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Services**

Part II: Reference of 1999 Table Egg Layer Management in the U.S.



National Animal Health Monitoring System

January 2000

Acknowledgments

This report has been prepared from material received and analyzed by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) during a nationwide study of management and flock health on layer operations.

The Layers '99 study was a cooperative effort between State and Federal agricultural statisticians, animal health officials, university researchers, extension personnel, and table egg layer operators. We want to thank the industry members who helped determine the direction and objectives of this study by participating in focus groups.

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All participants are to be commended for their efforts, particularly the producers whose voluntary efforts made the Layers '99 study possible.

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Introduction

The National Animal Health Monitoring System's (NAHMS) Layers '99 study was designed to provide both participants and the industry with information on the nation's table egg layer population for education and research. NAHMS is sponsored by the USDA:APHIS:Veterinary Services (VS).

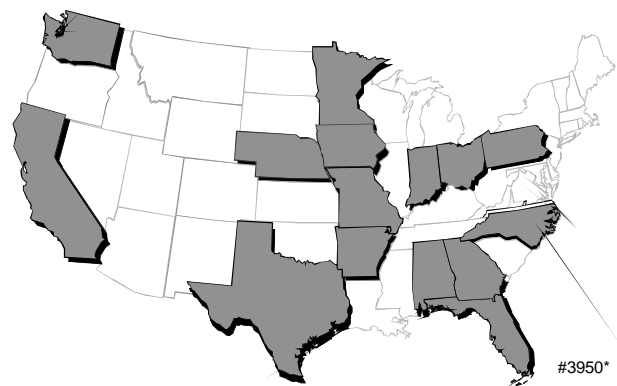
Layers '99 is the first NAHMS national study of the layer industry. NAHMS developed study objectives by exploring existing literature and contacting industry members and researchers about their informational needs and priorities. The objectives are listed inside the back cover of this report.

The USDA's National Agricultural Statistics Service (NASS) collaborated with VS to select a statistically-valid sample from 15 states for Layers '99 (see map below). The 15-state target population accounted for over three-quarters of the table egg layers in the U.S. on December 1, 1998.

NASS enumerators collected data for *Part I: Reference of 1999 Table Egg Layer Management in the U.S.* from 208 single and multiple-farm companies via a questionnaire administered February 1-26, 1999. These respondents provided information on 526 farm sites which formed the basis of that report.

The second phase of data collection was done by Federal and state Veterinary Medical Officers (VMO's) and Animal Health Technicians (AHT's) in the 15 states. Data were collected on 252 farm sites for *Part II: Reference of 1999 Table Egg Layer Management in the U.S.* Via a questionnaire administered from March 22 through April 30, 1999.

States Participating in the Layers '99 Study



Information in both Parts I and II is operator-reported reflecting the operator's impression, which may or may not be based on laboratory results or veterinary advice. (See methodology information in Section II beginning on page 61.)

Results of the Layers '99 and other NAHMS studies are accessible on the World Wide Web at <http://www.aphis.usda.gov/vs/ceah/cahm>.

For questions about this report or additional Layers '99 and NAHMS results, please contact:

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* Identification numbers are assigned to each graph of this report for public reference.

Terms Used in This Report

Business visitor: Anyone who had a business reason for visiting the operation, such as a salesman, repairman, feed service personnel, veterinarian, and company personnel who did not normally work on the operation.

Company owned farm: A category that included independent producers.

Contract farm: A farm site that produces eggs for another company. Generally, the contractee owns the farm and provides the labor.

Contractor: A company that contracts with a farm to produce eggs for them. Usually the contractor owns the layers and supplies the feed.

Farm site: A contiguous land unit that makes up a single premises. A farm site may have one or more layer houses on it.

Flock: A group of birds of similar age (may vary several weeks from the median age of the flock) considered as a production unit. A flock usually fills only one layer house, but it may take up more or less than one house.

Hen-day egg production: The number of eggs produced on the particular day divided by the number of hens alive that day in that flock. (Producers usually calculate this parameter over a week.)

Hen-housed egg production at 60 weeks: The cumulative number of eggs produced by the flock until the birds are 60 weeks of age divided by the number of birds originally placed in the flock.

Last completed flock: The most recent flock that completed its production cycle and was then removed from the farm.

Layer: A chicken that produces eggs for table use or egg products.

Molt: That period of time when birds are taken out of production (usually around 65 weeks of age) until they return approximately to their 18-week weight. After a rest period, they are returned to production for another laying cycle.

N/A: Not applicable.

Non-business visitor: Anyone who did not have a business reason for visiting the operation, such as friends, family members, and tours.

Population estimates: Averages and proportions weighted to represent the population. For this report, the reference population was all company-owned and contract farms associated with (companies) operations that had 30,000 or more layers on December 1, 1998, in the 15 participating states. Most of the estimates in this report are provided with a measure of precision called the *standard error*. If the only error is sampling error, chances are 95 out of 100 that the interval created by the estimate plus or minus two standard errors will contain the true population value. In the example illustrated, an estimate of 7.5 with a standard error of 1.0 results in a range of 5.5 to 9.5 (two times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of

0.3 and results in a range of 2.8 to 4.0. Similarly, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of two. *Where differences between groups are noted in this report, the 90% confidence intervals do not overlap.* Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported. If there were no reports of the event, no standard error was reported.

Pullet: A female chicken less than 20 weeks of age. A pullet placed in the laying house is called a layer.

Regions:

Great Lakes: Indiana, Ohio, and Pennsylvania.

Southeast: Alabama, Florida, Georgia, and North Carolina.

Central: Arkansas, Iowa, Minnesota, Missouri, and Nebraska.

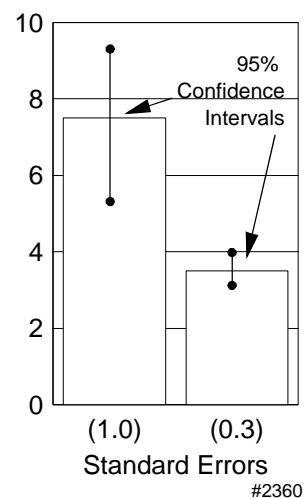
West: California, Texas, and Washington.

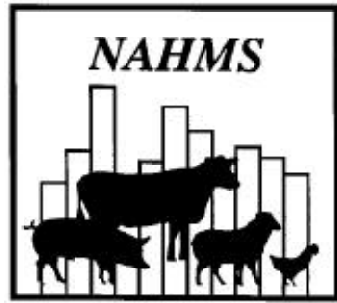
Sample profile: Information that describes characteristics of the operations from which Layers '99 data were collected.

Size of farm site: Size groupings based on number of layers 20 weeks of age or older present on December 1, 1998. For this report, sizes of farm sites were less than 100,000 and 100,000 or more.

Spent hen: A layer that has completed its egg production cycle.

Examples of a 95% Confidence Interval





Section I: Population Estimates

A. Facilities and Facility Management

1. Farm sites with pullets

A total of 11.5 percent of layer farm sites had pullet raising facilities on the farm site.

a. Percent of layer farm sites with pullet facilities on the same farm site:

Percent Farm Sites	Standard Error
11.5	(2.8)

2. Layer houses

About one-third (34.5 percent) of farm sites had only one layer house.

NOTE: Only operations with 30,000 or more layers were included in the study. Had smaller operations been included, the percentage of farm sites with only one house would likely have been higher.

a. Percent of farm sites by number of layer houses on the farm site:

Number Layer Houses	Percent Farm Sites	Standard Error
1	34.5	(7.0)
2	24.5	(3.8)
3 - 5	24.5	(3.9)
6 or more	<u>16.5</u>	(2.4)
Total	100.0	

All together, 76.8 percent of houses were 10 years old or older, and about half of those (38.7 percent) were 20 years old or older. Nearly one-half (45.4 percent) of farm sites had at least one house that was 20 years old or older. Data on age of houses were collected only by category.

b. Percent of farm sites (and percent of layer houses) by age of layer houses:

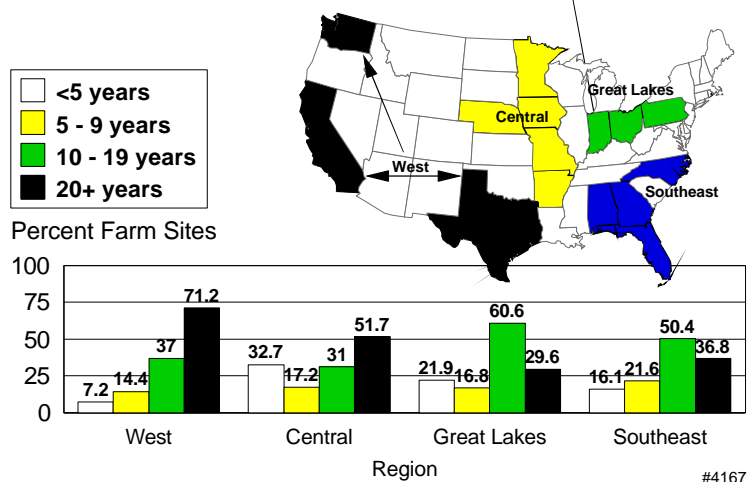
Layer House Age Category	Percent Farm Sites	Standard Error	Percent Layer Houses	Standard Error
Less than 5 years	18.9	(3.6)	9.7	(1.9)
5 - 9 years	17.4	(3.5)	13.5	(3.4)
10 - 19 years	47.2	(4.0)	38.1	(4.3)
20 or more years	45.4	(4.6)	<u>38.7</u>	(4.1)
Total	--		100.0	

The West region had the largest percentage of farm sites with at least one house that was 20 years old or older (71.2 percent).

i. Percent of farm sites by age of layer houses and by region:

Layer House Age Category	Percent Farm Sites by Region							
	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 5 years	21.9	(8.2)	16.1	(4.0)	32.7	(10.1)	7.2	(1.9)
5 - 9 years	16.8	(8.0)	21.6	(7.3)	17.2	(4.6)	14.4	(2.9)
10 - 19 years	60.6	(8.1)	50.4	(5.7)	31.0	(5.9)	37.0	(6.1)
20 or more years	29.6	(9.0)	36.8	(6.2)	51.7	(8.8)	71.2	(6.2)

Percent of Farm Sites by Age of Layer Houses and by Region



The largest percentage of houses (39.5 percent) had a maximum capacity of less than 30,000 layers. Only 1.3 percent of houses could hold 200,000 or more layers.

c. Percent of farm sites (and percent of layer houses) by house capacity (maximum number of layers housed):

House Capacity (Maximum Layers Housed)	Percent Farm Sites	Standard Error	Percent Layer Houses	Standard Error
Less than 30,000	40.2	(5.5)	39.5	(4.4)
30,000 - 69,999	39.0	(3.8)	24.7	(3.3)
70,000 - 119,999	31.8	(4.5)	22.3	(3.1)
120,000 - 199,999	12.2	(4.3)	12.2	(2.9)
200,000 or more	1.7	(1.1)	<u>1.3</u>	(0.8)
Total	--		100.0	

The Great Lakes region was the only region with layer houses that could hold 200,000 or more layers. No farm sites in the Southeast region had houses with a capacity of 120,000 or more. In the other regions, the percentage of farm sites with at least one house that could hold 120,000 to 199,999 layers ranged from a low of 4.0 percent of farm sites in the West region to a high of 23.6 percent of farm sites in the Great Lakes region.

i. Percent of farm sites by house capacity (maximum number of layers housed) and by region:

House Capacity (Number Layers Housed)	<u>Percent Farm Sites by Region</u>							
	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 30,000	30.0	(13.2)	40.6	(8.4)	33.2	(8.7)	59.3	(7.7)
30,000 - 69,999	42.9	(8.8)	34.3	(5.9)	48.5	(6.4)	30.9	(5.4)
70,000 - 119,999	30.2	(8.6)	46.6	(10.3)	31.4	(7.2)	20.8	(6.7)
120,000 - 199,999	23.6	(12.3)	0.0	(--)	17.1	(4.8)	4.0	(1.3)
200,000 or more	4.8	(3.1)	0.0	(--)	0.0	(--)	0.0	(--)

Nearly three-fourths (71.4 percent) of farm sites used power/fan ventilation in at least one layer house. Systems in the Other category included primarily a combination of curtain and fan ventilation.

d. Percent of farm sites (and percent of layer houses) by ventilation systems in the layer houses:

Ventilation System	Percent Farm Sites		Percent Layer Houses	
	Percent	Standard Error	Percent	Standard Error
Curtain/natural ventilation	31.3	(3.8)	36.5	(4.0)
Power/fan ventilated	71.4	(4.4)	60.6	(4.4)
Other	4.3	(1.9)	2.9	(1.2)
Total	--		100.0	

The most common ventilation system used in the West region was curtain/natural, whereas farm sites in the other regions used primarily power/fan ventilation.

i. Percent of farm sites by ventilation systems in the layer houses and by region:

Ventilation System	Percent Farm Sites by Region							
	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Curtain/natural ventilation	11.1	(6.6)	44.6	(6.7)	11.2	(5.0)	62.5	(5.5)
Power/fan ventilated	83.2	(9.8)	72.1	(6.9)	88.3	(5.6)	41.9	(6.4)
Other	5.7	(4.8)	1.1	(0.8)	5.2	(2.7)	4.7	(2.1)

Overall, 91.2 percent of farm sites used some type of cooling method, with the most common method being fans.

e. Percent of farm sites by cooling methods used (and *primary* cooling method) in the layer houses:

Cooling Method	Percent Farm Sites			
	Methods Used		Primary Method Used	
	Percent Farm Sites	Standard Error	Percent Farm Sites	Standard Error
Fans	80.1	(3.5)	65.1	(4.3)
Evaporative pads/cool cells	17.8	(3.5)	12.0	(3.0)
Foggers	11.1	(3.1)	4.8	(1.8)
Roof sprinklers	11.7	(2.2)	6.6	(1.4)
Tunnel ventilation	13.8	(2.7)	2.0	(0.8)
Other	0.3	(0.2)	0.7	(0.3)
None	8.8	(2.9)	<u>8.8</u>	(2.9)
Total	--		100.0	

Fans were the only cooling method reported in the Great Lakes region. Roof sprinklers were used by 26.9 percent of farm sites in the West region but not in any other region.

i. Percent of farm sites by *primary* cooling method used in the layer houses and by region:

Cooling Method	Percent Farm Sites by Region							
	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Fans	86.4	(7.1)	50.6	(9.1)	77.8	(4.9)	38.9	(7.5)
Evaporative pads/cool cells	0.0	(--)	32.8	(10.4)	11.3	(3.1)	10.5	(2.8)
Foggers	0.0	(--)	2.5	(2.0)	2.5	(1.3)	15.4	(6.6)
Roof sprinklers	0.0	(--)	0.0	(--)	0.0	(--)	26.9	(5.6)
Tunnel ventilation	0.0	(--)	4.0	(2.8)	3.1	(1.6)	2.1	(1.0)
Other	0.0	(0.0)	1.2	(1.1)	0.0	(--)	1.8	(1.0)
Other	<u>13.6</u>	(7.1)	<u>8.9</u>	(5.5)	<u>5.3</u>	(3.1)	<u>4.4</u>	(1.5)
Total	100.0		100.0		100.0		100.0	

Although rare, there were some houses (0.8 percent) that relied on natural light only, with no supplemental artificial light.

f. Percent of layer houses by type of lighting used:

Type of Lighting	Percent Layer Houses	Standard Error
Artificial only	47.5	(5.3)
Both natural and artificial (bracketed day length)	51.7	(5.3)
Natural light only	<u>0.8</u>	(0.5)
Total	100.0	

Fluorescent lighting was used alone in 56.8 percent of layer houses and in combination with incandescent lighting in 12.1 percent of houses.

i. For layer houses in which artificial light was used, percent of layer houses by type of artificial lighting used:

Type of Artificial Lighting	Percent Layer Houses	Standard Error
Fluorescent	56.8	(5.3)
Incandescent	31.1	(5.3)
Both fluorescent and incandescent	<u>12.1</u>	(3.5)
Total	100.0	

About one-third (34.2 percent) of layer houses had six or more banks of cages. Non-caged layers accounted for less than 1 percent of layer houses.

g. Percent of layer houses by number of banks¹ (rows or batteries of cages):

Number of Banks ¹ (Rows or Batteries of Cages)	Percent Layer Houses	Standard Error
1	1.9	(0.9)
2 - 3	12.5	(2.6)
4 - 5	50.8	(4.5)
6 or more	34.2	(5.1)
Non-caged layers	<u>0.6</u>	(0.2)
Total	100.0	

About one-fourth (25.6 percent) of layer houses had only one tier (vertical level) of cages, whereas 41.7 percent of houses had four or more levels. The exact number of tiers was not collected above four. The West region had the lowest percentage (8.3 percent) of layer houses with four or more tiers.

h. Percent of layer houses by number of tiers (vertical levels of cages) and by region:

Number of Tiers (Vertical Levels of Cages)	Percent Layer Houses by Region									
	Great Lakes		Southeast		Central		West		All Layer Houses	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
1	4.2	(2.6)	16.3	(11.4)	4.4	(2.8)	51.8	(7.2)	25.6	(3.7)
2	10.5	(6.6)	24.2	(6.4)	17.5	(8.4)	33.8	(7.7)	23.7	(4.3)
3	8.9	(3.3)	8.9	(2.3)	15.0	(3.8)	6.1	(1.7)	9.0	(1.4)
4 or more	<u>76.4</u>	(9.1)	<u>50.6</u>	(12.1)	<u>63.1</u>	(14.4)	<u>8.3</u>	(2.0)	<u>41.7</u>	(5.0)
Total	100.0		100.0		100.0		100.0		100.0	

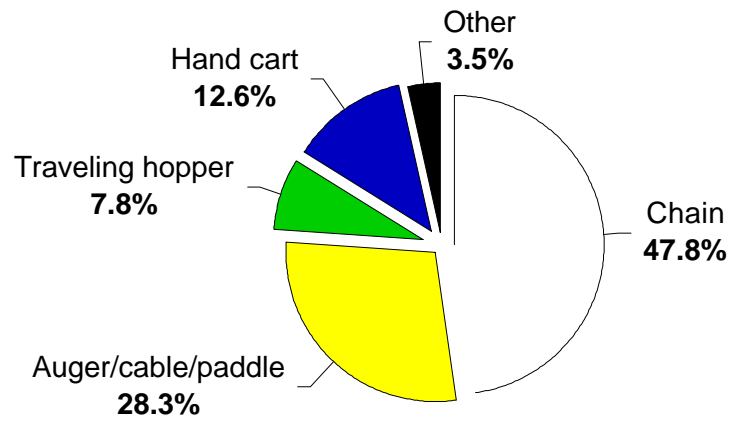
1 Bank: All cages between two aisles or between a wall and an aisle.

Nearly one-half (47.8 percent) of layer houses used a chain feed delivery system. A hand cart feeding system was used for 12.6 percent of layer houses.

i. Percent of layer houses by system used to deliver feed to layers:

Feed System	Percent Layer Houses	Standard Error
Chain	47.8	(4.4)
Auger, cable, or paddle system	28.3	(4.1)
Traveling hopper system	7.8	(3.6)
Hand cart system	12.6	(3.1)
Other	<u>3.5</u>	(1.8)
Total	100.0	

Percent of Layer Houses by System Used to Deliver Feed to Layers



#4168

B. General Management

1. Egg gathering

Gathering eggs by hand was most common in the West region where over one-half (58.3 percent) of farm sites gathered eggs only by hand, and another 9.7 percent of farm sites used both belt and hand gathering.

a. Percent of farm sites by method of gathering eggs in December 1998 and by region:

Percent Farm Sites by Region

Primary Method of Gathering Eggs	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Hand gathered only	16.8	(9.8)	19.5	(6.8)	22.6	(7.8)	58.3	(7.0)	28.6	(4.5)
Belt gathered only	77.9	(10.1)	79.5	(6.7)	74.1	(8.1)	32.0	(6.8)	66.3	(4.6)
Both hand and belt	<u>5.3</u>	(5.0)	<u>1.0</u>	(0.7)	<u>3.3</u>	(3.3)	<u>9.7</u>	(2.3)	<u>5.1</u>	(1.9)
Total	100.0		100.0		100.0		100.0		100.0	

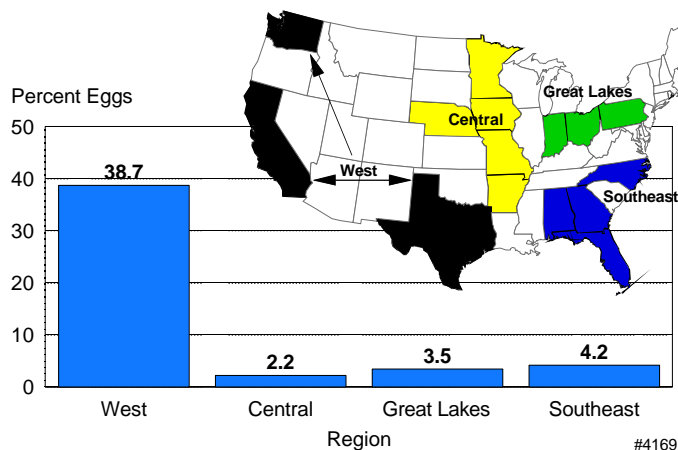
The percentage of eggs gathered by hand ranged from 2.2 percent in the Central region to 38.7 percent in the West region.

i. Percent of eggs gathered in December 1998 by method and by region:

Percent Eggs by Region

Method Used to Gather	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Hand	3.5	(2.9)	4.2	(2.4)	2.2	(0.9)	38.7	(5.9)	10.6	(2.1)
Belt	<u>96.5</u>	(2.9)	<u>95.8</u>	(2.4)	<u>97.8</u>	(0.9)	<u>61.3</u>	(5.9)	<u>89.4</u>	(2.1)
Total	100.0		100.0		100.0		100.0		100.0	

Percent Eggs Gathered by Hand in December 1998 by Region



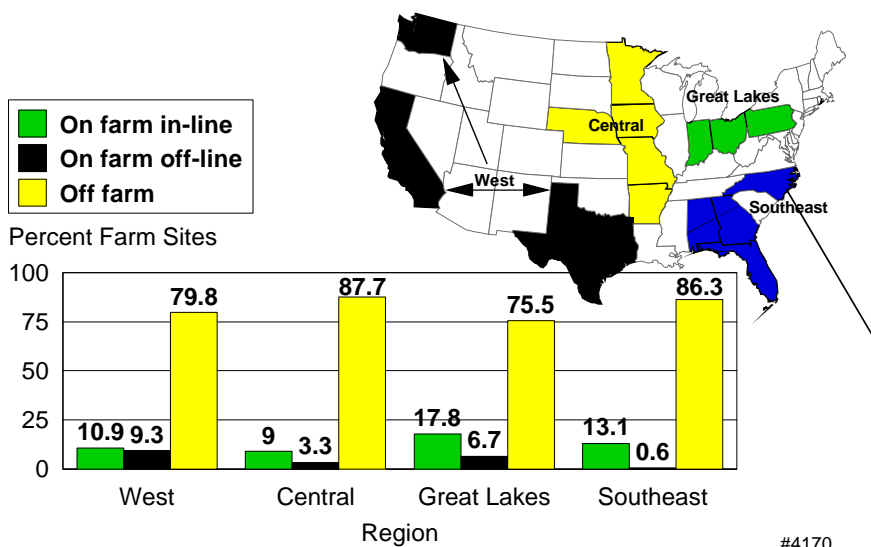
2. Egg processing

Over three-fourths of farm sites in every region processed eggs off farm.

a. Percent of farm sites by primary egg processing location and by region:

Primary Egg Processing Location	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
On farm in-line	17.8	(8.4)	13.1	(4.3)	9.0	(3.2)	10.9	(2.4)	13.5	(3.0)
On farm off-line	6.7	(5.4)	0.6	(0.6)	3.3	(3.3)	9.3	(2.4)	5.3	(2.1)
Off farm	<u>75.5</u>	(8.1)	<u>86.3</u>	(4.4)	<u>87.7</u>	(4.5)	<u>79.8</u>	(3.6)	<u>81.2</u>	(3.2)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites by Primary Egg Processing Location and by Region



#4170

Only 6.4 percent of farm sites had an average of 6 or more days between egg pickups. Over one-third (38.8 percent) of farm sites did not know the humidity at which eggs were stored on farm. (Less than 5 percent of farm sites did not report the other parameters in this table.) Eggs from over three-fourths (77.1 percent) of farm sites traveled 10 or more miles to a processing plant. Prewashing of eggs before processing was relatively uncommon (4.9 percent of farm sites).

b. For farm sites that primarily processed eggs off farm, percent of farm sites by on-farm egg management characteristics:

Management Characteristic	Percent Farm Sites	Standard Error
Average number days between egg pickups:		
1 - 2	48.5	(7.4)
3 - 5	45.1	(7.5)
6 - 9	6.2	(2.7)
10 or more	<u>0.2</u>	(0.1)
Total	100.0	
Usual temperature for egg storage on farm:		
Less than 50 degrees	21.2	(5.2)
50 - 59 degrees	51.0	(8.2)
60 or more degrees	<u>27.8</u>	(5.7)
Total	100.0	
Usual humidity level for egg storage on farm:		
Less than 50 percent	2.6	(1.3)
50 - 74 percent	29.4	(5.5)
75 percent or higher	29.2	(5.8)
Didn't know	<u>38.8</u>	(6.6)
Total	100.0	
Distance (miles) to the processing plant where the majority of eggs were processed:		
Less than 5 miles	12.0	(3.1)
5 - 9 miles	10.9	(2.5)
10 or more miles	<u>77.1</u>	(4.5)
Total	100.0	
Prewashed eggs before sending them to be processed:		
Yes	4.9	(2.3)
No	<u>95.1</u>	(2.3)
Total	100.0	

The majority of farm sites (71.6 percent) used reusable plastic flats that were cleaned and disinfected between uses. Racks were returned to the same farm site on 29.2 percent of farm sites.

c. For farm sites that primarily processed eggs off farm, percent of farm sites by:

Management Characteristic	Percent Farm Sites	Standard Error
Primary types of flats used for storage/transportation:		
Disposable fiber	18.5	(8.1)
Reusable plastic, cleaned and disinfected	71.6	(8.0)
Reusable plastic, <i>not</i> cleaned and disinfected	<u>9.9</u>	(2.5)
Total	100.0	
Usual handling of racks:		
Returned to the same farm site	29.2	(8.8)
Cleaned before reuse	35.4	(6.2)
Disinfected before reuse	24.8	(6.9)

About three-fourths (78.6 percent) of eggs produced by the last completed flocks (one flock per farm site) were size large or above.

d. For the last completed flock, percent of eggs that were size large and above:

Percent Eggs	Standard Error
78.6	(1.4)

A total of 5.8 percent of eggs produced at 60 weeks of age by the last completed flocks (one flock per farm site) were broken or cracked.

e. For the last completed flock, percent of eggs that were broken/cracked at 60 weeks of age:

Percent Eggs	Standard Error
5.8	(0.4)

3. Molting

Routine molting was most common in the Southeast and West regions (97.0 percent and 94.9 percent of farm sites respectively).

a. Percent of farm sites by routine molting method used and by region:

Percent Farm Sites by Region

Routine Molting Method	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Do not usually molt	22.1	(10.1)	3.0	(1.9)	43.1	(9.0)	5.1	(1.6)	17.4	(4.2)
Withhold or restrict feed a set number of days	7.6	(5.7)	12.5	(5.0)	13.9	(5.4)	24.7	(6.7)	14.0	(3.3)
Withhold or restrict feed until a certain weight is achieved (monitor weight)	70.3	(10.0)	84.5	(5.8)	43.0	(9.9)	70.2	(6.3)	68.6	(4.6)
Other	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>0.0</u>	(--)
Total	100.0		100.0		100.0		100.0		100.0	

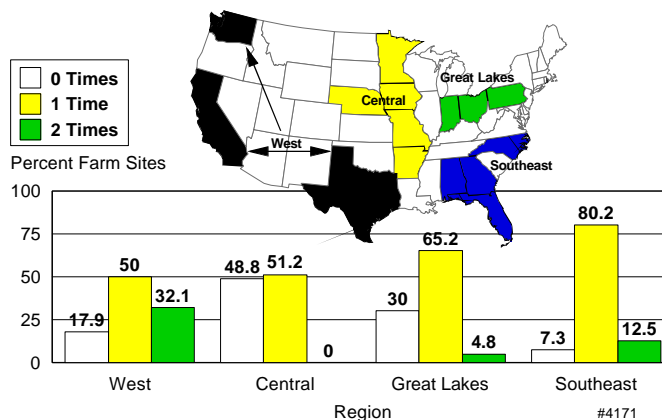
While 17.4 percent of farm sites usually did not molt (Table B.3.a), 25.8 percent of farm sites did not molt their last completed flock. In the West, 32.1 percent of last completed flocks were molted twice.

