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Inspection
Service

Veterinary
Services

Part III: Reference of Swine Health & Environmental Management in the United States, 2000

National Animal Health Monitoring System

September 2002

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 study of animal health and health management on swine operations.

The Swine 2000 study was a cooperative effort between State and Federal agricultural statisticians, animal health officials, university researchers, extension personnel, and pork producers, owners, and operators. We want to thank the hundreds of industry members who helped determine the direction and objectives of this study by participating in focus groups.

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- University of Wisconsin - Madison, School of Veterinary Medicine
- The Ohio State University
- Pfizer
- Schering-Plough
- University of Tennessee
- IDEXX Laboratories, Inc.
- Iowa State University

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Director
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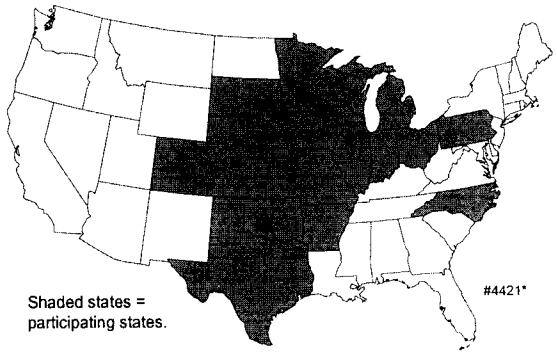
Introduction

As part of the National Animal Health Monitoring System (NAHMS), the USDA:APHIS:Veterinary Services (VS) conducted its first national study of the swine industry with the 1990 National Swine Survey, which focused on farrowing sows and preweaning piglets. Survey results provided an overview of swine health, productivity, and management for 95 percent of the U.S. swine herd, the population represented by the survey's 1,661 participating producers.

NAHMS' second national swine study, Swine '95, was designed to provide both participants and the industry with information on more than 90 percent of the U.S. swine herd.

Part I: Reference of Swine Health and Management in the United States, 2000 is the first of a series of reports containing national information resulting from NAHMS' third national swine project, the Swine 2000 study. Swine 2000 was designed to provide both participants and the industry with information on nearly 94 percent of the U.S. swine on operations with 100 or more pigs. Data for Part I were collected from 2,499 swine production sites from 2,328 operations. The USDA's National Agricultural Statistics Service (NASS) collaborated with VS to select a producer sample statistically designed to provide inferences to the nation's swine population on operations with 100 or more pigs. Included in the study were 17 of the major pork-producing States (see map) that accounted for 94 percent of the U.S. pig inventory and 92 percent of U.S. pork producers with 100 or more pigs. NASS interviewers contacted producers from June 1 through July 14, 2000.

States Participating in the Swine 2000 Study



Part II: Reference of Swine Health & Management in the United States, 2000 is the second of a series of reports from the NAHMS' Swine 2000 study. Data were collected from 895 swine production sites by Federal and State Veterinary Medical Officers (VMOs) and Animal Health Technicians (AHTs) from August 21, 2000, through November 3, 2000.

Part III: Reference of Swine Health & Environmental Management in the United States, 2000 is the third of a series of reports from the NAHMS' Swine 2000 study. For this report, data were collected from December 1, 2000, through February 28, 2001, from 799 swine production sites.

Methodology and number of respondents can be found at the end of this report. Further information on NAHMS studies and reports is available online at www.aphis.usda.gov/vs/ceah/cahm

For questions about this report or additional copies, please contact the address shown below.

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www.aphis.usda.gov/vs/ceah/cahm

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

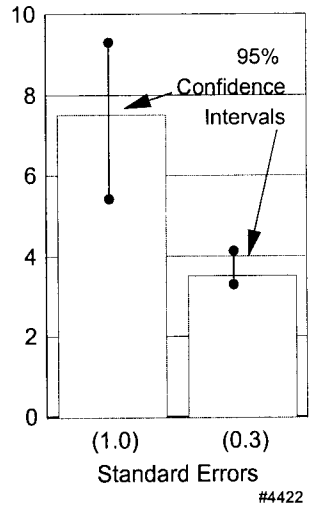
Terms Used in This Report

N/A: Not applicable.

Percent animals: The number of animals on sites with a certain attribute divided by the total number of animals on all sites. In some cases, it is assumed the attribute applies to all animals on the site. The animal type is defined in each table and may include total inventory, sow inventory, number of pigs that entered the nursery, or other specific pig groups. The "percent-animals" estimates reflect the larger sites which have the majority of pigs.

Percent sites: The number of sites with a certain attribute divided by the total number of sites. Percentages will sum to 100 where the attributes are mutually exclusive (e.g., percentage of sites located within each region). Percentages will ***not*** sum to 100 where the attributes are not mutually exclusive (e.g., the percentage of sites using treatment methods where sites may have used more than one method). The "percent-sites" estimates reflect the smaller producers, since they make up the majority of operations.

Examples of a 95% Confidence Interval



Population estimates: Estimates in this report are provided with a measure of precision called ***standard error***. A confidence interval can be created with bounds equal to the estimate plus or minus two standard errors. If the only error is sampling error, then confidence intervals created in this manner will contain the true population mean 95 out of 100 times. In the example at right, an estimate of 7.5 with a standard error of 1.0 results in limits 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 limits of 2.8 and 4.0. Alternatively, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2. 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. See the table below for an example:

Estimate	Std. Error	Interpretation
0.0	(--)	All respondents answered "no" to question
0.0	(0.0)	<0.1 percent answered "yes" to question
NA	(--)	No respondents answered question
*	(--)	Too few respondents to report estimate

Regions:

Northern: Michigan, Minnesota, Pennsylvania, and Wisconsin.
West Central: Colorado, Kansas, Missouri, Nebraska, and South Dakota.
East Central: Illinois, Indiana, Iowa, and Ohio.
Southern: Arkansas, North Carolina, Oklahoma, and Texas.

Sample profile: Information that describes characteristics of the sites from which Swine 2000 data were collected.
Site: Distinct geographic locations or premises designated as a production site for commercial swine. Multiple premises were considered to be one site if a single farm manager was involved in the day-to-day activities at all locations. (See operation selection in methodology section for details on site selection within operations.)
Total inventory: All swine present on the site on June 1, 2000.
Too few respondents to report estimate: If the denominator was 20 or less, estimates were not reported, except where noted.

Section I: Population Estimates

A. Inventory and Marketing

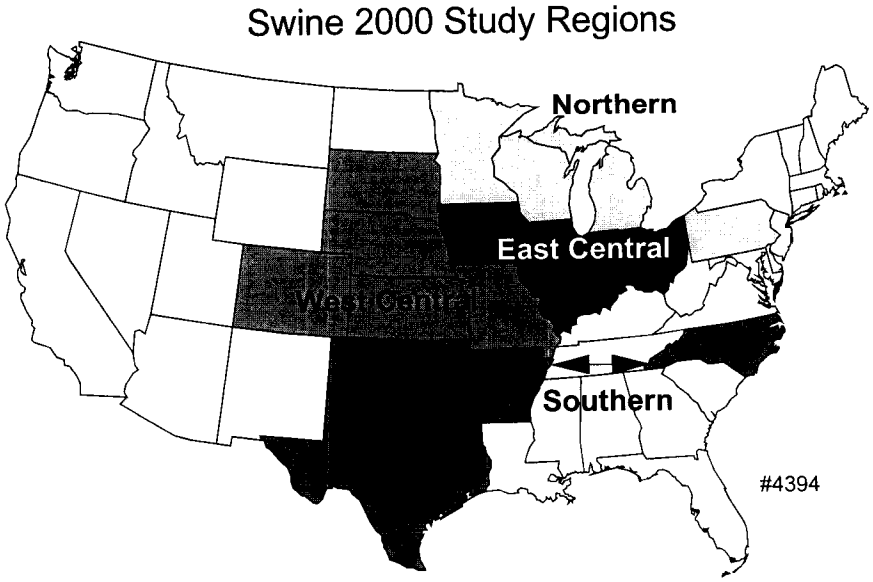
1. Types of animals

The estimates in this report represent all production sites with at least 100 pigs in total inventory in the top 17 statess. The table below shows what percentage of these sites had a specified pig type. Many of the tables in this report are only for sites with a specified pig type, e.g., sites with breeding females. The table below also shows the proportion of all production sites with specified pig types. The fact that all sites do not have all pig types exhibits how pork production has become segmented.

a. Percent of sites with the following types of animals from June 1, 2000, through November 30, 2000, by region:

Percent Sites

	Region									
	Northern		West Central		East Central		Southern		All Sites	
Type of Animals	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Sows and gilts	45.5	(7.1)	59.9	(6.9)	60.6	(5.2)	42.0	(4.3)	56.3	(3.6)
Nursery-age pigs	67.0	(7.5)	80.4	(5.6)	77.0	(3.7)	58.7	(4.3)	74.4	(2.8)
Grower/ finisher-age pigs	82.4	(5.5)	91.4	(2.2)	84.2	(3.9)	77.5	(3.2)	84.5	(2.6)



2. Number of swine marketed

a. Percent of sites that sold or moved off site at least one pig between June 1, 2000, and November 30, 2000:

Percent Sites	Standard Error
97.8	(1.1)

b. For sites that sold or moved off site at least one pig, percent of sites (and percent pigs sold or moved off site) between June 1, 2000, and November 30, 2000, by type of pigs sold or moved:

Pig Type	Percent Sites	Standard Error	Percent Pigs	Standard Error
Slaughter market pigs	85.0	(2.5)	59.7	(2.9)
Weaner pigs	7.5	(2.0)	17.3	(2.6)
Feeder pigs	17.4	(2.7)	19.4	(2.4)
Replacement stock	8.2	(2.6)	0.9	(0.2)
Culled breeding stock	51.2	(3.7)	1.7	(0.2)
Other type of pig	17.2	(2.3)	1.0	(0.2)
Total			100.0	

B. Productivity and Death Loss

1. Sow and gilt culling and death loss

Culling and death-loss rates are shown below for a 6-month period. The annual removal rate of breeding-age females via death loss and culling was 45.9 percent. Average sow and gilt death loss ranged from 3.0 percent to 4.0 percent during the 6-month period, depending on herd size. Nearly 22 percent of sows and gilts were culled during the same period. Both the percent of sows and gilts that died and were culled increased slightly during the first 6-month period (December 1, 1999, through May 31, 2000) to the second 6-month period (June 1, 2000, through November 30, 2000).

a. Breeding-age females that died or were culled from June 1, 2000, through November 30, 2000, as a percent of the December 1, 2000, sow and gilt inventory, by size of site:

	Percent Breeding Females							
	Size of Site (Sow and Gilt Inventory)							
	Small (Less than 250)		Medium (250-499)		Large (500 or More)		All Breeding Females	
Reason Removed	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Died	3.0	(0.7)	3.2	(0.2)	4.0	(0.3)	3.6	(0.3)
Culled	22.4	(2.7)	27.4	(6.1)	18.9	(0.8)	21.5	(1.4)

Females culled from the breeding herd were placed in several areas prior to shipping. The majority were placed in holding pens before shipping (61.7 percent). Smaller percentages of sows and gilts culled were placed in gilt acclimatization pens or in pens with finisher pigs (5.0 percent and 3.8 percent, respectively). More than 28 percent of sows and gilts culled from farrowing or gestation facilities were placed directly in cull trucks.

b. Percent of culled breeding-age females by area where females were placed after culling, from June 1, 2000, through November 30, 2000:

Area Placed After Culling	Percent Culled Females	Standard Error
Placed in pen with finisher pigs	3.8	(1.2)
Placed in holding pen prior to being shipped	61.7	(5.2)
Placed directly in cull truck from farrowing or gestation facility	28.2	(5.3)
Placed in gilt acclimatization pen	5.0	(1.6)
Placed elsewhere	1.3	(0.6)
Total	100.0	

2. Farrowing productivity and death loss

The number of pigs born alive is a measure of the reproductive performance of the breeding herd. Stillbirths and mummies are an indication of possible reproductive problems. The number of pigs weaned per litter is a measurement for farrowing management and reproductive efficiency. Overall, 10.9 pigs were born per litter, of which 10.0 were born alive and 8.8 were weaned. These values are similar to those calculated for the first 6-month period (December 1, 1999, through May 30, 2000).

a. Average per litter productivity for 6-month period (June 1, 2000, through November 30, 2000):

i. Overall

	Average Per Litter Productivity June 1 Through November 30, 2000			
Measure	Number	Standard Error	Percent	Standard Error
Stillbirths and mummies per litter	0.9	(0.0)	8.2	(0.3)
Born alive per litter	10.0	(0.1)	91.8	(0.3)
Total born per litter	10.9	(0.1)	100.0	
Preweaning deaths per litter	1.2	(0.0)	12.2	(0.4)
Weaned per litter	8.8	(0.1)	87.8	(0.4)
Total born alive per litter	10.0	(0.1)	100.0	

ii. Average per litter productivity, by sow herd size:

