Sampling-Western Lab-Non-Food Surface-Listeria		1		1				1	1	1					1				6	0.38
69	INTENV_SA_E	For-Cause Sampling-Eastern Lab-Non-Food Surface-Salmonella		1		1				1	1	1					1				6	0.38
70	INTENV_SA_M	For-Cause Sampling-Midwest Lab-Non-Food Surface-Salmonella		1		1				1	1	1					1				6	0.38
71	CG_RES_EL	Collector Generated - Residue - Eastern Lab	1			1									1				1		4	0.40
72	CG_RES_MWL	Collector Generated - Residue - Midwestern Lab	1			1									1				1		4	0.40
73	CG_RES_WL	Collector Generated - Residue - Western Lab	1			1									1				1		4	0.40
74	CG_SHOW_MWL	Collector Generated-Residues-Show Animals-Midwest Lab	1			1									1				1		4	0.40
75	CG_SHOW_WL	Collector Generated-Residue-Show Animals-Western Lab	1			1									1				1		4	0.40
76	NRP_BC_S	National Residue Program - Beef Cows - State	1			1									1				1		4	0.40
77	NRP_BV_S	National Residue Program - Bob Veal - State	1			1									1				1		4	0.40
78	NRP_DC_S	National Residue Program - Dairy Cows - State	1			1									1				1		4	0.40
79	NRP_HF_S	National Residue Program - Heifers - State	1			1									1				1		4	0.40
80	NRP_MS_S	National Residue Program - Market Swine - State	1			1									1				1		4	0.40
81	NRP_ST_S	National Residue Program - Steers - State	1			1									1				1		4	0.40
82	NRP_SW_S	National Residue Program - Sows - State	1			1									1				1		4	0.40
83	NRP_YC_S	National Residue Program - Young Chickens - State	1			1									1				1		4	0.40
84	NRP_YT_S	National Residue Program - Young Turkeys - State	1			1									1				1		4	0.40
85	IMPABNCONT	Import-Abnormal Container	1			1									1						3	0.31
86	IMPAMRBEEF	Import - AMR Product - Beef	1			1									1						3	0.31
87	IMPFISH_CH_E	Import Siluriformes Chemistry Sampling - Eastern Laboratory	1			1									1						3	0.31
88	IMPFISH_CH_W	Import Siluriformes Chemistry Sampling - Western Laboratory	1			1									1						3	0.31
89	F_CH_CARC01	Follow-up sampling of Chicken Carcasses		1						1		1					1				4	0.32
90	F_TU_CARC01	Follow-up sampling of Turkey Carcasses		1						1		1					1				4	0.32
91	FLISTERIA	Import-Follow-up to Listeria monocytogenes Positive	1			1					1						1				4	0.29
92	RLMENVC_EL	Risk-based Verification-Eastern Lab - RTE - Non-Food Contact Surfa				1						1			1		1				4	0.31
93	RLMENVC_MWL	Risk-based Verification-Midwest Lab-RTE-Non-Food Contact Surfac				1						1			1		1				4	0.31
94	RLMENVC_WL	Risk-based Verification-Western Lab-RTE-Non-food Contact Surface				1						1			1		1				4	0.31
95	RLMENVR_EL	Risk-based Verification-Eastern Lab-RTE-Non-food Contact Brine Sa				1						1			1		1				4	0.31
96	RLMENVR_MWL	Risk-based Verification-Midwest Lab-RTE-Non-food Contact Brine S				1						1			1		1				4	0.31
97	RLMENVR_WL	Risk-based Verification-Western Lab-RTE-Non-food Contact Brine S				1						1			1		1				4	0.31
98	RES_FI	Domestic Siluriformes Testing for Residue and Speciation	1			1			1			1								1	5	0.37
99	AMS_PROD_RTE	AMS RTE Canada EV Program - Product Collected by FSIS	1														1			1	3	0.32
100	EXP_CH_MSK01	Exploratory Sampling for Mechanically Separated Chicken										1		1			1	1			4	0.23
101	EXP_CPT_OT01	Exploratory Sampling for Chicken Parts - Others Parts										1		1			1	1			4	0.23
102	EXP_CPT_QH01	Exploratory Sampling for Chicken Parts - Quarter and Half Carcasses										1		1			1	1			4	0.23
103	EXP_PK_COM02	Baseline Sampling for Pork - Comminuted (Ground, Mechanically S										1		1			1	1			4	0.23
104	EXP_PK_ICT02	Baseline Sampling for Pork - Intact cuts										1		1			1	1			4	0.23
105	EXP_PK_NCT02	Baseline Sampling for Pork - Non-Intact Cuts										1		1			1	1			4	0.23
106	EXP_TU_MSK01	Exploratory Sampling for Mechanically Separated Turkey										1		1			1	1			4	0.23
107	IMP_PORK	Imported Raw Pork Product Sampling				1									1		1				3	0.23
108	IMP_POULTRY	Import Sampling of Raw and NRTE Poultry Products				1									1		1				3	0.23
109	IMPFISH_MI	Import Siluriformes Microbiology Sampling				1									1		1				3	0.23
110	IMPHORMONES	Import Hormones	1			1															2	0.19

Order	Project Name	Description of Sampling Project	1ai	1aii	1aiii	1aiv	1av	1bi	1b ii	2a	2b	3a	3b	3c	4a	4b	4c	4d	4e	4f	Total	Wt Score
111	IMPHORMONES	Import Hormones	1			1															2	0.22
112	IMPMETALS	Import Metals	1			1															2	0.22
113	IMPPESTICIDE	Import Pesticides	1			1															2	0.22
114	IMPRESEGG	Import Egg Residues	1			1															2	0.22
115	IMPRESFR_EL	Import Residue for Fresh Products- Eastern Lab	1			1															2	0.22
116	IMPRESFR_WL	Import Residue for Fresh Products- Western Lab	1			1															2	0.22
117	IMPRESPR_EL	Import Residue for Processed Products- Eastern Lab	1			1															2	0.22
118	IMPRESPR_ML	Import Residue for Processed Products- Mid-Western Lab	1			1															2	0.22
119	EXP_FI_MIC01	Domestic Siluriformes Sampling for Microbiology				1						1		1			1				4	0.21
120	F_CPT_LBW01	Follow-up sampling of Chicken Parts; Legs, Breasts, Wings		1								1					1				3	0.20
121	F_CU_COM01	Follow-up sampling of Comminuted Chicken		1								1					1				3	0.20
122	F_TU_COM01	Follow-up sampling of Comminuted Turkey		1								1					1				3	0.20
123	AMR01	Advanced Meat Recovery Product	1						1												2	0.19
124	EXP_LV_ABX	Label Verification for Antibiotics	1						1												2	0.19
125	EXP_LV_HORM	Label Verification for Hormones	1						1												2	0.19
126	EXP_LV_SOY	Label Verification for Soy	1						1												2	0.19
127	FOODCHEM	Collector-Generated Food Chemistry Samples	1						1												2	0.19
128	UNKSUB	Samples for Identification of Unknown Substance	1						1												2	0.19
129	NARMS_BC	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
130	NARMS_DC	NARMS-Dairy Cows (Paired with RESNARMS_DC)														1	1	1	1		4	0.18
131	NARMS_HF	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
132	NARMS_MS	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
133	NARMS_ST	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
134	NARMS_SW	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
135	NARMS_YC	NARMS-Young Chickens (Paired with RESNARMS_YC)														1	1	1	1		4	0.18
136	NARMS_YT	NARMS-National Antimicrobial Resistance Monitoring Syst														1	1	1	1		4	0.18
137	IMPSPECIESID	Import-Species Identification				1			1						1						3	0.17
138	LO_CH_CARC01	Very Low Volume Sampling for Chicken Carcasses										1					1				2	0.15
139	LO_CH_COM01	Very Low Volume Sampling for Ground and Other Comminu										1					1				2	0.15
140	LO_CH_MSK01	Very Low Volume Sampling for Mechanically Separated Chi										1					1				2	0.15
141	LO_CPT_LBW01	Very Low Volume Sampling for Raw Chicken Parts - Legs, Br										1					1				2	0.15
142	LO_CPT_OT01	Very Low Volume Sampling for Raw Chicken Parts - Other Pa										1					1				2	0.15
143	LO_CPT_QH01	Very Low Volume Sampling for Chicken Parts - Quarters/Ha										1					1				2	0.15
144	LO_TU_CARC01	Very Low Volume Sampling for Turkey Carcasses										1					1				2	0.15
145	LO_TU_COM01	Very Low Volume Sampling for Ground and Other Comminu										1					1				2	0.15
146	RE_CH_CARC01	Religious Exempt Sampling for Chicken Carcasses										1					1				2	0.15
147	LO_TU_MSK01	Very Low Volume Sampling for Mechanically Separated Tur										1					1				2	0.15
148	FDS05	Food Defense Sampling- Inauguration Testing					1								1						2	0.13
149	IMPPATH	Import Pathology				1		1											1	1	4	0.09
150	PATH_LIVESTK	Samples for Histopathological Examination - Livestock				1		1											1	1	4	0.09
151	PATH_OTHER	Samples for Histopathological Examination - Other (non-m				1		1											1	1	4	0.09
152	PATH_POULTRY	Samples for Histopathological Examination - Poultry				1		1											1	1	4	0.09
153	PATH_PRODUCT	Samples for Histopathological Examination - Product				1		1											1	1	4	0.09
154	ABNCONT	Abnormal Container									1										1	0.02
155	FDS01	Food Defense Sampling - Meals Ready-to-Eat					1														1	0.01
156	EXP_LV_NUTR	Label Verification for Sodium and Fat Content							1												1	0.01
157	SPECID	Species Identification Sampling							1												1	0.01