b. Percent of farm sites by number of times the last completed flock was molted by region:

Percent Farm Sites by Region

Number Times Molted	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
0	30.0	(9.5)	7.3	(3.0)	48.8	(7.9)	17.9	(3.5)	25.8	(4.1)
1	65.2	(8.7)	80.2	(8.1)	51.2	(7.9)	50.0	(6.1)	62.1	(4.2)
2	<u>4.8</u>	(4.4)	<u>12.5</u>	(6.4)	<u>0.0</u>	--	<u>32.1</u>	(7.8)	<u>12.1</u>	(3.0)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites by Number of Times the Last Completed Flock Was Molted and by Region



For last completed flocks that were molted, 7.9 percent of flocks molted at less than 62 weeks of age, and 18.1 percent molted at 72 weeks of age or older.

c. For farms where the last completed flock was molted, percent of farms by age (weeks) at which flock started first molt:

Age (Weeks)	Percent Farm Sites	Standard Error
Less than 62	7.9	(3.1)
62 - 66	32.6	(4.9)
67 - 71	41.4	(5.4)
72 or more	<u>18.1</u>	(3.9)
Total	100.0	

4. Feeding practices

During peak production, about one-third (35.5 percent) of farm sites normally fed layers five or more times per day, and another 5.6 percent fed continuously.

a. Percent of farm sites by number of times per day layers are normally fed during peak production and by region:

Number of Feedings per Day During Peak Production	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
1 - 2	16.8	(9.8)	14.2	(6.9)	21.2	(7.4)	26.3	(5.6)	19.3	(4.1)
3	32.1	(13.3)	11.6	(4.7)	10.2	(4.2)	8.0	(3.3)	17.6	(5.6)
4	12.9	(7.4)	27.5	(8.9)	30.8	(6.5)	23.4	(7.3)	22.0	(4.2)
5 or more	27.8	(13.8)	46.7	(6.8)	37.8	(8.9)	34.5	(4.6)	35.5	(5.7)
Continuously fed	<u>10.4</u>	(7.1)	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>7.8</u>	(2.8)	<u>5.6</u>	(2.5)
Total	100.0		100.0		100.0		100.0		100.0	

Less than 1 percent of farm sites fed their layers pelleted or crumbled feed (0.9 percent each).

b. Percent of farm sites by type of feed fed to layers:

Type of Feed Fed	Percent Farm Sites	Standard Error
Mash/ground	98.2	(0.8)
Pelleted	0.9	(0.7)
Crumbled	<u>0.9</u>	(0.5)
Total	100.0	

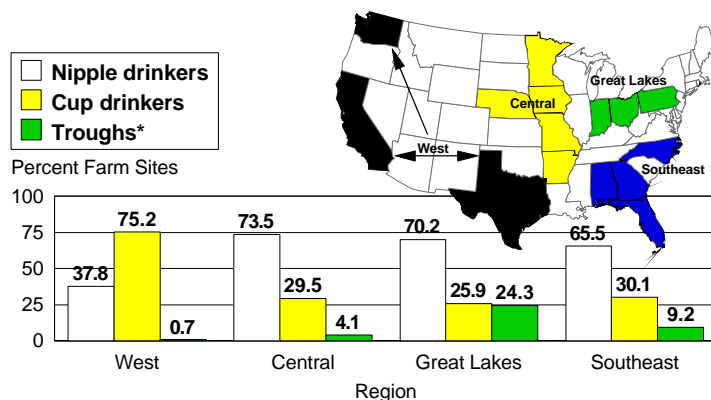
5. Water management

Cup drinkers were the most common water delivery system used in the West (75.2 percent of farm sites), whereas nipple drinkers were more common in the other regions.

a. Percent of farm sites by water delivery systems used and by region:

Water Delivery System	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Nipple drinkers	70.2	(13.5)	65.5	(8.9)	73.5	(10.4)	37.8	(6.7)	61.7	(5.8)
Cup drinkers	25.9	(8.9)	30.1	(9.6)	29.5	(9.3)	75.2	(5.5)	39.6	(5.1)
Troughs (includes basin, and bell Plasson)	24.3	(9.9)	9.2	(2.7)	4.1	(2.5)	0.7	(0.6)	11.5	(3.9)

Percent of Farm Sites by Water Delivery Systems Used and by Region



*Includes basin and bell plasson.

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About one-half (43.4 percent) of farm sites had an average of six to nine layers per drinker.

i. For farm sites that used nipple or cup drinkers, percent of farms by average number of layers per drinker:

Average Number Layers	Percent Farm Sites	Standard Error
Less than 6	37.1	(5.2)
6 - 9	43.4	(5.4)
10 or more	19.5	(3.1)
Total	100.0	

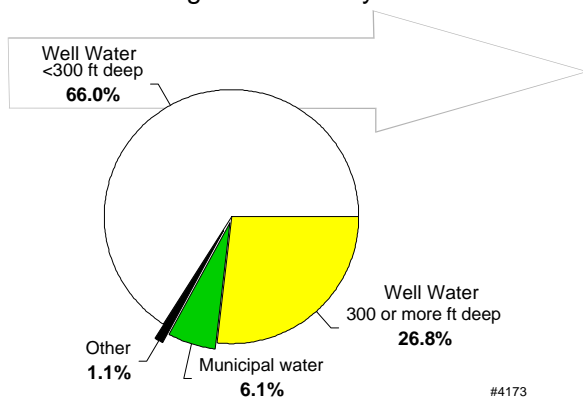
About two-thirds (66.0 percent) of farm sites used wells less than 300 feet deep as their primary water source. A municipal water source was most commonly used in the West region (16.7 percent of farm sites).

b. Percent of farm sites by primary source of drinking water for layers and by region:

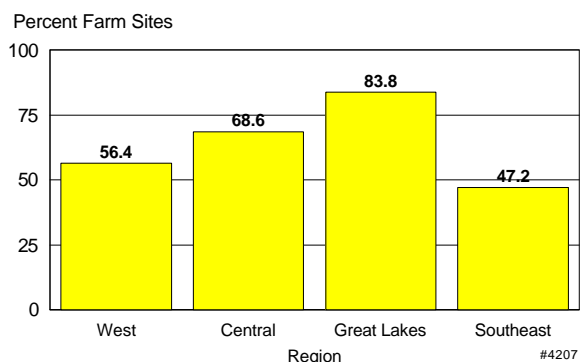
Percent Farm Sites by Region

Primary Source	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Well water less than 300 feet deep	83.8	(8.8)	47.2	(7.7)	68.6	(4.7)	56.4	(7.4)	66.0	(4.3)
Well water 300 feet deep or more	16.2	(8.8)	48.2	(7.4)	21.7	(4.6)	25.6	(6.9)	26.8	(4.2)
Municipal water	0.0	(--)	4.6	(2.1)	5.3	(2.9)	16.7	(4.0)	6.1	(1.4)
Other	0.0	(--)	0.0	(--)	4.4	(2.7)	1.3	(0.7)	1.1	(0.5)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites by Primary Source of Drinking Water for Layers



Percent of Farm Sites Where the Primary Source of Drinking Water for Layers Was from a Well Less than 300 Feet Deep by Region



For farm sites that did not use a municipal water source, 15.0 percent of farm sites chlorinated the water, 7.6 percent of farm sites used water softeners, and 9.9 percent of farm sites used ionizers for drinking water for layers.

i. For farm sites where the primary source of drinking water for layers was *not* municipal, percent of farm sites that used the following water treatments on drinking water for layers:

Water Treatments Used	Percent Farm Sites	Standard Error
Chlorination	15.0	(3.5)
Water softeners	7.6	(3.2)
Ionizers	9.9	(4.2)
Any of the above	28.1	(5.0)

6. Hen density (cages) for the last completed flock

For flocks in cages, an average of 5.6 layers was placed per cage.

a. Average number hens placed per cage:

Average Number Hens per Cage	Standard Error
5.6	(0.2)

The average floor space for flocks in cages was 53.4 square inches per layer placed.

b. Average number of square inches of floor space per hen placed:

Average Number Square Inches	Standard Error
53.4	(0.7)

A total of 83.4 percent of farm sites provided 48 square inches or more of cage floor space per layer placed.

c. Percent of farm sites by number of square inches of floor space per hen placed:

Number Square Inches	Percent Farm Sites	Standard Error
Less than 48.0	16.6	(3.6)
48.0 - 53.9	45.1	(5.3)
54.0 or more	<u>38.3</u>	(6.2)
Total	100.0	

Over one-half (59 percent) of farm sites provided three inches or more of feeder space per layer.

d. Percent of farm sites by average length (inches) of feeder space per layer:

Average Length (Inches)	Percent Farm Sites	Standard Error
Less than 3	41.0	(6.0)
3	40.9	(4.0)
4	12.3	(2.9)
More than 4	<u>5.8</u>	(3.8)
Total	100.0	

C. Production Cycle of Last Completed Flock

1. Age at placement

On 4.7 percent of farm sites, the last flock to complete production was placed in the layer house at over 60 weeks of age (recycled flocks).

a. Percent of farm sites (and percent of layers placed) where the last completed flock was over 60 weeks of age when placed (recycled flocks):

Percent Farm Sites	Standard Error	Percent Layers	Standard Error
4.7	(2.2)	3.9	(1.9)

The average age at which flocks were placed for their first production cycle was 17.5 weeks. This estimate is for the last flock placed per farm and excludes flocks that were placed for a second cycle, e.g., recycled flocks over 60 weeks of age.

b. For layer flocks in their first production cycle, average age (weeks) at which the last completed flock was moved into the layer house:

Average Flock Age (Weeks)	Standard Error
17.5	(0.1)

Nearly one-half (43.3 percent) of the last completed flocks (excluding recycled flocks) were placed at 18 weeks of age, while nearly one-third (30.8 percent) were placed at 17 weeks of age.

c. For layer flocks in their first production cycle, percent of farm sites by average age (weeks) at which the last completed flock was moved into the layer house by pullet source:

Percent Farm Sites by Pullet Source

Average Flock Age (Weeks)	Any Pullets Raised on This Farm Site		No Pullets Raised on this Farm Site		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 17	5.1	(3.1)	15.8	(3.2)	14.7	(2.9)
17	43.8	(10.8)	29.2	(4.1)	30.8	(3.9)
18	15.5	(6.7)	46.6	(4.9)	43.3	(4.5)
19 or more	<u>35.6</u>	(13.1)	<u>8.4</u>	(2.7)	<u>11.2</u>	(3.0)
Total	100.0		100.0		100.0	

2. Ages during the first production cycle

For flocks in their first production cycle, the average age at the time the flock reached 5 percent, 50 percent, and peak production was 20.0, 22.6, and 28.6 weeks respectively.

- a. For flocks in their first production cycle, average age (weeks) at which the last completed flock reached 5 percent hen-day egg production, 50 percent hen-day egg production, and peak egg production:

Average Flock Age (Weeks) By Hen-Day Egg Production Level

5%		50%		Peak	
Age (Weeks)	Standard Error	Age (Weeks)	Standard Error	Age (Weeks)	Standard Error
20.0	(0.1)	22.6	(0.2)	28.6	(0.2)

About two-thirds (67.0 percent) of last completed flocks reached 5 percent production (5 eggs per 100 hens per day) between 19 and 20 weeks of age.

- b. For flocks in their first production cycle, percent of farm sites by average age (weeks) at which the flock reached 5 percent hen-day egg production:

Average Flock Age (Weeks)	Percent Farm Sites	Standard Error
Less than 19	5.1	(1.3)
19	25.3	(4.0)
20	41.7	(3.9)
21 or more	<u>27.9</u>	(5.3)
Total	100.0	

About one-half (48.2 percent) of last completed flocks reached 50 percent production (50 eggs per 100 hens per day) between 22 and 23 weeks of age.

c. For flocks in their first production cycle, percent of farm sites by average age (weeks) at which the last completed flock reached 50 percent hen-day egg production:

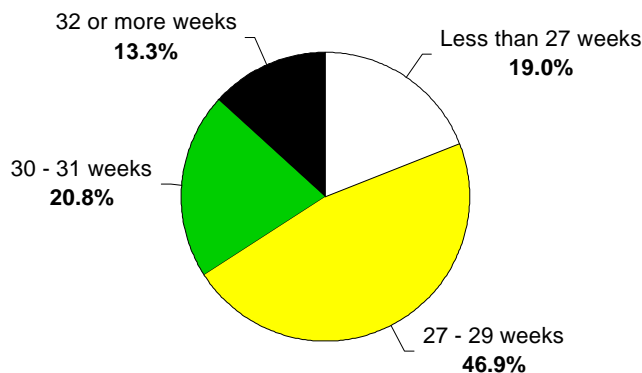
Average Flock Age (Weeks)	Percent Farm Sites	Standard Error
Less than 22	27.1	(4.2)
22	21.1	(3.5)
23	27.1	(4.2)
24 or more	<u>24.7</u>	(7.0)
Total	100.0	

About one-half (46.9 percent) of last completed flocks reached peak production between 27 and 29 weeks of age.

d. For flocks in their first production cycle, percent of farm sites by average age (weeks) at which the last completed flock reached peak egg production:

Average Flock Age (Weeks)	Percent Farm Sites	Standard Error
Less than 27	19.0	(3.3)
27 - 29	46.9	(3.4)
30 - 31	20.8	(3.7)
32 or more	<u>13.3</u>	(3.3)
Total	100.0	

Percent of Farm Sites* by Average Age (in Weeks) at Which the Flock Reached Peak Egg Production



* For flocks in their first production cycle.

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3. Peak hen-day egg production

Overall, the average peak hen-day egg production for the last completed flock was 90.1 (average maximum production of 90.1 eggs per 100 hens per day).

- a. Average peak hen-day egg production for the last completed flock by region:

Average Number Eggs per 100 Hens per Day by Region									
Great Lakes		Southeast		Central		West		All Farm Sites	
Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error
89.6	(0.8)	90.5	(0.5)	90.9	(0.4)	89.7	(0.7)	90.1	(0.4)

Larger farms (100,000 or more layers) had a higher peak hen-day egg production than smaller farms.

- i. Average peak hen-day egg production for the last completed flock by farm site size (number of layers):

Average Number Eggs per 100 Hens per Day by Farm Size (Number Layers)			
Less than 100,000		100,000 or More	
Number Eggs	Standard Error	Number Eggs	Standard Error
89.5	(0.5)	91.0	(0.3)

Peak hen-day egg production for the last completed flock did not differ significantly by flock size.

