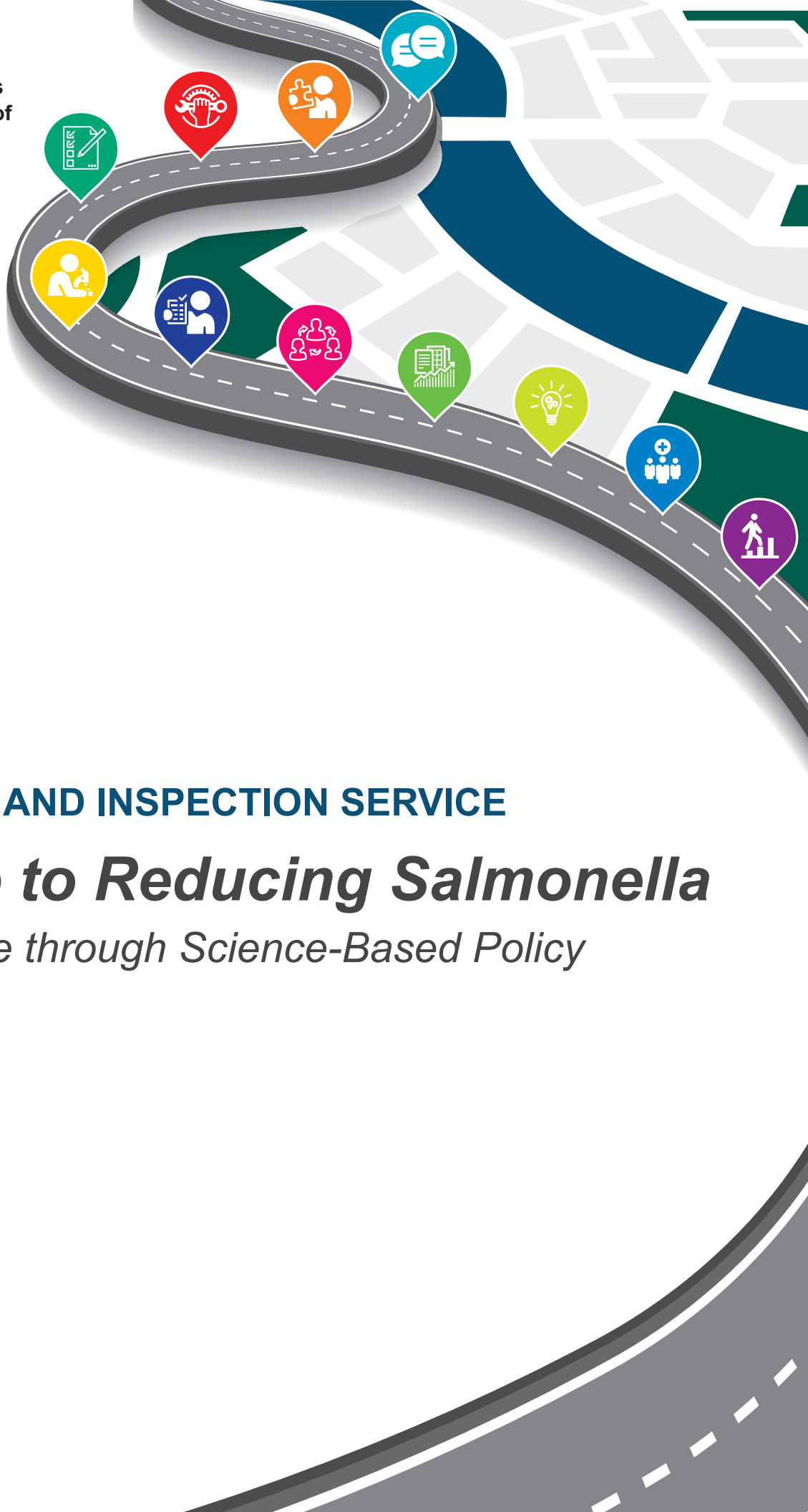




United States
Department of
Agriculture



FOOD SAFETY AND INSPECTION SERVICE

Roadmap to Reducing Salmonella

Driving Change through Science-Based Policy

2020

Message From the Under Secretary



As the Under Secretary of Food Safety at the U.S. Department of Agriculture, I am intensely focused on finding science-based approaches to prevent foodborne illness and save lives. *Salmonella* is a leading cause of foodborne illness and decreasing *Salmonella* in meat, poultry, and egg products is a priority for me and for the Food Safety and Inspection Service (FSIS). I am proud of FSIS' vast breadth of activities to protect public health and reduce pathogens such as *Salmonella*. Together, these activities support a holistic approach to addressing *Salmonella* that I was eager to capture as part of this plan.

The Roadmap to Reducing Salmonella: Driving Change through Science-Based Policy, outlines FSIS programs and policies that are science-based, data-driven, and promote innovation to reduce *Salmonella*. The roadmap sets us on a course to aggressively target *Salmonella* and other foodborne pathogens. It also represents FSIS' commitment to lead with science and data in all that we do. FSIS policies are grounded in sound science and our employees are well-trained and prepared to lead the Agency in making data-driven decisions. As we put this plan into action, I am confident that the activities described here and the work we will continue to do at FSIS will drive us toward our destination of reducing *Salmonella*.