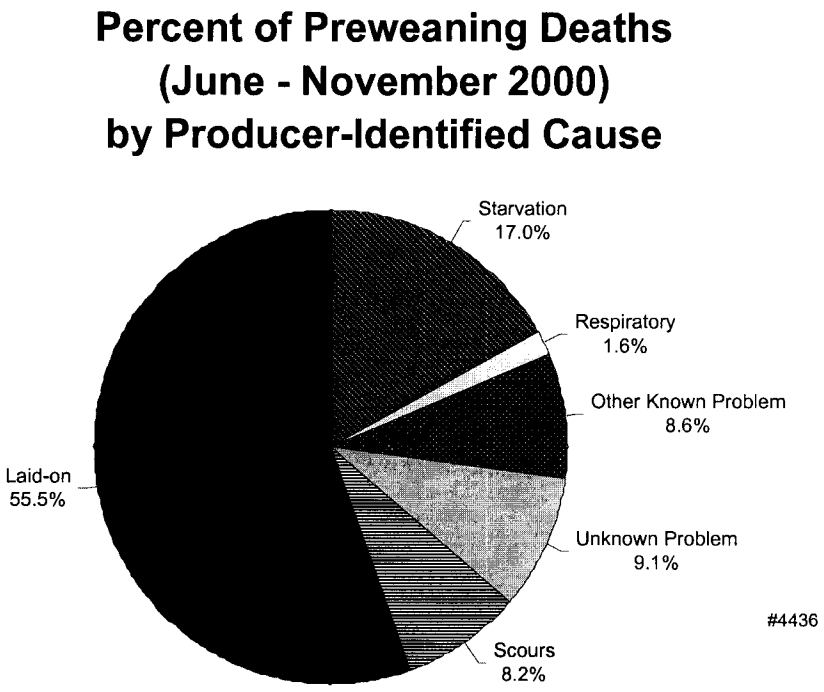
	Average Per Litter Productivity											
	Size of Site (Sow and Gilt Inventory)											
	Small (Less than 250)				Medium (250-499)				Large (500 or More)			
Measure	Number	Std. Error	Percent	Std. Error	Number	Std. Error	Percent	Std. Error	Number	Std. Error	Percent	Std. Error
Stillbirths	0.7	(0.1)	7.1	(0.7)	0.9	(0.1)	8.2	(0.6)	1.0	(0.0)	8.7	(0.4)
Born alive	9.8	(0.2)	92.9	(0.7)	10.1	(0.1)	91.8	(0.6)	10.1	(0.1)	91.3	(0.4)
Total Born	10.5	(0.2)	100.0		11.0	(0.1)	100.0		11.1	(0.1)	100.0	
Preweaning deaths	1.3	(0.1)	12.8	(1.0)	1.3	(0.1)	13.2	(0.6)	1.2	(0.0)	11.7	(0.3)
Weaned	8.5	(0.1)	87.2	(1.0)	8.8	(0.1)	86.8	(0.6)	8.9	(0.1)	88.3	(0.3)
Total	9.8	(0.2)	100.0		10.1	(0.1)	100.0		10.1	(0.1)	100.0	

Preweaning mortality is affected by season, gilt/sow mothering ability and/or farrowing facility management. As with the first 6-month period (December 1, 1999, through May 31, 2000), laid-on and starvation continued to be the most common causes of preweaning death loss, together accounting for more than 70 percent of preweaning deaths. Cause of death varied slightly compared to the first 6-month period. Estimates for the first 6-month period can be found on page 15 of Part I: Reference of Swine Health and Management in the United States, 2000.

b. Percent of preweaning deaths, by producer-identified cause and by time period:

Percent Preweaning Deaths

	Time Period					
	June - August 2000		September - November 2000		June - November 2000	
Producer-Identified Cause	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Scours	7.9	(0.8)	8.5	(0.8)	8.2	(0.8)
Laid-on	55.7	(1.7)	55.2	(1.7)	55.5	(1.7)
Starvation	17.2	(1.3)	16.8	(1.3)	17.0	(1.2)
Respiratory problem	1.7	(0.3)	1.6	(0.3)	1.6	(0.3)
Other known problem	8.7	(1.3)	8.4	(1.2)	8.6	(1.2)
Unknown problem	8.8	(1.3)	9.5	(1.3)	9.1	(1.2)
Total	100.0		100.0		100.0	



3. Nursery death loss

a. Nursery-age pigs that died or were culled from June 1, 2000, through November 30, 2000, as a percent of pigs that entered the nursery during that time frame, by size of site:

Percent Nursery Pigs

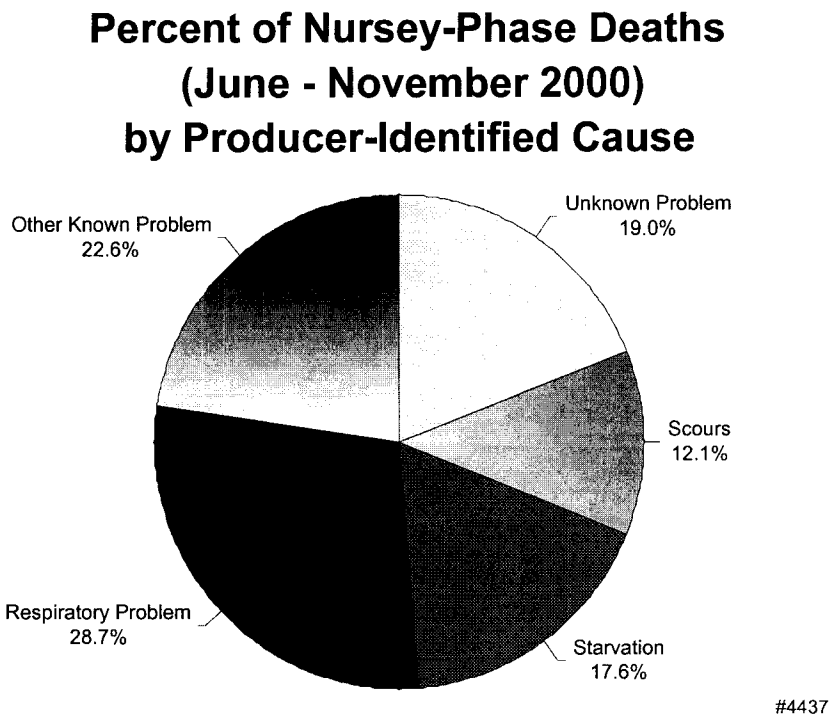
	Size of Site (Total Inventory)							
	Small (Less than 2000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Reason Removed	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Died	2.3	(0.2)	2.4	(0.2)	2.4	(0.2)	2.4	(0.1)
Lightweight (stunted or junk) pigs	0.4	(0.1)	0.5	(0.1)	0.2	(0.1)	0.4	(0.1)

Similar to the first 6-month period (December 1, 1999, through May 31, 2000) respiratory disease was the most common cause of nursery mortality. The percentage of starvation deaths increased slightly from June 1, 2000, through November 30, 2000 (17.6 percent) compared to the first 6-month period (13.3 percent). The majority of deaths due to other known problems was attributed to *Streptococcus suis* infections.

b. Percent of nursery-phase deaths, by producer-identified cause and by time period:

Percent Nursery Deaths

	Time Period					
	June - August 2000		September - November 2000		June - November 2000	
Producer-Identified Cause	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Scours	10.8	(1.2)	13.4	(2.3)	12.1	(1.6)
Starvation	18.5	(2.0)	16.7	(2.0)	17.6	(1.9)
Respiratory problem	28.5	(2.2)	28.9	(2.4)	28.7	(2.2)
Other known problem	23.3	(2.4)	21.9	(2.1)	22.6	(2.1)
Unknown problem	18.9	(1.5)	19.1	(1.7)	19.0	(1.4)
Total	100.0		100.0		100.0	



c. Percent of nursery-phase deaths, by producer-identified cause and by size of site for the 6-month period from June 1, 2000, through November 30, 2000:

	Percent Nursery Deaths							
	Size of Site (Total Inventory)							
	Small (Less than 2000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Producer-Identified Cause	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Scours	9.1	(1.7)	14.2	(2.7)	11.2	(3.7)	12.1	(1.6)
Starvation	16.0	(3.0)	16.8	(2.6)	22.9	(5.1)	17.6	(1.9)
Respiratory problem	27.5	(3.2)	27.2	(3.2)	35.2	(5.1)	28.7	(2.2)
Other known problem	22.5	(3.6)	23.9	(2.8)	18.7	(5.7)	22.6	(2.1)
Unknown problem	24.9	(3.0)	17.9	(1.6)	12.0	(2.0)	19.0	(1.4)
Total	100.0		100.0		100.0		100.0	

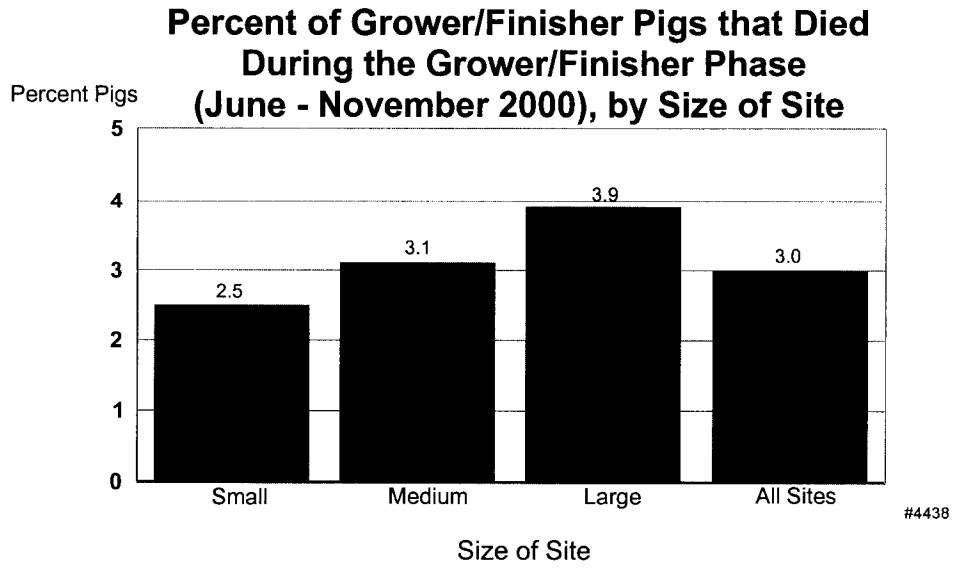
4. Grower/finisher death loss

Mortality in the grower/finisher phase can contribute to serious economic loss due to feed costs incurred for older, larger pigs. From June 1, 2000, through November 30, 2000, a higher percentage of grower/finisher pigs died (3.0 percent) than nursery pigs (2.4 percent). More than 2.0 percent of grower/finisher pigs were removed as lightweight pigs. The percentage of death losses in grower/finisher pigs was higher on large sites (3.9 percent) than small sites (2.5 percent).

Note: Estimates do not add to 100 percent since not all pigs entering the grower/finisher phase during the 6-month period were removed during that same 6-month period.

a. Grower/finisher-age pigs that died or were culled from June 1, 2000, through November 30, 2000, as a percent of pigs that entered the grower/finisher phase during that time frame, by size of site:

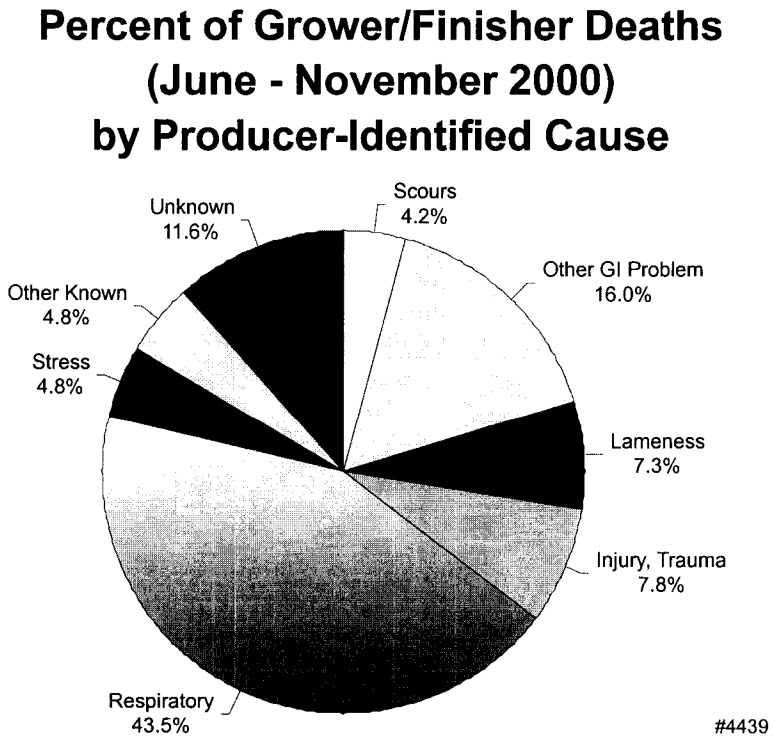
	Percent Grower/Finisher Pigs							
	Size of Site (Total Inventory)							
	Small (Less than 2000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Reason Removed	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Died	2.5	(0.2)	3.1	(0.2)	3.9	(0.3)	3.0	(0.1)
Lightweight (stunted or junk) pigs	1.6	(0.3)	2.0	(0.2)	3.1	(0.6)	2.1	(0.2)
Market weight or permanently removed under contract arrangement	87.6	(2.0)	93.4	(1.3)	92.3	(1.3)	91.2	(1.0)



From June 1, 2000, through November 30, 2000, respiratory disease was the cause of death most common in grower/finisher pigs (43.5 percent), followed by gastrointestinal problems (20.2 percent).

b. Percent of grower/finisher deaths, by producer-identified cause from June 1, 2000, through November 30, 2000:

Producer-Identified Cause	Percent Deaths	Standard Error
Diarrhea (Scours)	4.2	(0.6)
Other GI problem	16.0	(1.6)
Lameness	7.3	(0.6)
Injury or trauma (tail-biting, etc.)	7.8	(1.0)
Respiratory problem	43.5	(2.1)
Stress	4.8	(0.7)
Other known problem	4.8	(1.1)
Unknown problem	11.6	(0.9)
Total	100.0	