Appendix E: Required Number of Samples Estimates for Published Pathogen Rates

FSIS posts pathogen rates for select sampling projects quarterly. Reported estimates are either prevalence, volume-weighted percent positive, or straight percent positive. This appendix uses values from CY2018 published values because it has the most current pathogen rates to demonstrate the number of samples required for confidence interval estimates and to determine a difference between two proportions.

The number of samples required to meet the maximum margin of error for the estimated pathogen rate is based off the requirement discussed in Phase 3 on **Table 5: Parameters for a standard maximum margin of error of a confidence interval for an estimate of a pathogen rate** .

The number of required samples for these projects tends to be much higher than the number of samples allocated in the Annual Sampling Plan. In a few instances, the number of samples required is much lower. The projects where the required number of samples is considerably lower than the Annual Sampling Plan are highlighted.

The number of samples required for each proportion is calculated from either the current estimated pathogen rate, or from the actual FSIS documentation. For current estimated rates, the goal listed is a 25% pathogen (the stated Healthy People 2020 goal) rate reduction. For projects with specific goals, the number of samples required is based on the target pathogen rate, not the current estimated pathogen rate.

Table E1: Estimated Number of Samples Required for Projects with Published Pathogen Rates

Work-group	Project	Pathogen	FY 2019 Annual Sampling Plan	Interval Estimates				Difference Between Two Proportions		
				Estimated Pathogen Rate CY 2018	Max Margin of Error	Significance Level (alpha)	Required # of Samples	Initial Pathogen Rate	Target Pathogen Rate	Required # of Samples for Each Proportion
SCCG	HC_CH_CARC01	*Salmonella*	*9,000*	4.49%[1]	1%	0.05	1,791	7.50%	5.63%	2,735[4]
		Campylobacter		13.03%[3]	1%	0.05	4,354			
	HC_CH_LBW01	*Salmonella*	*9,000*	12.99%[1]	1%	0.05	4,342	28%	18%	275[4]
		Campylobacter		15.40%[3]	1%	0.05	5,005			
	HC_CH_COM01	*Salmonella*	*2,500*	38.32%[1]	1%	0.05	9,080	49%	34%	166[4]
		Campylobacter		7.96%[3]	1%	0.05	2,815			
	HC_TU_CARC01	*Salmonella*	*2,000*	0.53%[1]	0.53%	0.05	721	1.70%	1.275%	12,732[4]
		Campylobacter		0.51%[3]	0.51%	0.05	750			
	HC_TU_COM01	*Salmonella*	*1,500*	23.21%[1]	1%	0.05	6,847	19.90%	14%	631[4]
		Campylobacter		2.53%[3]	1%	0.05	948	1.20%	1.0%	42,691[4]
	EXP_CH_MSK01	*Salmonella*	*150*	80.95%[3]	5%	0.05	237	80.95%	60.71%	76
		Campylobacter		62.50%[3]	5%	0.05	361	62.50%	46.88%	156
	EXP_TU_MSK01	*Salmonella*	*150*	48.48%[3]	1%	0.05	9,595	48.48%	36.36%	258
		Campylobacter		9.09%[3]	1%	0.05	3,175	9.09%	6.82%	2,227
	EXP_CPT_QH01	*Salmonella*	*120*	15.60%[3]	1%	0.05	5,058	15.60%	11.70%	1,213
		Campylobacter		20%[3]	1%	0.05	6,147	20%	15%	903
	EXP_CPT_OT01	*Salmonella*	*360*	54.15%[3]	5%	0.05	382	54.15%	40.62%	210
STEC	MT43	*E. coli* O157:H7	*11,500*	0.01%[1]	0.01%	0.05	38,411			
		Salmonella		3.36%[1]	1.00%	0.05	1,248	3.36%	2.52%	6,345
	MT60	*E. coli* O157:H7	*3,750*	0.15%[1]	0.15%	0.05	2,558			
		non-O157 STEC		0.25%[1]	0.25%	0.05	1,533			
		Salmonella		1.86%[1]	1.00%	0.05	702	1.86%	1.39%	11,620
	MT64	*E. coli* O157:H7	*1,050*	0.17%[3]	0.24%	0.05	2,256			
		Salmonella		7.11%[3]	1.00%	0.05	2,538	7.11%	5.33%	2,895
	MT65	*E. coli* O157:H7	*1,500*	0.00%[3]	--%	0.05	--			
		Salmonella		0.58%[3]	0.58%	0.05	659	0.58%	0.44%	37,695
Pork	EXP_PK_ICT02	*Salmonella*	*1,521*	10.57%[3]	1.00%	0.05	3,632	10.57%	7.93%	1,883
	EXP_PK_NCT02	*Salmonella*	*1,272*	7.15%[3]	1.00%	0.05	2,551	7.15%	5.37%	2,878
	EXP_PK_COM02	*Salmonella*	*1,704*	20.88%[3]	1.00%	0.05	6,347	20.88%	15.66%	857
Egg Products	EM	*Salmonella*	*1,600*	0.00%[2]	--%	0.05	--			
		L. monocytogenes		0.00%[2]	--%	0.05	--			
RTE	RTEPROD_RAND	*Salmonella*	*7,400*	0.01%[2]	0.01%	0.05	38,411			
		L. monocytogenes		0.10%[2]	0.10%	0.05	3,838			
	RTEPROD_RISK	*Salmonella*	*7,400*	0.02%[2]	0.02%	0.05	19,204			
		L. monocytogenes		0.01%[2]	0.01%	0.05	38,411			

1 – Prevalence 2 – Volume Weighted Percent Positive 3 – Percent Positive 4 – Number of samples required to detect the difference officially stated by FSIS

Appendix F: Summary, by sampling project, of analyses conducted using results from each project

Table F1 documents how the Agency has used the data and what actions they are able to perform with the data. It also indicates how the Agency reports results. Information presented in this table were current during the time of the evaluation. The number of planned samples (for FY18 and FY19) and actual samples are included. The 'N/A' value for planned samples designates that the Agency cannot plan for these types of samples due to their nature. They are either collector generated, investigative or follow-up sampling which has been done on an ad hoc basis dependent upon the need. Many individual establishment specific sample results are posted on the website but are not reflected in this chart. These results can be found at https://www.fsis.usda.gov/wps/portal/fsis/topics/data-collection-and-reports/data.

