

## LFFM Year 3 Microbiology Surveillance Outcomes

The [Laboratory Flexible Funding Model](#) (LFFM) is a cooperative agreement intended to enhance the capacity and capabilities of state human and animal food testing laboratories in support of an integrated food safety system.

LFFM activities are organized into distinct project areas, called [tracks](#), some of which involve surveillance of human and animal foods for microbiological and chemical hazards (e.g., testing enoki mushrooms for *L. monocytogenes*, or pet foods for *Salmonella*). This document summarizes accomplishments for the Microbiology Human and Animal Food (M-HAF) Product Testing Tracks from 31 state laboratories between July 1, 2022, and June 30, 2023 (year three of the five-year LFFM cooperative agreement).

### How many samples were collected and analyzed?

A total of 11,115 samples were collected and a total of 14,677 analyses were performed in the M-HAF Product Testing Tracks for LFFM Year 3. This represents 115% of the planned capacity for the M-HAF Tracks in Year 3 (12,700 analyses).

Testing Area	Total Number of Samples Collected and Analyzed
Human Food	8,406
Animal Food	1,785
NARMS <sup>1</sup>	924

### Who collected the samples?

Samples are collected for a variety of reasons, including, but not limited to a state-proposed sample plan, emergency response and outbreak situations, or an FDA assignment. Most samples are collected and analyzed by state agencies, but samples may also be collected by other organizations (e.g., the FDA or a third party under contract) and submitted to LFFM laboratories for analysis. Two (2) laboratories participated in an FDA Imports Assignment, which ran from January to June 2023.

Collecting Organization	Human Food	Animal Food	NARMS
State Laboratory	1,918 (22%)	119 (7%)	924 (100%)
State Regulatory Program	6,442 (77%)	1,666 (93%)	--
FDA	46 (1%)	--	--

Collection Location (Facility Type)	Human Food	Animal Food	NARMS
Retailer	8,047 (96%)	1,173 (66%)	924 (100%)
Distributor, Manufacturer or Grower	313 (4%)	612 (34%)	--
Importer (Port of Entry)	46 (1%)	--	--

### What pathogens were the samples analyzed for?

Analytical results for human and animal food samples, excluding NARMS, were reported for *Salmonella*, *Listeria monocytogenes*, *E. coli* O157:H7 and other STECs, and prohibited materials (i.e., mammalian protein in foods for ruminant animals, BSE). Some samples were analyzed for more than one pathogen.

Pathogen of Interest	Total Number of Samples Analyzed	Total Confirmed Positive
<i>Salmonella</i> species	7,819	26
<i>Listeria monocytogenes</i>	4,200	15
Shiga-toxin producing <i>Escherichia coli</i> (STEC)	989	0

<sup>1</sup> National Antimicrobial Monitoring System (NARMS)

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Pathogen of Interest	Total Number of Samples Analyzed	Total Confirmed Positive
Prohibited materials <sup>2</sup>	257	0

Of the 41 confirmed *Salmonella* and *L. monocytogenes* positive samples, isolates from all 41 samples were sequenced and submitted to the National Center for Biotechnology Information. LFFM’s Whole Genome Sequencing track supports state laboratory participation in [GenomeTrakr](#).

Year 3 marked the first year that LFFM supported retail raw meat testing in support of the National Antimicrobial Resistance Monitoring System (NARMS). A total of 924 samples of raw ground pork and ground beef were analyzed for *Salmonella* and *Campylobacter*. NARMS maintains and publishes data reports on its [website](#), including data from LFFM samples.

### What human and animal food products were tested and what were the findings?

LFFM sampling is planned by food product (commodity), along with the pathogens (hazards) the food product will be analyzed for (referred to as “commodity-hazard pairs”). Commodity-hazard pairs may be proposed by FDA or the state; sampling plans are developed as a collaborative effort between FDA and state agencies. States may pivot planned sampling to address emerging and urgent needs such as outbreaks and other emergency response situations and may add additional pathogens at their discretion. Multiple laboratories may participate in any given commodity-hazard pair, and it is common for a single physical sample to be analyzed for more than one pathogen. The below tables are sorted by pathogen, followed by total number of samples positive per commodity.

### Animal Food Commodity-Hazard Pairs

Commodity	Hazard	Total # Samples Analyzed	Total # of Samples Positive
Extruded Cat Food (Kibble)	<i>E. coli</i> O157:H7	159	0 (0%)
Extruded Dog Food (Kibble)	<i>E. coli</i> O157:H7	151	0 (0%)
Dog and/or Cat Treats (Biscuits Only)	<i>E. coli</i> O157:H7	110	0 (0%)
Ruminant Food + Ingredients	<i>E. coli</i> O157:H7	1	0 (0%)
Ruminant Food + Ingredients	Prohibited materials (mammalian protein)	257	0 (0%)
Swine Food	<i>Salmonella</i>	217	5 (2%)
Peanut Meal	<i>Salmonella</i>	15	4 (27%)
Fish Meal	<i>Salmonella</i>	31	4 (13%)
Poultry Food	<i>Salmonella</i>	401	3 (1%)
Soybean Meal	<i>Salmonella</i>	51	2 (4%)
Distillers Products, AAFCO OP section 27	<i>Salmonella</i>	17	1 (1%)
Soybean Products, AAFCO OP section 84	<i>Salmonella</i>	15	1 (1%)
Extruded Cat Food (Kibble)	<i>Salmonella</i>	268	1 (<1%)
Extruded Dog Food (Kibble)	<i>Salmonella</i>	259	0 (0%)
Dog and/or Cat Treats (Biscuits Only)	<i>Salmonella</i>	209	0 (0%)
Wheat	<i>Salmonella</i>	38	0 (0%)