5. Grower/finisher productivity

Average daily gain (pounds gained per head, per day) was 1.69 pounds for all sites. This value did not vary appreciably by site size. For all sites, the average pounds fed for each pound gained (feed efficiency) during the grower/finisher phase was 3.03 pounds of feed. After producers responded to the question regarding average daily gain and feed efficiency, they were asked to indicate whether their response was calculated or estimated/guessed. When producers calculated this value it did not vary significantly among the different sized sites. However, when this value was estimated or guessed, it was lower on large sites (2.54 pounds of feed) than on small sites (2.77 pounds of feed).

a. Site average weight gained (in pounds) per head, per day (average daily gain), and pounds of feed fed during the grower/finisher phase for each pound gained (feed efficiency), by size of site and method used to obtain this data:

Method used	Average Size of Site (Total Inventory) Small (Less than 2,000) Average	Small (Less than 2,000) Standard Error	Medium (2,000-9,999) Average	Medium (2,000-9,999) Standard Error	Large (10,000 or More) Average	Large (10,000 or More) Standard Error	All Sites Average	All Sites Standard Error
Average Daily Gain (lbs./per head/per day)								
Calculated	1.63	(0.04)	1.71	(0.03)	1.69	(0.05)	1.66	(0.03)
Estimated/guessed	1.71	(0.05)	1.71	(0.04)	1.84	(0.08)	1.72	(0.03)
Overall	1.68	(0.03)	1.71	(0.02)	1.76	(0.05)	1.69	(0.02)
Feed Efficiency (lbs. fed/lbs. gained)								
Calculated	3.08	(0.07)	2.86	(0.05)	2.77	(0.08)	2.98	(0.04)
Estimated/guessed	3.12	(0.07)	2.96	(0.04)	2.54	(0.16)	3.07	(0.05)
Overall	3.11	(0.05)	2.90	(0.03)	2.66	(0.09)	3.03	(0.04)

Over half the sites did not know what the average daily gain or feed efficiency was for their grower/finisher phase.

b. For sites with grower/finisher pigs, percent of sites that provided average daily gain and feed efficiency information, by the method used to obtain this data:

Method Used	Percent Sites Average Daily Gain Percent Sites	Average Daily Gain Standard Error	Feed Efficiency Percent Sites	Feed Efficiency Standard Error
Calculated	18.6	(2.4)	16.6	(2.1)
Estimated/guessed	25.1	(2.8)	21.5	(2.5)
Producer did not know	56.3	(3.9)	61.9	(3.6)
Total	100.0		100.0	

C. Biosecurity/Quality Assurance

1. Building type

Less than 1 percent of small- and medium-sized production sites had no swine buildings. Sites with less than 10,000 head had, on average, 5 or 6 buildings used to house swine, while larger sites had, on average, 21 buildings used to house swine.

a. Percent of sites that had at least one of the following types of buildings, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Building Type	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Gestation building	49.4	(4.5)	40.6	(3.6)	41.0	(8.8)	47.8	(3.7)
Grower/finisher building	85.3	(2.8)	84.3	(2.4)	86.9	(6.8)	85.2	(2.4)
Any swine building	99.4	(0.5)	99.5	(0.5)	100.0	(--)	99.4	(0.4)
Feed storage building or unit	97.3	(1.6)	100.0	(--)	100.0	(--)	97.8	(1.3)

The average number of swine buildings per operation was 5.5. A few large operations with outdoor production reported using a large number of huts for housing, which increased the average number of swine buildings (14.4) on large sites.

b. For sites that had at least one building to house swine, average number of buildings used to house swine, by size of site:

Average Number Buildings for Housing Swine

Size of Site (Total Inventory)							
Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Average	Standard Error	Average	Standard Error	Average	Standard Error	Average	Standard Error
5.2	(0.7)	6.0	(0.3)	14.4	(3.4)	5.5	(0.6)

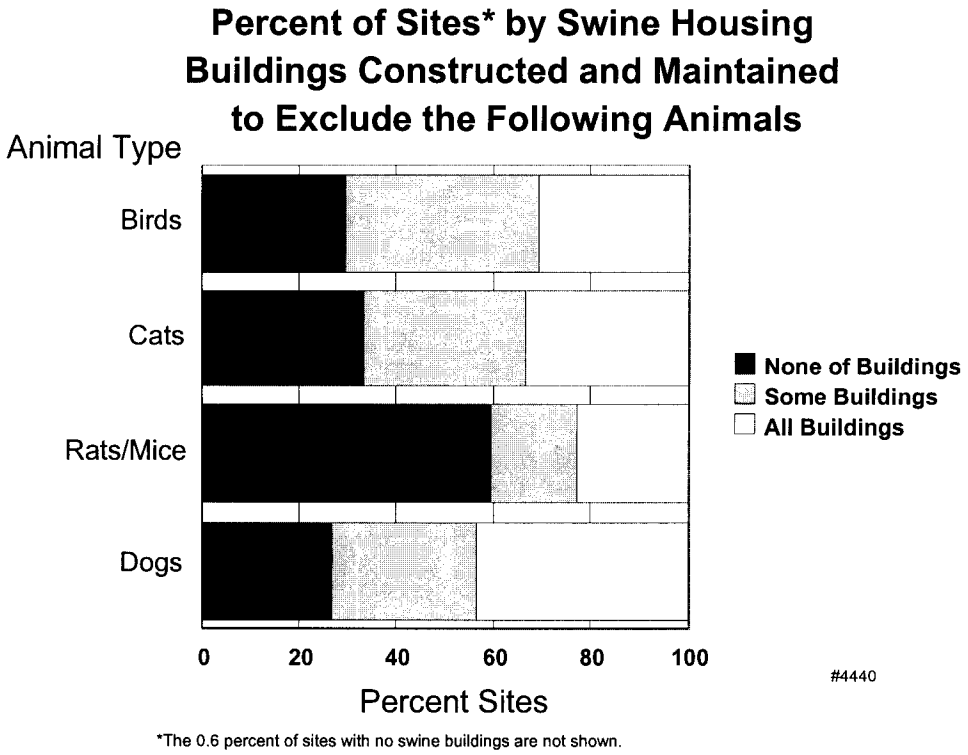
2. Building maintenance

Other animals can, and do, gain access to swine housing facilities. These animals, such as birds, cats, rats, mice, and dogs can present biosecurity hazards that may impact swine health as well as public health. Generally, small sites (less than 35 percent) were least likely to construct and maintain all swine facilities to keep out other species than were large sites (more than 75 percent). Rats and mice were not excluded from most buildings, while dogs were excluded from most buildings.

a. Percent of sites where either none, some, or all buildings or units used to **house swine** were constructed and maintained to keep out the following animals, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Animal Type	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Birds								
None of the swine buildings	36.2	(4.6)	0.4	(0.2)	0.0	(--)	29.5	(3.8)
Some swine buildings	40.7	(4.4)	34.9	(3.7)	14.1	(5.5)	39.4	(3.6)
All swine buildings	22.5	(3.6)	64.2	(3.7)	85.9	(5.5)	30.5	(3.1)
No swine buildings on site	0.6	(0.5)	0.5	(0.5)	0.0	(--)	0.6	(0.4)
Total	100.0		100.0		100.0		100.0	
Cats								
None of the swine buildings	39.7	(4.7)	4.8	(1.6)	2.6	(2.1)	33.2	(3.9)
Some swine buildings	34.3	(4.3)	28.3	(3.6)	11.9	(5.1)	33.0	(3.5)
All swine buildings	25.4	(3.7)	66.4	(3.6)	85.5	(5.6)	33.2	(3.2)
No swine buildings on site	0.6	(0.5)	0.5	(0.5)	0.0	(--)	0.6	(0.4)
Total	100.0		100.0		100.0		100.0	
Rats and Mice								
None of the swine buildings	64.1	(4.6)	39.3	(3.4)	13.9	(5.4)	59.2	(3.8)
Some swine buildings	17.8	(3.2)	17.2	(3.3)	7.5	(4.3)	17.5	(2.7)
All swine buildings	17.5	(3.5)	43.0	(3.5)	78.6	(6.8)	22.7	(2.9)
No swine buildings on site	0.6	(0.5)	0.5	(0.5)	0.0	(--)	0.6	(0.4)
Total	100.0		100.0		100.0		100.0	
Dogs								
None of the swine buildings	32.3	(4.6)	1.5	(0.6)	4.4	(2.7)	26.6	(3.8)
Some swine buildings	32.4	(4.3)	18.6	(3.2)	10.1	(4.9)	29.7	(3.5)
All swine buildings	34.7	(4.1)	79.4	(3.3)	85.5	(5.6)	43.1	(3.6)
No swine buildings on site	0.6	(0.5)	0.5	(0.5)	0.0	(--)	0.6	(0.4)
Total	100.0		100.0		100.0		100.0	

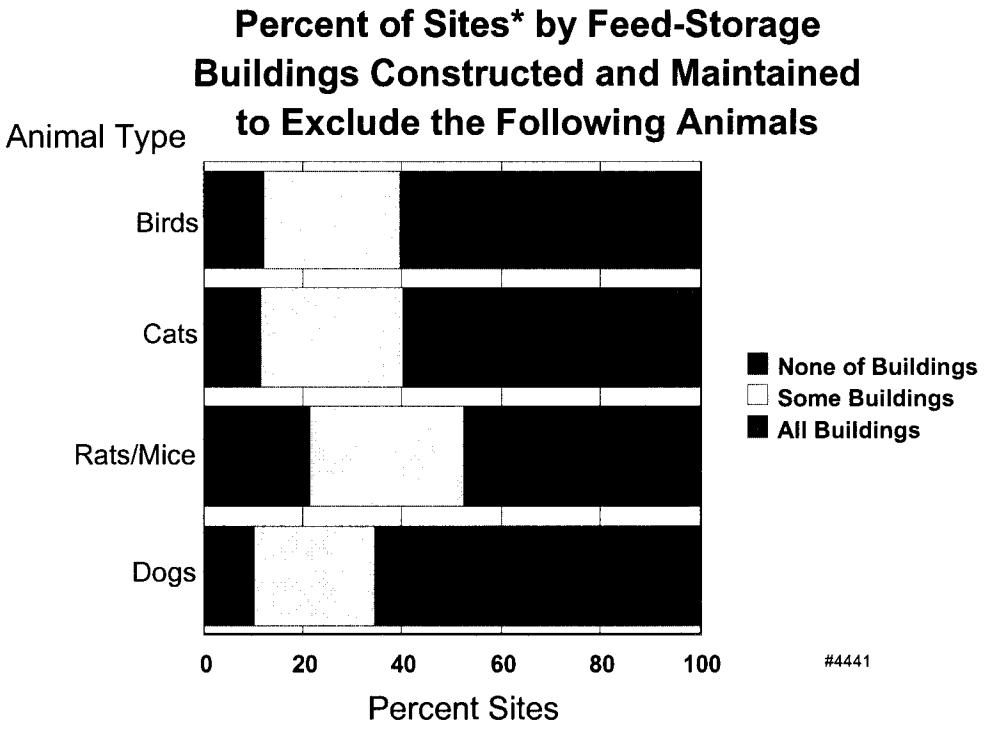


*The 0.6 percent of sites with no swine buildings are not shown.

Feed storage buildings or units were more apt than swine facilities to be constructed and maintained to keep out other animal species. Less than half of sites constructed and maintained all feed storage buildings or units to exclude rats or mice.

b. Percent of sites where either none, some, or all buildings or units used for **feed storage** were constructed and maintained to keep out the following animals, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Animal Type	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Birds								
None of the feed storage buildings	14.1	(3.9)	2.1	(0.9)	0.0	(--)	11.9	(3.2)
Some feed storage buildings	28.8	(4.3)	18.8	(2.8)	16.9	(6.6)	26.9	(3.6)
All feed storage buildings	54.4	(4.8)	79.1	(2.9)	83.1	(6.6)	59.0	(4.0)
No feed storage buildings on site	2.7	(1.6)	0.0	(--)	0.0	(--)	2.2	(1.3)
Total	100.0		100.0		100.0		100.0	
Cats								
None of the feed storage buildings	13.4	(3.8)	2.2	(0.9)	1.9	(1.7)	11.4	(3.1)
Some feed storage buildings	30.4	(4.4)	16.4	(2.5)	15.0	(6.4)	27.8	(3.6)
All feed storage buildings	53.5	(4.8)	81.4	(2.6)	83.1	(6.6)	58.6	(4.0)
No feed storage buildings on site	2.7	(1.6)	0.0	(--)	0.0	(--)	2.2	(1.3)
Total	100.0		100.0		100.0		100.0	
Rats and Mice								
None of the feed storage buildings	24.6	(4.7)	3.3	(1.0)	7.2	(4.5)	20.7	(3.9)
Some feed storage buildings	32.2	(4.2)	24.6	(3.4)	9.7	(5.0)	30.7	(3.5)
All feed storage buildings	40.5	(4.3)	72.1	(3.4)	83.1	(6.6)	46.4	(3.8)
No feed storage buildings on site	2.7	(1.6)	0.0	(--)	0.0	(--)	2.2	(1.3)
Total	100.0		100.0		100.0		100.0	
Dogs								
None of the feed storage buildings	11.8	(3.8)	2.4	(0.9)	1.9	(1.7)	10.1	(3.1)
Some feed storage buildings	25.9	(4.3)	14.0	(2.5)	15.0	(6.4)	23.7	(3.5)
All feed storage buildings	59.6	(4.8)	83.6	(2.6)	83.1	(6.6)	64.0	(4.0)
No feed storage buildings on site	2.7	(1.6)	0.0	(--)	0.0	(--)	2.2	(1.3)
Total	100.0		100.0		100.0		100.0	



*The 2.2 percent of sites with no feed storage buildings are not shown.