Table F1: Analyses of data by project

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
ABNCONT	Abnormal Container[a]	• OFO and OIEA collect ad hoc samples based on their observations. • Individual results can lead to regulatory action.	• No overall surveillance or reports.	N/A	0	N/A
AMR01	Advanced Meat Recovery Product	• Conducted ad hoc. • Individual results can lead to regulatory action. • Per Directive 7160.3, data are reviewed annually to determine effectiveness of the directive.	• No overall surveillance or reports.	150	101	150
AMS_PROD_RTE	AMS RTE Canada EV Project - Product Collected by FSIS	•Results used for export certificates as part of Export Verification program.	• No overall surveillance. • Included in Quarterly Establishment Letters.	N/A	N/A	N/A
CG_RES_EL; CG_RES_MWL; CG_RES_WL	Collector Generated - Residue - Eastern Lab/ Midwestern Lab/ Western Lab	• Chemical Residue workgroup analyzes results to inform guidance to IPP on which animals to target.	• Residue sampling results are published annually in the Red Book • Included in Quarterly Establishment Letters.	N/A	197	N/A
CG_SHOW_MWL; CG_SHOW_WL	Collector Generated-Residues-Show Animals-Midwest Lab/Western Lab	• Residue testing results inform future allocations of residue testing. • Violative results are shared with FDA for FDA regulatory action.	• Residue sampling results are published annually in the Red Book. • Included in Quarterly Establishment Letters.	N/A	82	N/A
COMPLIAN	Investigative Sampling	• OIEA conducts ad hoc testing. • Individual results can lead to regulatory action. • Results from investigations have informed policy for specific establishments, outreach, and guidelines. • Supports recalls and investigations and is used as evidence in court cases.	• No overall surveillance or reports.	N/A	151	N/A
EGGIMP	Import-Egg Products-*Salmonella* and *Lm*	• Individual results can lead to regulatory action. • Results used to verify ongoing country equivalence.	• Import refusals are posted to FSIS website.	150	104	150

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
EM31	Egg Product Sampling-Pasteurized-Egg Whites-*Salmonella* and *Lm*	• Sampled lot of product shipped to non-official plant must be held pending negative test results. • Sampling data posted on FSIS website. • Positive test results require plants to conduct investigation on root cause and implement corrective actions. • Product that tests positive cannot enter commerce, but it can be reprocessed and must pass all parts of 9 CFR 590 prior to release..	• Aggregate data posted on FSIS website.	1,600	1,693	1,600
EM32	Egg Product Sampling-Pasteurized-Whole Egg or Yolks - *Salmonella* and *Lm*					
EM33	Egg Product Sampling-Pasteurized-Whole Eggs with Added Yolks or Whole Egg Blends-*Salmonella* and *Lm*					
EM34	Egg Product Sampling-Pasteurized-Whole Eggs or Yolks with > 2% salt or sugar added-*Salmonella* and *Lm*					
EM35	Egg Product Sampling-Pasteurized-Dried Yellow Egg Products - *Salmonella* and *Lm*					
EM36	Egg Product Sampling-Pasteurized-Dried Egg Whites - *Salmonella* and *Lm*					
EM37	Egg Product Sampling-Pasteurized-Pan Dried Egg Whites - *Salmonella* and *Lm*					
EXP_CH_MSK01	Exploratory Sampling for Mechanically Separated Chicken	* The results of this sampling project have been analyzed on multiple occasions. This product can be used in comminuted product, which is under a performance standard. A decision for the mechanically separated poultry projects is pending the results of an establishment survey regarding product usage.	• No overall surveillance. • Aggregate data posted on FSIS website. • Included in Quarterly Establishment Letters	150	105	150
EXP_CPT_OT01	Exploratory Sampling for Chicken Parts – Other Parts	* As a result of analysis of the data and particularly high pathogen positive rates in chicken livers, FSIS developed a Chicken Liver Action Plan * The SCCG has compared these sampling results with that of LBW (legs, breasts, wings). In FY 2020, FSIS will consider having Quarters and Halves fall under the LBW sampling project. This would provide additional opportunities for establishments to be categorized (more product for IPP to select from) and prevent establishments from escaping performance standards and/or sampling by altering their cut of the bird.	• Aggregate data posted on FSIS website. • Included in Quarterly Establishment Letters	360	332	360
EXP_CPT_QH01	Exploratory Sampling for Chicken Parts - Quarter and Half Carcasses			120	109	120

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
EXP_FI_MIC01	Domestic Siluriformes Sampling for Microbiology	* The domestic Siluriformes data, particularly that for *Salmonella*, is continually analyzed to determine what kind of risk such fish poses. * There is indication that *Salmonella* in these fish demonstrate seasonality, but more data is needed to confirm.	• No overall surveillance.	650	611	650
EXP_LV_NUTR	Label Verification for Sodium and Fat Content	* The data is used to inform policy development for product labeling, future sampling, to verify that the labels are truthful and not misleading (317.8 and 381.129) and to verify product is not adulterated. * Results from previous analyses have been used to inform establishments when they are not following the label verification guidelines, such as the nutrition facts panel testing.	• No overall surveillance.	200	121	200
EXP_LV_SOY	Label Verification for Soy			200	12	200
EXP_LV_ABX	Label Verification for Antibiotics			400	70	400
EXP_LV_HORM	Label Verification for Hormone Free			200	23	200
EXP_PK_COM02	Baseline Sampling for Pork - Comminuted (Ground, Mechanically Separated, and Other Comminuted)	• FSIS is currently using the results from these sampling projects to develop performance standards for pork products.	• Aggregate data posted on FSIS website. • Included in Quarterly Establishment Letters	1,120	1,665	1,704
EXP_PK_ICT02	Baseline Sampling for Pork - Intact cuts			840	1,315	1,521
EXP_PK_NCT02	Baseline Sampling for Pork - Non-Intact Cuts			840	1,193	1,272
EXP_TU_MSK01	Exploratory Sampling for Mechanically Separated Turkey	* The results of this sampling project have been analyzed on multiple occasions. This product can be used in comminuted product, which is under a performance standard. A decision for the mechanically separated poultry projects is pending the results of an establishment survey regarding product usage.	• Aggregate data posted on FSIS. • No overall surveillance. • Included in Quarterly Establishment Letters	150	99	150
F_CH_CARC01	Follow-up sampling of Chicken Carcasses	• Results of follow-up sampling inform PHRE evaluation and to determine effectiveness of corrective actions implemented by establishments in response to not meeting a performance standard.	• No overall surveillance. • Included in Quarterly Establishment Letters	N/A	2,634	N/A
F_TU_CARC01	Follow-up sampling of Turkey Carcasses					
F_CPT_LBW01	Follow-up sampling of Chicken Parts					
F_TU_COM01	Follow-up sampling of Comminuted Turkey					
F_CH_COM01	Follow-up sampling of Comminuted Chicken					

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
FAMR01	Follow-up Sampling to Advanced Meat Recovery Positive	• Per Directive 7160.3, data are reviewed annually to determine effectiveness of the directive. • Individual results can lead to regulatory action.	• No overall surveillance or reports.	N/A	40	N/A
FDS01	Food Defense Sampling - Meals Ready-to-Eat		• No overall surveillance or reports.	N/A	14	N/A
FDS05	Food Defense Sampling- Inauguration Testing		• No overall surveillance or reports.	N/A	N/A	N/A
FLISTERIA	Import-Follow-up to *Listeria monocytogenes* Positive	• Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence	• Import refusals are posted to FSIS website.	N/A	34	N/A
FOODCHEM	Collector-Generated Food Chemistry Samples	• Individual results can lead to regulatory action.	• No overall surveillance or reports.	N/A	3	N/A
FRTESA*LM*ONEL	Import-Follow-up to *Salmonella* Positive in RTE Product	• Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence.	• Import refusals are posted to FSIS website.	N/A	0	N/A
HC_CH_CARC01	HACCP Verification for Young Chicken Carcasses	• Sampling results are used to verify process control through verification of meeting a performance standard. • Establishments are categorized based on sample results. • Establishment categories are posted on FSIS website. • Sampling results are used to calculate prevalence. • Sampling results have set a *Salmonella* performance standard for industry.	• Aggregate data posted on FSIS website • Individual establishment category status is posted on the FSIS website. • Included in Quarterly Establishment Letters	10,000	9,207	9,000
HC_TU_CARC01	HACCP Verification for Turkey Carcasses			2,000	1,936	2,000
HC_CH_COM01	Sampling for Ground and Other Comminuted Chicken (not Mechanically Separated)			2,500	1,895	2,500
HC_TU_COM01	Sampling for Ground and Other Comminuted Turkey (not Mechanically Separated)			1,500	1,467	1,500
HC_CPT_LBW01	Sampling for Chicken Parts – Legs, Breasts, and Wings			8,000	7,860	9,000
IMP_PORK	Imported Raw Pork Product Sampling		• Import refusals are posted to FSIS website.	1,000	384	900
IMP_POULTRY	Import Sampling of Raw and NRTE Poultry Products		• Import refusals are posted to FSIS website.	1,000	551	900
IMPABNCONT	Import - Abnormal Container	• Individual results can lead to regulatory action.	• No overall surveillance or reports.	N/A	10	N/A