- ii. Average peak hen-day egg production for the last completed flock by flock size (number of layers in flock):

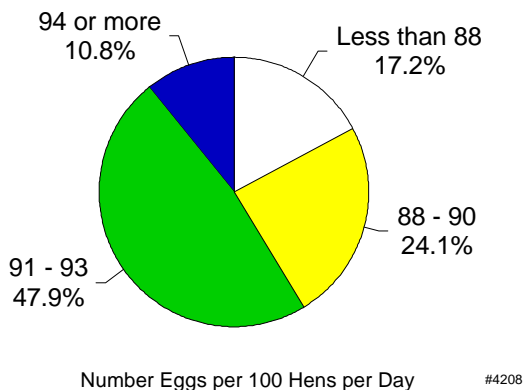
Average Number Eggs per 100 Hens per Day by Flock Size (Number Layers in Flock)			
Less than 100,000		100,000 or More	
Number Eggs	Standard Error	Number Eggs	Standard Error
89.8	(0.5)	90.8	(0.4)

Overall, 17.2 percent of last completed flocks (one flock per farm site) had a peak production of less than 88 eggs per 100 hens per day, and 10.8 percent peaked at 94 or more eggs per 100 hens per day.

b. Percent of farm sites by peak hen-day egg production for the last completed flock:

Number Eggs per 100 Hens per Day	Percent Farm Sites	Standard Error
Less than 88	17.2	(4.1)
88 - 90	24.1	(3.8)
91 - 93	47.9	(4.1)
94 or more	<u>10.8</u>	(2.0)
Total	100.0	

Percent of Farm Sites by Peak Hen-Day Egg Production for the Last Completed Flock



4. Egg production at 60 weeks of age

The number of eggs produced by 60 weeks of age per hen placed ranged from 211.0 in the Great Lakes region to 225.6 in the Central region.

a. Average hen-housed egg production at 60 weeks of age for the last completed flock by region:

Average Hen-Housed Egg Production by Region									
Great Lakes		Southeast		Central		West		All Farm Sites	
Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error	Number Eggs	Standard Error
211.0	(6.9)	223.1	(2.2)	225.6	(1.5)	218.5	(2.8)	218.1	(2.7)

Average egg production at 60 weeks of age per hen placed for the last completed flock was higher for large farms (100,000 or more layers) than small farms; however, a statistical difference is not detectable when the standard error is taken into consideration.

i. Average hen-housed egg production at 60 weeks of age for the last completed flock by farm site size (number of layers):

Average Hen-Housed Egg Production
By Farm Site Size (Number Layers)

Less than 100,000		100,000 or More	
Number Eggs	Standard Error	Number Eggs	Standard Error
215.0	(4.3)	222.7	(1.4)

Average egg production at 60 weeks of age per hen placed for the last completed flock was higher for large flocks (100,000 or more layers in flock) than small flocks, but the difference was statistically insignificant when the standard error is taken into consideration.

ii. Average hen-housed egg production at 60 weeks of age for the last completed flock by flock size (number of layers in flock):

Average Hen-Housed Egg Production
By Flock Size (Number Layers in Flock)

Less than 100,000		100,000 or More	
Number Eggs	Standard Error	Number Eggs	Standard Error
216.1	(3.7)	222.9	(1.6)

About one-third (31.6 percent) of last completed flocks (one flock per farm site) produced less than 216 eggs by 60 weeks of age per hen placed, while 14.9 percent produced 236 eggs or more.

b. Percent of farm sites by average hen-housed egg production at 60 weeks of age for the last completed flock:

Average Number Eggs per Hen Housed	Percent Farm Sites	Standard Error
Less than 216	31.6	(4.6)
216 - 225	31.0	(5.2)
226 - 235	22.5	(3.6)
236 or more	<u>14.9</u>	(4.3)
Total	100.0	

5. End of production

Three-fourths (74.2 percent) of last completed flocks were molted (Table B.3.b). Molted flocks were removed on average at 111.4 weeks of age, while the last completed flocks that were not molted were removed from production at an average of 73.7 weeks of age.

a. Average age (weeks) at which the last completed flock was removed by molting practice:

Molting Practice	Average Age (Weeks)	Standard Error
Molted	111.4	(1.4)
Not molted	73.7	(1.7)
All flocks	101.5	(2.4)

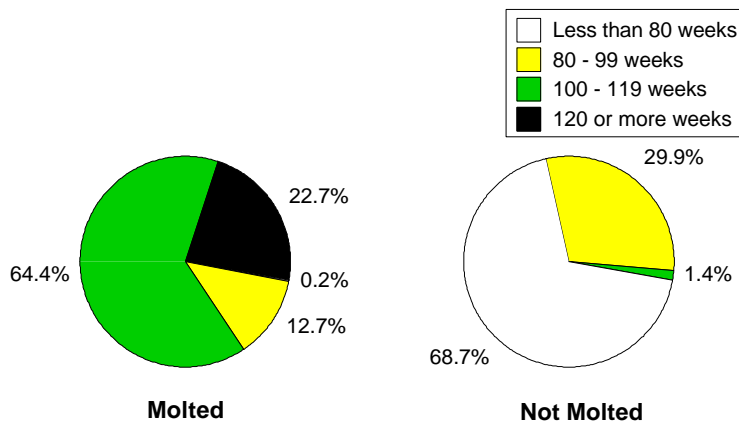
About one-half (47.7 percent) of the last completed flocks were removed from production at 100 to 119 weeks of age. About two-thirds (64.4 percent) of molted flocks ended production at 100 to 119 weeks of age, and two-thirds (68.7 percent) of non-molted flocks ended production before 80 weeks of age.

b. Percent of farm sites by age (weeks) at which the last completed flock was removed by molting practice:

Percent Farm Sites by Molting Practice

Age (Weeks)	Molted		Not Molted		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 80	0.2	(0.1)	68.7	(7.1)	18.3	(4.3)
80 - 99	12.7	(5.9)	29.9	(6.8)	17.3	(4.0)
100 - 119	64.4	(6.5)	1.4	(1.1)	47.7	(6.3)
120 or more	<u>22.7</u>	(4.2)	<u>0.0</u>	(--)	<u>16.7</u>	(3.3)
Total	100.0		100.0		100.0	

Percent of Farm Sites by Molting Practice and by Age (in Weeks) at Which the Last Completed Flock Was Removed



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6. Morbidity

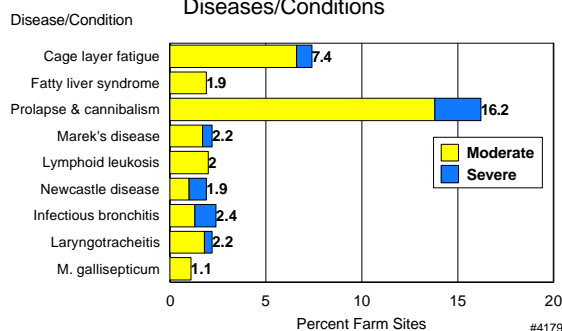
Generally, few producers had any severe or moderate morbidity problems. In fact, less than 3 percent of farms sites had severe or moderate problems with the infectious diseases listed below.

About one-half (53.2 percent) of the last completed flocks experienced prolapse problems, and 16.2 percent of flocks had moderate or severe prolapse problems. About one-third (32.8 percent) of last completed flocks had problems with cage layer fatigue, and 7.4 percent of flocks had moderate or severe problems. Morbidity estimates were based on producer perception with no further confirmation.

a. Percent of farm sites by severity of problem the last completed flock had with the following diseases/conditions:

Disease/Condition	Severe		Moderate		Minor		No Problem		Never Heard of It		Total
	Percent	Stand. Error	Percent	Stand. Error	Percent	Stand. Error	Percent	Stand. Error	Percent	Stand. Error	
Cage layer fatigue	0.8	(0.3)	6.6	(1.8)	25.4	(4.1)	63.5	(4.8)	3.7	(1.4)	100.0
Fatty liver syndrome	0.0	(--)	1.9	(0.8)	15.7	(3.4)	77.8	(3.9)	4.6	(1.5)	100.0
Prolapse (blow out) and cannibalism	2.4	(0.9)	13.8	(3.4)	37.0	(4.5)	46.1	(5.3)	0.7	(0.6)	100.0
Marek's disease	0.5	(0.4)	1.7	(0.6)	16.0	(3.2)	80.2	(3.4)	1.6	(0.9)	100.0
Lymphoid leukosis	0.0	(--)	2.0	(1.2)	10.2	(2.4)	84.1	(3.0)	3.7	(1.3)	100.0
Fowl pox	0.0	(--)	0.5	(0.3)	10.3	(3.3)	88.1	(3.4)	1.1	(0.7)	100.0
Mycotoxycosis	0.0	(--)	0.2	(0.2)	9.4	(2.7)	87.4	(3.0)	3.0	(1.9)	100.0
Avian encephalomyelitis	0.0	(--)	0.0	(--)	2.4	(1.8)	93.0	(2.4)	4.6	(1.9)	100.0
Newcastle disease	0.9	(0.7)	1.0	(0.6)	2.1	(1.8)	95.0	(2.2)	1.0	(0.7)	100.0
Infectious bronchitis	1.1	(0.7)	1.3	(0.6)	12.5	(2.9)	84.5	(3.2)	0.6	(0.4)	100.0
Laryngotracheitis	0.4	(0.3)	1.8	(1.1)	3.2	(1.8)	92.6	(2.4)	2.0	(1.1)	100.0
Infectious coryza	0.2	(0.2)	0.3	(0.2)	3.2	(1.8)	92.1	(2.7)	4.2	(2.1)	100.0
<i>Mycoplasma gallisepticum</i> (MG)	0.0	(--)	1.1	(0.5)	5.0	(2.2)	92.2	(2.4)	1.7	(0.9)	100.0
Respiratory disease (no specific diagnosis)	0.0	(--)	0.4	(0.3)	7.1	(2.3)	92.3	(2.3)	0.2	(0.2)	100.0
Other diseases	2.1	(1.8)	0.6	(0.3)	4.0	(2.8)	93.3	(3.3)	0.0	(--)	100.0

Percent of Farm Sites Where the Last Completed Flock Had Moderate and Severe Problems with the Following Diseases/Conditions



Overall, more producers in the West region observed disease problems in their last completed flocks than in other regions. Problems with avian encephalomyelitis, Newcastle disease, and infectious coryza were reported only in the Great Lakes and West regions. Morbidity estimates were based on producer perception with no further confirmation.

b. Percent of farm sites in which the last completed flock had a minor, moderate, or severe problem with the following diseases/conditions by region:

Disease/Condition	Percent Farm Sites by Region							
	Great Lakes		Southeast		Central		West	
	Percent	Stand. Error	Percent	Stand. Error	Percent	Stand. Error	Percent	Stand. Error
Cage layer fatigue	27.6	(9.3)	22.4	(7.5)	31.8	(6.6)	49.8	(6.6)
Fatty liver syndrome	13.6	(6.9)	11.0	(5.4)	16.9	(7.4)	41.8	(7.7)
Prolapse (blow out) and cannibalism	51.5	(12.3)	27.0	(6.8)	60.8	(5.2)	72.3	(5.2)
Marek's disease	17.3	(7.5)	12.1	(4.4)	20.4	(5.1)	22.7	(5.2)
Lymphoid leukosis	9.8	(5.8)	5.2	(3.2)	23.8	(5.6)	13.1	(3.7)
Fowl pox	5.3	(5.0)	15.7	(9.1)	2.2	(1.1)	20.7	(6.6)
Mycotoxycosis	10.7	(6.6)	7.4	(3.5)	5.4	(2.9)	12.9	(3.9)
Avian encephalomyelitis	5.3	(5.0)	0.0	(--)	0.0	(--)	2.2	(1.2)
Newcastle disease	5.3	(5.0)	0.0	(--)	0.0	(--)	8.1	(4.0)
Infectious bronchitis	12.7	(6.9)	14.7	(5.3)	4.0	(2.8)	26.1	(5.1)
Laryngotracheitis	10.5	(6.3)	1.7	(1.5)	2.8	(1.6)	3.1	(1.6)
Infectious coryza	5.3	(5.0)	0.0	(--)	0.0	(--)	7.0	(2.2)
<i>Mycoplasma gallisepticum</i> (MG)	5.3	(5.0)	2.0	(1.3)	3.7	(2.2)	12.4	(5.0)
Respiratory disease (no specific diagnosis)	10.1	(6.1)	5.8	(2.8)	10.7	(3.4)	2.9	(1.2)
Other diseases	8.8	(7.9)	0.7	(0.5)	5.0	(2.0)	10.0	(6.8)

7. Mortality

A total of 6.5 percent of hens placed in the last completed flock (one flock per farm site) died by 60 weeks of age.

a. Percent of hens placed in the last completed flock that died by 60 weeks of age:

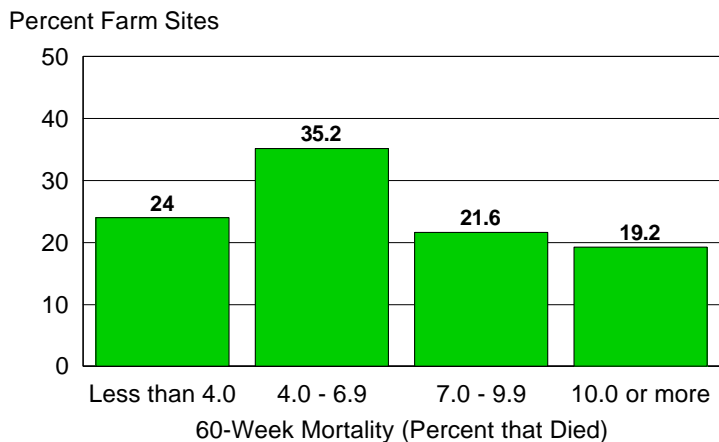
Percent Hens Placed	Standard Error
6.5	(0.3)

The 60-week mortality was less than 4 percent for 24.0 percent of last completed flocks (one flock per farm site). The 60-week mortality was 10 percent or higher for 19.2 percent of last completed flocks.

i. Percent of farm sites by 60-week mortality for the last completed flock:

Mortality (Percent that Died)	Percent Farm Sites	Standard Error
Less than 4.0	24.0	(3.1)
4.0 - 6.9	35.2	(3.6)
7.0 - 9.9	21.6	(2.9)
10.0 or more	<u>19.2</u>	(3.7)
Total	100.0	

Percent of Farm Sites by 60-Week Mortality for the Last Completed Flock



#4209

Overall, the average cumulative mortality (percent of hens placed that died during production) was 14.6 percent. As might be expected, the cumulative mortality was somewhat higher for flocks removed at 90 weeks of age or older (15.1 percent) than for flocks removed at less than 90 weeks of age (12.6 percent).

b. Percent of hens that died during the life of the flock by age at which the flock was removed:

Age Removed	Percent Hens	Standard Error
Less than 90 weeks	12.6	(0.6)
90 weeks or older	15.1	(0.9)
All hens	14.6	(0.7)

The cumulative mortality was less than 8 percent for 14.3 percent of last completed flocks (one flock per farm site). The cumulative mortality was 18.0 percent or higher for 23.2 percent of last completed flocks.

i. Percent of farm sites by cumulative mortality:

Mortality (Percent that Died)	Percent Farm Sites	Standard Error
Less than 8.0	14.3	(2.4)
8.0 - 12.9	36.3	(4.0)
13.0 - 17.9	26.2	(4.3)
18.0 or more	<u>23.2</u>	(4.6)
Total	100.0	

8. Disposal of dead and spent hens

Rendering was the most common method of disposing of *dead* hens at 41.4 percent. Disposal at landfills was the most common method included in the Other category.