3. Rodent bait stations

Baits should be placed no more than 25 feet apart for mice and no more than 50 feet apart for rats. Of sites using baits around the outside of gestation buildings, about half placed baits more than 50 feet apart, which is too far for either mice or rats. Producers were more likely to place rodent bait stations inside swine facilities rather than outside at the recommended placement of 50 feet apart or less. For large sites, bait stations were placed inside of gestation buildings more often than outside at 50 feet apart or less. However, the opposite was true for grower/finisher and feed facilities on large sites.

a. For sites with at least one **gestation building**, percent of sites that placed rodent bait stations in the following areas, by size of site:

Percent Sites

	Size of Site (Sow and Gilt Inventory)							
	Small (Less than 250)		Medium (250-499)		Large (500 or More)		All Sites	
Rodent Bait Station Placement	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Inside building	38.8	(5.8)	76.2	(7.7)	80.1	(4.3)	47.0	(4.9)
Outside building perimeter, 50 feet apart or less	16.0	(4.7)	11.2	(3.6)	30.9	(4.9)	16.8	(3.8)
Outside building perimeter, more than 50 feet apart	12.5	(4.8)	34.8	(8.2)	32.1	(5.1)	16.9	(4.0)
No rodent bait stations placed in or around gestation buildings	46.6	(6.2)	6.6	(2.9)	7.0	(3.2)	38.3	(5.1)

b. For sites with at least one **grower/finisher building,** percent of sites that placed rodent bait stations in the following areas, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Rodent Bait Station Placement	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Inside building	41.0	(4.8)	71.5	(3.6)	36.7	(8.4)	46.2	(4.1)
Outside building perimeter, 50 feet apart or less	22.0	(3.5)	29.1	(3.4)	68.0	(7.6)	23.8	(3.0)
Outside building perimeter, more than 50 feet apart	13.8	(3.2)	32.5	(3.9)	25.7	(6.8)	17.1	(2.7)
No rodent bait stations placed in or around grower/finisher buildings	42.8	(5.2)	10.6	(2.3)	1.5	(1.3)	36.8	(4.5)

c. For sites with at least one **feed storage building,** percent of sites that placed rodent bait stations in the following areas, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Rodent Bait Station Placement	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Inside feed storage area	29.8	(4.4)	26.3	(3.1)	14.8	(5.6)	29.0	(3.6)
Outside area perimeter, 50 feet apart or less	20.2	(3.6)	35.8	(3.4)	69.6	(7.6)	23.5	(3.0)
Outside area perimeter, more than 50 feet apart	8.6	(2.1)	19.1	(2.9)	15.6	(5.3)	10.5	(1.8)
No rodent bait stations placed in or around feed storage buildings	51.9	(4.8)	37.6	(3.7)	14.4	(6.0)	48.9	(4.0)

4. Other biosecurity concerns

Humans can transfer disease agents from one farm to another via boots or clothing. To prevent disease introduction by these routes, some operations do not allow employees to come in contact with swine from other production sites. The Swine 2000 study found that only 10.3 percent of sites allowed employees to come in contact with swine from other sites.

a. Percent of sites that allowed any employees to come in contact with swine not owned or managed by the site (for example, pigs on a neighbor's farm or on an employee's farm), by size of site:

Percent Sites

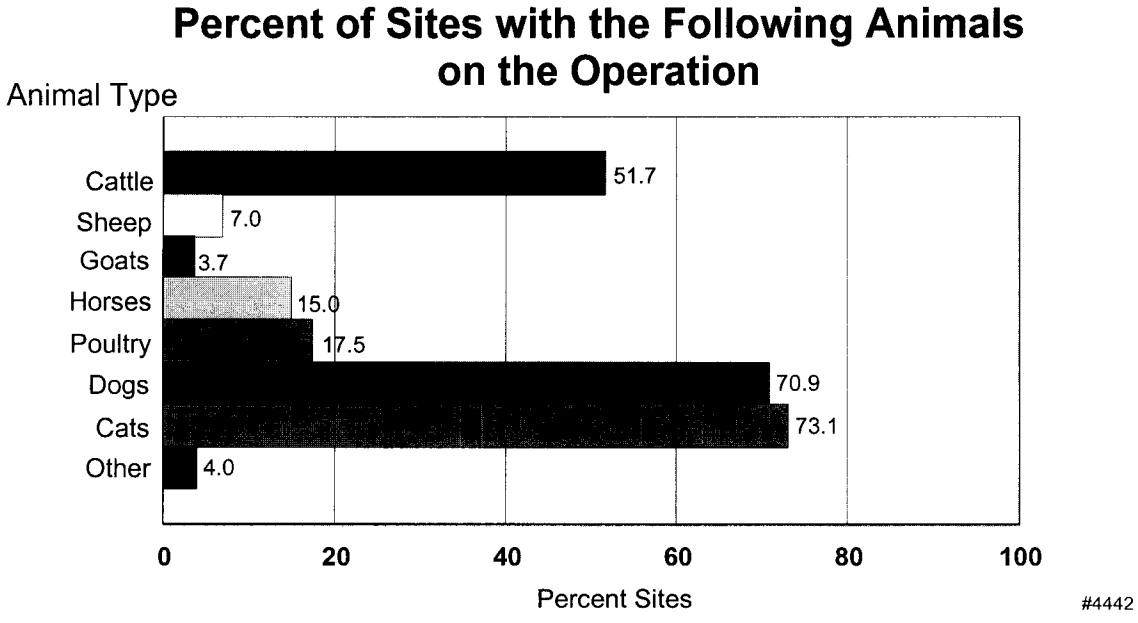
Size of Site (Total Inventory)								
Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
10.0	(2.1)	12.3	(2.2)	3.6	(2.3)	10.3	(1.8)

The majority of U.S. swine production sites had cats, dogs, and cattle on their operations. Generally, the larger the operation the less likely it was that the following types of animals were on the operation.

b. Percent of sites with the following types of animals on the operation, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Animal Type	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Cattle	54.8	(4.6)	38.1	(3.6)	37.9	(9.5)	51.7	(3.9)
Sheep	7.8	(3.2)	3.6	(1.6)	1.8	(1.4)	7.0	(2.6)
Goats	4.1	(1.5)	1.9	(0.8)	0.0	(--)	3.7	(1.2)
Horses	14.5	(3.0)	16.6	(2.5)	26.9	(9.4)	15.0	(2.5)
Poultry	19.3	(4.0)	9.5	(2.0)	8.1	(3.2)	17.5	(3.3)
Dogs	74.0	(3.8)	59.3	(3.6)	21.9	(6.1)	70.9	(3.2)
Cats	78.0	(4.0)	53.2	(3.6)	26.7	(7.5)	73.1	(3.4)
Other domestic animals	4.2	(1.7)	3.2	(1.5)	4.6	(4.1)	4.0	(1.4)

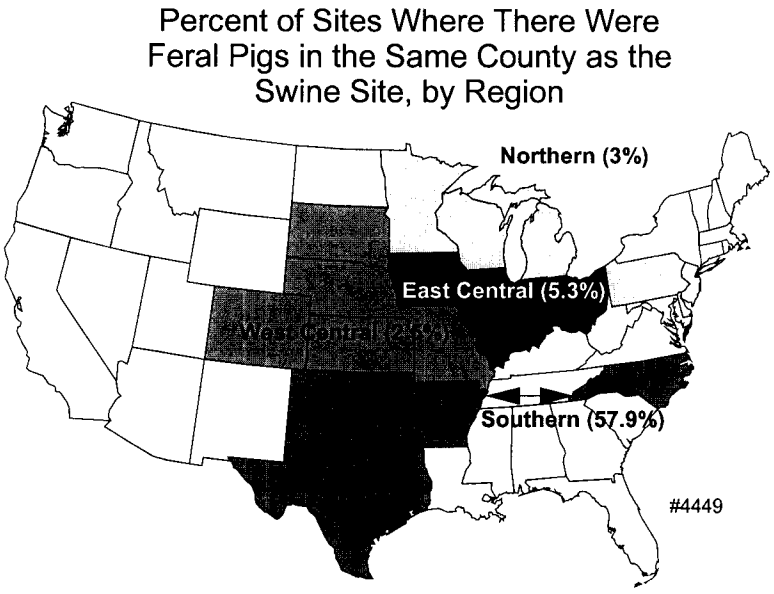


Feral swine may harbor disease agents that can be transmitted to domestic swine. Almost 60 percent of swine production sites in the southern region reported the presence of feral swine in their county, compared to less than 6 percent of sites in the other regions.

c. Percent of sites where there were feral (wild) pigs in the same county as the swine site, by region:

Percent Sites

Region									
Northern		West Central		East Central		Southern		All Sites	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
3.0	(1.3)	2.5	(1.5)	5.3	(2.6)	57.9	(5.0)	7.3	(1.6)



D. Food Safety

The three most important sources of food safety information were veterinarians, pork industry magazines, and industry programs.

1. Information sources

a. Percent of sites by level of importance of the following sources of information regarding food safety in pork:

	Percent Sites								
	Very Important		Moderately Important		Slightly Important		Not Important		Total
Source of Information	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent
Pork industry magazines	32.2	(3.5)	39.7	(3.9)	23.0	(3.3)	5.1	(1.8)	100.0
Veterinarian	50.1	(3.9)	26.0	(3.6)	16.1	(3.0)	7.8	(2.0)	100.0
Extension	24.0	(3.5)	32.3	(3.4)	27.5	(3.9)	16.2	(3.5)	100.0
Formal education	20.4	(3.1)	33.3	(3.5)	22.1	(3.4)	24.2	(3.6)	100.0
Pork industry programs and/or information	34.3	(3.6)	35.4	(3.5)	15.3	(3.3)	15.0	(3.3)	100.0
Internet or World Wide Web	9.8	(2.5)	16.5	(3.1)	25.2	(3.7)	48.5	(3.9)	100.0
Other sources	4.3	(1.1)	2.0	(0.7)	0.5	(0.3)	93.2	(1.3)	100.0

b. Percent of sites that indicated the following sources of information for food safety in pork were either **very or moderately** important, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Source of Information	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Pork industry magazines	70.7	(4.3)	79.2	(3.2)	52.7	(9.7)	71.9	(3.6)
Veterinarian	74.7	(4.1)	80.9	(3.1)	95.7	(2.2)	76.1	(3.4)
Extension	54.7	(4.8)	64.4	(3.4)	49.9	(10.0)	56.3	(3.9)
Formal education	53.5	(4.8)	54.4	(3.6)	64.1	(9.3)	53.7	(4.0)
Pork industry programs and/or information	67.3	(4.8)	79.7	(3.2)	91.4	(3.3)	69.7	(4.0)
Internet or World Wide Web	23.2	(4.4)	39.1	(3.5)	50.0	(9.8)	26.3	(3.6)
Other sources	6.4	(1.5)	5.6	(1.6)	5.1	(3.5)	6.3	(1.3)

E. Environmental Practices and Odor Control

Overall, 22.9 percent of sites had a lagoon. Lagoon use was more common on large sites. Nearly 25 percent of small sites reported using "other waste storage systems," which included scraper systems that resulted in manure piles that were either spread, hauled away, and/or composted.

1. Waste storage

a. Percent of sites that used the following waste storage systems, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Type of Waste Storage System	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Above ground slurry storage	4.2	(1.1)	8.9	(2.2)	1.3	(1.1)	5.0	(1.0)
Below ground slurry storage either inside or outside (deep pit)	55.2	(4.8)	67.1	(3.0)	48.6	(9.8)	57.2	(4.0)
Oxidation ditch	0.7	(0.7)	0.0	(--)	0.0	(--)	0.6	(0.5)
Waste solids separated from liquids	15.9	(4.1)	8.3	(2.2)	19.7	(9.4)	14.6	(3.4)
Other waste storage systems	24.7	(5.0)	3.2	(1.0)	1.0	(0.8)	20.7	(4.2)
Anaerobic lagoon with cover	3.1	(2.2)	1.1	(0.8)	3.0	(2.8)	2.7	(1.8)
Anaerobic lagoon without cover	14.4	(1.8)	43.9	(3.4)	62.1	(9.8)	20.1	(1.8)
Aerated lagoon	0.2	(0.1)	1.0	(0.3)	1.6	(1.0)	0.4	(0.1)
Any type of lagoon	17.6	(2.7)	45.3	(3.5)	66.1	(9.8)	22.9	(2.4)

2. Lagoon management

Lagoons should be built as deep as possible without affecting groundwater quality. Smaller surface areas result in less odor when lagoons are turned over. Generally, lagoons on larger sites were deeper and bigger than lagoons on smaller sites. Many respondents on small sites (40 to 50 percent) could not answer questions about lagoon volume or surface area. Freeboard is the minimum distance in feet from the surface of a full lagoon to its berm or spillway. Average freeboard height did not vary by size of site.

a. For sites with a lagoon, lagoon's average volume, deepest point, total surface area, and height of freeboard, by size of site:

	Site Average							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Measurement	Average	Standard Error	Average	Standard Error	Average	Standard Error	Average	Standard Error
Volume (1,000 cubic feet)	137.2	(36.7)	892.6	(183.5)	2,328.8	(393.2)	502.5	(114.0)
Deepest point (feet)	10.4	(0.6)	14.0	(0.6)	17.1	(1.3)	11.8	(0.4)
Total surface area (1,000 square feet)	21.0	(4.1)	71.7	(10.3)	162.2	(22.1)	45.4	(7.2)
Height of freeboard (feet)	3.0	(0.5)	2.4	(0.2)	2.5	(0.2)	2.7	(0.3)