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
IMPAMRBEEF	Import - AMR Product - Beef	• Individual results can lead to regulatory action. • Per Directive 7160.3, data are reviewed annually to determine effectiveness of the directive. • Results used to verify ongoing county equivalence.	• Import refusals are posted to FSIS website.	10	0	10
IMPFISH_CH_E; IMPFISH_CH_W	Import Siluriformes Chemistry Sampling - Eastern Laboratory/Western Laboratory	• Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence.	• Import refusals are posted to FSIS website.	1,800	582	2,000
IMPFISH_MI	Import Siluriformes Microbiology Sampling	• The import Siluriformes data is continuously analyzed to determine what kind of risk Siluriformes poses. • Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence	• Import refusals are posted to FSIS website	1,800	223	1,000
IMPMETALS	National Residue Plan - Import Sampling - Metals - Eastern Lab	• Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence.	• Import refusals are posted to FSIS website.	3,000	2,823	2,000
IMPPESTICIDE	National Residue Plan - Import Sampling - Pesticides - Western Lab					
IMPRESEGG	Import Residue Sampling - Egg Products					
IMPRESFR_EL; IMPRESFR_WL	National Residue Plan - Import Sampling - Fresh Product					
IMPRESPR_EL; IMPRESPR_MWL	National Residue Plan - Import Sampling - Processed Products					
IMPSPECIESID	Import-Species Identification			250	155	250
IMVRTE	Import-Micro Pathogen Sampling of RTE Products			3,000	2,942	3,000
INTCONT_*LM*_E; INTCONT_*LM*_M; INTCONT_*LM*_W	For-Cause Sampling- RTE Food Contact Surface-*Listeria*	• Conducted after positive results from RTEPROD_RAND, RTEPROD_RISK sampling project. • Individual results can lead to regulatory action. • Verification of 9 CFR 430 requirements to control *Listeria monocytogenes* in post-lethality RTE products and food contact surfaces. • Evaluation of potential cross-contamination or harborage of *Listeria monocytogenes* • Results of follow-up sampling inform PHRE evaluation and to determine effectiveness of corrective actions implemented by establishments in response to a previous positive.	• No overall surveillance. • Included in Quarterly Establishment Letters	N/A	970	N/A
INTCONT_SA_E; INTCONT_SA_M	For-Cause Sampling- RTE Food Contact Surface-*Salmonella*					
INTENV_*LM*_E; INTENV_*LM*_M; INTENV_*LM*_W	For-Cause Sampling- Non-Food Surface-*Listeria*			N/A	543	N/A
INTENV_SA_E; INTENV_SA_M	For-Cause Sampling- Non-Food Surface-*Salmonella*					

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
INTPROD_*LM*_E; INTPROD_*LM*_M; INTPROD_*LM*_W	For-Cause Sampling- RTE Product-*Listeria*			N/A	480	N/A
INTPROD_SA_E; INTPROD_SA_M	For-Cause Sampling-RTE Product-*Salmonella*					
KIS	KIS - Samples from In-plant Testing	• Used to inform policy changes about inspector-generated sampling and NRP. • KIS tests conducted ad hoc when a PHV suspects use of antibiotics in livestock. Positive KIS tests are sent to the labs for verification.	• KIS tests conducted ad hoc. Positive KIS tests are sent to the labs for verification.	N/A	3,841	N/A
RE_CH_CARC01	Religious Exempt Sampling for Chicken Carcasses	• Data are being analyzed to determine Agency next steps.	• Aggregate data posted on FSIS. • No overall surveillance. • Included in Quarterly Establishment Letters	6,600	360	2,200
LO_CH_CARC01	Very Low Volume Sampling for Chicken Carcasses				2,005	
LO_CH_COM01	Very Low Volume Sampling for Ground and Other Comminuted Chicken (not Mechanically Separated)					
LO_CPT_LBW01	Very Low Volume Sampling for Raw Chicken Parts - Legs, Breast, Wings					
LO_CPT_OT01	Very Low Volume Sampling for Raw Chicken Parts - Other Parts					
LO_CPT_QH01	Very Low Volume Sampling for Chicken Parts - Quarters/Halves					
LO_TU_CARC01	Very Low Volume Sampling for Turkey Carcasses					
LO_TU_COM01	Very Low Volume Sampling for Ground and Other Comminuted Turkey (not Mechanically Separated)					
LO_CH_MSK01	Very Low Volume Sampling for Mechanically Separated Chicken					
LO_TU_MSK01	Very Low Volume Sampling for Mechanically Separated Turkey					
MT05	Raw Ground Beef or Veal Sampling - Retail	• Individual results can lead to regulatory action. • The sample questionnaire includes questions regarding the Grinding Records Rule to evaluate compliance with recordkeeping requirements to	• Results are posted on the FSIS website.	575	557	575

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
		ensure trace back, which is evaluated annually to inform outreach to retailers.				
MT06	Raw Ground Beef or Veal Sampling - Retail - Follow-up	• Individual results can lead to regulatory action.		N/A	0	N/A
MT08	Import-Sampling of Raw Ground or Comminuted Beef or Veal Product	• Individual results can lead to regulatory action. • Results used to verify ongoing country equivalence.	• Import refusals are posted to FSIS website.	50	35	50
MT44	Follow-up Risk-based Sampling of Positive Raw Ground Beef or Veal Sample -*E. coli* O157:H7/ *Salmonella*	• Individual results can lead to regulatory action. Results of follow-up sampling inform PHRE evaluation and to determine effectiveness of corrective actions implemented by establishments in response to producing adulterated product (for *E. coli*)	• Results are posted on the FSIS website. • Included in Quarterly Establishment Letters	N/A	50	N/A
MT44T	Follow-up *E. coli* Sampling of Raw Ground Beef, Trimmings or Components (Traceback)			N/A	64	N/A
MT51	Import-Raw Beef Manufactured Trimmings or Components for use in Ground Beef or Beef Products	• Individual results can lead to regulatory action. • Results used to verify ongoing county equivalence.	• Import refusals are posted to FSIS website.	2,000	1,003	1,500
MT52	Follow-up Sampling of Suppliers of Raw Ground Beef Trim or Components	• Individual results can lead to regulatory action. • Results of routine sampling inform PHRE evaluation and to determine effectiveness of STEC and *Salmonella* controls implemented by establishments.	• Results are posted on the FSIS website. • Included in Quarterly Establishment Letters	N/A	59	N/A
MT53	Follow-up Sampling of Beef Mfg. Trim or Other Raw Ground Beef or Beef Patty Components			N/A	601	N/A
MT43	Risk-based Sampling of Raw Ground Beef or Veal Products - *E. coli* O157:H7 & *Salmonella*		• Aggregate data posted on FSIS website. • Results are posted on the FSIS website. • Included in Quarterly Establishment Letters	11,500	11,035	11,500
MT60	Sampling of Beef Manufacturing Trimmings			3,750	3,737	3,750
MT64	Sampling of Raw Ground Beef or Beef Patty Components (other than trim)			600	1,170	1,050
MT65	Sampling of Bench Trim for further use in ANY raw, non-intact beef products			1,500	1,206	1,500
NARMS_BC	NARMS-Sampling-Beef Cows		• Data is incorporated into a NARMS integrated report, which is a combined analysis of FDA/CDC/FSIS NARMS-related test results with a	6,400	6,486	6,400
NARMS_DC	NARMS- Sampling-Dairy Cows (Paired with RESNARMS_DC)					
NARMS_HF	NARMS- Sampling-Heifers					

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
NARMS_MS	NARMS- Sampling-Market Swine		focus on trends in antimicrobial resistance.			
NARMS_ST	NARMS- Sampling-Steers					
NARMS_SW	NARMS- Sampling-Sows					
NARMS_YC	NARMS- Sampling-Young Chickens (Paired with RESNARMS_YC)					
NARMS_YT	NARMS- Sampling-Young Turkeys					
NRP_BC_S	National Residue Project Sampling-Beef Cows – State	• Tier 1 projects are used to verify establishment control. Tier 2 projects are exploratory in nature. • Sampling results are evaluated annually to develop the next sampling plan (the Blue Book). • Results of all residue sampling are used to update guidance to PHVs for targeted sampling.	• Residue sampling results are published annually in the Red Book. • Sampling results are shared with the FDA, and used to develop the repeat violators list. • Included in Quarterly Establishment Letters (non-state)	700	482	660
NRP_BV_S	National Residue Project Sampling - Bob Veal – State					
NRP_DC_S	National Residue Project Sampling - Dairy Cows – State					
NRP_HF_S	National Residue Project Sampling - Heifers – State					
NRP_MS_S	National Residue Project Sampling - Market Swine – State					
NRP_ST_S	National Residue Project Sampling - Steers – State					
NRP_SW_S	National Residue Project Sampling - Sows – State					
NRP_YC_S	National Residue Project Sampling - Young Chickens – State					
NRP_YT_S	National Residue Project Sampling - Young Turkeys – State					
NRP_BC	National Residue Project Sampling - Beef Cows			712	782	712
NRP_BS	National Residue Project Sampling - Bull/Stag			100	171	100
NRP_BV	National Residue Project Sampling - Bob Veal			356	328	356
NRP_DC	National Residue Project Sampling - Dairy Cows			712	833	712
NRP_FFV	National Residue Project Sampling - Formula-Fed Veal			100	158	150