Mindy Brashears, Ph.D.
Under Secretary for Food Safety

NAVIGATION



Introduction

3



FSIS Employees

5



Modernization of Inspection Systems

6



Inspection Tasks and Public Health

9



FSIS Laboratories and Sampling

10



Salmonella Performance Standards

12



Outreach and Communication

14



Data Transparency and Analytics

19



Research and Innovation

21



Collaboration with Public Health Partners

24



Looking Forward

27



INTRODUCTION

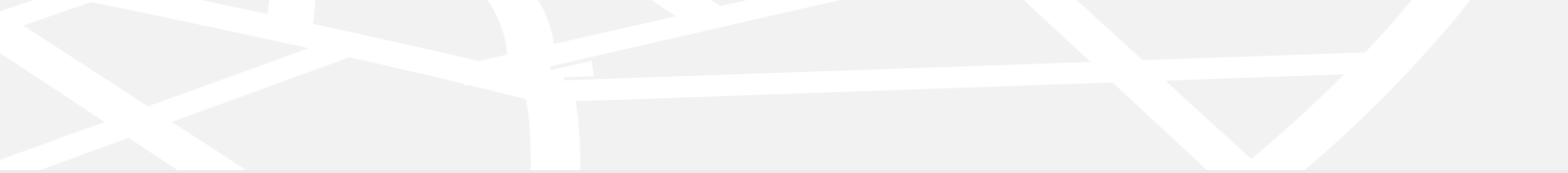
Under the purview of the United States Department of Agriculture's (USDA) Office of Food Safety (OFS), the Food Safety and Inspection Service (FSIS) is the public health agency in USDA responsible for ensuring the safety of the Nation's commercial supply of meat, poultry, and processed egg products, and is committed to identifying ways to reduce foodborne illness attributed to these FSIS-regulated food products. *Salmonella* is a leading cause of foodborne illness, and outbreaks of *Salmonella* have been linked to poultry, pork, and beef products. Using outbreak data through 2017, the Interagency Food Safety Analytics Collaboration (IFSAC) estimates that approximately 38% of foodborne salmonellosis in the United States is attributed to meat and poultry products.¹

These data highlight that the Agency plays an important role in helping achieve national public health goals aimed at reducing foodborne illness caused by *Salmonella*. Although findings from a recent analysis of FSIS data show there has been an overall reduction in the occurrence of *Salmonella* on meat and poultry products over the past 20 years,² there is still work to be done. The food safety community did not meet the 2020 national public health goal for reduction of *Salmonella* illnesses, and FSIS remains committed to working toward achieving the target set for 2030.

The daily work of implementing the Federal Meat Inspection Act (FMIA), the Poultry Products Inspection Act (PPIA), and the Egg Products Inspection Act is carried out by FSIS inspectors who are present in each of the nearly 6,500 establishments across the country, inspecting each and every live animal and carcass. Although not always apparent to the public, there are many other components of the Agency's expertise, programs, and policies that help support the work of our field personnel in addressing foodborne pathogens. While the scope of FSIS authority to enforce the FMIA and PPIA is centered on the meat and poultry industries, the activities of the Agency drive change along the entire farm-to-fork continuum to protect our food supply.

¹ Interagency Food Safety Analytics Collaboration. Foodborne illness source attribution estimates for 2017 for *Salmonella*, *Escherichia coli* O157, *Listeria monocytogenes*, and *Campylobacter* using multi-year outbreak surveillance data, United States. GA and D.C.: U.S. Department of Health and Human Services, CDC, FDA, USDA-FSIS. 2019.

² Williams et al., 2020. Changes in *Salmonella* Contamination in Meat and Poultry Since the Introduction of the Pathogen Reduction; Hazard Analysis and Critical Control Point Rule. Accepted for publication. Journal of Food Protection (early view) doi.org/10.4315/JFP-20-126.



Food safety is a shared responsibility, and FSIS, in partnership with the greater food safety community, ensures that safe and wholesome foods are on our dinner table and in our restaurants, schools and institutions every day. FSIS aggressively targets all foodborne pathogens of importance within our regulatory authority, including *Salmonella*. As food safety challenges evolve, the Agency will use the latest science and data to modernize inspection systems, laboratory and sampling methods, and communications to meet consumer needs and protect public health. We are focused on improving our ability to predict, detect, and reduce pathogens while encouraging industry to adopt the latest technology and innovations to produce a safer product. At the same time, we work to ensure that consumers are empowered with information on how to safely handle, cook, and store food.

This document serves as a roadmap describing how FSIS advances science-based, data-driven programs and policies to promote innovations to reduce *Salmonella* and other pathogens in meat, poultry, and egg products. Additionally, it is a visual representation of the activities within the Agency that are directly related to pathogen reduction. Our current programs are described in this roadmap, including some of our future efforts to meet Healthy People 2030 public health goals. In 2020 and beyond, we will strengthen our commitment to reduce pathogen contamination as we lead with science, build relationships, and influence behavior change to reduce *Salmonella* infections associated with FSIS-regulated products and to save lives.



EMPLOYEES

To effectively address the control of *Salmonella* in the meat and poultry supply, the right combination of people must be present who understand the pathogen on a scientific level and how an inspection system operates to control pathogens.

FSIS employees represent that combination by:

- Being professionally diverse, with decades of hands-on experience as inspectors, experts in public health and food safety, analysts, public health veterinarians, scientists, public health communicators, and Commissioned Corps officers in the United States Public Health Service.
- Working cooperatively and collaboratively within and across government agencies to ensure food safety and public health.
- Being well-trained and prepared to lead the Agency in making data-driven decisions.



MODERNIZATION OF INSPECTION SYSTEMS

Inspection systems from more than a century ago relied heavily on the use of organoleptic inspection, where food inspectors used their sense of smell, sight, and touch to detect abnormalities associated with food safety hazards. Over the past several decades, we have implemented advancements in inspection methods that continue to provide a high level of public health safety while staying committed to the visual examination of each and every animal before harvest and on each and every carcass. However, microbial pathogens cannot be directly detected by sight or smell. Our inspection system must be augmented to provide the inspection force with more tools to address these invisible threats.