- a. Percent of farm sites that disposed of dead hens from the last completed layer flock (and percent of dead hens disposed of) by the following methods:

Method of Disposal	Percent			
	Farm Sites		Dead Hens	
	Percent	Standard Error	Percent	Standard Error
Composting	15.0	(3.5)	11.7	(4.1)
Incineration	9.0	(2.9)	10.4	(4.5)
Covered deep pit	32.0	(5.8)	17.9	(4.3)
Rendering	32.0	(4.9)	41.4	(8.6)
Other	16.1	(3.6)	<u>18.6</u>	(5.4)
Total	--		100.0	

Most of the *spent* hens from the last completed flock were disposed of by processing for food. Although 10.8 percent of the farm sites disposed of some spent hens through live bird markets, these birds accounted for only 2.6 percent of the spent hens from the last completed flocks.

- b. Percent of farm sites (and percent of spent hens) that disposed of spent hens by the following methods:

Method of Disposal	Percent			
	Farm Sites		Spent Hens	
	Percent	Standard Error	Percent	Standard Error
Processing	78.6	(4.4)	86.1	(3.1)
Rendering	8.8	(2.1)	8.9	(2.5)
Live bird market	10.8	(4.1)	2.6	(1.1)
Other	3.8	(2.0)	<u>2.4</u>	(1.3)
Total	--		100.0	

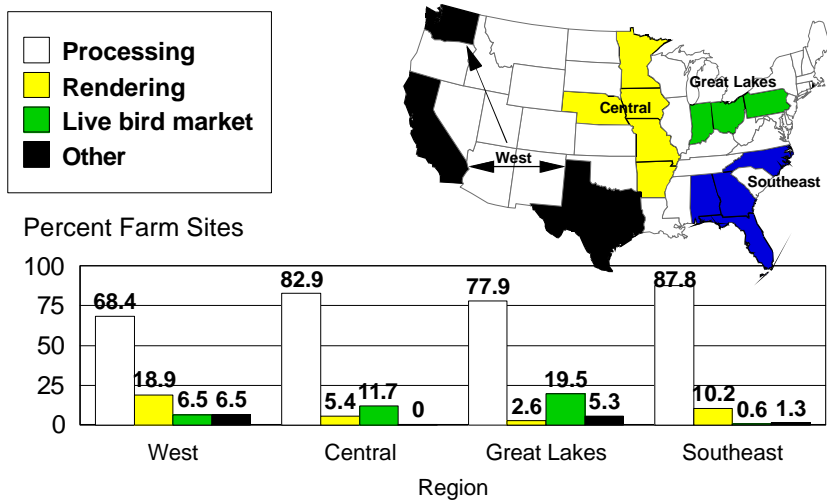
Disposal of *spent* hens via rendering was most common in the West (18.9 percent of farm sites). The percentage of farm sites that disposed of any spent hens from their last completed flock via the live bird market ranged from 0.6 percent of farm sites in the Southeast region to 19.5 percent of farm sites in the Great Lakes region.

i. Percent of farm sites that disposed of spent hens by the following methods and by region:

Percent Farm Sites by Region

Method of Disposal	Great Lakes		Southeast		Central		West	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Processing	77.9	(10.0)	87.8	(4.1)	82.9	(7.7)	68.4	(6.6)
Rendering	2.6	(2.3)	10.2	(3.8)	5.4	(3.4)	18.9	(5.3)
Live bird market	19.5	(10.1)	0.6	(0.6)	11.7	(7.5)	6.5	(2.3)
Other	5.3	(5.0)	1.3	(1.3)	0.0	(--)	6.5	(3.0)

Percent of Farm Sites that Disposed of Spent Hens by Method and by Region



#4178

D. *Salmonella* and Mycoplasma

1. Testing for *Salmonella*

A total of 58.0 percent of farm sites routinely tested for *Salmonella enteritidis* (S.e.), an increase from 15.7 percent in 1994. Percent of farm sites with a *Salmonella enteritidis* (S.e.) testing program ranged from 25.6 percent of farm sites in the Central region to 83.8 percent of farm sites in the Southeast region.

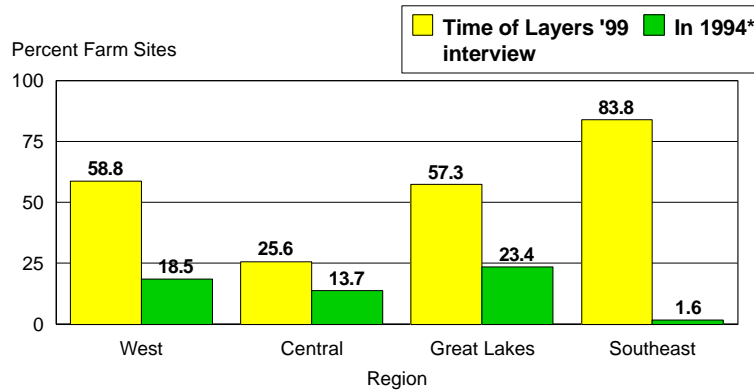
Results of tests were not recorded for the Layers '99 study.

a. Percent of farm sites that were routinely testing for *Salmonella enteritidis* (S.e.) in the layer houses at the time of the Layers '99 interview and in 1994 (5 years earlier) by region:

Time Frame	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Time of interview	57.3	(12.3)	83.8	(6.2)	25.6	(6.2)	58.8	(9.2)	58.0	(5.7)
In 1994*	23.4	(13.3)	1.6	(1.5)	13.7	(5.0)	18.5	(6.6)	15.7	(5.1)

* Excluded farm sites that were less than 5 years old at the time of the Layers '99 interview.

Percent of Farm Sites that Routinely Tested for *Salmonella enteritidis* in the Layer Houses by Time Frame and by Region



* Excluded farm sites that were less than 5 years old at the time of the Layers '99 interview.. #4180

NOTE: The following tables describe those farm sites that tested for *Salmonella enteritidis* (S.e.) at the time of the Layers '99 interview and those farm sites that tested for *Salmonella enteritidis* (S.e.) in 1994. Less than one in five farm sites tested in 1994, whereas nearly three in five farm sites tested during Layers '99 (Table D.1.a).

The most common method of testing for *Salmonella enteritidis* (S.e.) was by manure culture (89.7 percent of farm sites that tested). Approximately one-half of the farm sites that tested for *Salmonella enteritidis* (S.e.) cultured swabs from egg belts and elevator equipment. More than one test method may have been used on a farm site.

- i. For farm sites that tested for *Salmonella enteritidis* (S.e.) in the layer houses for each time period, percent of farm sites that used the following methods to test for *Salmonella enteritidis* (S.e.) in the layer houses at the time of the Layers '99 interview and in 1994:

Method of Testing	Percent Farm Sites by Time Frame			
	Time of Interview		In 1994	
	Percent	Standard Error	Percent	Standard Error
Manure culture (swab)	89.7	(3.6)	84.2	(11.1)
Egg belts culture (swab)*	52.6	(9.2)	41.3	(18.2)
Elevator/equipment culture (swab)*	42.0	(8.7)	34.7	(16.7)
Egg culture	10.4	(3.5)	26.8	(12.1)
Serology	12.7	(3.9)	27.7	(13.0)
Other	0.6	(0.4)	0.0	(--)

* For those farm sites that had such equipment.

Company or farm personnel collected samples for *Salmonella enteritidis* (S.e.) testing in 1999 on nearly three out of four farm sites (70.1 percent). A private veterinarian was the most frequent sample collector included in the Other category.

- ii. For farm sites that tested for *Salmonella enteritidis* (S.e.) in the layer houses, percent of farm sites by primary sample collector for *Salmonella enteritidis* (S.e.) testing at the time of the Layers '99 interview and in 1994:

Primary Sample Collector	Percent Farm Sites by Time Frame			
	Time of Interview		In 1994	
	Percent	Standard Error	Percent	Standard Error
Company or farm personnel	70.1	(6.3)	59.1	(15.3)
State or Federal personnel	8.5	(2.4)	17.2	(10.9)
Other	21.4	(5.4)	23.7	(13.0)
Total	100.0		100.0	

In 1999, approximately equal percentages of farm sites tested (by any method) for *Salmonella enteritidis* (S.e.) before and during the last 4 weeks of production. Testing during the last 4 weeks of production was more common in 1999 than in 1994 for farm sites that tested for *Salmonella enteritidis* (S.e.). About one in three farm sites in each time frame tested before layers were placed. Farm sites may have tested more than once during a production cycle.

iii. For farm sites that tested for *Salmonella enteritidis* (S.e.) in the layer houses, percent of farm sites by when testing for *Salmonella enteritidis* (S.e.) was usually performed at the time of the Layers '99 interview and in 1994:

Time Testing Was Performed	Time of Interview		In 1994	
	Percent	Standard Error	Percent	Standard Error
Before layers were placed	29.4	(6.7)	33.7	(12.8)
After layers were placed but before the last 4 weeks of production	59.8	(8.1)	62.1	(15.1)
During the last 4 weeks of production	59.2	(9.0)	24.5	(9.9)

2. *Salmonella* quality assurance programs

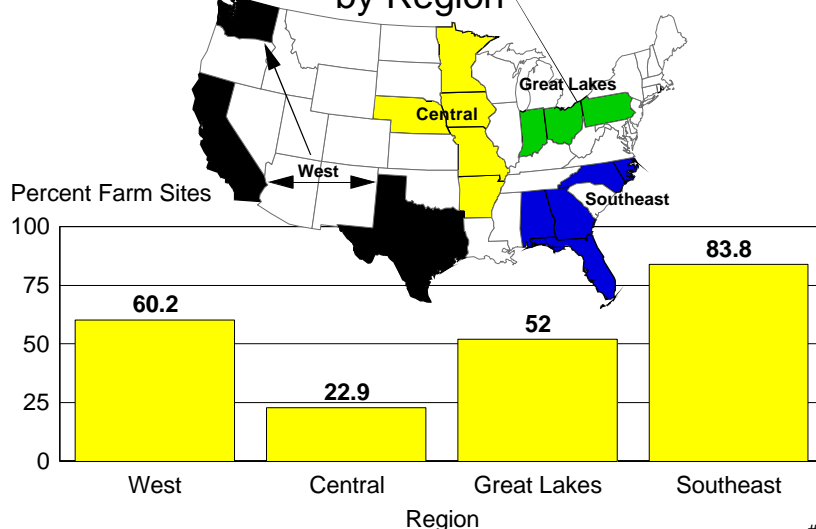
Over one-half (56.1 percent) of farm sites participated in a *Salmonella enteritidis* (S.e.) quality assurance program, with the most common being a company sponsored program (40.3 percent of farm sites). The percentage of farm sites participating in any program ranged from 22.9 percent in the Central region to 83.8 percent in the Southeast. In some states, a state or company program may have been the same as the commodity program and may have been included in one or both categories.

Estimates of participation in programs were based on producer reports with no further confirmation. Note that the percentages of farm sites participating in any quality assurance program are similar to the percentages of farm sites testing for *Salmonella enteritidis* (S.e.) (see Table D.1.a on page 36).

a. Percent of farm sites that participated in the following *Salmonella enteritidis* (S.e.) quality assurance programs by region:

<i>Salmonella enteritidis</i> (S.e.) Quality Assurance Program	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
State program	25.1	(13.4)	9.4	(3.6)	0.0	(--)	48.2	(8.4)	22.7	(5.3)
Company sponsored program	29.5	(9.7)	72.4	(8.5)	21.8	(5.5)	39.5	(8.8)	40.3	(5.3)
Commodity group program (e.g., United Egg Producers)	18.1	(12.1)	59.6	(12.1)	10.2	(3.0)	27.2	(6.8)	28.4	(6.2)
Other	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)
Any	52.0	(12.4)	83.8	(6.2)	22.9	(5.5)	60.2	(9.2)	56.1	(5.7)

Percent of Farm Sites that Participated in Any *Salmonella enteritidis* Quality Assurance Program by Region



#4182

Over one-half (55.0 percent) of farm sites that participated in a *Salmonella enteritidis* (SE) quality assurance program had an inspection by someone not associated with the farm.

- i. For farm sites that participated in a *Salmonella enteritidis* (SE) quality assurance program, percent of farm sites that had an inspection by someone not associated with the farm site or company to verify compliance with the *Salmonella enteritidis* (SE) quality assurance program:

Percent Farm Sites	Standard Error
55.0	(8.2)

3. *Mycoplasma*

About two-thirds (66.4 percent) of farm sites considered themselves free of *Mycoplasma gallisepticum* (MG), while 22.8 percent of farm sites did not have an opinion about their *Mycoplasma gallisepticum* (MG) status. Note that this information was obtained from farm site managers who may not have been aware of their *Mycoplasma gallisepticum* (MG) status, whereas corporate staff may have had more information.

- a. Percent of farm sites that considered their farm sites to be *Mycoplasma gallisepticum* (MG) free:

Percent Farm Sites by MG Status

Free		Don't Know		Not Free		Total
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent
66.4	(5.1)	22.8	(4.8)	10.8	(2.7)	100.0

(See the graph on page 41.)

About two-thirds (67.0 percent) of farm sites used some method to determine *Mycoplasma gallisepticum* (MG) status. Vaccination was the most common method included in the Other category.