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
NRP_HC	National Residue Project Sampling - Heavy Calf					
NRP_NFFV	National Residue Project Sampling - Non-Formula-Fed Veal					
NRP_GO	National Residue Project Sampling – Goats			300	332	300
NRP_HF	National Residue Project Sampling – Heifers			356	369	3,556
NRP_MS	National Residue Project Sampling - Market Swine			712	744	712
NRP_OBT	National Residue Project Sampling - Old Breeder Turkeys			0	1	0
NRP_RS	National Residue Sampling Project Sampling - Roaster Swine			300	309	300
NRP_SH	National Residue Project Sampling – Sheep			150	168	150
NRP_ST	National Residue Project Sampling – Steers			356	387	356
NRP_SW	National Residue Project Sampling - Sows			712	639	712
NRP_YC	National Residue Project Sampling - Young Chickens			712	696	712
NRP_YT	National Residue Project Sampling - Young Turkeys			712	747	712
PATH_LIVESTK	Samples for Histopathological Examination - Livestock	• Data are used to inform carcass disposition determinations.	• No overall surveillance. • Included in Quarterly Establishment Letters	N/A	3,480	N/A
PATH_OTHER	Samples for Histopathological Examination - Other (non-meat)					
PATH_POULTRY	Samples for Histopathological Examination - Poultry					
PATH_PRODUCT	Samples for Histopathological Examination – Product					

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
RES_FI	Domestic Siluriformes Testing for Residue and Speciation	• Data are being analyzed to determine Agency next steps. • Sampling results are evaluated annually to develop the next sampling plan (the Blue Book). • Sampling results are shared with the FDA, and used to develop the repeat violators list. • Results of all residue sampling are used to update guidance to PHVs for targeted sampling.		650	636	650
R*LM*CONT_EL R*LM*CONT_MWL; R*LM*CONT_WL	Risk-based Verification - FSL Lab - RTE - Food Contact Surface Sample - Listeria	• Individual results can lead to regulatory action. • Verification of 9 CFR 430 requirements to control *Listeria monocytogenes* in post-lethality RTE products and food contact surfaces. • Evaluation of potential cross-contamination or harborage of *Listeria monocytogenes* • Results of sampling inform PHRE evaluation •Evaluation of trends in product positives	• No overall surveillance. • Included in Quarterly Establishment Letters	1,150	3,283	4,218
R*LM*ENVC_EL; R*LM*ENVC_MWL; R*LM*ENVC_WL	Risk-based Verification - FSL Lab - RTE - Non-Food Contact Surface Sample-Listeria			115	331	423
R*LM*PRODC_EL; R*LM*PRODC_MWL; R*LM*PRODC_WL	Risk-based Verification- FSL Lab - RTE - Listeria - Product Sample (Composite)			115	335	423
RTEPROD_RAND	RTEPROD Sampling - Random RTE Products	• Individual results can lead to regulatory action. • Verification of 9 CFR 430 requirements to control *Listeria monocytogenes* in post-lethality exposed RTE products. • Evaluation of potential harborage of *Listeria* monocytogenes (if historical isolates exist for comparison). • Verification of lethality treatment effectiveness (primarily *Salmonella* results). •Results of sampling inform PHRE evaluation •Evaluation of trends in product positives. • In response to a continued trend in beginning of FY19 of under-collection in the RAND project, additional sampling tasks have been added for the remainder of FY19.	• Aggregate data posted on FSIS website • Included in Quarterly Establishment Letters	7,400	7,089	7,400
RTEPROD_RISK	RTEPROD Sampling - Risk-based RTE Products			7,400	7,974	7,400
SPECID	Species Identification Sampling	• Conducted ad hoc. • Individual results can lead to regulatory action.	• No overall surveillance or reports	N/A	2	N/A

Project Code	Sampling Project Name	Analyses Conducted and Decisions Based on Results from Sampling Project	Results Reporting	# Samples FY18 Sampling Plan	# Samples Analyzed FY18	# Samples FY19 Sampling Plan
UNKSUB	Samples for Identification of Unknown Substance		• No overall surveillance or reports		2	

Appendix G: Details of Costs Associated with Sampling Projects

Table G1 provides a summary of estimates of costs per sampling project, and includes the discipline for the type of analysis that is typically performed for the sampling project. For more detail, please see a description of what is included in Phase 5 (page **38**).

Table G1: Estimate of Costs by Sampling Project

Lab Project List	PHIS Name	Field Personnel			Laboratory		Total Cost Estimate per sample ($)
		IPP or non-IPP	Minutes	Costs per sample ($)[1]	Analysis Type	Costs per sample ($)	
ABNCONT	Abnormal Container	IPP	54	28.38	Chemical Residue	115.06	143.44
AMR01	Advanced Meat Recovery Product	IPP	54	28.38	Pathology	96.41	124.75
AMS_PROD_RTE	AMS RTE Canada EV Project - Product Collected by FSIS	IPP	54	28.38	Microbiological	82.17	110.55
CG_RES_EL	Collector Generated - Residue - Eastern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
CG_RES_MWL	Collector Generated - Residue - Midwestern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
CG_RES_WL	Collector Generated - Residue - Western Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
CG_SHOW_MWL	Collector Generated-Residues-Show Animals-Midwest Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
CG_SHOW_WL	Collector Generated-Residue-Show Animals-Western Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
COMPLIAN	Investigative Sampling	Non-IPP	54	28.38	Microbiological	82.17	110.55
EGGIMP	Import-Egg Products-Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM31	Egg Product Sampling-Pasteurized-Egg Whites-Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM32	Egg Product Sampling-Pasteurized-Whole Egg or Yolks - Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM33	Egg Product Sampling-Pasteurized-Whole Eggs with Added Yolks or Whole Egg Blends-Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM34	Egg Product Sampling-Pasteurized-Whole Eggs or Yolks with > 2% salt or sugar added-Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM35	Egg Product Sampling-Pasteurized-Dried Yellow Egg Products - Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM36	Egg Product Sampling-Pasteurized-Dried Egg Whites - Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EM37	Egg Product Sampling-Pasteurized-Pan Dried Egg Whites - Salmonella and Lm	IPP	54	28.38	Microbiological	82.17	110.55
EXP_CH_MSK01	Exploratory Sampling for Mechanically Separated Chicken	IPP	54	28.38	Microbiological	82.17	110.55
EXP_CPT_OT01	Exploratory Sampling for Chicken Parts - Others Parts	IPP	54	28.38	Microbiological	82.17	110.55
EXP_CPT_QH01	Exploratory Sampling for Chicken Parts - Quarter and Half Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
EXP_FI_MIC01	Domestic Siluriformes Sampling for Microbiology	IPP	54	28.38	Microbiological	82.17	110.55
EXP_LV_ABX	Label Verification for Antibiotics	IPP	54	28.38	Chemical Residue	115.06	143.44
EXP_LV_HORM	Label Verification for Hormones	IPP	54	28.38	Chemical Residue	115.06	143.44
EXP_LV_NUTR	Label Verification for Sodium and Fat Content	IPP	54	28.38	Chemical Residue	115.06	143.44
EXP_LV_SOY	Label Verification for Soy	IPP	54	28.38	Pathology	30.38	58.76
EXP_PK_COM02	Baseline Sampling for Pork - Comminuted (Ground, Mechanically Separated, and Other Comminuted)	IPP	54	28.38	Microbiological	82.17	110.55
EXP_PK_ICT02	Baseline Sampling for Pork - Intact cuts	IPP	54	28.38	Microbiological	82.17	110.55
EXP_PK_NCT02	Baseline Sampling for Pork - Non-Intact Cuts	IPP	54	28.38	Microbiological	82.17	110.55
EXP_TU_MSK01	Exploratory Sampling for Mechanically Separated Turkey	IPP	54	28.38	Microbiological	82.17	110.55
F_CH_CARC01	Follow-up sampling of Chicken Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
F_CH_COM01	Follow-up sampling of Comminuted Chicken	IPP	54	28.38	Microbiological	82.17	110.55
F_CPT_LBW01	Follow-up sampling of Chicken Parts; Legs, Breasts, Wings	IPP	54	28.38	Microbiological	82.17	110.55