The goal of modernized inspection is to focus resources on the inspection tasks that directly impact public health and that are associated with a reduction in *Salmonella* or other pathogens in the final product. Modernization at FSIS is a science-based and data-driven process, based on thousands of inspection sampling and verification data points and rigorous risk assessments. FSIS categorizes inspection tasks, identifying those that impact the pathogen presence or public health outcomes in a particular operation; our modernized systems then target those that have the most impact. By modernizing, the Agency requires establishments to test for pathogen indicators for verification and it increases the FSIS inspectors' verification of controls and other measures employed by the food industry to anticipate and prevent foodborne hazards, including pathogens.

Current Modernization: Poultry and Swine

With the modernization of poultry and swine slaughter inspection, FSIS demonstrated its commitment to focusing inspection resources on evidence-based verification activities. FSIS used approximately 20 years of data to scientifically support poultry and swine modernization efforts. Risk assessments predict that the new inspection systems will continue to provide sufficient and necessary public health protection from *Salmonella* contamination and associated foodborne illnesses. Inspection modernization represents the further implementation of a science- and data-driven system: Hazard Analysis and Critical Control Points (HACCP).

All meat and poultry processors were required to implement HACCP in the late 1990s. Modernized systems support HACCP-based principles. Under HACCP, establishments are responsible for identifying microbiological, chemical, and physical hazards that could potentially affect the process and products. Establishments must implement food safety systems to monitor, control, and prevent these hazards from occurring. In turn, FSIS inspectors verify that an establishment's food safety system is working to ensure the safety of products by performing inspection and sampling tasks. FSIS personnel also continue to inspect each carcass for visible contamination and adulteration.

Modernizing inspection systems addresses *Salmonella* reduction by:

- Creating a new inspection system that establishments could choose to operate under; the new system increases the utilization of FSIS inspectors conducting offline inspection tasks that have the biggest impact on public health, while maintaining online carcass-by-carcass inspection.
- Requiring additional establishment microbiological sampling so the establishment can assess the effectiveness of its food safety system, make decisions that improve pathogen control, and ensure food safety.

Future Modernization: Egg Products and Beef Slaughter

FSIS is in the process of modernizing egg products inspection. Additionally, modernization of beef slaughter inspection using a science-based process is under consideration. Both egg products and beef modernization allow for more innovation in how establishments target and control pathogens, including *Salmonella*, in their production processes.

Egg products (e.g., liquid, frozen, and dried eggs), unlike meat and poultry, are currently being inspected under traditional inspection protocols rather than HACCP principles. FSIS has finalized a rule to modernize egg products inspection by requiring egg products plants to adopt the prevention-focused principles of HACCP, creating opportunities for new innovations and measures to control pathogens at egg products plants. These regulatory changes better support food safety decision making by producers and align egg products regulations with current meat and poultry products regulations. These changes are consistent with FSIS risk assessments that found that pasteurization and rapid cooling of eggs are effective for reducing illnesses from *Salmonella* Enteritidis in eggs and *Salmonella* species in egg products.



When the HACCP requirements in the final rule are in effect, egg products plants will be required to use science-based decisions to verify that pathogen controls, including controls for *Salmonella*, are adequate and functioning. Inspectors will verify the plants have validated HACCP plans that effectively address hazards to prevent, eliminate, or reduce their occurrence.

FSIS continues to look to the future to embrace food safety-focused interventions to control *Salmonella* and other pathogens in beef products. Establishments can request inspection under a modernized inspection system in beef slaughter operations as part of a waiver program. Establishments can apply for waivers from specific regulations to allow for testing of new procedures, equipment, and processing techniques. The Agency is interested in requests for waivers that would modernize ante-mortem or post-mortem inspection (e.g., establishment identification and trimming of defects on carcasses and parts before presentation for post-mortem inspection or alternative process control), and thus, impact the pathogen presence in the facility.

Establishments that receive a waiver must agree to participate in the *Salmonella* Initiative Program and submit data to FSIS on a monthly basis that may be used in future rulemaking. The Agency will analyze establishment data, Agency test results, and other inspection data to inform policy and to modernize beef slaughter inspection in the future.



INSPECTION TASKS AND PUBLIC HEALTH

Inspectors focus efforts on inspection tasks that are associated with public health outcomes. Each year, through a systematic, data-driven process, FSIS identifies regulations verified during inspection tasks that are statistically associated with public health outcomes, such as pathogen positive results and recall of products. The noncompliance rates of these public health regulations are further analyzed to determine thresholds both for early warning and to prioritize establishments for public health risk evaluations (PHRE).

The PHRE is an in-depth evaluation of an individual inspected establishment's performance and may result in a food safety assessment (FSA) or enforcement actions, such as a suspension of inspection. Other for-cause public health associated triggers prompting the PHRE include failure to meet a pathogen performance standard, positive *Listeria monocytogenes* or Shiga toxin-producing *Escherichia coli* (STEC) Agency sample results, and product recalls. FSIS will continue to review and refine its process for identifying the most informative triggers for PHREs, FSAs, and other actions to ensure adequate controls are in place for *Salmonella* and other hazards.



FSIS LABORATORIES AND SAMPLING

FSIS operates three International Organization for Standardization (ISO) 17025 accredited, field service laboratories located in Athens, Georgia; St. Louis, Missouri; and Albany, California. These labs are state of the art and conduct laboratory analytical services in support of the Agency's farm-to-table food safety and inspection verification strategies that affect and protect the health and safety of consumers worldwide. Diagnostic services include food and residue chemistry, microbiology, and pathology. In addition to inspector-collected verification samples, the labs analyze enforcement and outbreak investigative samples, National Antimicrobial Resistance Monitoring System (NARMS) samples, and maintain a biosafety level-3 facility to test high-risk food defense suspect materials and agents. The diagnostic methods used in FSIS laboratories are also used around the world to analyze meat, poultry, Siluriformes, and processed egg products samples to ensure food safety and prevent foodborne illness.

