REPORT OF THE COMMITTEE ON SALMONELLA

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Vice Chair: Richard Sellers, VA

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The Committee met on October 23, 2012 at the Greensboro Sheraton Hotel, Greensboro, North Carolina, from 8:00 a.m. – 12:00 p.m. There were at least 14 members and 28 guests present. After the Chair opened the meeting and welcomed the attendees, he reminded those present to sign the attendance sheets and if a member to check to see that their contact information was correct and if they were not members to indicate if they would like to become a member of the committee. The Chair briefly overviewed the requirements of becoming a member and that only members could propose resolutions, recommendations and vote. However, everyone was encouraged to participate in the discussion.

Salmonella in Unpasteurized Dairy Products

Stacey Bosch
Division of Foodborne, Waterborne, and Environmental Diseases, US Centers for Disease Control and Prevention (CDC),]

In 1987 the Food and Drug Administration (FDA) banned interstate sale of unpasteurized dairy products, however the intrastate sale is regulated by states. From 1993 – 2006 25 states permitted the sale of unpasteurized dairy products. There have been many attempts to circumvent these regulations.

From 1993 – 2006 there were 121 dairy product outbreaks involving 4,413 cases, 232 hospitalizations and three deaths. These can be divided into unpasteurized and pasteurized outbreaks. Of the total, 73 were unpasteurized consisting of 1,571 cases, 202 hospitalizations and two deaths, compared to 48 pasteurized involving 2,842 cases, 37 hospitalizations, and one death. The top three etiologies of unpasteurized dairy products were 54% due to *Campylobacter*, 22% due to *Salmonella*, and 13% due to Shiga Toxin-Producing *Escherichia coli* (STEC).

One example of outbreak due unpasteurized dairly products was due to *Salmonella newport* in Utah in 2009. Seventy-nine illnesses were linked to consuming a soft Mexican-style cheese called queso fresco. The proponents of raw milk say that it produces a creamier cheese than if pasteurized. It is legal to sell raw milk in Utah, but dairies and sellers must have a permit. The cheese was made by a home-based manufacturing business that did not have a license from raw milk from an unlicensed dairy. The cheese was sold to a local restaurant/deli that sold it to the public. The cheese was made in unsanitary conditions.

Other examples were the *Salmonella typhimurium* outbreak in Pennsylvania in 2007 due to raw milk and unpasteurized cheese that resulted in 15 illnesses and the multidrug resistant *Salmonella newport* outbreak in Illinois in 2006-2007 sickened 85 people.

Update: Outbreaks of Human Salmonella Infections linked to Live Poultry from Mail-Order Hatcheries

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A network of more than 85 public health and regulatory laboratories isolate and identify *Salmonella*. These isolates are molecular subtyped using pulse field gel electrophoresis (PFGE) to produce DNA fingerprints. These fingerprints are monitored by PulseNet USA looking for clusters which would signal a possible outbreak. The Centers for Disease Control and Prevention (CDC) investigate these potential outbreaks using questionnaires and interviews.

In the United States there is an increasing interest in people owning poultry, whether as pets, a hobby, for eggs or for meat. This is not restricted to rural areas, but fully includes urban homes where the term “urban chickens” have been adopted. There are about 20 mail-order hatcheries that supply the baby chicks. Over 50 million chicks are sold annually and may be purchased from catalogs, the internet or feed stores. Millions of these chicks are shipped through the mail.

Since 1990 there have been 42 *Salmonella* outbreaks associated with live poultry consisting of 1,340 illnesses, 129 hospitalizations and three deaths. More recent outbreaks include:

Salmonella montevideo outbreak strain A (2005-2011)	source: Hatchery A	316 cases
Salmonella montevideo outbreak strain B (2007-2010)	source: Hatchery B	370 cases
Salmonella johannesburg (2009)	source: Hatchery C	
Salmonella thompson (2009)	source: Hatchery D	
Salmonella typhimurium (2009-2010)	source: Hatchery C	62 cases
Salmonella altona and *johannesburg* (2011)	source: Hatchery C	68 and 28 cases, respectively
Salmonella hadar (2011)		
Salmonella berta (2011)		
Salmonella lille, Infantis, and *newport* (2012)	source: Hatchery C	175 cases
Salmonella montevideo (2012)	source: Hatchery D	87 cases
Salmonella hadar (2012)	source: Hatchery E	44 cases

Some hatcheries, especially Hatchery C, have been implicated in multiple outbreaks. Typically the mean age of patients is very young due to young children playing or even kissing the chicks. Often these chicks are kept indoors.