Lab Project List	PHIS Name	Field Personnel			Laboratory		Total Cost Estimate per sample ($)
		IPP or non-IPP	Minutes	Costs per sample ($)[1]	Analysis Type	Costs per sample ($)	
F_TU_COM01	Follow-up sampling of Comminuted Turkey	IPP	54	28.38	Microbiological	82.17	110.55
F_TU_CARC01	Follow-up sampling of Turkey Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
FAMR01	Follow-up Sampling to Advanced Meat Recovery Positive	IPP	54	28.38	Pathology	96.41	124.75
FDS01	Food Defense Sampling - Meals Ready-to-Eat	IPP	54	28.38	Microbiological	82.17	110.55
FDS05	Food Defense Sampling- Inauguration Testing	IPP	54	28.38	Microbiological	82.17	110.55
FLISTERIA	Import-Follow-up to Listeria monocytogenes Positive	IPP	54	28.38	Microbiological	82.17	110.55
FOODCHEM	Collector-Generated Food Chemistry Samples	IPP	54	28.38	Microbiological	82.17	110.55
FRTESALMONEL	Import-Follow-up to Salmonella Positive in RTE Product	IPP	54	28.38	Microbiological	82.17	110.55
HC_CH_CARC01	HACCP Verification for Young Chicken Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
HC_CH_COM01	Sampling for Ground and Other Comminuted Chicken (not Mechanically Separated)	IPP	54	28.38	Microbiological	82.17	110.55
HC_CPT_LBW01	Sampling for Chicken Parts – Legs, Breasts, and Wings	IPP	54	28.38	Microbiological	82.17	110.55
HC_TU_CARC01	HACCP Verification for Young Turkey Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
HC_TU_COM01	Sampling for Ground and Other Comminuted Turkey (not Mechanically Separated)	IPP	54	28.38	Microbiological	82.17	110.55
IMP_PORK	Imported Raw Pork Product Sampling	IPP	54	28.38	Microbiological	82.17	110.55
IMP_POULTRY	Import Sampling of Raw and NRTE Poultry Products	IPP	54	28.38	Microbiological	82.17	110.55
IMPABNCONT	Import-Abnormal Container	IPP	54	28.38	Microbiological	82.17	110.55
IMPAMRBEEF	Import - AMR Product - Beef	IPP	54	28.38	Pathology	96.41	124.75
IMPFISH_CH_E	Import Siluriformes Chemistry Sampling - Eastern Laboratory	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPFISH_CH_W	Import Siluriformes Chemistry Sampling - Western Laboratory	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPFISH_MI	Import Siluriformes Microbiology Sampling	IPP	54	28.38	Microbiological	82.17	110.55
IMPMETALS	National Residue Plan - Import Sampling - Metals - Eastern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPPESTICIDE	National Residue Plan - Import Sampling - Pesticides - Western Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPRESEGG	Import Residue Sampling - Egg Products	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPRESFR_EL	National Residue Plan - Import Sampling - Fresh Product - Eastern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPRESFR_WL	National Residue Plan - Import Sampling - Fresh Product - Western Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPRESPR_EL	National Residue Plan - Import Sampling - Processed Products - Eastern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPRESPR_MWL	National Residue Plan - Import Sampling - Processed Product - Midwestern Lab	IPP	54	28.38	Chemical Residue	115.06	143.44
IMPSPECIESID	Import-Species Identification	IPP	54	28.38	Microbiological	82.17	110.55
IMVRTE	Import-Micro Pathogen Sampling of RTE Products	IPP	54	28.38	Microbiological	82.17	110.55
INTCONT_LM_E	For-Cause Sampling-Eastern Lab-RTE Food Contact Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTCONT_LM_M	For-Cause Sampling-Midwest Lab-RTE Food Contact Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTCONT_LM_W	For-Cause Sampling-Western Lab-RTE Food Contact Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTCONT_SA_E	For-Cause Sampling-Eastern Lab-RTE Food Contact Surface-Salmonella	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTCONT_SA_M	For-Cause Sampling-Midwest Lab-RTE Food Contact Surface-Salmonella	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTENV_LM_E	For-Cause Sampling-Eastern Lab-Non-Food Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTENV_LM_M	For-Cause Sampling-Midwest Lab-Non-Food Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTENV_LM_W	For-Cause Sampling-Western Lab-Non-Food Surface-Listeria	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTENV_SA_E	For-Cause Sampling-Eastern Lab-Non-Food Surface-Salmonella	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTENV_SA_M	For-Cause Sampling-Midwest Lab-Non-Food Surface-Salmonella	Non-IPP	54	28.38	Microbiological	82.17	110.55
INTPROD_LM_E	For-Cause Sampling-Eastern Lab-RTE Product-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
INTPROD_LM_M	For-Cause Sampling-Midwest Lab-RTE Product-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
INTPROD_LM_W	For-Cause Sampling-Western Lab-RTE Product-Listeria	IPP	54	28.38	Microbiological	82.17	110.55

Lab Project List	PHIS Name	Field Personnel			Laboratory		Total Cost Estimate per sample ($)
		IPP or non-IPP	Minutes	Costs per sample ($)[1]	Analysis Type	Costs per sample ($)	
INTPROD_SA_E	For-Cause Sampling-Eastern Lab-RTE Product-Salmonella	IPP	54	28.38	Microbiological	82.17	110.55
INTPROD_SA_M	For-Cause Sampling-Midwest Lab-RTE Product-Salmonella	IPP	54	28.38	Microbiological	82.17	110.55
KIS	KIS - Samples from In-plant Testing	IPP	54	28.38	Chemical Residue	115.06	143.44
LO_CH_CARC01	Very Low Volume Sampling for Chicken Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
LO_CH_COM01	Very Low Volume Sampling for Ground and Other Comminuted Chicken (not Mechanically Separated)	IPP	54	28.38	Microbiological	82.17	110.55
LO_CH_MSK01	Very Low Volume Sampling for Mechanically Separated Chicken	IPP	54	28.38	Microbiological	82.17	110.55
LO_CPT_LBW01	Very Low Volume Sampling for Raw Chicken Parts - Legs, Breast, Wings	IPP	54	28.38	Microbiological	82.17	110.55
LO_CPT_OT01	Very Low Volume Sampling for Raw Chicken Parts - Other Parts	IPP	54	28.38	Microbiological	82.17	110.55
LO_CPT_QH01	Very Low Volume Sampling for Chicken Parts - Quarters/Halves	IPP	54	28.38	Microbiological	82.17	110.55
LO_TU_CARC01	Very Low Volume Sampling for Turkey Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
LO_TU_COM01	Very Low Volume Sampling for Ground and Other Comminuted Turkey (not Mechanically Separated)	IPP	54	28.38	Microbiological	82.17	110.55
LO_TU_MSK01	Very Low Volume Sampling for Mechanically Separated Turkey	IPP	54	28.38	Microbiological	82.17	110.55
MT05	Raw Ground Beef or Veal Sampling - Retail	IPP	54	28.38	Microbiological	82.17	110.55
MT06	Raw Ground Beef or Veal Sampling - Retail - Follow-up	IPP	54	28.38	Microbiological	82.17	110.55
MT08	Import-Sampling of Raw Ground or Comminuted Beef or Veal Product	IPP	54	28.38	Microbiological	82.17	110.55
MT43	Risk-based Sampling of Raw Ground Beef or Veal Products - E.coli O157:H7 & Salmonella	IPP	54	28.38	Microbiological	82.17	110.55
MT44	Follow-up Risk-based Sampling of Positive Raw Ground Beef or Veal Sample -E.coli O157:H7/Salmonella	IPP	54	28.38	Microbiological	82.17	110.55
MT44T	Follow-up E.coli Sampling of Raw Ground Beef, Trimmings or Components (Traceback)	IPP	54	28.38	Microbiological	82.17	110.55
MT51	Import-Raw Beef Manufactured Trimmings or Components for use in Ground Beef or Beef Products	IPP	54	28.38	Microbiological	82.17	110.55
MT52	Follow-up Sampling of Suppliers of Raw Ground Beef Trim or Components	IPP	54	28.38	Microbiological	82.17	110.55
MT53	Follow-up Sampling of Beef Mfg. Trim or Other Raw Ground Beef or Beef Patty Components	IPP	54	28.38	Microbiological	82.17	110.55
MT60	Sampling of Beef Manufacturing Trimmings[2]	IPP	108	56.75	Microbiological	82.17	138.92
MT64	Sampling of Raw Ground Beef or Beef Patty Components (other than trim)	IPP	54	28.38	Microbiological	82.17	110.55
MT65	Sampling of Bench Trim for further use in ANY raw, non-intact beef products[2]	IPP	108	56.75	Microbiological	82.17	138.92
NARMS_BC	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Beef Cows	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_DC	NARMS-Dairy Cows (Paired with RESNARMS_DC)	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_HF	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Heifers	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_MS	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Market Swine	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_ST	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Steers	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_SW	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Sows	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_YC	NARMS-Young Chickens (Paired with RESNARMS_YC)	IPP	54	28.38	Microbiological	82.17	110.55
NARMS_YT	NARMS-National Antimicrobial Resistance Monitoring System Sampling-Young Turkeys	IPP	54	28.38	Microbiological	82.17	110.55
NRP_BC	National Residue Project Sampling - Beef Cows	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_BC_S	National Residue Project - Beef Cows - State	IPP	54	28.38	Chemical Residue	115.06	143.44