Freeboard height was lower (1.8 feet) in lagoons placed in the southern region than in the other regions. Lagoon depth was fairly consistent across regions.

b. For sites with a lagoon, lagoon's average volume, deepest point, total surface area, and height of freeboard, by region:

	Site Average							
	Region							
	Northern		West Central		East Central		Southern	
Measurement	Average	Std. Error	Average	Std. Error	Average	Std. Error	Average	Std. Error
Volume (1,000 cubic feet)	362.2	(85.2)	751.9	(249.3)	362.1	(129.3)	636.8	(119.6)
Deepest point (feet)	10.8	(0.8)	12.9	(1.1)	11.5	(0.6)	11.0	(0.6)
Total surface area (1,000 square feet)	52.8	(19.0)	64.7	(12.8)	33.5	(8.1)	55.7	(10.8)
Height of freeboard (feet)	2.5	(0.4)	2.5	(0.2)	3.3	(0.6)	1.8	(0.0)

Lagoons should be designed to meet State regulatory standards, which usually require a 1- to 2-foot freeboard. Nearly 20 percent of small sites with lagoons had a freeboard less than 1 foot, compared to less than 5 percent of large sites. Small sites had more variability in freeboard height than medium and large sites, where most freeboards fell in the 2-foot range.

c. For sites with a lagoon, percent of sites with the following average height of freeboard, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Freeboard Average Height	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 1 foot	19.2	(5.0)	10.8	(2.9)	4.2	(2.7)	15.8	(3.2)
1 to 2 feet	36.0	(6.4)	58.1	(4.7)	59.5	(12.2)	44.3	(4.9)
Greater than 2 feet	44.8	(8.7)	31.1	(4.7)	36.3	(12.6)	39.9	(6.0)
Total	100.0		100.0		100.0		100.0	

d. For sites with a lagoon, percent of sites with the following average height of freeboard, by region:

	Percent Sites							
	Region							
	Northern		West Central		East Central		Southern	
Freeboard Average Height	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 1 foot	23.4	(8.6)	14.8	(4.7)	19.8	(6.3)	4.2	(1.6)
1 to 2 feet	26.9	(8.7)	41.3	(6.5)	31.2	(7.3)	90.4	(3.2)
Greater than 2 feet	49.7	(10.1)	43.9	(7.5)	49.0	(10.5)	5.4	(2.8)
Total	100.0		100.0		100.0		100.0	

Lagoons should be sealed to prevent seepage into groundwater. Almost 85 percent of sites with lagoons used compact clay liners. More than 12 percent of large sites with lagoons used nonpermeable liners. Almost 10 percent of small and medium sites with lagoons used no liners, whereas all large sites with lagoons used liners.

e. For sites with a lagoon, percent of sites that used the following types of lagoon liners, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Type of Liner	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Compact clay	83.7	(5.4)	84.5	(3.7)	87.5	(9.1)	84.1	(3.7)
Nonpermeable synthetic material	3.7	(2.2)	2.5	(1.6)	12.5	(9.1)	3.6	(1.5)
Other type of liner	3.3	(3.1)	3.3	(1.6)	0.0	(--)	3.2	(2.1)
No liner used	9.3	(4.0)	9.7	(3.2)	0.0	(--)	9.1	(2.8)
Total	100.0		100.0		100.0		100.0	

In the northern region, sites with lagoons used compact clay liners ***less frequently*** and nonpermeable liners ***more frequently*** than did sites in the other regions. Sites with lagoons in the southern region were most likely to use some type of liner.

f. For sites with a lagoon, percent of sites that used the following types of lagoon liners, by region:

	Percent Sites							
	Region							
	Northern		West Central		East Central		Southern	
Type of Liner	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Compact clay	70.2	(9.7)	83.5	(6.9)	84.5	(5.6)	93.9	(2.2)
Nonpermeable synthetic material	12.2	(7.2)	1.2	(1.2)	4.1	(2.7)	2.9	(1.9)
Other type of liner	4.5	(3.2)	0.1	(0.1)	5.5	(4.1)	0.0	(--)
No liner used	13.1	(7.6)	15.2	(6.9)	5.9	(2.7)	3.2	(1.1)
Total	100.0		100.0		100.0		100.0	

Diluting lagoons with fresh water helps reduce odor and enhance decomposition of organic matter. Over half of large sites with lagoons added fresh water to lagoons, compared to 22.2 percent for medium-sized sites and 18.4 percent for small-sized sites. Only one-third of sites with a lagoon constructed emergency spillways.

g. For sites with a lagoon, percent of sites that used the following lagoon management practices, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Lagoon Management Practice	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Diluted lagoon manure by adding fresh water	18.4	(4.9)	22.2	(3.6)	55.6	(10.6)	20.9	(3.5)
Used a multistage lagoon	15.8	(4.7)	31.7	(4.3)	25.8	(8.5)	21.1	(3.6)
Had an emergency spillway for the lagoon	34.4	(9.9)	32.5	(4.3)	23.3	(7.4)	33.4	(6.7)

h. For sites with a lagoon, percent of sites that used the following lagoon management practices, by region:

Percent Sites

	Region							
	Northern		West Central		East Central		Southern	
Lagoon Management Practice	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Diluted lagoon manure by adding fresh water	20.8	(8.1)	30.4	(5.6)	13.4	(5.3)	28.9	(6.0)
Used a multistage lagoon	14.2	(5.7)	10.8	(2.3)	25.1	(6.9)	38.6	(6.5)
Had an emergency spillway for the lagoon	29.2	(9.9)	30.3	(5.4)	38.8	(11.8)	19.2	(4.0)

The average age of lagoons ranged from 11.3 years in the southern region to 14.9 years in the northern region. Most often, lagoons on large sites were newer (just 17.3 percent were over 10-years old) than lagoons on small sites (62.7 percent were over 10-years old).

i. For sites with a lagoon, lagoon's average age (in years), by size of site:

Lagoon Average Age

Size of Site (Total Inventory)							
Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Years	Standard Error	Years	Standard Error	Years	Standard Error	Years	Standard Error
13.8	(0.8)	12.4	(0.9)	7.8	(1.4)	13.2	(0.6)

j. For sites with a lagoon, lagoon's average age (in years), by region:

Lagoon Average Age

Region								All Sites	
Northern		West Central		East Central		Southern			
Years	Std. Error	Years	Std. Error	Years	Std. Error	Years	Std. Error	Years	Std. Error
14.9	(1.8)	12.4	(1.0)	13.7	(0.9)	11.3	(0.9)	13.2	(0.6)

k. For sites with a lagoon, percent of sites by lagoon average age (in years) and by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Lagoon Age	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 5 years	2.6	(1.1)	5.7	(1.9)	17.4	(8.0)	4.1	(1.0)
5 to 10 years	34.7	(7.2)	56.4	(4.7)	65.3	(9.9)	42.7	(5.4)
Greater than 10 years	62.7	(7.4)	37.9	(4.7)	17.3	(7.1)	53.2	(5.7)
Total	100.0		100.0		100.0		100.0	

l. For sites with a lagoon, percent of sites by lagoon average age (in years) and by region:

Percent Sites

	Region							
	Northern		West Central		East Central		Southern	
Lagoon Age	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 5 years	4.2	(2.2)	9.2	(2.8)	1.7	(0.9)	1.3	(0.8)
5 to 10 years	44.5	(10.3)	40.7	(6.5)	41.1	(9.2)	55.3	(6.6)
Greater than 10 years	51.3	(10.2)	50.1	(6.9)	57.2	(9.4)	43.4	(6.6)
Total	100.0		100.0		100.0		100.0	

The combination of manure and rainfall entering lagoons often exceeds evaporation. Therefore, lagoons should be dewatered (pumped down) usually once or twice a year. Sites in the northern region dewatered more frequently than sites in the other regions. Almost 26 percent of sites never dewatered lagoons.

m. For sites with a lagoon, percent of sites that pumped down or dewatered the lagoon the following number of times during the past 3 years, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Number of Times (in the past 3 years)	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Once	5.7	(2.1)	7.9	(2.7)	11.3	(6.5)	6.6	(1.7)
Twice	9.6	(3.8)	8.8	(3.4)	6.1	(3.7)	9.3	(2.7)
Three times	19.4	(5.0)	31.6	(4.3)	39.2	(9.2)	23.9	(3.7)
Four or more times	32.2	(6.7)	39.7	(4.7)	29.7	(9.5)	34.4	(4.8)
Never	33.1	(10.1)	12.0	(2.8)	13.7	(8.4)	25.8	(7.3)
Total	100.0		100.0		100.0		100.0	

n. For sites with a lagoon, percent of sites that pumped down or dewatered the lagoon the following number of times during the past 3 years, by region:

Percent Sites

	Region							
	Northern		West Central		East Central		Southern	
Number of Times (in the past 3 years)	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Once	3.9	(3.6)	6.3	(2.1)	6.7	(2.9)	8.8	(3.4)
Twice	1.7	(1.5)	7.6	(2.7)	12.2	(5.1)	5.4	(2.4)
Three times	22.8	(8.3)	32.2	(6.5)	20.0	(5.4)	18.8	(3.7)
Four or more times	61.9	(10.0)	24.1	(5.2)	37.8	(8.7)	29.0	(6.2)
Never	9.7	(7.3)	29.8	(7.8)	23.3	(13.6)	38.0	(6.6)
Total	100.0		100.0		100.0		100.0	

3. Nutrient management

When managing manure, a decision producers must make is whether to take either a treatment approach (attempting to reduce the amount of nutrients in manure) or utilization approach (using nitrogen as fertilizer). Nearly two-thirds of producers indicated the utilization approach was very important. Overall, more than 80 percent of producers indicated that a treatment approach was not important. Almost 40 percent of large sites indicated the treatment approach was moderately or very important.

a. Percent of sites by importance of the following strategies used to manage nitrogen in manure:

	Percent Sites								
	Very Important		Moderately Important		Slightly Important		Not Important		Total
Nitrogen Management Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent
Reduce manure nitrogen, for example, through diet manipulation	2.9	(0.6)	5.7	(1.0)	8.5	(1.4)	82.9	(1.9)	100.0
Use the nitrogen, for example, as fertilizer	65.2	(3.8)	21.6	(3.2)	4.7	(1.8)	8.5	(2.0)	100.0

b. Percent of sites that indicated the following strategies used to manage nitrogen in manure was either very or moderately important, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Nitrogen Management Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Reduce manure nitrogen, for example, through diet manipulation	6.5	(1.3)	17.0	(2.6)	39.9	(10.7)	8.6	(1.2)
Use the nitrogen, for example, as fertilizer	86.3	(3.1)	88.7	(2.4)	96.3	(1.9)	86.8	(2.6)

The goal of a nutrient management plan (NMP) is to balance whole farm nutrients using diet manipulation, proper storage, handling and application of manure, and reduction of commercial fertilizer use. NMP use varied significantly by site size and by region. More than 90 percent of large sites had a formal, written NMP, compared to less than 20 percent of small sites. Sites in the west central region were least likely to have a NMP (14.6 percent), while sites in the southern region were most likely to have a NMP (79.5 percent).

c. Percent of sites that had a formal, written manure-nutrient management plan, by size of site:

Percent Sites								
Size of Site (Total Inventory)								
Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
19.4	(2.6)	67.3	(3.5)	91.3	(3.3)	28.5	(2.6)

d. Percent of sites that had a formal, written manure-nutrient management plan, by region:

Percent Sites

Region								All Sites	
Northern		West Central		East Central		Southern			
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
36.2	(5.9)	14.6	(3.1)	24.7	(3.6)	79.5	(3.4)	28.5	(2.6)

Some of the most common elements of a nutrient management plan (NMP) included by producers were: farm and field maps; crop yield expectations; testing of manure and soil for nutrient levels; manure application rates; types of application methods used; crop rotations; and land area required for manure application.

e. For sites that had a formal, written manure-nutrient management plan, percent of sites with a manure-nutrient management plan that contained the following components, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Components	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Farm and field maps	88.7	(3.5)	86.2	(2.6)	90.2	(5.1)	87.7	(2.2)
Crop yield expectations	75.8	(4.6)	81.8	(2.8)	84.7	(6.1)	78.6	(2.8)
Testing of manure and soil for nutrient levels	87.9	(3.8)	77.8	(4.0)	92.3	(4.9)	84.0	(2.7)
Manure application rates are adjusted due to other nutrient sources	77.6	(5.4)	78.8	(3.2)	88.0	(5.8)	78.5	(3.3)
Equipment calibration and operation records	54.7	(6.3)	58.7	(4.3)	62.1	(10.3)	56.6	(4.0)
Records for each application (including amount, dates, and climatic conditions when manure applied)	60.5	(6.2)	76.9	(3.2)	88.4	(5.5)	68.2	(3.9)
Types of application methods used	82.1	(4.8)	86.2	(2.6)	90.2	(5.1)	84.1	(2.8)
Crop rotations	73.1	(5.2)	78.5	(2.9)	86.0	(6.0)	75.8	(3.1)
Purchase and use of fertilizers	60.6	(5.8)	56.7	(4.1)	80.4	(8.6)	59.8	(3.7)
Land area needed for manure application	85.4	(5.3)	85.7	(2.8)	92.3	(4.9)	85.8	(3.2)
Emergency spill recovery plans	28.2	(4.9)	41.8	(4.1)	78.2	(7.3)	35.7	(3.4)
Other components	0.8	(0.7)	2.6	(1.1)	6.1	(3.0)	1.7	(0.7)