FSIS is continually evaluating sampling approaches to optimize public health impact. As technology has advanced, FSIS has modernized sampling programs and resources over the years, including the following:

- Moving from Pulsed-Field Gel Electrophoresis to whole genome sequencing (WGS) to characterize pathogens.
- Testing for the top seven STECs important to public health.
- Testing meat and poultry samples for multiple pathogens and indicators simultaneously.

The HACCP rule, implemented in the late 1990s, required testing of carcasses for performance standards, but a careful evaluation of the scientific data over the years indicated that carcasses may not be the best sampling point or method to determine the *Salmonella* status of the products that reach consumers. Therefore, the Agency continues to search for new ways to optimize sampling of all products. Currently we have moved to sampling beef trim instead of carcasses and pork products instead of carcasses. Poultry carcass sampling is supplemented with end product sampling, including chicken parts and ground chicken and turkey.



FSIS is also evaluating and adjusting sampling algorithms to assign and schedule inspectors' sampling verification tasks to maximize sample collection rates and laboratory testing. The Agency has streamlined sampling to reduce egg products sampling from seven categories to two to improve the collection and quality of data. FSIS continues to explore more efficient methods to enumerate pathogens in samples, detect virulence factors in pathogens for potential risk ranking, and investigate new pathogen characterization methods. As science and sampling methods advance, we will continue to use the most innovative and sensitive methods to protect consumers.

FSIS also collaborates with its public health and food safety partners, the U.S. Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC) to monitor antimicrobial resistance (AMR) in bacteria collected from animal ceca and routine food sampling. The NARMS sampling data are used to promote interventions that reduce resistance in foodborne bacteria, as well as to investigate the trends and pathways of AMR.

FSIS activities that protect consumers and live animals and help to preserve the effectiveness of antimicrobials include:

- Developing a process for routine monitoring and reporting of AMR trends related to *Salmonella* serotypes of public health concern to promote timely information sharing with internal and external stakeholders.
- Expanding cecal sampling to include veal, sheep, goat, and lamb, and begin testing mesenteric lymph nodes from cattle for *Salmonella* species.
- Using advancements in WGS to characterize AMR based on genotype, complementing our current phenotypic antimicrobial sensitivity testing approach.

In addition to our internal sampling programs, we intend to propose a regulatory change that would expand the Agency's Accredited Laboratory Program (ALP) to include accreditations for pathogen analysis and additional chemical analysis. Expansion of the program for FSIS accredited nonfederal laboratories would provide greater confidence in laboratory analysis to those in the industry who rely on the ALP labs to conduct testing and open a potential pathway for establishments to voluntarily submit industry data to FSIS.



***SALMONELLA* PERFORMANCE STANDARDS**

Salmonella performance standards are in place to encourage establishments to take action to reduce *Salmonella* in their products. Performance standards hold the industry responsible for maintaining control of pathogens and implementing best practices and intervention technologies to keep their products safe for the consumer. FSIS currently has performance standards in place for *Salmonella* in poultry products. Proposed standards for *Campylobacter* in comminuted poultry and for *Salmonella* in ground beef and beef manufacturing trimmings were open for public comment and FSIS is analyzing the public comments while finalizing the standards under development. By the end of the year, we plan to propose *Salmonella* pork performance standards for comminuted products and pork cuts, thus, addressing all major meat and poultry commodities under FSIS authority.

The Agency uses pathogen reduction performance standards to assess the food safety performance of establishments that slaughter and process FSIS-regulated products. Performance standards are designed to meet public health goals such that if most establishments meet pathogen reduction performance standards, a reduction in *Salmonella* illness due to FSIS-regulated products will follow. Specific commodities and products are targeted based on attribution estimates, monitoring of foodborne outbreaks, and data from baseline and exploratory sampling projects. Performance standards allow establishments to address the pathogen at any point upstream of the sampling point from preharvest, through processing, to the sample collection point. The performance standards allow for innovation and pathogen control customized for a particular operation.

Poultry

Salmonellosis associated with the consumption of poultry represents a significant portion of foodborne illnesses each year. FSIS established *Salmonella* performance standards for young chicken carcasses and ground poultry in 1996. Performance standards for chicken parts and comminuted chicken and turkey were implemented in 2016. These standards are of such importance to FSIS that the Agency uses this information as a “key performance indicator” on a quarterly basis to evaluate its own success. To incentivize industry to find innovative and effective ways to reduce *Salmonella*, FSIS posts information on how well each establishment producing poultry carcasses,



chicken parts, and comminuted chicken and turkey products is meeting performance standards on its public website (www.fsis.usda.gov/SalmonellaCategorization). Consumers and businesses can use these data to make purchasing decisions based on plant performance.

FSIS inspectors verify that establishments implement food safety systems that reduce *Salmonella*, and poultry establishments are categorized based on their test results for each commodity produced. Establishments that meet the performance standards are classified as either category 1 or 2. If an establishment falls into category 3 (not meeting the performance standard), the Agency assigns a PHRE, during which FSIS investigators evaluate whether the establishment has adequately addressed *Salmonella* in the food safety system. The establishment must take corrective actions and may also need to reassess and modify food safety programs to adequately address *Salmonella*. FSIS employees may also perform an FSA to investigate any existing vulnerabilities in the food safety system.

Pork

As of 2019, FSIS has fully implemented routine pork products sampling at regulated establishments. This sampling continues and has replaced carcass sampling that found few positive *Salmonella* samples. Pork cuts and comminuted products are analyzed for *Salmonella* and aerobic plate counts. The sample results and analysis will be used to develop future policies and propose *Salmonella* performance standards to target reduction in the levels of *Salmonella* in raw pork products by the end of the year. These data are also important measures that pork establishments and swine producers can use to make changes to reduce *Salmonella* contamination in pork products.