- i. Percent of farm sites by method of determining *Mycoplasma gallisepticum* (MG) status:

Method of Determining MG Status	Percent Farm Sites	Standard Error
Serology	58.5	(5.4)
Culture	13.7	(5.2)
Other	2.2	(1.0)
Any	67.0	(5.2)

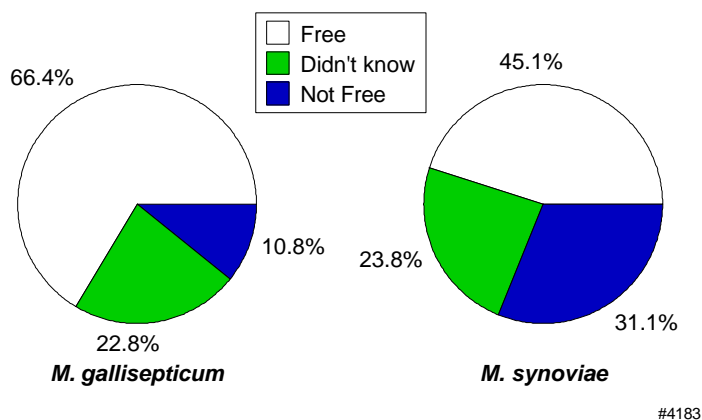
Slightly less than one-half (45.1 percent) of farm sites considered themselves free of *Mycoplasma synoviae* (MS), while 23.8 percent of farm sites did not have an opinion about their *Mycoplasma synoviae* (MS) status.

b. Percent of farm sites that considered their farm sites to be *Mycoplasma synoviae* (MS) free:

Percent Farm Sites by MS Status

Free		Don't Know		Not Free		Total
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
45.1	(4.7)	23.8	(4.8)	31.1	(6.2)	100.0

Percent of Farm Sites by Considered *Mycoplasma gallisepticum* and *Mycoplasma synoviae* Status



#4183

(See also Table D.3.a on the previous page.)

About two-thirds (64.8 percent) of farm sites used some method to determine *Mycoplasma synoviae* (MS) status.

i. Percent of farm sites by method of determining *Mycoplasma synoviae* (MS) status:

Method of Determining MS Status	Percent Farm Sites	Standard Error
Serology	58.0	(5.4)
Culture	11.9	(4.9)
Other	1.7	(1.0)
Any	64.8	(5.4)

E. Manure Handling

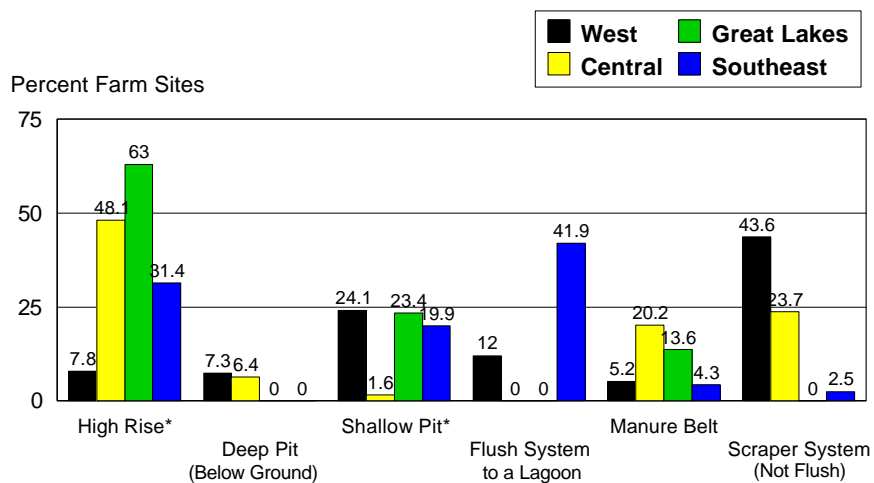
1. Manure handling method

Manure handling systems varied by region. High rise housing was the most common method used in the Great Lakes and Central regions (63.0 percent and 48.1 percent of farm sites, respectively). In the Southeast region, the most common method was flushing to a lagoon (41.9 percent of farm sites). Scraper systems (not flush) were the most common method used in the West region (43.6 percent of farm sites).

a. Percent of farm sites by primary manure handling method and by region:

Primary Manure Handling Method	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
High rise (pit at ground level with house above)	63.0	(12.3)	31.4	(6.0)	48.1	(6.0)	7.8	(2.1)	39.7	(4.4)
Deep pit (below ground)	0.0	(--)	0.0	(--)	6.4	(3.9)	7.3	(2.5)	2.9	(1.0)
Shallow pit (pit at ground level with raised cages)	23.4	(9.6)	19.9	(7.3)	1.6	(1.2)	24.1	(7.2)	18.9	(4.4)
Flush system to a lagoon	0.0	(--)	41.9	(5.9)	0.0	(--)	12.0	(3.6)	12.5	(2.5)
Manure belt	13.6	(6.7)	4.3	(2.1)	20.2	(4.9)	5.2	(1.5)	10.6	(2.7)
Scraper system (not flush)	0.0	(--)	2.5	(2.1)	23.7	(8.7)	43.6	(6.4)	15.4	(2.6)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites by Primary Manure Handling Method by Region



* High rise: pit at ground level with house above. Shallow pit: pit at ground level with raised cages.

#4184

Nearly all (96.6 percent) of farm sites that had a high rise, deep, or shallow pit removed manure between each flock or more frequently.

i. For farm sites that used a high rise, deep, or shallow pit, percent of farm sites by frequency of manure disposal:

Frequency of Manure Disposal	Percent Farm Sites with Manure Pits	Standard Error
After each flock removed or more frequently	96.6	(1.6)
After 2 - 3 flocks	3.4	(1.6)
After 4 or more flocks	0.0	--

The lagoon was at least 100 feet away from the nearest layer house on about one-half (49.9 percent) of farm sites that used a flush system.

ii. For farm sites that used a flush system, percent of farm sites by minimum distance (in feet) from the lagoon to the nearest layer house:

Distance (Feet)	Percent Farm Sites	Standard Error
Less than 50	23.0	(6.9)
50 - 99	27.1	(5.8)
100 or more feet	<u>49.9</u>	(9.5)
Total	100.0	

Most (71.0 percent) of the farm sites that used a scraper system or manure belt disposed of the manure within 7 days, while 14.9 percent composted the manure on farm.

iii. For farm sites that used a scraper system or manure belt, percent of farm sites by disposition of the manure once it was removed from the layer house:

Disposition	Percent Farm Sites	Standard Error
Disposed of within 7 days (spread on fields or removed from the farm)	71.0	(5.6)
Stored in a manure pile on farm for more than 7 days	14.1	(3.5)
Composted on farm (aerated and/or stirred) or dehydrated on farm	<u>14.9</u>	(5.0)
Total	100.0	

2. Manure disposal

Farm sites may have disposed of manure by more than one method. Manure was sold or given away by 39.7 percent of farm sites, which accounted for over one-half (51.6 percent) of the manure produced. Less than one-half (44.9 percent) of manure was spread on fields; 33.4 percent of manure was spread on fields where no livestock grazed; and 11.5 percent of manure was spread on fields grazed by livestock. Data were collected within the categories listed below.

a. Percent of farm sites (and percent of manure¹) by disposal method:

Manure Disposal Method	Percent Farm Sites	Standard Error	Percent Manure ¹	Standard Error
Applied on fields where no livestock grazed	53.8	(4.8)	33.4	(6.1)
Applied on fields where livestock grazed	31.7	(5.4)	11.5	(2.5)
Sold or given away	39.7	(5.3)	51.6	(6.9)
Other	6.7	(1.7)	<u>3.5</u>	(1.0)
Total	--		100.0	

When manure was spread on fields, the application rate was usually based on crop nutrient requirement (72.8 percent of farm sites that spread manure on fields).

i. For farm sites that spread any manure on fields, percent of farm sites where the manure application rate was based on crop nutrient requirements:

Percent Farm Sites	Standard Error
72.8	(5.2)

Most (86.2 percent) farm sites viewed manure as a valuable by-product, regardless of size of the farm site.

b. Percent of farm sites by opinion of value of manure and by farm site size (number of layers):

Value of Manure	Percent Farm Sites by Farm Site Size (Number Layers)					
	Less than 100,000		100,000 or More		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Waste product to be properly disposed of	11.7	(4.9)	17.5	(4.7)	13.8	(3.7)
Valuable by-product	<u>88.3</u>	(4.9)	<u>82.5</u>	(4.7)	<u>86.2</u>	(3.7)
Total	100.0		100.0		100.0	

1 Weighted by number of layers on hand December 1, 1998.

F. Pest control

1. Access to feed

Most likely, if animals or insects have access to the layer house, they have access to the feed trough. Rodents and flies had access to feed in the feed troughs on nearly all farm sites (89.9 and 91.3 percent, respectively) but had access to feed prior to it being fed to the birds on 21.4 and 31.4 percent of farm sites, respectively.

- a. Percent of farm sites where the following animals and insects had access to: 1) feed in tanks, bins, lines, hoppers, etc., *prior* to the feed being fed to layers and 2) feed in the layer feed troughs (i.e., in front of birds):

Animal/Insect	<u>Percent Farm Sites by Location</u>			
	Tanks, Bins, Lines, Hoppers, Etc.		Layer Feed Troughs (In Front of Birds)	
	Percent	Standard Error	Percent	Standard Error
Rodents	21.4	(4.3)	89.9	(4.1)
Wild birds	7.6	(2.1)	23.5	(3.9)
Flies	31.4	(4.9)	91.3	(3.9)
Cats	5.0	(2.0)	19.6	(3.6)
Dogs	1.6	(0.9)	4.0	(1.2)
Any of the above	32.6	(4.8)	92.8	(3.9)

2. Fly control

Use of baits was the most common form of fly control, used on 72.1 percent of farm sites (primary method on 34.5 percent of farm sites). Biological predators (e.g., wasps) were used on 13.8 percent of farm sites and this was the primary fly control method for 8.9 percent of farm sites.

a. Percent of farm sites by fly control methods (and **primary** fly control method) used in the layer houses in 1998:

Percent Farm Sites by Fly Control Method

Fly Control Method	Methods Used		Primary Method Used	
	Percent	Standard Error	Percent	Standard Error
Residual spray	58.2	(5.5)	20.0	(4.4)
Baits	72.1	(4.4)	34.5	(5.5)
Larvicide (spot treatment)	20.6	(5.2)	0.5	(0.3)
Larvicide in feed	36.5	(5.3)	15.1	(4.1)
Space sprays/foggers	39.0	(6.2)	8.6	(2.5)
Biological predators	13.8	(3.5)	8.9	(3.2)
Other	7.1	(1.9)	3.0	(1.0)
None	9.4	(2.5)	<u>9.4</u>	(2.5)
Total	--		100.0	

3. Rodent control

Nearly all (99.2 percent) farm sites used some method of rodent control. Chemicals or baits were by far the most common method of rodent control. Traps or sticky tape were used by almost one-half (46.0 percent) of farm sites but was the primary method of rodent control for only 6.7 percent of farm sites.

a. Percent of farm sites by rodent control methods (and *primary* rodent control method) used in the layer houses in 1998:

Rodent Control Method	Methods Used		Primary Method Used	
	Percent	Standard Error	Percent	Standard Error
Chemicals or bait including those used by an exterminator	92.7	(2.3)	84.3	(3.1)
Traps or sticky tape	46.0	(6.5)	6.7	(2.4)
Cats	25.6	(4.3)	7.8	(2.3)
Other	1.2	(0.4)	0.4	(0.2)
None	0.8	(0.5)	<u>0.8</u>	(0.5)
Total	--		100.0	

A professional exterminator was used on 14.1 percent of farm sites that used at least one method of rodent control.

i. For farm sites that used at least one rodent control method during 1998, percent of farm sites that used a professional exterminator for rodent control in any of the layer houses during 1998:

Percent Farm Sites	Standard Error
14.1	(3.0)

Larger percentages of farm sites in the West (30.8 percent) and Southeast (20.8 percent) regions considered rats to be the major rodent problem compared to the Great Lakes (5.3 percent) and Central (8.7 percent) regions, where over 90.0 percent of farm sites each considered mice to be the greatest rodent problem.

b. Percent of farm sites by rodent that caused the greatest on-going problems in the layer houses during 1998 and by region:

Rodent	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Mice	94.7	(5.0)	79.2	(7.2)	91.3	(4.3)	66.7	(8.1)	84.0	(3.6)
Rats	5.3	(5.0)	20.8	(7.2)	8.7	(4.3)	30.8	(8.2)	15.4	(3.6)
Other	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>0.0</u>	(--)	<u>2.5</u>	(1.4)	<u>0.6</u>	(0.3)
Total	100.0		100.0		100.0		100.0		100.0	

A total of 27.9 percent of farm sites considered their farms to have a moderate or severe problem with mice, and 8.5 percent considered their farms to have a moderate or severe problem with rats. The most common rodent specified in the Other category was squirrels. These estimates were based on producer interpretations of *severe*, *moderate*, and *slight* problem levels.

i. Percent of farm sites by level of on-going problems with rodents in the layer houses during 1998 and by rodent type:

Rodent Type	Severe		Moderate		Slight		None		Total
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Mice	2.4	(1.7)	25.5	(4.5)	62.4	(5.3)	9.7	(3.5)	100.0
Rats	1.6	(0.6)	6.9	(2.1)	43.7	(5.8)	47.8	(6.1)	100.0
Other	0.0	(--)	0.8	(0.3)	1.2	(0.4)	98.0	(0.5)	100.0

G. Biosecurity

A non-business visitor was defined as anyone who did not have a business reason for visiting the operation, such as friends, family members, and tours.

1. Non-business visitors

About two-thirds (68.1 percent) of farm sites did not allow non-business visitors in the layer houses. This percentage was similar across regions.

a. Percent of farm sites by policy for *non-business* visitors in the layer houses and by region:

Policy	<u>Percent Farm Sites by Region</u>									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Visitors were required to sign in	15.5	(11.6)	11.7	(4.4)	5.0	(2.0)	11.2	(4.2)	11.7	(4.3)
Visitors were <i>not</i> required to sign in	16.0	(7.5)	28.1	(9.6)	22.6	(6.6)	17.2	(5.1)	20.2	(3.9)
No visitors were allowed	<u>68.5</u>	(14.1)	<u>60.2</u>	(9.2)	<u>72.4</u>	(6.7)	<u>71.6</u>	(6.3)	<u>68.1</u>	(5.7)
Total	100.0		100.0		100.0		100.0		100.0	

(See graph on page 51.)

The percentage of farm sites that allowed non-business visitors into the layer houses did not differ by size of farm site. However, visitors were more likely to be required to sign in on large farm sites.