For sites that had a formal, written nutrient management plan (NMP), agricultural extension was the most important source for creating the plan. Other important sources included certified crop consultants, Natural Resources Conservation Service (NRCS) engineers, and agronomists. Large sites placed greater importance than did the other-sized sites on State/local natural resource departments, private environmental consultants, and agronomists, and less importance on agricultural extension and certified crop consultants.

f. For sites that had a written, formal manure-nutrient management plan, percent of sites by importance of the following sources in the creation of the nutrient management plan:

	Percent Sites								
	Very Important		Moderately Important		Slightly Important		Not Important		Total
Source	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent
Agriculture extension	35.3	(3.9)	21.7	(3.0)	17.1	(3.6)	25.9	(3.5)	100.0
Private environmental consultant	14.6	(3.2)	11.4	(3.0)	10.5	(2.1)	63.5	(4.0)	100.0
Natural Resources Conservation Service (NRCS) engineer	29.7	(3.4)	16.8	(3.5)	13.4	(2.1)	40.1	(4.2)	100.0
Certified crop consultant	31.8	(4.4)	15.8	(2.7)	9.3	(2.0)	43.1	(3.9)	100.0
State or local department of natural resources	21.2	(3.3)	17.1	(3.0)	13.8	(3.5)	47.9	(4.1)	100.0
Agronomist	24.4	(4.0)	17.6	(3.2)	12.0	(2.4)	46.0	(4.1)	100.0
Pork industry magazines	5.3	(1.2)	22.3	(3.3)	27.5	(3.9)	44.9	(4.1)	100.0
Other sources	6.6	(1.4)	2.5	(1.2)	89.8	(1.9)	1.1	(0.5)	100.0

g. For sites that had a formal, written manure-nutrient management plan, percent of sites that indicated the following sources were either very or moderately important in the creation of the nutrient management plan, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Source	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Agriculture extension	52.5	(6.4)	65.8	(4.2)	33.6	(8.9)	57.0	(4.1)
Private environmental consultant	20.9	(6.4)	28.9	(4.0)	69.0	(8.9)	26.0	(3.6)
Natural Resources Conservation Service (NRCS) engineer	49.4	(6.4)	41.6	(4.2)	54.6	(11.0)	46.5	(4.1)
Certified crop consultant	50.4	(6.4)	46.5	(4.5)	17.4	(5.8)	47.6	(4.1)
State or local department of natural resources	28.6	(5.9)	48.7	(4.5)	72.1	(8.0)	38.3	(4.0)
Agronomist	42.1	(6.7)	39.5	(4.3)	64.8	(9.7)	42.0	(4.2)
Pork industry magazines	24.5	(5.1)	31.6	(4.1)	31.1	(10.8)	27.6	(3.4)
Other sources	11.2	(3.0)	6.7	(1.8)	3.3	(2.0)	9.1	(1.8)

4. Manure application

Almost 95 percent of swine production sites applied manure to land owned or rented by the site. The method of application used most commonly varied by herd size. Small sites most often applied solid manure using broadcast spreaders. Medium-sized sites applied slurry via surface application or subsurface injection. Large sites applied manure most commonly in liquid via irrigation.

a. Percent of sites where swine manure was applied to any land owned or rented by the site, by size of site:

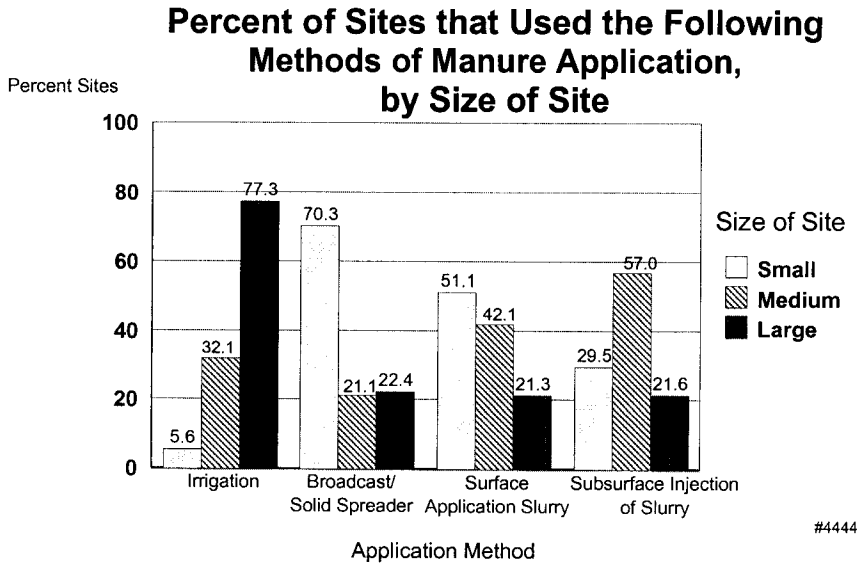
Percent Sites							
Size of Site (Total Inventory)							
Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
94.7	(1.6)	95.4	(1.3)	95.2	(2.8)	94.8	(1.3)

b. Percent of sites where swine manure was applied to any land owned or rented by the site, by region:

Percent Sites							
Region							
Northern		West Central		East Central		Southern	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
96.9	(1.6)	90.1	(3.5)	96.2	(1.9)	86.0	(2.7)

c. For sites where swine manure was applied to any land owned or rented by the sites, percent of sites that used the following methods of manure application, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Method of Application	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Irrigation	5.6	(0.9)	32.1	(3.0)	77.3	(7.2)	11.2	(1.2)
Broadcast/solid spreader	70.3	(3.6)	21.1	(3.4)	22.4	(9.6)	61.0	(3.4)
Surface application slurry	51.1	(4.9)	42.1	(3.7)	21.3	(7.0)	49.1	(4.0)
Subsurface injection of slurry	29.5	(3.7)	57.0	(3.6)	21.6	(6.6)	34.3	(3.3)
Other application methods	0.0	(0.0)	0.4	(0.3)	1.8	(1.6)	0.1	(0.1)



The predominant method of manure application in the southern region was irrigation, a practice rarely implemented in the other regions.

d. For sites where swine manure was applied to any land owned or rented by the sites, percent of sites that used the following methods of manure application, by region:

	Percent Sites							
	Region							
	Northern		West Central		East Central		Southern	
Method of Application	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Irrigation	2.9	(1.4)	22.4	(4.0)	4.3	(1.0)	88.8	(2.6)
Broadcast/solid spreader	60.9	(6.5)	59.8	(6.3)	65.6	(4.8)	13.2	(3.3)
Surface application slurry	36.8	(6.8)	37.7	(6.3)	59.8	(5.9)	12.0	(2.3)
Subsurface injection of slurry	36.3	(6.2)	15.2	(4.1)	41.3	(5.4)	1.4	(0.7)
Other application methods	0.0	(--)	0.3	(0.2)	0.1	(0.1)	0.0	(--)

During 2000, the 3-month period most common for applying manure to land was September through November.

e. For sites where swine manure was applied to any land owned or rented by the sites, percent of sites that applied manure to this land during the following 3-month periods, by size of site:

Percent Sites

	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
3-Month Period	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
December 1999, through February 2000	72.2	(3.6)	38.3	(3.8)	61.5	(9.5)	66.4	(3.3)
March 2000, through May 2000	84.6	(2.6)	74.6	(3.0)	63.3	(10.1)	82.7	(2.3)
June 2000, through August 2000	67.3	(4.1)	44.9	(3.7)	64.9	(10.1)	63.5	(3.6)
September 2000, through November 2000	91.2	(2.0)	90.4	(1.9)	84.4	(6.3)	91.0	(1.7)

f. For sites where swine manure was applied to any land owned or rented by the sites, percent of sites that applied manure to this land during the following 3-month periods, by region:

Percent Sites

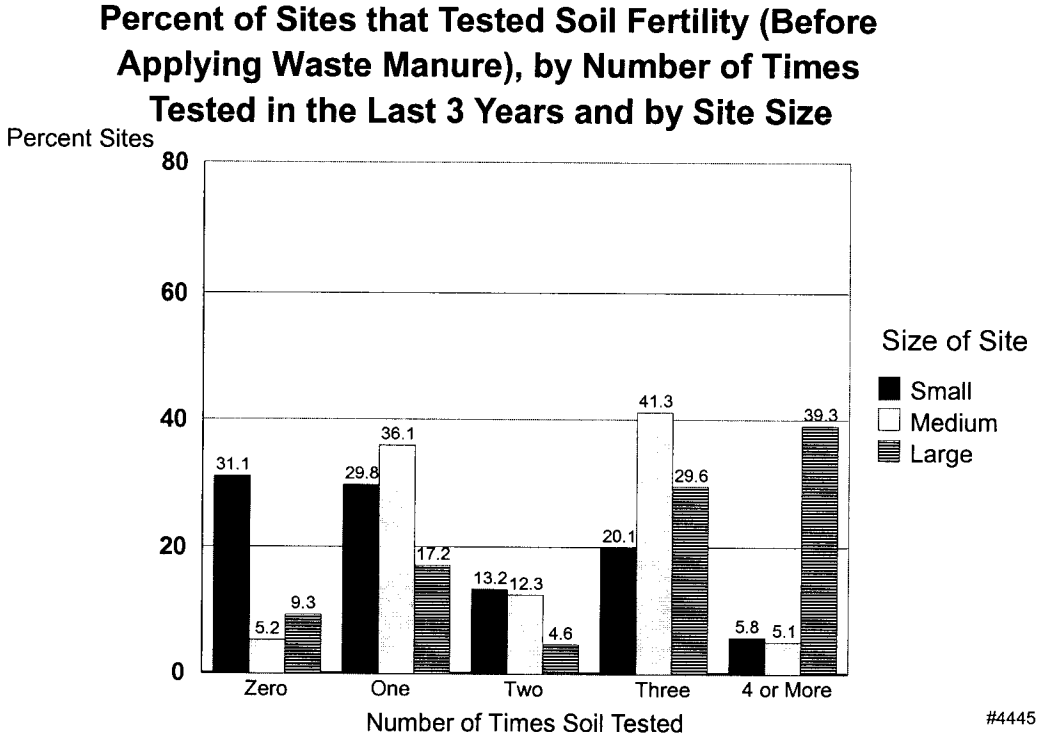
	Region							
	Northern		West Central		East Central		Southern	
3-Month Period	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
December 1999, through February 2000	53.6	(7.3)	63.6	(6.3)	71.6	(4.3)	68.8	(5.0)
March 2000, through May 2000	82.2	(4.4)	72.0	(5.5)	84.9	(3.1)	94.3	(2.2)
June 2000, through August 2000	57.3	(7.4)	61.7	(6.7)	64.9	(5.0)	84.2	(4.3)
September 2000, through November 2000	94.9	(2.9)	70.7	(6.1)	94.9	(2.0)	86.0	(2.9)

Before applying manure to fields, soils should be tested to determine fertility levels and manure should be tested to determine nutrient content. Almost one-third of small sites did no soil testing **during the previous 3 years,** while almost half of medium sites and over two-thirds of large sites tested soils at least once a year.

g. For sites where swine manure was applied to any land owned or rented by the sites, percent of sites that tested soil fertility (before applying waste manure to the land) the following number of times during the previous 3 years, by size of site.

Percent Sites

Number of Times Soil Fertility was Tested	Size of Site (Total Inventory) Small (Less than 2,000) Percent	Small Standard Error	Medium (2,000-9,999) Percent	Medium Standard Error	Large (10,000 or More) Percent	Large Standard Error	All Sites Percent	All Sites Standard Error
0	31.1	(4.6)	5.2	(1.8)	9.3	(5.3)	26.2	(3.8)
1	29.8	(4.3)	36.1	(3.9)	17.2	(6.4)	30.8	(3.5)
2	13.2	(3.6)	12.3	(2.3)	4.6	(3.1)	12.9	(3.0)
3	20.1	(3.2)	41.3	(3.5)	29.6	(7.9)	24.0	(2.7)
4 or more	5.8	(3.9)	5.1	(1.6)	39.3	(11.0)	6.1	(3.2)
Total	100.0		100.0		100.0		100.0	



5. Odor control*

Odor complaints were received most commonly by large sites. Of the large sites, 12.7 percent received at least one odor complaint during the previous 12 months.

a. Percent of sites that received the following number of odor complaints during the previous 12 months, including direct complaints from individuals and complaints filed with local or State government offices, by size of site:

Percent Sites

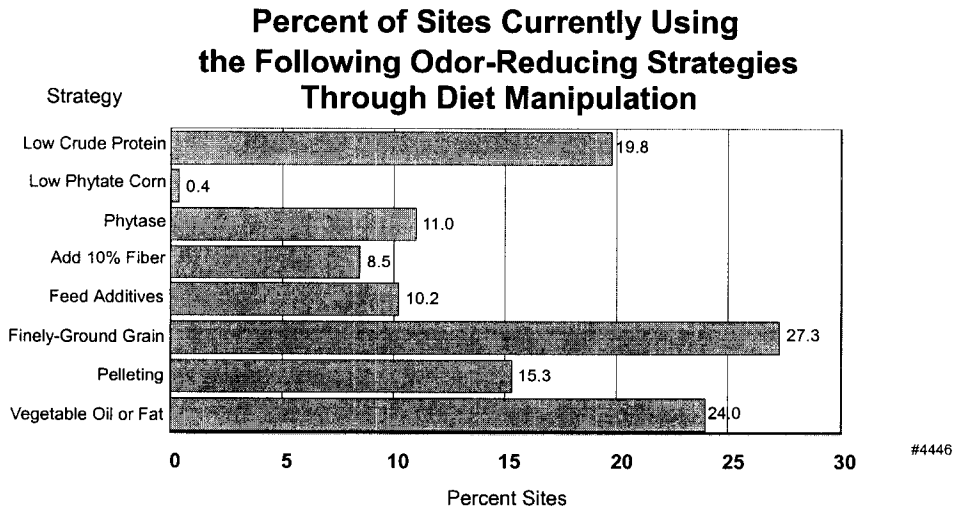
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Number of Complaints	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
0	98.6	(0.5)	94.7	(1.4)	87.3	(5.2)	97.8	(0.5)
1	1.0	(0.5)	3.3	(1.2)	10.0	(4.9)	1.5	(0.5)
2 or more	0.4	(0.2)	2.0	(0.8)	2.7	(1.6)	0.7	(0.2)
Total	100.0		100.0		100.0		100.0	