The resolution of these outbreaks is complicated by the production practices of these hatcheries. There are multiple source flocks that produce the eggs for hatching. In addition drop shipping, which is another hatchery supplying chicks under the original hatchery's name, and trans shipping, which is another hatchery delivering chicks to a hatchery that then ships them out under their name, all make it difficult to determine the sources of contamination.

Efforts to reduce these outbreaks have taken two routes. First, through the efforts of the National Poultry Improvement Plan (NPIP) and veterinary consultants the hatcheries have instituted various intervention strategies in their hatchery and their source flocks, such as biosecurity, rodent and pest control, hatching egg disinfection, the use of autogenous vaccines and routine monitoring, to reduce the level of *Salmonella*. Second, the NPIP and CDC have worked together to produce literature and brochures to educate the hatcheries, the feed stores, petting zoos, and especially the consumers of the risk of *Salmonella* in baby poultry.

NVSL Salmonella Update

Kristina Lantz
Diagnostic Bacteriology Laboratory – Bacterial Identification, National Veterinary Service Laboratory (USDA, APHIS, NVSL), Ames, Iowa

***Salmonella* serotypes isolated from animals in the United States: January 1 - December 31, 2011**

M.M. Erdman, K. Lantz, B.R. Morningstar-Shaw, D.A. Barker, T.A. Mackie, M.I. Munoz, E.A. Palmer, L.K. Cox
Diagnostic Bacteriology Laboratory, National Veterinary Services Laboratories (NVSL), USDA

The Diagnostic Bacteriology Laboratory within the National Veterinary Services Laboratories (NVSL) routinely serotype *Salmonella* isolates submitted by private, state, and federal laboratories as well as veterinarians, researchers and other animal health officials. Most submissions were from diagnostic laboratories across the US, and although only counted as a single submitter, these laboratories typically submitted *Salmonella* isolates from a variety of sources, herds, or flocks. This report summarizes *Salmonella* serotyping submissions to NVSL from January 1 through December 31, 2011. The *Salmonella* isolates are identified as clinical (clinical signs of salmonellosis from primary or secondary infection) or non-clinical (herd and flock monitoring programs, environmental sources, food). Serotyping data from isolates submitted for research purposes are not included in the source specific summaries. Based on information provided by the submitter the isolates were divided into animal source categories for analysis. The animal sources include Avian (avian of unknown origin, condor, crow, finch, hawk, goose, sparrow, partridge, parrot, parakeet, pheasant, pigeon quail, duck, and owl), Cattle, Chicken, Dog/Cat, Horse (horse, donkey, mule), Other Domestic (alpaca, ferret, goat, sheep, guinea pig, llama, mink), Pigs, Reptiles/Amphibians (iguana, lizard, reptile, snake, turtle, tortoise, amphibian, frog, alligator, crocodile), Turkey, Wild/Zoo (antelope, deer, fish, marine mammals, opossum, rabbit, raccoon, rodent, camel, monkey, lemur, tiger, zebra, rhinoceros, wallaby, cervid, cheetah, coyote, gazelle, jaguar, leopard, lion, warthog), and Other (environment, unknown).

Salmonella serotyping at the NVSL is an ISO 17025 accredited test. Sera used for typing *Salmonella* isolates consists of polyvalent sera against the O serogroups and single factor sera against the individual O and H antigens. Approximately 50% of the sera used at the NVSL is produced in house as previously described (Ewing), and the rest is purchased from commercial vendors. All sera are subjected to quality control testing prior to use. *Salmonella* antigenic formulae are determined essentially as previously described (Ewing) and interpreted via the White-Kauffmann-Le Minor scheme (Grimont). The subspecies designation precedes the antigenic formula for those serotypes other than subspecies I. Those serotypes previously reported as "Arizona" are now listed with "III" (both monophasic and diphasic) followed by the antigenic formula. Those serotypes belonging to subspecies II or IV that had been previously named are now listed with their antigenic formula preceded by II or IV.