Beef

In 2019, FSIS proposed updated pathogen reduction performance standards for *Salmonella* in raw ground beef and new *Salmonella* performance standards for beef manufacturing trimmings, the primary component used to make ground beef, to ensure that establishments are consistently controlling or reducing *Salmonella*. FSIS also proposed to allocate resources more effectively. The proposed performance standards will drive change in the beef processing industry to utilize more effective *Salmonella* controls. These performance standards will supplement testing for the seven STECs that are considered adulterants in certain raw beef products.



OUTREACH AND COMMUNICATION

Outreach to industry, retailers, stakeholders, and consumers is critical to the food safety successes FSIS has experienced over the years and will continue to be at the forefront of our communications. Communication tools are available to assist industry in the implementation of regulations or to meet standards. FSIS actively reaches out to the industry to provide resources and technical assistance, with an emphasis on small and very small establishments.

The Agency also develops written and visual guidance for industry, retailers, and consumers on specific topics that includes best practices and technical resources for meeting FSIS regulations. In addition to online resources, FSIS dedicates time (up to 25% for some positions) for personal, one-on-one consultation with establishments to address specific needs.

Guidance for the FSIS-regulated Industry

Guidance documents related to pathogen reduction provide establishments with information to help them meet pathogen performance standards and to reduce pathogen loads in finished products. Additionally, guidance documents can be found on sampling and a variety of other practices and controls that reduce *Salmonella*. A list of guidance documents related to pathogen reduction can be found on the FSIS website (www.fsis.usda.gov/Guidance).

The Agency is currently developing or revising a number of guidance documents focused specifically on controlling *Salmonella*; they are highlighted below.

- FSIS will reissue two guidance documents for *Salmonella* and *Campylobacter* control in poultry, one specific to each pathogen, with updates reflecting new innovations and technologies available. Guidance documents include information related to preharvest production. The Agency does not have regulatory authority before harvest of the product, but the establishment is encouraged to utilize best practices or interventions in the live animal, if available and proven effective.

- FSIS is updating guidance to industry for controlling *Salmonella* in market hogs to add the latest science supporting preharvest, slaughter, and processing controls. These measures are intended to address *Salmonella* contamination in pork products, enhance consumer food safety protections, and bring focus to control measures industry can use to address pathogen reduction in pork.
- The Agency has developed guidance to control *Salmonella* in raw beef products to provide resources that address hazard controls from preharvest through processing.
- When FSIS proposed updating the egg products inspection regulations to align with current requirements in the meat and poultry products inspection regulations, the Agency posted guidance to provide resources to egg products plants under HACCP, including safe harbors based on current regulations and other safe harbors validated by establishments under regulatory waivers to control *Salmonella*. FSIS updated the guidance and published it with the Egg Products Inspection Regulations final rule.

Outreach to Retail Firms

FSIS conducts investigations and surveillance activities in commerce where meat, poultry, and egg products are produced, sold, distributed, imported, exported, stored, or otherwise prepared or handled. To reduce *Salmonella* contamination in ground products, FSIS is continuing to conduct surveillance in commerce to verify that retail stores that grind raw beef products keep records to trace the source materials used to make the ground beef back to the supplying establishment. The Agency is also increasing awareness of grinding records requirements. Grinding records are necessary to improve FSIS' ability to accurately trace the source of foodborne illness outbreaks caused by *Salmonella*, and other pathogens from ground beef, to identify the source materials attributable to outbreaks.

Outreach to Small and Very Small Plants

Approximately 5,200 FSIS-regulated establishments are small (10–499 employees) or very small (less than 10 employees or doing business at less than \$2.5 million per year). FSIS is committed to assisting small and very small establishments understand and comply with Federal inspection requirements by communicating policies, regulations, and providing tools and resources to improve compliance, ultimately ensuring the safety of the food supply.

Outreach takes several forms including roundtable discussions; direct contact by Enforcement, Investigation, and Analysis Officers; and technical support through Agency tools, such as the Small Plant Help Desk (www.fsis.usda.gov/sphelpdesk), askFSIS (askfsis.custhelp.com/), industry guidelines, and webinars to assist small and very small plants with various regulatory requirements.

The help desk and askFSIS are available by phone and through an online question and answer library to provide answers to numerous questions that may be unique to small and very small plants. Small and very small plants can also access educational materials and training resources on topics such as how to develop a recall plan, HACCP plan, and a robust systematic approach to humane handling. Agency leadership also communicates with small and very small plants through monthly town hall calls.

Consumer Education

One of the ways that FSIS achieves our food safety mission is by empowering consumers to handle and prepare our regulated products in the safest way possible. The public plays an important role in preventing foodborne illness and the Agency provides education to consumers on how to handle meat and poultry products in a manner that will keep them safe and healthy. Factors such as improper holding (time and temperature), inadequate cooking, and poor personal hygiene can contribute to foodborne illness. Foodborne illness from pathogens such as *Salmonella* and *Campylobacter* can be reduced by cooking products to safe internal temperatures and preventing cross-contamination.

- Consumer research is the backbone of FSIS' educational outreach. The Agency uses research to assess whether its food safety messaging meets the needs of the consumer. This data-driven approach allows FSIS to refine its consumer outreach efforts to ensure they address gaps and emerging opportunities.
- The Agency works with partners at various Federal, State, regional and local levels to communicate with the constituents of organizations we would not otherwise be able to reach with food safety educational material. This approach to reach individuals promotes collaboration through events, workshops, distribution of educational materials, and digital media messages.