Lab Project List	PHIS Name	Field Personnel			Laboratory		Total Cost Estimate per sample ($)
		IPP or non-IPP	Minutes	Costs per sample ($)[1]	Analysis Type	Costs per sample ($)	
NRP_BS	National Residue Project Sampling - Bull/Stag	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_BV	National Residue Project Sampling - Bob Veal	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_BV_S	National Residue Project - Bob Veal - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_DC	National Residue Project Sampling - Dairy Cows	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_DC_S	National Residue Project - Dairy Cows - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_FFV	National Residue Project Sampling - Formula-Fed Veal	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_FS	National Residue Project Sampling – Feral Swine	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_GO	National Residue Project Sampling - Goats	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_HC	National Residue Project Sampling - Heavy Calf	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_HF	National Residue Project Sampling - Heifers	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_HF_S	National Residue Project - Heifers - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_MS	National Residue Project Sampling - Market Swine	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_MS_S	National Residue Project - Market Swine - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_NFFV	National Residue Project Sampling - Non Formula-Fed Veal	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_OBT	National Residue Project - Old Breeder Turkeys	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_RS	National Residue Sampling Project - Roaster Swine	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_SH	National Residue Project Sampling - Sheep	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_ST	National Residue Project Sampling - Steers	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_ST_S	National Residue Project - Steers - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_SW	National Residue Project Sampling - Sows	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_SW_S	National Residue Project - Sows - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_YC	National Residue Project Sampling - Young Chickens	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_YC_S	National Residue Project - Young Chickens - State	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_YT	National Residue Project Sampling - Young Turkeys	IPP	54	28.38	Chemical Residue	115.06	143.44
NRP_YT_S	National Residue Project - Young Turkeys - State	IPP	54	28.38	Chemical Residue	115.06	143.44
PATH_LIVESTK	Samples for Histopathological Examination - Livestock	IPP	54	28.38	Pathology	30.38	58.76
PATH_OTHER	Samples for Histopathological Examination - Other (non-meat)	IPP	54	28.38	Pathology	30.38	58.76
PATH_POULTRY	Samples for Histopathological Examination - Poultry	IPP	54	28.38	Pathology	30.38	58.76
PATH_PRODUCT	Samples for Histopathological Examination - Product	IPP	54	28.38	Pathology	30.38	58.76
RE_CH_CARC01	Religious Exempt Sampling for Chicken Carcasses	IPP	54	28.38	Microbiological	82.17	110.55
RES_FI	Domestic Siluriformes Testing for Residue and Speciation	IPP	54	28.38	Chemical Residue	115.06	143.44
RLMCONT_EL	Risk-based Verification-Eastern Lab - RTE - Food Contact Surface Sample - Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMCONT_MWL	Risk-based Verification-Midwest Lab-RTE-Food Contact Surface Sample-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMCONT_WL	Risk-based Verification-Western Lab-Food Contact Surface Sample-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVC_EL	Risk-based Verification-Eastern Lab - RTE - Non-Food Contact Surface Sample-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVC_MWL	Risk-based Verification-Midwest Lab-RTE-Non-Food Contact Surface Sample-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVC_WL	Risk-based Verification-Western Lab-RTE-Non-food Contact Surface Sample-Listeria	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVR_EL	Risk-based Verification-Eastern Lab-RTE-Non-food Contact Brine Sample	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVR_MWL	Risk-based Verification-Midwest Lab-RTE-Non-food Contact Brine Sample	IPP	54	28.38	Microbiological	82.17	110.55
RLMENVR_WL	Risk-based Verification-Western Lab-RTE-Non-food Contact Brine Sample	IPP	54	28.38	Microbiological	82.17	110.55

Lab Project List	PHIS Name	Field Personnel			Laboratory		Total Cost Estimate per sample ($)
		IPP or non-IPP	Minutes	Costs per sample ($)[1]	Analysis Type	Costs per sample ($)	
RLMPRODC_EL	Risk-based Verification-Eastern Lab - RTE - Listeria - Product Sample (Composite)	IPP	54	28.38	Microbiological	82.17	110.55
RLMPRODC_MWL	Risk-based Verification-Midwestern Lab - RTE - Listeria - Product Sample (Composite)	IPP	54	28.38	Microbiological	82.17	110.55
RLMPRODC_WL	Risk-based Verification-Western Lab - RTE - Listeria - Product Sample (Composite)	IPP	54	28.38	Microbiological	82.17	110.55
RTEPROD_RAND	RTEPROD Sampling - Random RTE Products	IPP	54	28.38	Microbiological	82.17	110.55
RTEPROD_RISK	RTEPROD Sampling - Risk-based RTE Products	IPP	54	28.38	Microbiological	82.17	110.55
SPECID	Species Identification Sampling	IPP	54	28.38	Microbiological	82.17	110.55
UNKSUB	Samples for Identification of Unknown Substance	IPP	54	28.38	Microbiological	82.17	110.55

1 The field hourly rate is $31.53. Cost per sample derived by multiplying the hourly rate by the fractional hours. For instance 54 minutes equates to 0.9 hours. This is then multiplied by the hourly rate to get the field cost per sample.

2 N-60 Composite Sample

Appendix H: Details by Project of Master Table

Table H1 provides a graphical representation while H2 gives the tabular representation of the benefit score and categorized cost per sample for each individual sampling project, with individual projects sorted by group. The costs have been categorized into low, medium and high in order to better compare cost/benefit between projects. This is a similar presentation to Table ES1, which presented this information summarized by sampling group.