*Odor control strategies in this section were taken from an article in the *National Hog Farmer,* June 15, 1999

Numerous strategies exist for controlling odors from swine production sites. These strategies may be grouped into three categories: diet manipulation; manure management; and air quality. Diet manipulation was the strategy used most commonly.

b. Percent of sites that were either **currently using, had tried but were not currently using**, or **had never tried** the following odor-reducing strategies through **diet manipulation:**

	Percent Sites						
	Currently Using		Tried but Not Currently Using		Never Tried		
Odor-Reducing Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Total
Use synthetic amino acids and/or low crude protein	19.8	(3.1)	3.0	(0.8)	77.2	(3.2)	100.0
Use low phytate corn	0.4	(0.1)	0.5	(0.3)	99.1	(0.3)	100.0
Use phytase	11.0	(1.9)	3.6	(1.4)	85.4	(2.3)	100.0
Add 10 percent fiber	8.5	(2.8)	3.1	(0.8)	88.4	(2.8)	100.0
Add other feed additives for odor control (e.g., Microaid)	10.2	(1.8)	7.5	(1.4)	82.3	(2.3)	100.0
Use finely-ground grain	27.3	(3.2)	2.9	(1.0)	69.8	(3.4)	100.0
Use pelleting	15.3	(3.0)	4.7	(1.1)	80.0	(3.1)	100.0
Add vegetable oil or fat to feed to control dust	24.0	(2.7)	7.9	(1.8)	68.1	(3.2)	100.0
Use other diet manipulations for odor control	1.4	(0.4)	1.0	(0.5)	97.6	(0.7)	100.0



Half of the sites (50.2 percent) used some sort of diet manipulation to reduce odor. The most common methods were: finely-ground grain; vegetable oil or fat (to control dust); and synthetic amino acids. Each of the previous was practiced more commonly on large sites than small sites. While use of low-phytate corn is rare, more than 10 percent of sites used phytase in feed. Almost half of large sites fed pelleted feed, which reduces odors.

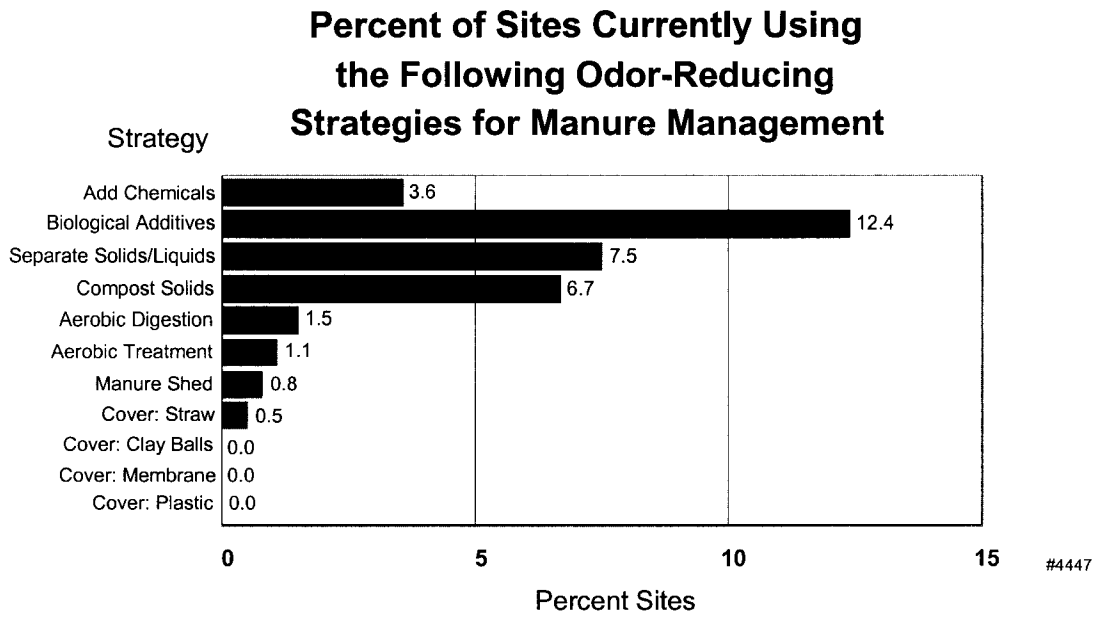
c. Percent of sites that were **currently using** the following odor-reducing strategies through **diet manipulation**, by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Odor-Reducing Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Use synthetic amino acids and/or low crude protein	18.8	(3.7)	23.9	(2.9)	31.8	(7.9)	19.8	(3.1)
Use low phytate corn	0.2	(0.1)	1.2	(0.7)	2.3	(2.2)	0.4	(0.1)
Use phytase	8.8	(2.2)	22.2	(3.0)	16.0	(5.5)	11.0	(1.9)
Add 10 percent fiber	8.8	(3.4)	6.6	(1.3)	16.2	(6.2)	8.5	(2.8)
Add other feed additives for odor control (e.g., Microaid)	8.7	(2.1)	17.1	(2.8)	16.6	(5.8)	10.2	(1.8)
Use finely-ground grain	25.7	(3.8)	32.9	(3.4)	58.0	(10.2)	27.3	(3.2)
Use pelleting	13.1	(3.6)	24.3	(3.0)	47.4	(9.6)	15.3	(3.0)
Add vegetable oil or fat to feed to control dust	20.7	(3.0)	37.2	(3.8)	65.3	(9.6)	24.0	(2.7)
Use other diet manipulations for odor control	1.3	(0.5)	1.9	(0.8)	1.9	(1.7)	1.4	(0.1)
Any diet manipulation	47.0	(4.6)	62.4	(3.3)	84.5	(5.3)	50.2	(3.9)

Adding chemical or biological additives to manure to control odor was practiced on 3.6 percent and 12.4 percent of sites, respectively. Approximately 11 percent of sites had tried but were no longer adding chemicals to manure. Likewise, approximately 1 in 10 sites were no longer using biological additives. Almost 7 percent of sites (of which most were small sites) composted solid manure. Nearly one-fourth of large sites separated solids from liquids, and more than 17 percent of large sites aerobically treated manure.

d. Percent of sites that were either **currently using, had tried but were not currently using**, or **had never tried** the following odor-reducing strategies for **manure management:**

	Percent Sites						
	Currently Using		Tried but not Currently Using		Never Tried		
Odor-Reducing Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Total
Add chemicals to manure	3.6	(0.8)	11.3	(2.2)	85.1	(2.4)	100.0
Add biological additives to manure	12.4	(2.7)	10.9	(1.7)	76.7	(3.1)	100.0
Separate solids from liquids	7.5	(2.7)	0.8	(0.4)	91.7	(2.7)	100.0
Compost solids	6.7	(2.0)	1.1	(0.5)	92.2	(2.1)	100.0
Use aerobic digestion	1.5	(0.8)	0.2	(0.1)	98.3	(0.8)	100.0
Use aerobic treatment	1.1	(0.4)	0.4	(0.2)	98.5	(0.4)	100.0
Use manure shed	0.8	(0.3)	0.1	(0.0)	99.1	(0.3)	100.0
Cover manure stored outside with straw	0.5	(0.3)	1.8	(0.8)	97.7	(0.8)	100.0
Cover manure stored outside with floating clay balls	0.0	(--)	0.0	(--)	100.0	(--)	100.0
Cover manure stored outside with geotextile membranes	0.0	(--)	0.0	(--)	100.0	(--)	100.0
Cover manure stored outside with plastic cover (floating or rigid)	0.0	(0.0)	0.1	(0.0)	99.9	(0.0)	100.0
Use other manure controls	3.5	(1.3)	0.9	(0.5)	95.6	(1.4)	100.0


Percent of Sites Currently Using the Following Odor-Reducing Strategies for Manure Management
Strategy
Add Chemicals
Biological Additives
Separate Solids/Liquids
Compost Solids
Aerobic Digestion
Aerobic Treatment
Manure Shed
Cover: Straw
Cover: Clay Balls
Cover: Membrane
Cover: Plastic
3.6
12.4
7.5
6.7
1.5
1.1
0.8
0.5
0.0
0.0
0.0
0
5
10
15
#4447
Percent Sites

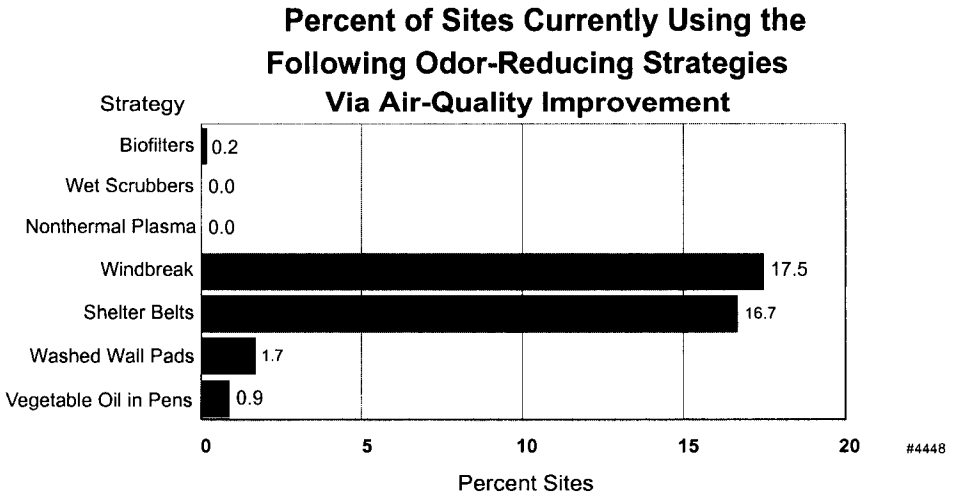
e. Percent of sites that were **currently using** the following odor-reducing strategies for **manure management,** by size of site:

	Percent Sites							
	Size of Site (Total Inventory)							
	Small (Less than 2,000)		Medium (2,000-9,999)		Large (10,000 or More)		All Sites	
Odor-Reducing Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Add chemicals to manure	2.5	(0.8)	9.0	(1.9)	7.7	(3.1)	3.6	(0.8)
Add biological additives to manure	9.8	(3.2)	25.7	(3.4)	8.4	(3.5)	12.4	(2.7)
Separate solids from liquids	7.2	(3.2)	7.9	(2.8)	23.2	(9.8)	7.5	(2.7)
Compost solids	7.6	(2.4)	2.4	(1.0)	0.0	(--)	6.7	(2.0)
Use aerobic digestion	1.3	(1.0)	3.0	(0.7)	0.7	(0.5)	1.5	(0.8)
Use aerobic treatment	0.1	(0.0)	4.8	(1.7)	17.2	(10.0)	1.1	(0.4)
Use manure shed	0.5	(0.3)	2.6	(1.0)	0.0	(--)	0.8	(0.3)
Cover manure stored outside with straw	0.2	(0.1)	2.2	(1.4)	0.0	(--)	0.5	(0.3)
Cover manure stored outside with floating clay balls	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)
Cover manure stored outside with geotextile membranes	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)
Cover manure stored outside with plastic cover (floating or rigid)	0.0	(0.0)	0.0	(0.0)	0.0	(--)	0.0	(0.0)
Use other manure controls	3.3	(1.5)	4.5	(1.5)	6.4	(4.3)	3.5	(1.3)
Any manure management	25.4	(4.1)	43.2	(3.6)	54.1	(9.6)	28.9	(3.4)

Approximately 17 percent of sites used windbreaks or shelter belts to reduce dust in order to reduce odor.

f. Percent of sites that were either **currently using, had tried but were not currently using**, or **had never tried** the following odor-reducing strategies via **air-quality improvement:**

	Percent Sites						
	Currently Using		Tried but not Currently Using		Never Tried		
Odor-Reducing Strategy	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error	Total
Treated exhaust air with biofilters	0.2	(0.1)	0.6	(0.3)	99.2	(0.3)	100.0
Treated exhaust air with wet scrubbers	0.0	(--)	0.0	(--)	100.0	(--)	100.0
Treated exhaust air with nonthermal plasma	0.0	(--)	0.0	(--)	100.0	(--)	100.0
Reduced dust using a windbreak	17.5	(3.9)	1.0	(0.5)	81.5	(3.9)	100.0
Reduced dust using shelter belts (vegetative windbreaks)	16.7	(2.8)	0.9	(0.5)	82.4	(3.0)	100.0
Reduced dust using "washing wall" pads (wetted pads in tunnel-ventilated building that air flows through	1.7	(0.6)	0.1	(0.1)	98.2	(0.6)	100.0
Reduced dust by sprinkling vegetable oil in pens	0.9	(0.5)	4.0	(3.0)	95.1	(3.1)	100.0
Other air-quality management strategies	4.8	(1.4)	0.1	(0.1)	95.1	(1.4)	100.0



g. Percent of sites that were **currently using** the following odor-reducing strategies via **air-quality improvement,** by size of site:

Percent Sites

Odor-Reducing Strategy	Size of Site (Total Inventory) Small (Less than 2,000) Percent	Standard Error	Medium (2,000-9,999) Percent	Standard Error	Large (10,000 or More) Percent	Standard Error	All Sites Percent	Standard Error
Treated exhaust air with biofilters	0.2	(0.1)	0.2	(0.1)	0.0	(--)	0.2	(0.1)
Treated exhaust air with wet scrubbers	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)
Treated exhaust air with nonthermal plasma	0.0	(--)	0.0	(--)	0.0	(--)	0.0	(--)
Reduced dust using a windbreak	19.1	(4.7)	10.5	(2.0)	10.1	(4.3)	17.5	(3.9)
Reduced dust using shelter belts (vegetative windbreaks)	17.4	(3.4)	12.4	(2.0)	29.0	(9.9)	16.7	(2.8)
Reduced dust using "washing wall" pads (wetted pads in tunnel-ventilated building that air flows through)	1.4	(0.7)	3.1	(1.5)	1.3	(1.1)	1.7	(0.6)
Reduced dust by sprinkling vegetable oil in pens	0.6	(0.5)	2.2	(1.4)	0.0	(--)	0.9	(0.5)
Other air-quality improvements	4.2	(1.6)	7.9	(2.1)	3.7	(2.6)	4.8	(1.4)
Any air-qaulity improvements	29.0	(4.7)	24.1	(3.0)	34.2	(9.3)	28.2	(3.9)

Section II: Methodology

A. Needs Assessment

Objectives were developed for the Swine 2000 study from input obtained over a period of several months, via a number of focus groups and individual contacts. Participants included representatives of producer and veterinary organizations, academia, State and Federal government, and private business. Topics identified for the Swine 2000 study were:

1) Research respiratory diseases such as porcine reproductive and respiratory syndrome (PRRS), Mycoplasma, and swine influenza virus (SIV).