- 
- FSIS is researching possible updates to the safe handling instructions label that has been required on all raw and not-ready-to-eat products since 1994. The label was first required to help consumers understand and execute recommended safe handling behaviors when preparing raw and not-ready-to-eat products. This new project uses behavior change theory and consumer research to develop alternative labels. The effectiveness of these label updates is empirically evaluated using eye-tracking technology while participants prepare a meal in a test kitchen. Based on the results of this project, FSIS will be able to make informed, data-driven decisions to improve ways to educate consumers about safe handling on labels.

Media Engagement and Education

FSIS' Office of Public Affairs and Consumer Education regularly engages with the media and general public to provide timely responses to inquiries, proactively educate, and provide plain language explanations of how the Agency's programs and policies promote public health. Staff actively work to educate consumers and the media to explain how slaughter, processing, inspection, and food production practices work and how FSIS policies impact food safety. They also promote dissemination of recall and public health alerts to notify the public of when they should take action to prevent foodborne illness.

Stakeholder Engagement

Each month, OFS and FSIS leadership meet with stakeholder groups that represent consumers and the regulated industry. These stakeholder groups provide input from a diverse population of individuals who can help us improve food safety and public health. The purpose of these meetings is to work collaboratively to improve food safety and public health communications. We encourage stakeholder groups to provide data and engage with us on the common goal of protecting public health. FSIS is committed to considering petitions on changing policy and making data-driven decisions that span the breadth of the industry, including small and very small processors, to implement the best technologies to protect meat, poultry, and processed egg products from foodborne pathogens. We will continue to encourage the stakeholder groups to lead with scientific data and to work cooperatively with us on our common public health goals.



Consumer Outreach on Raw and Undercooked Products

FSIS has identified certain products that may be consumed raw or undercooked and have been associated with foodborne illness outbreaks from *Salmonella* and other pathogens. These include meat products designed to be consumed raw (e.g., “tiger meat” or kibbeh, which are dishes made from raw beef or lamb); chicken livers that may contain pathogens inside the livers and are often eaten without being fully cooked; and raw, stuffed chicken products that appear cooked due to browning on the outside.

FSIS has developed messaging around stuffed chicken, roaster pigs, rotisserie chicken, and chicken liver products, to ensure that chefs, retailers, and consumers are aware of the risks. The Agency is continuing to work with industry and public health partners to understand consumer handling of these products and ensure that consumers are aware of the risk. FSIS has also taken actions such as recommending changes to labeling for raw, stuffed chicken products that appear par-fried and ready-to-eat to address the risk from these products.



DATA TRANSPARENCY AND ANALYTICS

The Agency collects over nine million food safety data points each year, including sampling data, food safety and food defense verification tasks, and in-commerce surveillance activities. FSIS is expanding and enhancing access to critical public health data to inform decisions at all levels of the Agency. Data transparency creates market-based incentives for food safety and provides actionable information that can be used to enhance detection and prevention of *Salmonella* in food products. We are developing reports and interactive dashboards to allow our employees to assess establishment performance over time, identify establishments needing assistance, and inform policy for decision making regarding food safety concerns.

FSIS is also committed to being more transparent and sharing data with stakeholders, including regulated establishments, other government agencies, industry groups, consumers, and the general public. The Agency posts datasets, including establishment-specific data, on its website (www.fsis.usda.gov/datacollectionandreports). FSIS also communicates the results of exploratory projects, along with conclusions, to share valuable data with stakeholders that inform decision making.

***Salmonella* Testing Results**

FSIS provides the public with *Salmonella* sampling results for meat, poultry, and processed egg products. In addition, the Agency provides the public with individual establishment FSIS test results that are updated on a quarterly basis on the FSIS website (www.fsis.usda.gov/datacollectionandreports/datasets) and Data.gov (www.data.gov/). The Agency directly shares results of pathogen testing with regulated establishments. FSIS communicates aggregate data trends with industry associations so that these data can be shared with their membership. The Agency is continually expanding the amount of data shared with establishments and external partners, including WGS information. FSIS provides data and pathogen isolates to research partners that contribute to food safety studies and publications.

Whole Genome Sequencing

FSIS uses WGS to characterize *Salmonella* isolates collected from product samples, NARMS cecal samples, and USDA's Agricultural Marketing Service samples. WGS is an important tool used to detect *Salmonella* outbreaks and to help identify possible sources of contamination in coordination with State and Federal public health and regulatory partners.

FSIS will explore ways to decrease the time it takes to perform WGS and will examine the use of WGS analyses, in combination with other existing techniques, to inform inspection activities. The Agency is researching methods of sharing WGS results with establishments and continues to explore appropriate ways to share WGS information with inspectors, industry, consumer stakeholders, and other State and Federal public health and regulatory partners, as it becomes available.

Risk Assessments

The Agency develops and applies cutting-edge scientific methods to conduct quantitative risk assessments that determine the risks of biological and chemical hazards in meat, poultry, and egg products. These risk assessments guide, support, and enhance FSIS' goals and allow the Agency to estimate the potential effects of policy options, inform regulatory decisions in support of the Agency's food safety mission, and assess the public health impacts of FSIS actions. The risk assessments and analytic products also support the Agency's risk management and risk communication functions. All risk assessments conducted by FSIS are posted on the Agency's webpage (www.fsis.usda.gov/riskassessments).



RESEARCH AND INNOVATION

FSIS scientists identify research needs and address gaps, author peer-reviewed scientific publications (www.fsis.usda.gov/scientificliterature), and present at scientific conferences to advance *Salmonella* research. The Agency proposes food safety research priorities (www.fsis.usda.gov/researchpriorities) and maintains a list of food safety research studies (www.fsis.usda.gov/researchpriorities/researchstudies) as a resource for industry, academia, and research funding agencies. Current FSIS research priorities address topics such as *Salmonella* detection and enumeration. Between FY 2016 and FY 2019, the USDA contributed over \$100 million to fund *Salmonella* research. FSIS hosts a weekly scientific seminar series to foster communication between the Agency and leading scientists conducting food safety research. FSIS is establishing a fellowship program that will provide students an opportunity to learn more about the Agency and to undertake research projects that could include strategies to control *Salmonella* and other food safety hazards.