Table H1: Detailed Master Table Summary by Individual Project Scatter Plot

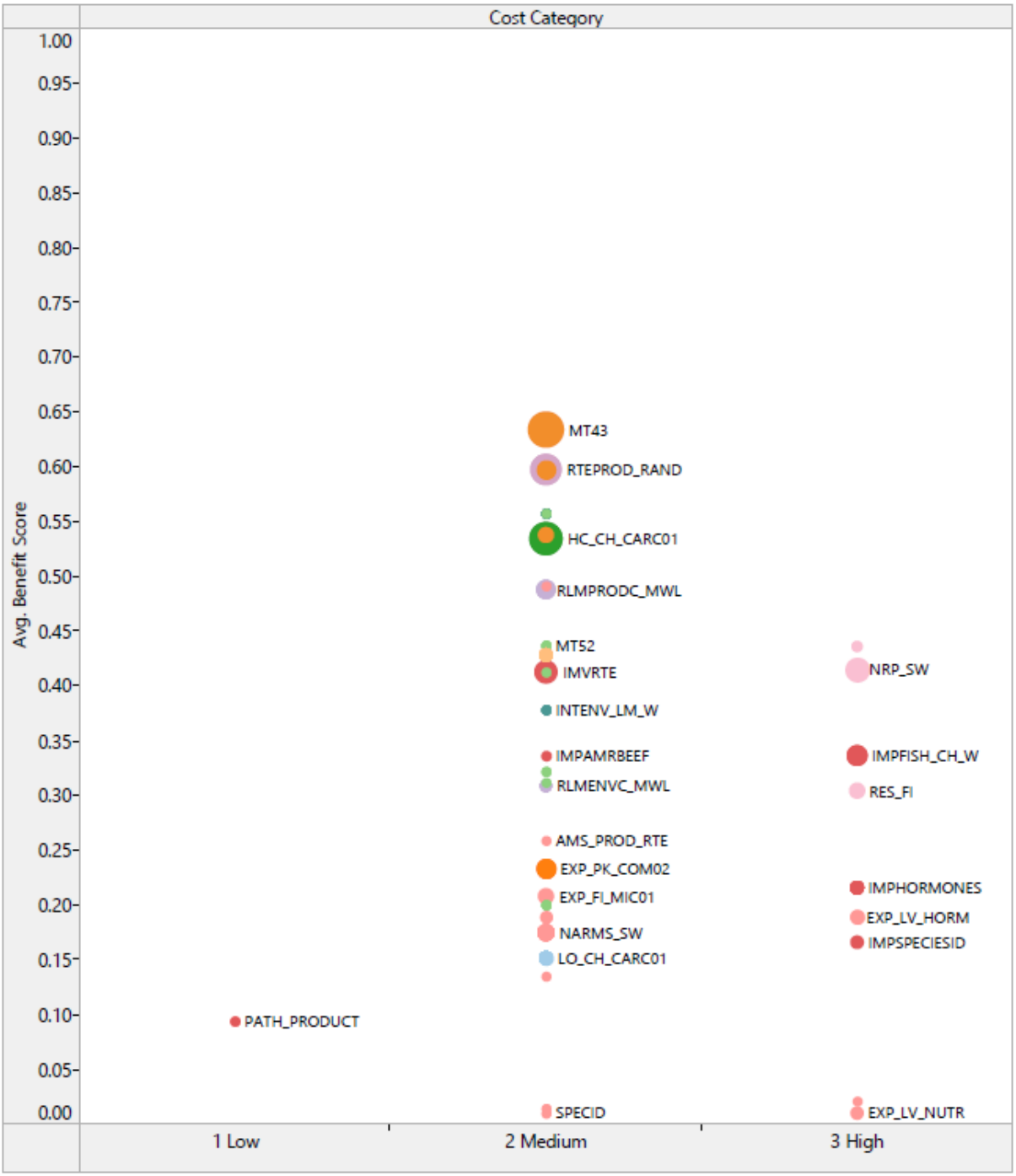

Table H2: Detailed Master Table Summary by Individual Project Tablix

		Benefit Score	$ Category	Samples
RTEPROD Sampling	RTEPROD_RAND	0.60	2	7,400
	RTEPROD_RISK	0.60	2	7,400
Beef Sampling	MT43	0.63	2	11,500
	MT64	0.60	2	1,050
	MT05	0.54	2	575
	MT60	0.63	2	3,750
	MT65	0.60	2	1,500
Poultry Verification	HC_CH_CARC01	0.53	2	9,000
	HC_CH_COM01	0.53	2	2,500
	HC_CPT_LBW01	0.53	2	9,000
	HC_TU_CARC01	0.53	2	2,000
	HC_TU_COM01	0.53	2	1,500
For-Cause Sampling	INTCONT_LM_E	0.56	2	
	INTCONT_LM_M	0.56	2	
	INTCONT_LM_W	0.56	2	
	INTCONT_SA_E	0.56	2	
	INTCONT_SA_M	0.56	2	
	INTPROD_LM_E	0.56	2	
	INTPROD_LM_M	0.56	2	
	INTPROD_LM_W	0.56	2	
	INTPROD_SA_E	0.56	2	
	INTPROD_SA_M	0.56	2	
	INTENV_LM_E	0.38	2	
	INTENV_LM_M	0.38	2	
	INTENV_LM_W	0.38	2	
	INTENV_SA_E	0.38	2	
	INTENV_SA_M	0.38	2	
Egg Product Sampling	EM31	0.43	2	229
	EM32	0.43	2	229
	EM33	0.43	2	229
	EM34	0.43	2	229
	EM35	0.43	2	228
	EM36	0.43	2	228
	EM37	0.43	2	228
RLM	RLMCONT_EL	0.49	2	1,406
	RLMCONT_MWL	0.49	2	1,406
	RLMCONT_WL	0.49	2	1,406
	RLMPRODC_EL	0.49	2	141
	RLMPRODC_MWL	0.49	2	141
	RLMPRODC_WL	0.49	2	141
	RLMENVC_EL	0.31	2	71
	RLMENVC_MWL	0.31	2	71
	RLMENVC_WL	0.31	2	71
	RLMENVR_EL	0.31	2	70
	RLMENVR_MWL	0.31	2	70
	RLMENVR_WL	0.31	2	70
Follow-up sampling	MT44T	0.56	2	
	MT06	0.44	2	0
	MT44	0.44	2	
	MT52	0.44	2	
	MT53	0.44	2	
	FRTESALMONEL	0.41	2	
	F_CH_CARC01	0.32	2	
	F_TU_CARC01	0.32	2	
	FLISTERIA	0.31	2	
	F_CPT_LBW01	0.20	2	
	F_CU_COM01	0.20	2	
	F_TU_COM01	0.20	2	
	FAMR01	0.20	2	

		Benefit Score	$ Category	Samples
Residue	NRP_FS	0.44	3	38
	KIS	0.42	3	
	NRP_BC	0.42	3	712
	NRP_BS	0.42	3	100
	NRP_BV	0.42	3	356
	NRP_DC	0.42	3	712
	NRP_FFV	0.42	3	38
	NRP_GO	0.42	3	300
	NRP_HF	0.42	3	47
	NRP_HF	0.42	3	3,556
	NRP_MS	0.42	3	712
	NRP_NFFV	0.42	3	37
	NRP_OBT	0.42	3	0
	NRP_RS	0.42	3	300
	NRP_SH	0.42	3	150
	NRP_ST	0.42	3	356
	NRP_SW	0.42	3	712
	NRP_YC	0.42	3	712
	NRP_YT	0.42	3	712
	CG_RES_FI	0.34	3	
	CG_RES_MWI	0.34	3	
	CG_RES_WI	0.34	3	
	CG_SHOW_MWI	0.34	3	
	CG_SHOW_WI	0.34	3	0
	NRP_BC_S	0.34	3	73
	NRP_BV_S	0.34	3	73
	NRP_DC_S	0.34	3	73
	NRP_HF_S	0.34	3	73
	NRP_MS_S	0.34	3	74
	NRP_ST_S	0.34	3	74
	NRP_SW_S	0.34	3	74
	NRP_YC_S	0.34	3	74
	NRP_YT_S	0.34	3	73
	RES_FI	0.30	3	650
Import Sampling	FGGIMP	0.41	2	150
	IMVRTF	0.41	2	3,000
	MT08	0.41	2	50
	MT51	0.41	2	1,500
	IMPAMRBEFF	0.34	2	10
	IMPARNCONT	0.34	3	
	IMPFISH_CH_F	0.34	3	2,000
	IMPFISH_CH_W	0.34	3	2,000
	IMP_PORK	0.23	2	900
	IMP_POULTRY	0.23	2	900
	IMPFISH_MI	0.23	2	1,000
	IMPPATH	0.09	1	0
	IMPHORMONES	0.22	3	250
	IMPMETALS	0.22	3	250
	IMPPESTICIDE	0.22	3	250
	IMPRESFRG	0.22	3	250
	IMPRESFR_EL	0.22	3	250
	IMPRESFR_WI	0.22	3	250
	IMPRESPR_FI	0.22	3	250
	IMPRESPR_MI	0.22	3	250
	IMPSPECIESID	0.17	3	250
Exploratory Pork	EXP_PK_COM02	0.23	2	1,704
	EXP_PK_ICT02	0.23	2	1,521
	EXP_PK_NCT02	0.23	2	1,272
Exploratory Poultry	EXP_CH_MSK01	0.23	2	150
	EXP_CPT_OT01	0.23	2	360
	EXP_CPT_OH01	0.23	2	120
	EXP_TU_MSK01	0.23	2	150
Other	COMPLIAN	0.49	2	
	AMS_PROD_RTF	0.26	2	
	EXP_FI_MIC01	0.21	2	650
	FOODCHEM	0.19	2	
	LINKSUB	0.18	2	0
	PATH_LIVESTK	0.09	1	
	PATH_OTHER	0.09	1	
	PATH_POULTRY	0.09	1	
	PATH_PRODUCT	0.09	1	
	NARMS_BC	0.18	2	800
	NARMS_DC	0.18	2	800
	NARMS_HF	0.18	2	800
	NARMS_MS	0.18	2	800
	NARMS_ST	0.18	2	800
	NARMS_SW	0.18	2	800
	NARMS_YC	0.18	2	800
	NARMS_YT	0.18	2	800
	AMR01	0.19	2	150
	EXP_LV_ARX	0.19	3	400
	EXP_LV_HORM	0.19	3	0
	EXP_LV_SOY	0.19	3	200
	FDS05	0.13	2	
	ARNCONT	0.02	3	0
	FDS01	0.01	2	
	SPECID	0.01	2	0
	EXP_LV_NUTR	0.01	3	200
Very Low Volume Sampling	LO_CH_CARC01	0.15	2	244
	LO_CH_COM01	0.15	2	244
	LO_CH_MSK01	0.15	2	245
	LO_CPT_LBW01	0.15	2	244
	LO_CPT_OT01	0.15	2	244
	LO_CPT_OH01	0.15	2	244
	LO_TU_CARC01	0.15	2	245
	LO_TU_COM01	0.15	2	245
	LO_TU_MSK01	0.15	2	245
	RF_CH_CARC01	0.15	2	360