In 2011 there were 15,977 submissions for *Salmonella* serotyping originating from 40 different states and DC. Of these, 770 were identified as not *Salmonella*, contaminated, or mixed culture and were not further tested. The remaining 15,207 *Salmonella* isolates were divided into clinical isolates (6,589), non-clinical isolates (6,810), and research isolates (1,808). *Salmonella* rule-out isolates are included in the clinical and non-clinical counts. The sources of clinical and non-clinical *Salmonella* isolates are shown in Table 1. There were 289 different serotypes identified in 2011. Table 2 lists the ten most common serotypes when all animal sources were combined. The most common isolates from chickens, turkeys, cattle, pigs, horses, and dog/cat are listed in Tables 3-8.

The NVSL provided a *Salmonella* Group D proficiency test in order for laboratories to assess their ability to isolate *Salmonella* from environmental samples and determine the serogroup (specifically group D) of any *Salmonella* isolated. The samples consisted of drag swabs spiked with *Salmonella* and/or common contaminants. The 2012 test included *Salmonella* serotypes *Enteritidis, Berta, Heidelberg*, 9,12: non-motile, *Montevideo, Senftenburg*, *Escherichia coli*, *Citrobacter freundii*, *Pseudomonas aeruginosa*, and *Proteus mirabilis*. The test consisted of seven samples which were shipped to laboratories overnight on ice packs. Laboratories were instructed to use whatever protocol they choose and to report the results within three weeks. The NVSL randomly retained 7% of the test kits and tested them blindly for quality assurance (QA) purposes. For the first time, a significant number of laboratories chose to use a screening test specific for Group D *Salmonella*. As a result, the grading method was changed to grade only based on the correct identification of the samples as Group D positive or negative. The results of the proficiency test are shown in Table 9.

The NVSL provided a *Salmonella* serotyping proficiency test in order for laboratories to assess their ability to serogroup or serotype *Salmonella* isolates. The samples consisted of ten pure *Salmonella* cultures which included *Salmonella* serotypes *Heidelberg*, 4,[5],12:i:-, *Ouakam, Schwarzengrund, Oranienburg, Senftenberg, Dublin, Enteritidis, Newport, and Infantis*. Participants were given the option to perform serogrouping, partial serotyping, or full serotyping of the isolates and were graded based on the appropriate identification to the level of typing they performed. The NVSL randomly retained 18% of the test kits and tested them blindly for QA purposes. The results of the proficiency test are shown in Table 10.

Table 1: Sources of submissions to the NVSL for *Salmonella* serotyping in 2011

Source	No. Clinical Submissions	No. Non-Clinical Submissions	Total
Avian	91	11	102
Cattle	1475	21	1496
Chicken	244	3696	3940
Dog/Cat	96	21	117
Horse	470	11	481
Other	131	607	738
Other Domestic	66	2	68
Reptile/Amphibian	80	9	89
Swine	1876	1299	3175
Turkey	226	1106	1332
Wild/Zoo	97	27	124
Total	**4892**	**6810**	**11702**

Table 2: Most common serotypes in 2011: All sources

Clinical		Non-Clinical	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Typhimurium var 5-	595	Enteritidis	694
Typhimurium	359	Kentucky	668
Dublin	323	Senftenberg	458

Cerro	283	Heidelberg	406
Agona	272	Derby	350
Derby	218	Mbandaka	299
Newport	213	Anatum	194
Infantis	194	Typhimurium var 5-	178
Enteritidis	186	Typhimurium	175
Montevideo	173	Infantis	164
All others	2036	All others	3224
Total	**4852**	**Total**	**6810**