<sup>2</sup> Prohibited materials testing involves detection of prohibited mammalian protein in foods for ruminant animals, as addressed by 21 CFR Part 589.2000 and 589.2001. Some mammalian proteins, such as milk, are allowed to be fed to ruminants, and positive samples are typically followed-up by investigation into what triggered the initial result and whether the sample is truly violative. In LFFM Year 3 we did not identify any violative samples.

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### Human Food Commodity-Hazard Pairs

Commodity	Hazard	Total # Samples Analyzed	Total # of Samples Positive
Enoki mushrooms	<i>Listeria monocytogenes</i>	199	11 (6%)
Fish, smoked	<i>Listeria monocytogenes</i>	804	2 (<1%)
Queso Fresco-Type Soft Cheese	<i>Listeria monocytogenes</i>	1758	1 (<1%)
Controlled environment agriculture leafy greens	<i>Listeria monocytogenes</i>	558	1 (<1%)
Dried Mushrooms	<i>Listeria monocytogenes</i>	483	0 (0%)
Soft-Serve Ice Cream/Yogurt mixes	<i>Listeria monocytogenes</i>	328	0 (0%)
Ready-to-eat refrigerated dips	<i>Listeria monocytogenes</i>	34	0 (0%)
Raw Milk Cheese	<i>Listeria monocytogenes</i>	25	0 (0%)
Tahini or Sesame Paste	<i>Listeria monocytogenes</i>	4	0 (0%)
Granola	<i>Listeria monocytogenes</i>	3	0 (0%)
Partially sprouted seed and nut products	<i>Listeria monocytogenes</i>	2	0 (0%)
Cashews, Raw	<i>Listeria monocytogenes</i>	1	0 (0%)
Tree nut-based cheese alternatives (e.g., cashew "cheese")	<i>Listeria monocytogenes</i>	1	0 (0%)
Dried Mushrooms	<i>Salmonella spp.</i>	486	3 (1%)
Tahini or Sesame Paste	<i>Salmonella spp.</i>	873	1 (<1%)
Partially sprouted seed and nut products	<i>Salmonella spp.</i>	545	1 (<1%)
Cashews, Raw	<i>Salmonella spp.</i>	995	0 (0%)
Granola	<i>Salmonella spp.</i>	951	0 (0%)
Fish, smoked	<i>Salmonella spp.</i>	800	0 (0%)
Tree nut-based cheese alternatives (e.g., cashew "cheese")	<i>Salmonella spp.</i>	648	0 (0%)
Controlled environment agriculture leafy greens	<i>Salmonella spp.</i>	558	0 (0%)
Queso Fresco-Type Soft Cheese	<i>Salmonella spp.</i>	137	0 (0%)
Cut and whole cantaloupe & watermelon	<i>Salmonella spp.</i>	109	0 (0%)
Onion (raw, whole)	<i>Salmonella spp.</i>	68	0 (0%)
Soft-Serve Ice Cream/Yogurt mixes	<i>Salmonella spp.</i>	50	0 (0%)
Ready-to-eat refrigerated dips	<i>Salmonella spp.</i>	40	0 (0%)
Raw Milk Cheese	<i>Salmonella spp.</i>	25	0 (0%)
Other (miscellaneous)	<i>Salmonella spp.</i>	7	0 (0%)
Enoki mushrooms	<i>Salmonella spp.</i>	6	0 (0%)
Controlled environment agriculture leafy greens	Shiga-toxin producing <i>Escherichia coli</i> (STEC)	558	0 (0%)
Other (miscellaneous)	Shiga-toxin producing <i>Escherichia coli</i> (STEC)	6	0 (0%)
Queso Fresco-Type Soft Cheese	Shiga-toxin producing <i>Escherichia coli</i> (STEC)	3	0 (0%)
Partially sprouted seed and nut products	Shiga-toxin producing <i>Escherichia coli</i> (STEC)	1	0 (0%)

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### What public health interventions resulted from positive samples?

This table lists public recalls and consumer advisories that resulted from LFFM positive samples in Year 3. Follow-up investigation activities are conducted for all positive samples, regardless of whether a recall occurred. Not all positive samples are violative or result in a recall. Follow-up investigation activities include notifying the responsible firm, discussing preventive measures and corrective actions with the firm, document collection/traceback, collecting additional samples, adding firms to import alert, and/or conducting an investigation at the facility.