National Advisory Committees

The National Advisory Committee on Microbiological Criteria for Foods (NACMCF) and the National Advisory Committee on Meat and Poultry Inspection (NACMPI) are two active Federal advisory committees that provide recommendations and guidance to Federal food safety agencies on a variety of topics related to enhancing food safety. Membership is diverse and represents State and local governments; industry and trade associations; public health, scientific and academic communities; consumers; and consumer organizations.

NACMCF provides advice on an integrated national food safety systems approach that ensures the safety of domestic, imported, and exported foods. The Committee reports to the Secretary of Agriculture and to the Secretary of Health and Human Services. FSIS has incorporated past NACMCF recommendations regarding the control of *Salmonella* into guidelines and continues to work closely with subject matter experts from the advisory board to collaboratively improve food safety. NACMPI advises FSIS on matters affecting Federal inspection program activities, including policies that will contribute to USDA's regulatory development, and provides recommendations to the Secretary of Agriculture.

New Technology

To further enhance innovation, FSIS operates a new technology review process which facilitates the listing of interventions in FSIS Directive 7120.1 (www.fsis.usda.gov/7120.1.pdf), reviewing protocols for in-plant trials, and providing regulatory waivers, where appropriate, such that rulemaking can stay in step with technological advancements. The Agency is always considering ways to remove barriers to adoption of new technologies, such as an expedited approval process for new technology. This process can include establishing a testing pathway for new interventions and rapidly communicating with industry when new technologies have been approved for use. Any process must include a mechanism to verify the efficacy of new technologies, while still ensuring that establishments are meeting food safety standards.

FSIS also wants to encourage adoption of proven technologies such as low dose irradiation. Low dose irradiation is still one of the most promising interventions to reduce pathogens in raw product, extend shelf life, and improve the quality and safety of foods. National and international organizations and regulatory agencies have concluded that irradiated food is safe and wholesome. Yet irradiation has not been widely adopted by industry due to labeling requirements and consumer perceptions surrounding that labeling. FSIS is considering options for assessing the current consumer and industry climate around low dose irradiation with the potential to realize significant public health benefits.

Consumer Research

FSIS is working closely with Federal, State, and local public health partners to explore novel ways to educate consumers and conduct consumer research. Our consumer research uses observations with interviews, focus groups, and web surveys to investigate food safety behaviors. This multi-modal approach allows FSIS to capitalize on the strengths of each method and gain a broader understanding of consumer food safety behavior. Results from the research directly inform subsequent studies, policies, and development of effective food safety messaging that reduces consumers' exposure to foodborne pathogens.



About 400 participants are observed each year to understand how well they follow recommended food handling practices. Participants are randomly selected into control and treatment (intervention) groups; results from the control group are reported as a proxy for the public.

Key findings include:

Handwashing: Participants are failing to properly clean their hands up to 99 percent of the time.

- The most common reason for unsuccessful handwashing was not scrubbing hands with soap and water for at least 20 seconds.
- Other errors made by participants included not wetting their hands with water before applying soap and not drying their hands with a clean or one-use towel.
- Food Safety Message: Wash hands frequently, for at least 20 seconds with soap and running water, and dry using a clean towel.

Cross Contamination and Cleaning/Sanitizing: Unsafe food handling behaviors can lead to germs from raw meat and poultry being spread to other locations in the kitchen, including on ready-to-eat foods. If participants prepare food while cooking at home the same way they do during our research, many will serve meals that could potentially cause foodborne illness.

- When participants prepared turkey burgers, 48 percent of spice containers used during preparation were contaminated. About 5 percent of the side salads prepared were contaminated.
- Participants who washed or rinsed poultry contaminated the inner sink 60 percent of the time, and they contaminated the side salad they prepared 26 percent of the time.
- Food Safety Message: Keep bacteria away from ready-to-eat foods and other places in your kitchen by separating ready-to-eat foods from raw meat or poultry, and by immediately washing your hands after handling raw meat or poultry. Clean and sanitize any surfaces or utensils that may be contaminated by raw meat or poultry, including the sink.



COLLABORATION WITH PUBLIC HEALTH PARTNERS

FSIS collaborates with Federal and State public health partners, industry, consumers, and academia to advance food safety. Among these collaborations are the following.

- FSIS regularly participates in scientific meetings, conferences, and work groups to address *Salmonella* in regulated products.
- The Agency works closely with stakeholders to facilitate the implementation of innovative tools in establishments to prevent and control *Salmonella* in meat, poultry, and processed egg products.
- FSIS co-leads the Healthy People Food Safety Workgroup (health.gov/healthypeople), which develops a *Salmonella* reduction target for the United States every 10 years.
- The Interagency Food Safety Analytics Collaboration (IFSAC) (www.cdc.gov/foodsafety/ifsac/index.html) coordinates data and analyses between USDA, CDC, and FDA to improve and harmonize estimates of the sources of foodborne illness. Current projects include developing a method for food source attribution estimates using data from outbreaks of multiple-ingredient foods; evaluating use of WGS and case exposure data for food source attribution of *Salmonella* Enteritidis illnesses; and evaluating the National Health and Nutrition Examination Survey and case exposure ascertainment data for food source attribution of *Salmonella* Enteritidis illnesses. FSIS uses data products from this collaboration to develop *Salmonella* reduction performance standards.
- The Agency works closely with the Conference for Food Protection (CFP) (www.foodprotect.org/) to develop and implement recommendations for food safety issues in the Food Code.
 - In 2020, FSIS recommended that CFP create Food Code guidance for cooking rotisserie chicken products at retail to protect against *Salmonella* and other foodborne pathogens. We also recommended that CFP update the “CFP Guidance Document for the Production of Raw Ground Beef at Various Types of Retail Food Establishments,” (www.foodprotect.org/media/guide/CFP%20Beef%20Grinding%20Log%20Template%20Guidance%20Document%20-%208-8-2014.pdf) including referencing the grinding records regulation.
 - In 2018, following four *Salmonella* outbreaks associated with roaster pigs, FSIS recommended that the CFP develop guidance for retailers regarding the safe handling, preparing, and cooking of roaster pigs. Upon creation of a committee, FSIS has served as co-chair to participate in developing the guidance document.