Table 3: Most common serotypes in 2011: Chickens

Clinical		**Non-Clinical**	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Enteritidis	127	Enteritidis	649
Kentucky	40	Kentucky	586
Typhimurium	13	Senftenberg	316
Rough O: g,m:-	10	Mbandaka	236
Infantis	8	Heidelberg	233
All others	46	Tennessee	106
		Typhimurium	105
		Schwarzengrund	79
		Newport	61
		Braenderup	57
		All others	1268
Total	**244**	**Total**	**3696**

Table 4: Most common serotypes in 2011: Turkeys

Clinical		Non-Clinical	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Senftenberg	37	Hadar	142
Albany	34	Heidelberg	123
Ouakam	30	Saintpaul	102
Heidelberg	23	Senftenberg	89
Montevideo	13	Muenster	80
All others	89	Orion	60
		Berta	54
		Kentucky	45
		Albany	43
		Ouakam	38
		All others	330
Total	**226**	**Total**	**1106**

Table 5: Most common serotypes in 2011: Cattle

All Sources	
Serotype	**No. Isolates**
Dublin	319
Cerro	267
Montevideo	127
Typhimurium	114
Newport	88
Typhimurium var 5-	83
Kentucky	46
4,5,12:i:-	39
Agona	35
Heidelberg	35
All others	343
Total	**1496**

Table 6: Most common serotypes in 2011: Pigs

Clinical		Non-Clinical	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Typhimurium var 5-	450	Derby	339
Derby	210	Typhimurium var 5-	124
Agona	206	Infantis	96
Typhimurium	148	Agona	89
Infantis	99	Anatum	88

Heidelberg	95	London	53
Worthington	54	Johannesburg	47
Senftenberg	53	Heidelberg	40
Anatum	50	Ohio	29
Johannesburg	44	Senftenberg	29
All others	467	All others	365
Total	**1876**	**Total**	**1299**

Table 7: Most common serotypes in 2011: Horses

All Sources	
Serotype	**No. Isolates**
Newport	72
Infantis	59
Javiana	32
Norwich	31
Typhimurium	27
Anatum	26
4,5,12:i:-	22
Braenderup	20
Typhimurium var 5-	17
4,12:i:-	13
All others	162
Total	**481**

Table 8: Most common serotypes in 2011: Dogs and Cats

All Sources	
Serovar	**No. Isolates**
Typhimurium	23
Senftenberg	14
Muenchen	10
Newport	10
Javiana	5
All others	55
Total	**117**

Table 9: Summary of NVSL *Salmonella* Group D proficiency test

	2009	**2010**	**2011**	**2012**
Participants	40	55	70	73
Mean Score	93%	92%	97%	92%
Score Range	100-44%	100-44%	100-85%	100%-29%
Below Passing	4	3	0	N/A*

Because of the change in grading method, a pass/fail designation was not assigned. Seven participants scored less than 80%.

Table 10: Summary of NVSL *Salmonella* Serotyping proficiency test

	Serogrouping 2012	Serotyping 2012
Participants	22	13
Mean Score	98%	92%
Score Range	100%-90%	100-70%

Ewing, WH. 1986. Edward and Ewing's Identification of Enterobacteriaceae. 4th edition. Elsevier Science Publishing Co., Inc., New York, U.S.
Grimont, PAD, Weill, FX. 2007. Antigenic Formulae of the *Salmonella* Serovars. 9th edition. WHO Collaborating Centre for Reference and Research on *Salmonella*. Paris, France.

Salmonella in Animal Feed

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Division of Animal Feeds, Office of Surveillance and Compliance, Center of Veterinary Medicine (CVM), Food and Drug Administration (FDA)

The Draft Compliance Policy Guide (CPG) Section 690.800 Salmonella in Food for Animals was published August 2, 2010 and is still circulating within FDA. There is no date set for the final CPG document. The CPG represents FDA's current thinking and contains nonbinding recommendations. It consists of two parts: pet food and animal feed. For pet foods, such as dog and cat food, aquarium fish food, raw meat formulations for pets, pet treats or chews, and nutritional supplements, if any *Salmonella* serotype is isolated (and there is no further kill step) the food is considered adulterated and FDA will act accordingly based on 402(a)(1) of the Food, Drug, and Cosmetic (FD&C) Act. For animal feed the focus is on *Salmonella* serotypes that are pathogenic to the animals receiving the feed. Therefore action is taken by FDA on animal feed only if the following serotypes are found:

- Poultry feed: pullorum, gallinarum, or enteritidis
- Swine feed: choleraesuis
- Sheep feed: abortusovis
- Horse feed: abortusequi
- Dairy and Beef feed: newport or dublin

FDA released a Salmonella Assignment for Poultry Feed for 2012. The intent was to collect and culture 100 feed samples and determine the *Salmonella* serotypes present. The assignment is not complete, but to date 33 samples of layer feed, 25 samples of broiler feed, and 17 samples of turkey feed have been sampled resulting in 18%, 28%, and 24% positive for *Salmonella*, respectively. Previous surveillance data for 2002-2009 was published by Li in Foodborne Pathogens and Disease Volume 9 No. 8, 2012.

Companion Animal and Big Cat Salmonellosis – Current Issues: Diets and Associated Problems

Patrick McDonough
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A literature search of salmonellosis in dogs and cats shows an increasing number of citations that are relating to their food or diets. Normally dogs and cats are naturally resistant to *Salmonella*; however, stress, immunological suppression, or antibiotic therapy may reduce their resistance and result in infection and even death.

An analysis of five vet hospital outbreaks in cats pointed to several risk factors: hospitalization, antimicrobial therapy, FPLV and or FeLV status, and diet (ex. raw meat). The outbreaks usually involve veterinary hospitals and include related human cases. Dog outbreaks have been linked to dog treats and peanut butter, pig ear treats, raw meat, and dog jerky treats. The significance of these infections is not solely an animal problem, but usually more significantly the shedding of *Salmonella* by these animals is a source of infection to humans, often the young and old who are the most susceptible.

FSIS Office of Field Operations Salmonella Perspective

Daniel Engeljohn
Office of Field Operations, Food Safety Inspection Service (FSIS), USDA

The FSIS is "responsible for ensuring that the nation's commercial supply of meat, poultry, and processed egg products is safe, wholesome, and correctly labeled and packaged". In 1997 the baseline case rate for *Salmonella* infections was 13.6/100,000 population. This rate actually increased to 17.6/100,000 in 2010. The targeted 2020 rate is 11.4/100,000 population. Even though the *Salmonella* case rate has not decreased, FSIS is finding decreases in the percentage of *Salmonella* positive samples in the processing plants. For example, the baseline prevalence rate for *Salmonella* in young chickens was 20%, but young chickens were only 6.5% *Salmonella* positive in 2011 (Data from FSIS 2011 Progress Report on Salmonella and Campylobacter Testing of Raw Meat and Poultry Products, 1998-2011).

There was a question concerning the ground turkey recall due to *Salmonella*. FSIS declared the product to be adulterated due to unsanitary conditions in the plant (i.e. failure of Hazard Analysis Critical Control Point (HACCP) to address contamination). Also a question was asked about when the new standard for chicken part would be coming out. Dr. Engeljohn said that it would probably be printed in the Federal Register early in 2013 and be open for comment.

Clarification on FDA's View of Salmonella Heidelberg in Commercial Layer Flocks

Jerry Ramirez

Center for Food Safety and Applied Nutrition (CFSAN), FDA

A conference call was set up between the Committee and Dr. Ramirez, a spokesman for the Food and Drug Administration (FDA) Egg Rule. There is a substantial confusion within the poultry industry over FDA's recent response to the presence of *Salmonella heidelberg* in commercial layer flocks. The following points were summarized from an earlier conversation the Chair had with Dr. John Sheehan and from this call:

S. heidelberg (SH) can be vertically transmitted in a similar fashion to *S. enteritidis* (SE) and thus could potentially result in contamination of eggs resulting in egg-associated Salmonellosis. The evidence for this possibility includes scientific papers that document the ability of SH to colonize or infect the reproductive system of chickens and to be deposited into the egg (several papers by Gast, *et al*.). There are other scientific papers that describe foodborne outbreaks due to SH, for example:

1. Hennessy, *et al*., 2004 – Egg consumption is the principle risk factor for sporadic *Salmonella* serotype *heidelberg* infections: a case control study in FoodNet sites
2. Chittick, *et al*., 2006 – A summary of national reports of foodborne outbreaks of *Salmonella heidelberg* infections in the United States: clues for disease prevention

Because of the potential for egg-borne transmission, the presence of SH in the environment of the layer house may pose a public health threat. If FDA identifies or becomes aware of the presence of SH in the environment of layer houses, FDA may consider this a violation of section 402(a)(4) of the Food, Drug, and Cosmetic Act (FD&C Act) 21 U.S.C. § 342(a)(4) in that the product has been prepared, packed, or held under insanitary conditions whereby it may have been rendered injurious to health and may respond accordingly. The finding or knowledge of SH in a layer house environment may result in the producer having to prove that eggs have not become contaminated with SH and are therefore safe for public consumption. One method of ensuring eggs are safe would be through an egg testing scenario, as described for SE within FDA's egg rule.

Currently FDA does not have any plans, in the immediate future, to amend the egg rule to include SH, S*. typhimurium* or any other *Salmonella* serotype.

FDA does not require commercial layer operations to test for SH or any other *Salmonella* serotype other than SE.

FDA conducts two types of inspections under the egg rule: targeted and comprehensive. The primary difference is that comprehensive inspections include environmental testing by FDA. When these samples are taken, FDA typically will only test for Group D *Salmonella* and not for other serotypes. However, in a trace-back investigation where SH is involved, or when they have knowledge of the presence of SH in the environment (such as in follow up inspections), or in special situations where SH had been previously identified at a facility, they may serotype all *Salmonella* that are isolated and may choose to respond to any potentially vertically transmitted *Salmonella* serotype.

Committee Business:

No Resolutions were brought forth from the Committee.

Additional Submitted Report

NPIP Report *Salmonella* FY2012

Denise L. Brinson

National Poultry Improvement Plan (NPIP)

The value of the US Poultry Industry is approximately $35 billion dollars in revenue for FY2012. The success of this industry is largely due to the ability to control diseases such as *Salmonella pullorum* and *Salmonella typhoid*. USDA-APHIS-NPIP's Pullorum/Typhoid control program has contributed significantly to this success.

There were no isolations of *Salmonella pullorum* in commercial poultry in FY2012. There have been no isolations of *Salmonella gallinarum* in the US since 1987 in any type poultry. US Pullorum-Typhoid Clean participating hatcheries include: 253 egg and meat-type chicken hatcheries, 35 turkey hatcheries, and 772 waterfowl, exhibition poultry and game bird hatcheries.

NPIP US Pullorum-Typhoid Clean Participating Breeding Flocks and Number of Birds include:

- Egg-Type Chickens: 253 Flocks with 4,589,297 birds
- Meat-Type Chickens:5,176 Flocks with 96,372,550 birds
- Turkeys: 597 Flocks with 4,951,611 birds
- Waterfowl, Exhibition Poultry, and Game Birds: 5,016 Flocks with 1,724,248 birds.

Salmonella control programs administered by the NPIP are: Pullorum/Typhoid Clean for all poultry breeders and the basis of the program, *Salmonella enteriditis* clean (SE Clean) for egg type breeders and egg and meat type primary

breeders, Salmonella Monitored for primary meat type breeders and Sanitation Monitored for meat type breeders and turkey breeders.

There were no isolations of *Salmonella enteriditis* reported in egg type or egg type primary breeders in FY 2012.

Pullorum-Typhoid Status:

There were no isolations of S. pullorum in commercial poultry in FY2010 or 2011. There were 2 isolations of *Salmonella pullorum* in backyard birds in FY2011. There were no isolations of Salmonella Pullorum in any type of poultry in FY2012. There have been no isolations of *Salmonella gallinarum* since 1987 in any type poultry.