Type of Notice	Link	Commodity	Hazard
Recall	<a href="#">Tai Phat Wholesalers, LLC Recalls “Three Coins Dried Mushrooms” Because of Possible Health Risk   FDA</a>	Dried mushrooms	<i>Salmonella</i>
Recall	<a href="#">Recall Press Release: TW4115 Black Fungus (Nam Meo)   FDA</a>	Dried mushrooms	<i>Salmonella</i>
FDA consumer advisory	<a href="#">FDA Advises Restaurants and Retailers Not to Serve or Sell and Consumers Not to Eat Product Labeled as Sun Hong Foods, Inc. Enoki Mushrooms Sourced from China Due to Possible Listeria Contamination   FDA</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
FDA country-wide import alert	<a href="#">FDA Expands Country-Wide Import Alert for Enoki Mushrooms to China   FDA (based on LFFM, FDA, and other state samples)</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
FDA outbreak advisory	<a href="#">Outbreak Investigation of Listeria monocytogenes: Enoki Mushrooms (November 2022)   FDA (includes LFFM samples from Maryland and Missouri)</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
Recall	<a href="#">Utopia Foods Recalls “Enoki Mushrooms” Because of Possible Health Risk   FDA</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
Recall	<a href="#">Xin Ao International Group Corp. Recalls “Sss Enoki Mushroom” &amp; “K-Fresh Mushroom” Because of Potential Health Risk   FDA</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
Recall	<a href="#">Jan Fruits Inc. Recalls Enoki Mushrooms Because of Possible Health Risk   FDA</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
State partner consumer advisory	<a href="#">Maryland Department of Health issues consumer advisory for Enoki Mushrooms</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
State partner consumer advisory	<a href="#">News Releases from Department of Health   Recalled enoki mushrooms sold in Hawai’i associated with potential Listeria contamination (hawaii.gov)</a>	Enoki mushrooms	<i>Listeria monocytogenes</i>
Recall	<a href="#">TFP Nutrition Initiated Voluntary Recall of 16 lb. Bags of HEB TEXAS PETS Indoor Complete Dry Cat Food Because of Possible Salmonella Health Risk   FDA</a>	Kibbled cat food	<i>Salmonella</i>
Recall	<a href="#">Revolution Farms Announces the Voluntary Recall of Lettuce Because of Possible Health Risk   FDA</a>	Lettuce (Controlled Environment Agriculture)	<i>Listeria monocytogenes</i>
Recall	<a href="#">Seven Seas International USA, LLC Voluntarily Recalls Giant Food Private Label Wild Caught Alaskan Sockeye Smoked Salmon Because of Possible Health Risk   FDA</a>	Smoked salmon	<i>Listeria monocytogenes</i>
Recall	<a href="#">Seven Seas International USA, LLC is Voluntarily Recalling Biltmore Smoked Sockeye Salmon Because of Possible Health Risk   FDA</a>	Smoked salmon	<i>Listeria monocytogenes</i>
Recall	<a href="https://www.accessdata.fda.gov/scripts/ires/?Event=92319">https://www.accessdata.fda.gov/scripts/ires/?Event=92319</a>	Sprouted seed/nut butter	<i>Salmonella</i>

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Type of Notice	Link	Commodity	Hazard
Recall	<a href="#">Rushdi Foods Issues a Voluntary Recall on One Lot of Their Mighty Sesame Organic Tahini 10.9 oz Squeeze Bottle   FDA</a>	Tahini	<i>Salmonella</i>

### Case study: LFFM surveillance of enoki mushrooms for *Listeria monocytogenes*

FDA has a [prevention strategy](#) for imported enoki and wood ear mushrooms, which have been implicated as the source of multiple multi-state *Listeria monocytogenes* outbreaks. LFFM surveillance sampling supports this prevention strategy. LFFM enoki surveillance in Year 3 was concurrent with a multi-state outbreak of Listeriosis linked to enokis. Three LFFM samples identified the outbreak strains in product and aided the traceback investigation to identify the source of the outbreak.

An LFFM sample of enoki mushrooms collected by Missouri Department of Health and Senior Services in late November was positive for *L. monocytogenes*. The sample resulted in an FDA-issued [safety alert](#) on December 17, 2022. At that time, the product was not linked to the active outbreak investigation. Whole genome sequencing subsequently revealed that the strain of *Listeria* found in the sample matched one of the two strains linked to illnesses in a [multi-state \*Listeria\* outbreak](#). In early January 2023, Maryland Department of Health identified *L. monocytogenes* in two LFFM samples of enoki mushrooms with the same labelling as the Missouri sample. Whole genome sequencing revealed that both outbreak strains were present in the Maryland samples. These samples brought to light a distribution chain related to the ongoing outbreak, but not covered by the 12/13/22 or 1/13/23 Utopia Foods recalls. While neither Maryland nor Missouri had cases in the outbreak, their positive product samples helped confirm the traceback investigation and source associated with the outbreak. This case study demonstrates how surveillance sampling can support outbreak investigations.