- The Agency also currently chairs the Interagency Collaboration on Genomics for Food and Feed Safety and co-leads the biomarkers subgroup charged with identifying specific *Salmonella* genes related to virulence and pathogenicity; survival and adaptability; and resistance to biocides.
- FSIS has formed an interagency, cross-government working group to discuss the impact of preharvest pathogen presence on the safety of the final product.

Outbreak Investigations

FSIS works closely with public health partners, including the CDC; FDA; USDA's Animal and Plant Health Inspection Service (USDA APHIS), Agricultural Research Service (USDA ARS), and Agricultural Marketing Service (USDA AMS); and State and local departments of health, environmental health, and agriculture, to investigate and address strains of *Salmonella* responsible for foodborne outbreaks. The Agency collects and evaluates epidemiologic, laboratory, and traceback information to determine if there is an association between an FSIS-regulated product and human illnesses. If the evidence collected during an investigation identifies that an FSIS-regulated product is the likely source of illnesses, we can take actions to prevent additional illnesses, which may include requesting a voluntary recall of the product or issuing a public health alert to inform consumers.

Assessments of outbreaks associated with FSIS-regulated products are crucial to the Agency's mission to protect public health. FSIS conducts after-action reviews at the conclusion of foodborne outbreak investigations to identify lessons learned that can improve response and prevent future illnesses. Applying and sharing outbreak lessons learned can inform food safety research priorities, lead to improved food safety policies, strengthen collaborative investigations with public health partners, and improve transparency with the public. To view posted FSIS after-action review reports and examples of how we apply outbreak lessons learned toward illness prevention, visit Foodborne Outbreak Investigation Outcomes – Response and Prevention (www.fsis.usda.gov/OutbreakOutcomes).

Recall listings are an important consumer and media resource to prevent foodborne illness. FSIS maintains a list of recalled meat and poultry products on its website, including current recalls (www.fsis.usda.gov/currentrecalls) and archived recalls (www.fsis.usda.gov/archiverecalls) from previous years.



Stakeholders can register (service.govdelivery.com/accounts/USFSIS/subscriber/new) to receive email notifications when recalls or public health alerts are issued. Retail distribution lists are provided for all Class I recalls with retail sales. A Class I recall presents a health hazard situation where there is a reasonable probability that the use of the product will cause serious, adverse health consequences or death. FSIS also publishes an annual recall summary (www.fsis.usda.gov/recalls/summaries). In 2019, there were three recalls due to *Salmonella* that affected a total of 118,830 pounds of product.

International Engagement

The Agency engages with international partners to share information about FSIS regulatory requirements and to exchange best practices and technological advances for modernizing existing food safety inspection systems. FSIS is an active participant in the U.S. Codex Office, an interagency partnership that engages stakeholders in the development and advancement of science-based food standards for the benefit of the U.S. and the worldwide community. The U.S. Codex follows international risk assessment principles to give scientific rigor when making standards, office guidelines, and recommendations.

FSIS ensures that meat, poultry, and egg products imported to the United States are produced under standards equivalent to the U.S. inspection system and facilitates the certification of exported goods. We use a science-based equivalence program to ensure the safety of imported meat, poultry, and processed egg products. FSIS evaluates and verifies ongoing equivalence through annual reviews of foreign countries' food safety systems, onsite food regulatory system verification audits at least once every three years, and through point-of-entry reinspection for imported products, including visual inspection and microbiological and chemical laboratory analysis.



LOOKING FORWARD

In the face of a public health imperative, FSIS is committed to foster specific activities in 2020 that address *Salmonella* and other pathogens. Future activities might include:

- Removing barriers to the implementation of new technologies. We are considering protocols for in-plant testing of new technologies for the benefit of reducing *Salmonella*.
- Encouraging the implementation of low dose e-beam irradiation in meat and poultry processing environments coupled with consumer education of this technology.
- Implementing a research fellow program to raise up the next generation of FSIS employees from current graduate students who work in a field related to FSIS research priorities.
- Strengthening our recruiting program for veterinarians to grow our corps of public health veterinarians.
- Examining and considering semi-quantitative methods for *Salmonella* enumeration to inform future risk assessments.
- Supporting the development of modernized beef inspection systems in slaughter facilities across the Nation.
- Enhancing Federal inspection support for small and very small establishments.
- Developing a new consumer education program to identify consumer challenges and intervening to impart behavior change.

FSIS is committed to aggressively target *Salmonella* and other foodborne pathogens through the strategies and initiatives described in this roadmap. These activities will be reinforced through the development of our fiscal year 2022–2026 strategic plan and subsequent annual plans that align with and support the Agency’s strategic goals. Progress will be measured based on desired outcomes and how well FSIS meets targets and performance indicators for each associated objective. These metrics promote Agency accountability and ensure a continued focus on outcome-driven public health impacts. FSIS is looking forward to working with our food safety partners and stakeholders to continue to address *Salmonella* in meat, poultry, and processed egg products, and innovate new ways to ensure safe food for consumers.