Hatchery Participation in the National Poultry Improvement Plan Testing Year FY2012	
Egg and Meat-Type Chickens: Participating	253
Turkeys Participating	35
Waterfowl, Exhibition Poultry and Game Birds	772

Egg-Type Chicken Breeding Flocks in the National Poultry Improvement Plan Participation and Testing Summary Testing Year FY2012	
U.S. Pullorum-Typhoid Clean: Participating- Number	253
Birds in Flocks-Number	4,589,297
Birds tested	29,830

Meat-Type Chicken Breeding Flocks in the National Poultry Improvement Plan Participation and Testing Summary Testing Year FY2012	
U.S. Pullorum-Typhoid Clean: Participating- Number	5,176
Birds in Flocks-Number	96,372,550
Birds tested	225,120

Turkey Breeding Flocks in the National Poultry Improvement Plan Participation and Testing Summary Testing Year FY2012	
U.S. Pullorum-Typhoid Clean: Participating –Number	597
Birds in Flocks-Number	4,951,611
Birds tested	17,201

Waterfowl, Exhibition Poultry, and Game Birds Breeding Flocks In the National Poultry Improvement Plan Participation and Testing Summary Testing Year FY2012	
U. S. Pullorum-Typhoid Clean Participating	5,016
Birds in Flocks	1,724,248
Birds tested	150,285

No. of flocks and birds in flocks by State with *Salmonella enteritidis* isolates, 1990-2012

	Environmental	**Dead Germ**	**Bird**
Arkansas			
Flocks	1		15000
Birds in Flocks	6000		2
Georgia			
Flocks	3	2	
Birds in Flocks	30400	46000	

Illinois			
Flocks	3	2	1
Birds in Flocks	3900	3700	1200
Indiana	Environmental	Dead Germ	Bird
Flocks	15	2	1
Birds in Flocks	158345	27479	15092
Kentucky			
Flocks	1		
Birds in Flocks	6625		
Ohio			
Flocks	17		9
Birds in Flocks	192700		91600
Oregon			
Flocks	2		
Birds in Flocks	19516		
Pennsylvania			
Flocks	16		6
Birds in Flocks	166385		78450
Texas			
Flocks	1		
Birds in Flocks	10000		

U.S. *Salmonella enteritidis* Clean- Egg-Type Chickens

Phage type13	**Environmental**	**Dead Germ**
Flocks	11	2
Birds in Flocks	152000	3700
Phage type 13A		
Flocks	5	2
Birds in Flocks	54321	27479
Phage type 2		
Flocks	2	
Birds in Flocks	28900	
Phage type 23		
Flocks	21	
Birds in Flocks	16,000	
Phage type 28		
Flocks	2	2
Birds in Flocks	15000	46000
Phage type 34		
Flocks	2	
Birds in Flocks	12500	
Phage type RNDC		
Flocks	1	
Birds in Flocks	7000	
Phage type Untypable		
Flocks	2	

Birds in Flocks	24000	
Phage type 8		
Flocks	23	
Birds in Flocks	237701	

Egg-type Chicken breeding flocks with isolates of *Salmonella enteritidis* by phage type and by year 1989-2012		
Year	No. Flocks	Phage Type
1989	1	13A
1990	11	13A, 13, 8, 28
1991	12	13A, 13, 8
1992	10	Untypable,13A,8,28,34
1993	5	Untypable, 8, 2
1994	3	13A, 8
1995	2	13A, 28
1996	5	Untypable, RNDC, 13A,8,2
1997	2	8
1998	2	8
1999	1	13
2000	4	13, 8
2001	1	13
2002	0	
2003	0	
2004	0	
2005	1	13
2006	1	34
2007	4	13, 8
2008	3	8
2009	0	
2010	3	8(2), 13
2011	0	
2012	0	

***U.S. Salmonella enteritidis* Clean - Egg-Type Chickens**
No. of flocks and birds in the flocks with *Salmonella enteritidis* isolates, 1990-2012

	Environmental	Dead Germ	Bird
Flocks	71	6	19
Birds in Flocks	706,871	77,179	201,342