- i. Percent of farm sites by policy for *non-business* visitors in the layer houses and by farm site size:

Policy	Percent Farm Sites by Farm Site Size (Number Layers)			
	Less than 100,000		100,000 or More	
	Percent	Standard Error	Percent	Standard Error
Visitors were required to sign in	5.6	(1.8)	22.0	(8.9)
Visitors were <i>not</i> required to sign in	24.8	(6.1)	12.5	(3.5)
No visitors were allowed	<u>69.6</u>	(6.5)	<u>65.5</u>	(8.3)
Total	100.0		100.0	

About two-thirds (62.9 percent) of farm sites that allowed non-business visitors required the visitors' vehicles not to have been on another poultry farm that day. A total of 7.6 percent of farm sites that allowed non-business visitors required the vehicle to be cleaned and disinfected upon entering, and 30.3 percent required the vehicle to be parked in a restricted area.

- ii. For farm sites where *non-business* visitors were allowed to enter the production area, percent of farm sites by requirements for vehicles:

Policy	Percent Farm Sites	Standard Error
Cleaned and disinfected upon entering	7.6	(3.7)
Park in a restricted area away from chicken housing	30.3	(8.1)
Not to have been on another poultry farm that day	62.9	(8.9)
Any of the above	65.6	(8.7)
All of the above	7.6	(3.7)

A business visitor was defined as anyone who had a business reason for visiting the operation, such as a salesman, repairman, feed service personnel, veterinarian, and company personnel who did not normally work on the operation.

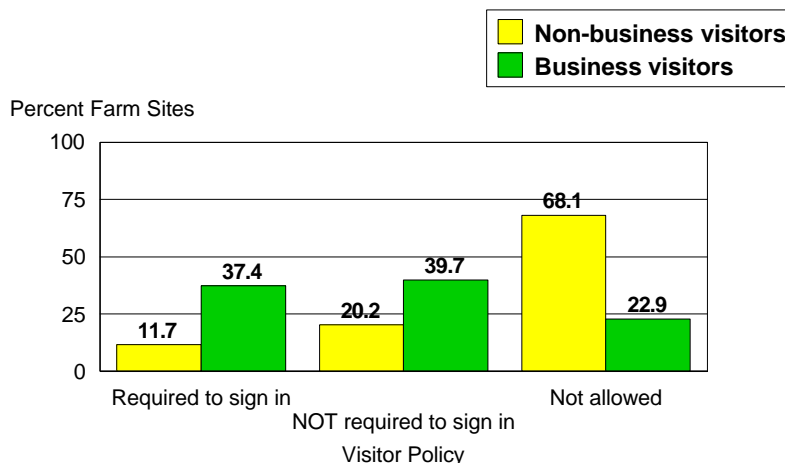
2. Business visitors

A total of 22.9 percent of farm sites did not allow business visitors in the layer houses. A similar percentage required business visitors to sign in (37.4 percent) as did not require it (39.7 percent). The percentage of farm sites that allowed business visitors in layer houses without signing in ranged from 29.1 percent of farm sites in the Great Lakes region to 59.7 percent in the Central region.

a. Percent of farm sites by policy for **business** visitors in layer houses and by region:

Policy	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Visitors were required to sign in	43.3	(16.6)	38.2	(12.5)	19.6	(5.0)	41.4	(7.1)	37.4	(6.7)
Visitors were <i>not</i> required to sign in	29.1	(13.5)	35.9	(11.7)	59.7	(7.8)	43.8	(6.7)	39.7	(6.0)
No visitors were allowed	<u>27.6</u>	(16.9)	<u>25.9</u>	(11.9)	<u>20.7</u>	(6.1)	<u>14.8</u>	(4.1)	<u>22.9</u>	(6.8)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites by Policies for Non-business and Business Visitors in the Layer Houses



#4185

About one-half (50.3 percent) of farm sites with 100,000 or more layers allowed business visitors in the layer houses but required them to sign in, while smaller farm sites most commonly allowed business visitors entry to the layer houses without signing in (42.0 percent).

- i. Percent of farm sites by policy for *business* visitors in layer houses and by farm site size:

Policy	Percent Farms Sites by Farm Size (Number Layers)			
	Less than 100,000		100,000 or More	
	Percent	Standard Error	Percent	Standard Error
Visitors were required to sign in	29.7	(7.2)	50.3	(8.1)
Visitors were <i>not</i> required to sign in	42.0	(8.4)	35.8	(6.6)
No visitors were allowed	28.3	(9.5)	13.9	(4.0)

About two-thirds (61.6 percent) of farm sites that allowed business visitors required the visitors' vehicles not to have been on another poultry farm that day. A total of 15.9 percent of farm sites that allowed business visitors required the vehicle to be cleaned and disinfected, and 27.2 percent required the vehicle to be parked in a restricted area.

- ii. For farm sites where *business* visitors were allowed to enter the production area, percent of farm sites by requirements for vehicles:

Policy	Percent Farm Sites	Standard Error
Cleaned and disinfected upon entering	15.9	(4.0)
Park in a restricted area away from chicken housing	27.2	(4.4)
Not to have been on another poultry farm that day	61.6	(6.4)
Any of the above	69.5	(6.1)
All of the above	7.8	(2.7)

3. Visitors in layer house(s)

Clean boots were required for visitors on 76.1 percent of farm sites, and footbaths were used by 34.0 percent of farm sites. Showers were required on 2.9 percent of farm sites.

- a. For farm sites that allowed *any* visitors to enter layer houses, percent of farm sites by requirements for visitors before entering the layer houses:

Policy	Percent Farm Sites	Standard Error
Shower	2.9	(1.5)
Clean boots	76.1	(4.8)
Clean coveralls	64.5	(5.9)
Footbaths	34.0	(6.6)
Any of the above	80.1	(4.3)

Footbaths were used an average of 5.1 days before being changed.

- i. For farm sites that required footbaths of visitors before entering layer houses, average number of days the footbath solution was used before it was changed:

Average Number (Days)	Standard Error
5.1	(0.9)

4. Barriers to farm site access

Over three-fourths (77.7 percent) of farm sites used some type of barrier to restrict access to the farm, with the most common being signs posted (72.9 percent). The most common method included in the Other category was locking the layer buildings.

- a. Percent of farm sites by barriers that restricted or limited visitor access to the farm site:

Barrier	Percent Farm Sites	Standard Error
Gated entrance	16.5	(2.3)
Fencing surrounding the farm	26.7	(4.3)
Signs posted (i.e., no trespassing)	72.9	(4.1)
Other	7.0	(1.6)
Any of the above	77.7	(3.8)

5. Employees/crews

NOTE: Company or contract crews were not used on 16.8 percent of farm sites. These farm sites were not included in the estimates for requirements for crews.

Over one-half the farm sites required employees and crews not to be around other poultry and not to own birds, although more farm sites had these requirements for employees than for crews. A change of clothes was required for employees by 17.6 percent of farm sites and for crews by 32.0 percent of farm sites.

a. Percent of farm sites by requirements for employees and company or contract crews¹ who worked in the layer houses:

Requirement	Employees		Company or Contract Crews ¹	
	Percent	Standard Error	Percent	Standard Error
Different personnel for different houses	19.2	(5.1)	17.2	(5.3)
Footbaths	24.5	(5.4)	24.6	(6.4)
Shower	3.9	(1.4)	4.8	(1.7)
Change clothes/coveralls	17.6	(3.7)	32.0	(5.6)
Not be around other poultry (e.g., other farms, markets, slaughter plants)	85.2	(3.2)	74.0	(6.6)
Cannot own their own poultry or birds	75.7	(4.5)	55.2	(6.5)
Any of the above	88.4	(2.8)	80.8	(6.3)

Most (72.3 percent) farm sites had fewer than 10 employees, while 2.3 percent of farm sites had 50 or more.

b. Percent of farm sites by the *highest* number of paid and unpaid workers (including family members) who worked on the farm site on any one day during 1998:

Number Workers	Percent Farm Sites	Standard Error
Less than 10	72.3	(5.3)
10 - 49	25.4	(5.3)
50 or more	<u>2.3</u>	(1.0)
Total	100.0	

¹ Excludes those operations that did not use company and contract crews.

On most (68.3 percent) farm sites, fewer than five employees had access to the layer houses, while 13.1 percent of farm sites had 10 or more employees with access to the layer houses.

c. Percent of farm sites by the number of paid and unpaid workers (including family members) who normally had access to the layer houses on any one day during 1998:

Number Workers	Percent Farm Sites	Standard Error
Less than 5	68.3	(4.6)
5 - 9	18.6	(3.5)
10 or more	<u>13.1</u>	(2.4)
Total	100.0	

An average of 1.9 workers lived on the farm site. This number was similar for farm sites of less than 100,000 layers and 100,000 or more layers.

d. Average number of workers (paid and unpaid, including family members) who lived on the farm site by farm site size:

Average Number by Farm Site Size (Number Layers)

Less than 100,000		100,000 or More		All Farm Sites	
Average Number	Standard Error	Average Number	Standard Error	Average Number	Standard Error
1.8	(0.1)	2.0	(0.3)	1.9	(0.1)

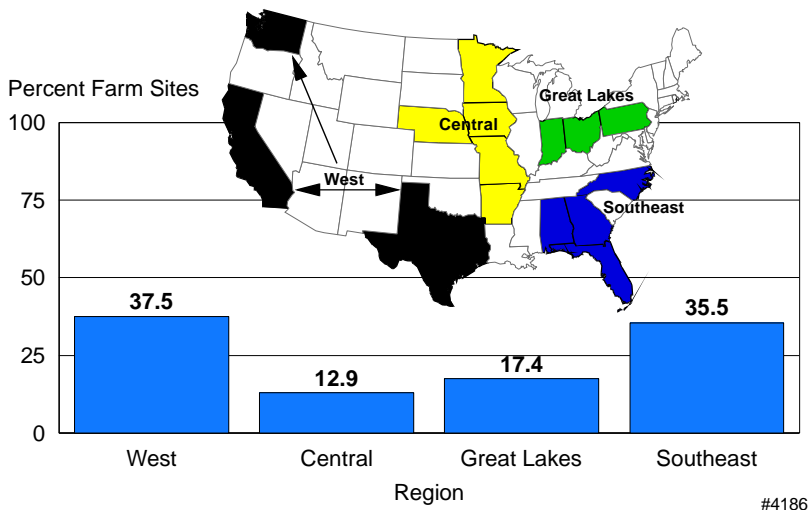
6. Proximity to poultry

Overall, 25.7 percent of farm sites were within one mile of another premises with poultry. The percentage of farm sites within one-quarter mile of another premises with poultry ranged from 2.8 percent of farm sites in the Central region to 15.6 percent of farm sites in the West.

a. Percent of farm sites by distance (miles) to the nearest premises with poultry and by region:

Distance (Miles)	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 0.25	7.6	(5.9)	5.9	(3.5)	2.8	(1.6)	15.6	(4.7)	8.4	(2.6)
0.25 - 0.9	9.8	(5.8)	29.6	(8.5)	10.1	(3.5)	21.9	(4.1)	17.3	(3.3)
1.0 - 4.9	58.7	(13.9)	30.7	(6.3)	48.8	(10.2)	44.7	(6.3)	47.2	(6.0)
5.0 or more	<u>23.9</u>	(13.1)	<u>33.8</u>	(10.3)	<u>38.3</u>	(10.0)	<u>17.8</u>	(4.0)	<u>27.1</u>	(5.6)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Farm Sites Within 1 Mile of Another Premise with Poultry by Region



Overall, less than 2 percent of farm sites had broilers, other poultry, or other domestic birds on the farm site. About one-third (34.1 percent) of farm sites had cattle. Cattle were most common on farm sites in the Southeast (44.2 percent) and West (42.8 percent) regions. One-half of the farm sites had cats (50.2 percent) and dogs (50.4 percent).

b. Percent of farm sites with the following domestic animals present on the farm site by region:

Animal	Percent Farm Sites by Region									
	Great Lakes		Southeast		Central		West		All Farm Sites	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Broilers	0.0	(--)	3.7	(2.2)	0.0	(--)	0.7	(0.6)	1.0	(0.6)
Other poultry (e.g., turkeys, ducks, geese)	0.0	(--)	2.2	(1.2)	0.0	(--)	4.9	(1.6)	1.7	(0.5)
Other domestic birds (ratites, peacocks, etc.)	0.0	(--)	0.0	(--)	0.0	(--)	0.7	(0.6)	0.2	(0.1)
Cattle	26.1	(9.8)	44.2	(9.4)	25.1	(5.4)	42.8	(8.3)	34.1	(5.0)
Horses or other equids	19.0	(9.5)	7.0	(2.9)	8.6	(3.1)	10.8	(3.9)	12.4	(3.7)
Sheep/goats	10.7	(6.8)	1.5	(0.8)	3.8	(1.7)	11.1	(2.8)	7.5	(2.5)
Pigs	10.3	(5.4)	3.8	(1.8)	22.6	(4.3)	6.9	(1.9)	10.2	(2.2)
Cats	44.2	(10.0)	41.9	(8.9)	65.8	(8.0)	55.2	(7.4)	50.2	(4.8)
Dogs	47.0	(9.1)	42.0	(9.2)	67.5	(5.6)	50.6	(6.6)	50.4	(4.4)
Any of the above	68.5	(7.8)	65.8	(11.4)	88.2	(3.2)	80.3	(5.4)	74.3	(4.2)

7. Down time

a. Usual farm site management

The average *usual* down time between flocks ranged from 10.5 days for farm sites in the Central region to 20.4 days in the Great Lakes region.

i. Average number of days layer houses were usually empty between flocks by region:

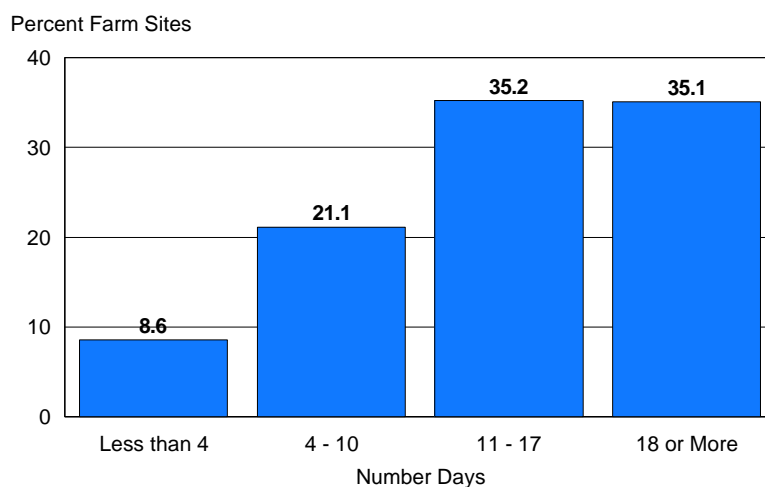
Number Days Empty by Region									
Great Lakes		Southeast		Central		West		All Farm Sites	
Number Days	Standard Error	Number Days	Standard Error	Number Days	Standard Error	Number Days	Standard Error	Number Days	Standard Error
20.4	(2.8)	15.2	(1.8)	10.5	(1.6)	18.8	(1.8)	17.1	(1.2)

About one-third (35.1 percent) of farm sites usually had a down time of 18 days or longer, while 8.6 percent of farm sites usually had a down time of less than 4 days. The median (midpoint) down time was 14 days (not shown in table).

ii. Percent of farm sites by number of days layer houses were usually empty between flocks:

Number Days	Percent Farm Sites	Standard Error
Less than 4	8.6	(2.7)
4 -10	21.1	(4.7)
11 -17	35.2	(5.9)
18 or more	<u>35.1</u>	(5.7)
Total	100.0	

Percent of Farm Sites by Number of Days Layer Houses Were Usually Empty Between Flocks



#4187

Nearly all (99.2 percent) farm sites *attempted* to capture and remove layers that had escaped from their cages before placing a new flock.

iii. Percent of farm sites that removed layers which escaped from their cages at the end of production:

Percent Farm Sites	Standard Error
99.2	(0.4)

b. Last completed flock

Although the usual practice is to have houses empty an average of 17.1 days (see Table G.7.a.i), variations from the usual practice may occur from time to time. For the last completed flock per farm site, the average down time (before placing the current flock) was 25.1 days. Some houses were empty for 6 months or longer for reasons such as remodeling.

i. Average number days between removing the last spent layer and placing the first hen of the next flock:

Average Number Days	Standard Error
25.1	(3.8)

In general, the down time distribution for the last completed flock was similar to the usual policy. The percentage of farm sites with a down time of 18 days or longer following their last completed flock was 44.8 percent, compared to 35.1 percent of farm sites with a usual down time this long (see Table G.7.a.ii).

ii. Percent of farm sites by number of days between removing the last spent layer and placing the first hens of the next flock:

Average Number Days	Percent Farm Sites	Standard Error
Less than 4	11.3	(3.0)
4 - 10	17.3	(3.0)
11 - 17	26.6	(4.9)
18 or more	<u>44.8</u>	(6.4)
Total	100.0	

Over 70 percent of farm sites emptied feeders (98.7 percent), emptied feed hoppers (91.3 percent), flushed water lines (81.3 percent), dry cleaned cages, walls and ceilings (79.4 percent) and cleaned fans and ventilation systems (71.8 percent) *between each* flock.

About one-third of farm sites never washed (39.4 percent) or disinfected (32.4 percent) egg belts/elevators between flocks.

c. Percent of farm sites by frequency of sanitation measures used during down time:

Procedure	Percent Farm Sites by Frequency								Total
	Between Each Flock		After Two or More Flocks		Never		Not Applicable		
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	
Empty feeders	98.7	(0.5)	0.7	(0.4)	0.6	(0.3)	0.0	(--)	100.0
Wash feeders	35.8	(5.3)	11.2	(5.2)	53.0	(5.4)	0.0	(--)	100.0
Disinfect feeders	45.6	(6.1)	8.8	(5.0)	45.6	(5.5)	0.0	(--)	100.0
Empty feed hoppers	91.3	(2.4)	0.7	(0.4)	5.8	(2.2)	2.2	(0.9)	100.0
Wash feed hoppers	24.2	(4.6)	13.9	(5.0)	59.7	(6.1)	2.2	(0.9)	100.0
Disinfect feed hoppers	37.7	(5.8)	11.7	(5.0)	48.4	(5.7)	2.2	(0.9)	100.0
Empty water tanks	18.9	(4.5)	3.6	(1.9)	26.7	(5.2)	50.8	(5.6)	100.0
Wash water tanks	13.6	(4.1)	1.7	(0.7)	33.9	(5.6)	50.8	(5.6)	100.0
Disinfect water tanks	16.7	(4.4)	2.9	(1.8)	29.6	(5.3)	50.8	(5.6)	100.0
Flush water lines	81.3	(3.4)	1.5	(0.9)	16.5	(3.2)	0.7	(0.3)	100.0
Disinfect water lines	57.0	(6.0)	5.3	(2.4)	37.2	(5.6)	0.5	(0.2)	100.0
Culture water source	18.8	(4.8)	19.1	(5.4)	62.1	(5.5)	0.0	(--)	100.0
Wash egg belts/elevators	22.6	(5.7)	11.4	(5.0)	39.4	(4.7)	26.6	(4.4)	100.0
Disinfect egg belts/elevators	32.3	(5.4)	8.7	(4.9)	32.4	(4.6)	26.6	(4.4)	100.0
Replace egg belts/elevators	11.0	(2.9)	15.0	(4.0)	47.4	(6.6)	26.6	(4.4)	100.0
Dry clean (blow down) cages, walls, ceilings	79.4	(3.7)	1.1	(0.6)	19.5	(3.7)	0.0	(--)	100.0
Wash cages, walls, ceilings	30.6	(4.5)	23.0	(5.7)	46.4	(5.8)	0.0	(--)	100.0
Disinfect cages, walls, ceilings	44.5	(5.4)	20.6	(5.9)	34.9	(5.2)	0.0	(--)	100.0
Fumigate cages, walls, ceilings	17.3	(3.2)	17.1	(6.3)	65.6	(6.5)	0.0	(--)	100.0
Clean fans, ventilation system, cool cells	71.8	(4.6)	6.0	(3.1)	8.8	(3.0)	13.4	(2.5)	100.0

Section II: Methodology

A. Needs assessment

NAHMS was approached by United Egg Producers and U.S. Poultry and Egg with a request for a national table egg layer study addressing the issue of *Salmonella enteritidis* (S.e.). To further identify information needs, four focus groups were assembled to represent a broad spectrum of information users. These focus groups represented researchers/academia, industry, state and federal government, and West coast interests. Conference calls were held to brainstorm potential study topics. Focus group members then voted on topics to set the study objectives. Key participants from each focus group continued to provide advice on the study objectives and to provide guidance throughout the study design, implementation, and analysis. These individuals met twice in person and communicated regularly via telephone and e-mail discussions.

B. Sampling and estimation

1. State selection

The goal for NAHMS national studies is to include states that account for at least 70 percent of the animal and farm population in the U.S. The National Agricultural Statistics Service (NASS) Layers and Egg Production, 1997 Summary (released January 1998) was used to determine state ranking for table egg layers. All states with 4.0 percent or more of the U.S. table egg layers were included in the study. In addition, five states were added to provide better geographic coverage (Missouri, Washington, North Carolina, Arkansas, Alabama), resulting in a total of 15 states participating, representing 82 percent of 1997 U.S. table egg layers. NASS does not publish the total number of layer farms (some data were received from the 1992 Census of Agriculture), and therefore, number of layer farms per state did not contribute to state selection for this study.

2. Operation selection

NASS maintains a list of all egg-laying operations with 30,000 or more laying hens which is the basis for estimating monthly egg production. An operation may have one farm or multiple farms. Farms from multiple-farm operations may be company owned or contract farms. The individual farms may have fewer than 30,000 layers, but the total layers for all farms associated with a company must equal or exceed 30,000. All operations (companies) that had 30,000 or more laying hens (20 weeks of age or older) in the 15 selected states were eligible to participate.

3. Farm selection

NASS enumerators made the first personal contact to the operations. Enumerators visited company headquarters except for single-farm operations, where the farm was visited. If a company had farms in more than one state, each state was treated as a separate operation (assigned a unique operation identification code), and the NASS enumerator contacted the person who reported for the company in that state. The NASS enumerator selected a random sample of farms to participate. All farms were selected for operations with 10 or fewer farms. If the operation had 11 to 29 farms, 10 farms were selected. If there were 30 or more farms, 15 farms were selected.

4. Population inferences

All operations (companies) that had 30,000 or more laying hens (20 weeks of age or older) in the 15 selected states were eligible to participate in the NAHMS Layers '99 study. Therefore, the probability of selection (selection weight) was one for all operations. This selection weight was adjusted for non-response within state and size group strata. For each participating farm, a farm-level weight was created, equal to the operation weight multiplied by an expansion factor (number of farms in the operation divided by number of the operation's farms participating). This weight was adjusted again for non-response at the VS phase.

C. Data collection

1. Marketing

NASS mailed a pre-survey letter, letters of support from the U.S. Poultry & Egg Association and United Egg Producers, and information on the NAHMS Layers '99 study to each eligible operation (company). Additional information about NAHMS and the Layers '99 study were delivered at the time of the first personal contact. Some focus group participants made additional contacts to encourage participation.

2. Layers Management Report, February 1 - 26, 1999

The NASS enumerator administered a Layers Management Report. This questionnaire was limited to items that could more readily be answered by company headquarters than by personnel on farm (e.g., pullet sources, feed sources). Practices that were expected to be the same on every farm were asked once of the operation, whereas a separate questionnaire for each farm was completed for those practices that may differ among farms. If an operation was willing to continue to the next stage of the study, a consent form was signed. The Layers '99 Part I report is from this phase of the Layers '99 study.

3. Initial VS Visit, March 22 - April 30, 1999

Farms for which the operation had signed a consent form were contacted by Veterinary Services (VS) for the second phase (on-farm) of the study. Veterinary Medical Officers (VMO's) contacted each farm for participating operations, explained the program, and administered a questionnaire that could most readily be answered by farm personnel (e.g., housing, biosecurity). Although these questionnaires were scheduled to be completed by April 30, some states were given an extension in order to increase the number of participants. The last questionnaire was completed July 14, 1999. Layers '99 Part II reports results of this phase of the Layers '99 study.

4. Environmental sampling, May 3 - September 30, 1999

Environmental culturing was offered to all farms. Up to two houses per farm were randomly selected for culturing, including manure (five samples per house), egg belts (five samples per house), elevators (five samples per house), and walkways (two samples per house). If the house did not have egg belts or elevators, then 10 samples were collected from cage floors. Each sample consisted of two swabs. Samples were placed in whirl-pak bags containing skim milk, and shipped overnight on ice to the Agriculture Research Service in Athens, GA, for culture and serogrouping. Group D isolates were then sent to National Veterinary Services Laboratories (NVSL) in Ames, IA, for serotyping. Information about the flocks and houses being sampled was recorded on a Clinical Evaluation Record. Results of environmental sampling are expected to be released in the Fall of 2000.

5. Rodent collection

Rodent collection was offered to 150 farms that also participated in environmental sampling. Twelve traps were placed per house. VMO's returned 4 to 7 days later to count the number of rodents caught. Rodents were euthanized using dry ice. House mice were placed in large whirl-pak bags and shipped overnight on ice to NVSL for culture. The number of rodents trapped, number submitted, trap location, and whether the trap had functioned properly were recorded on a rodent submission form. Results of rodent testing are expected to be released in the Fall of 2000.

6. Egg yolk antibody

Egg yolk collection was offered to 100 farms that also participated in environmental sampling and rodent collection. There were 150 eggs collected per farm. The egg yolks were aspirated from the eggs and shipped overnight on ice to the University of Minnesota for testing for presence of antibody to *Salmonella enteritidis* (S.e.). Results of testing for egg yolk antibodies are expected to be released in the Fall of 2000.

D. Data analysis

1. Editing and estimation

Initial data entry and editing for the Layers '99 Part I report were performed in each individual NASS state office. Data were entered into a SAS data set. NAHMS personnel performed additional data edits on the entire data set after data from all states were combined.

Data entry and editing for Part II were done by the NAHMS national staff in Fort Collins, CO. VS field staff followed up with producers where necessary. Summarization and estimation for Part I and Part II were performed by NAHMS national staff using SUDAAN software (1996. Research Triangle Park, NC).

2. Response rates

The sample for Part I included 341 operations, of which 328 were considered eligible to participate. Thirteen operations in the sample were ineligible (e.g., broiler operations, or pullet growers). Of the 328 eligible operations, 208 operations agreed to participate (63 percent). These 208 operations provided information on 526 individual farms (see Farm selection on page 61). Consent was given to contact 393 of these farms for the second phase of the study (75 percent). Of the 393 farms contacted by VS, 11 were ineligible (no longer in business). Of the 382 eligible farms, 252 participated in the VS phase of the study (66 percent).

Appendix I: Sample Profile

A. Responding Operations

To adjust for the number of responding farm sites by size and region, data were weighted to provide estimates that reflected the entire population.

1. Size

Size of Farm Site (Number Layers)	Number Responding Farm Sites
Less than 50,000	71
50,000-99,999	58
100,000-199,999	64
200,000 or more	<u>59</u>
Total	252

2. Region

Region	Number Responding Farm Sites
Great Lakes	27
Southeast	65
Central	58
West	<u>102</u>
Total	252

Appendix II: U.S. Table Egg Layers

During the Month of December 1998 in Flocks with 30,000 and Above*

Region	State	Table Egg Layers (Thousand)
Central	Arkansas	4,565
	Iowa	24,261
	Minnesota	11,403
	Missouri	5,179
	Nebraska	<u>10,522</u>
	Total	55,930
Great Lakes	Indiana	21,265
	Ohio	28,839
	Pennsylvania	<u>21,389</u>
	Total	71,493
Southeast	Alabama	4,325
	Florida	9,893
	Georgia	11,892
	North Carolina	<u>3,847</u>
	Total	29,957
West	California	25,657
	Texas	13,719
	Washington	<u>4,893</u>
	Total	44,269
Total (15 states)		201,649 (78.5% of US)
Total U.S. (50 states)		256,867

* There were 262,935,000 table egg layers during December 1998 in flocks of all sizes.

Source: National Agricultural Statistics Service (NASS), Chickens and Eggs, February 23, 1999.



Outputs and Related Study Objectives

1. Describe baseline health and management practices used by the U.S. layer industry, such as disposal methods for manure/waste/dead birds/spent hens, pest control (rodents, birds, flies), molting practices, vaccination/preventive practices, and housing/ventilation.

- Part I: Reference of 1999 Table Egg Layer Management in the U.S., October 1999
- ***Part II: Reference of 1999 Table Egg Layer Management in the U.S.***, January 2000

2. Estimate the national prevalence of *Salmonella enteritidis* in layer flocks by testing the environment and other sources of contamination on layer operations.

- Interpretive report, expected Fall 2000

3. Identify potential risk factors associated with the presence of *S. enteritidis* to support and enhance quality assurance programs.

- Interpretive report, expected Fall 2000

4. Describe biosecurity practices used in the layer industry and how they benefit flock health.

- ***Part II: Reference of 1999 Table Egg Layer Management in the U.S.***, January 2000

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