2) Add to a national swine serum bank established through NAHMS' 1990 National Swine Survey and Swine '95 study to ensure that this resource is available for future research on domestic swine diseases and emerging pathogens.

3) Collect on-farm information about foodborne pathogens, such as *Salmonella,* Toxoplasma, and Yersinia.

4) Describe the adoption level of good production practices and provide information on the decision-making process related to antibiotics.

5) Assess industry progress on environmental practices and target future efforts for developing guidelines and educational programs for producers.

B. Sampling and Estimation

1. State selection

Initial selection of States to be included in the study was done in February 1999, using the National Agricultural Statistics Service (NASS) December 1, 1998, Hog and Pig Report. A goal for NAHMS' national studies is to include States that account for at least 70 percent of the animal and producer populations in the U.S. The NASS hog and pig estimation program collects data quarterly from producers in 17 States and annually in all States. The 17 States accounted for 92.6 percent of the December 1, 1998, swine inventory in the United States, and 73.7 percent of operations with swine in the United States.

A workload memo identifying the 17 States in relation to all States in terms of size (inventory and operations) was provided to the USDA:APHIS:VS Regional Directors. Each Regional Director sought in-put from their respective States about being included or excluded from the study. By midyear 1999, 17 States were chosen: Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas, and Wisconsin. These States coincided with the States in the NASS quarterly reporting program, which now included the Western States of Colorado, Oklahoma, and Texas, and excluded the Southeastern States of Georgia, Tennessee, and Kentucky. The Western States were undergoing rapid growth, whereas in many of the Southeastern States, populations of pigs and producers were declining. As of December 1, 2000, the 17 States accounted for 93.6 percent (56,035,000 head) of pigs in the U.S. and 76.4 percent (65,500) of the operations in the U.S. (See Appendix II for respective data on individual States.)

2. Operation Selection

An evaluation of the total inventory and number of operations showed that the 1-99 size group (in 15 of the 17 States where estimates were available) contained 41.0 percent of the operations but only 1.5 percent of the inventory. Therefore, operations with fewer than 100 pigs (based on the telephone screening question) were declared ineligible for the study so that the number of participants could be concentrated in the larger size groups.

Due to the rapid decline in the number of producers in the U.S., and therefore the likelihood that many randomly selected producers would be out of the swine business, a large screening sample was selected. NASS chose a stratified random sample, with stratification based on State and herd size, of 13,000 operations from a list of individual and corporate producers as well as contractors. Contractor-only arrangements (contractors who did not own any pigs) were not eligible for selection. Operations identified via the screening process that had 100 or more pigs were eligible to be contacted for an on-site interview. A randomly selected sample of these eligible operations was chosen for participation in the on-site interview. At the first interview, if operations had multiple production sites under different day-to-day management, a maximum of three sites was randomly selected (one with breeding animals and two with weaned pigs).

3. Population Inferences

Inferences cover the population of swine operations with 100 or more total pigs in the 17 States, since these operations were the only ones eligible for sample selection. These States accounted for 92.3 percent of operations with 100 or more pigs in the U.S. and 93.6 percent of the U.S. pig inventory as of December 1, 2000. *All respondent data were statistically weighted to reflect the population from which they were selected.* The inverse of probability of selection for each operation was the initial selection weight. This selection weight was adjusted for nonresponse within each State and size group to allow for inferences back to the original population from which the sample was selected.

C. Data Collection

1. General Swine Farm Report - Screening, April - May 2000

NASS' telephone interviewers administered the screening questions, which took approximately 10 minutes. Participation in this interview is summarized in Table 2a in the Response Rate section.

2. General Swine Farm Report, June 1 - July 14, 2000

NASS' enumerators administered the General Swine Farm Report in person to each selected producer. The interview took approximately 1 hour. NASS' enumerators asked producers for permission for Veterinary Medical Officers (VMOs) to contact the producers and discuss additional phases of data collection.

3. Initial VS Visit, August 21 - November 3, 2000

State and Federal VMOs contacted producers to solicit participation in the next phase of the NAHMS Swine 2000 study. A producer agreement that promises data confidentiality and indicates producer intentions for biological sampling was signed with respondents. A face-to-face interview was conducted to complete the initial VS visit questionnaire, which took an average of 50 minutes.

4. Second VS Visit, December 1, 2000 - February 28, 2001

State and Federal VMOs completed the VS phase by making a second visit to participating producers. A face-to-face interview was conducted to complete the Second VS Visit questionnaire, which took 66 minutes on average. A subset of producers also allowed collection of biological samples (blood, feces, feed) which may have been collected during either the Initial VS visit or the Second VS visit.

D. Data Analysis

1. Validation and estimation

a. General Swine Farm Report

Initial data entry and validation for both the General Swine Farm Report screening form and General Swine Farm Report (results reported in Swine 2000, Part I) were performed in individual NASS State offices. Data were entered into a SAS data set. NAHMS national staff performed additional data validation on the entire data set after data from all States were combined.

b. Initial and Second VS Visit

Completed VS visit questionnaires were sent first to State NAHMS coordinators, where they were manually reviewed for errors and accuracy, then forwarded to CEAH. Data entry and validation for the VS visits were completed at CEAH directly into SAS. Data validation programs were run on data after being entered. NAHMS' national staff performed additional data checks on the entire dataset.

2. Response rates

a. General Swine Farm Report - Screening Questionnaire

A total of 11,138 operations (85.8 percent) completed the screening survey. Of these, 7,156 operations had 100 or more total pigs and, thus, were eligible for the next phase of data collection. The next survey, the General Swine Farm Report (GSFR) was completed approximately 2 months later via personal interview.

Response Category	Number Operations	Percent Operations
Eligible	7,156	55.1
Not eligible	3,189	24.6
Out of business	537	4.1
Out of scope (prison farms, research farms, etc.)	256	2.0
Refusal	1,040	8.0
Inaccessible	810	6.2
Total	12,988	100.0

Given an expected response rate of 60 percent, the 7,156 eligible operations would result in more than the 2,500 planned respondents. Therefore, 2,407 names were dropped (via random selection) from the respondent list. The final number of operations eligible for the GSFR was 4,749.

Most operations were independent, single-site enterprises, or contract nursery or finisher sites. For larger operations with multiple production sites, up to three production sites were randomly selected to complete the GSFR (one with breeding animals and two with weaned pigs).

b. General Swine Farm Report

Response Category	Number Operations	Percent Operations	Number Sites	Percent Sites
Survey complete and VMO consent	1,208	25.4	1,316	26.7
Survey complete, refused VMO consent	1,120	23.6	1,183	24.0
No pigs on June 1, 2000	181	3.8	181	3.7
Out of business	67	1.4	67	1.4
Out of scope (prison and research farms, etc.)	29	0.6	29	0.6
Refusal	1,736	36.6	1,736	35.3
Inaccessible	408	8.6	408	8.3
Total	4,749	100.0	4,920	100.0

c. Initial Visit

Response Category	Number Sites	Percent Sites
Survey complete	895	68.0
Refusal	292	22.2
Ineligible	25	1.9
Inaccessible	104	7.9
Total	1,316	100.0

d. Second Visit

Response Category	Number Sites	Percent Sites
Survey complete	799	89.3
Refusal	91	10.1
Ineligible	5	0.6
Total	895	100.0

Appendix I: Sample Profile

A. Responding Sites

1a. Total inventory

Size of Site (Total Number Pigs on Operation)	Number Responding Sites
Less than 2,000	434
2,000 - 9,999	326
10,000 or more	39
Total	799

1b. Sow inventory

Size of Site (Total Sows and Gilts on Operation)	Number Responding Sites
0	366
1-249	205
250-499	99
500 or more	129
Total	799

2. Type of site

Type of Site	Number Responding Sites
Contract producer	240
Independent-market own pigs	505
Independent - market through cooperative	40
Other	14
Total	799

3. Number of responding sites by region:

Region	Number Responding Sites
Northern	176
West Central	212
East Central	276
Southern	135
Total	799

4. Number of responding sites with the following production phases:

Production Phase	Number Responding Sites
Farrow to finish	290
Feeder pig producer	40
Weaned pig producer	68
Nursery site	41
Finisher site	249
Nursery and finisher site	77
Other phase	34
Total	799

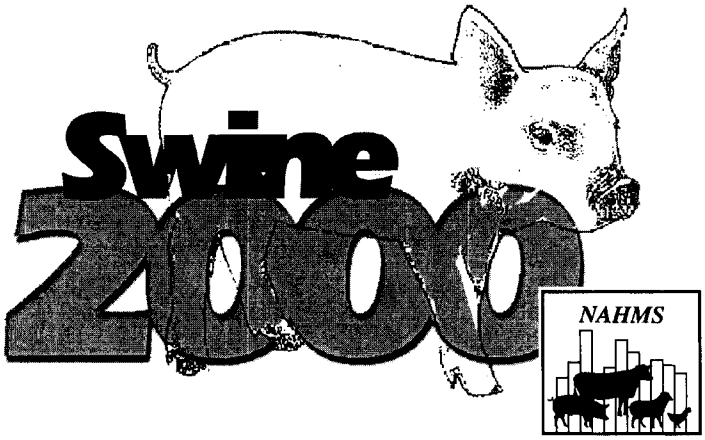
Appendix II: U.S. Populations & Operations

Number of Hogs and Pigs on December 1, 2000, and Number of Operations in 2000[1]

Region	State	Number Hogs and Pigs (Thousand Head)		Number Operations in 2000	
		All Operations	Operations with 100 or More Head	All Operations	Operations with 100 or More Head
East Central	Illinois	4,200	4,158	5,100	3,300
	Indiana	3,400	3,366	4,400	2,700
	Iowa	15,400	15,369	12,300	10,400
	Ohio	1,510	1,435	5,200	2,200
	Total	24,510	24,328	27,000	18,600
Northern	Michigan	950	936	2,200	800
	Minnesota	5,800	5,742	7,300	5,300
	Pennsylvania	1,040	1,009	3,000	900
	Wisconsin	620	577	2,700	800
	Total	8,410	8,264	15,200	7,800
West Central	Colorado	840	836	500	90
	Kansas	1,570	1,554	1,600	720
	Nebraska	3,100	3,053	4,000	2,600
	Missouri	2,900	2,871	3,600	1,800
	South Dakota	1,360	1,333	1,900	1,100
	Total	9,770	9,647	11,600	6,310
Southern	Arkansas	685	671	1,100	440
	North Carolina	9,400	9,372	3,600	1,700
	Oklahoma	2,340	2,305	2,700	300
	Texas	920	874	4,300	110
	Total	13,345	13,222	11,700	2,550
Total (17 States)		56,035 (93.6% of US)	55,461 (93.6% of US)	65,500 (76.4% of US)	35,260 (92.3% of US)
Total U.S. (50 States)		59,848	59,250	85,760	38,200

Note: The above inventory numbers and number of operations were revised as published in the December 28, 2001, Quarterly Hogs and Pigs report. The December 1, 2000, U.S. inventory was revised from 59,848,000 head to 59,138,000 head. The number of operations in 2000 was revised from 85,760 to 86,360. For further information see www.usda.gov/nass.

1 Source: NASS Hogs and Pigs, December 28, 2000. An operation was any place having one or more head of hogs and pigs on hand at any time during the year.


Swine
2000
NAHMS

Swine 2000 Study Objectives and Related Outputs

1) Research respiratory diseases such as porcine reproductive and respiratory syndrome (PRRS), mycoplasma, and swine influenza virus (SIV).

- Info sheets and interpretive reports, expected Fall 2002

2) Add to a swine serum bank established through NAHMS 1990 National Swine Survey and Swine '95 study to ensure that this resource is available for future national research on domestic swine diseases and emerging pathogens.

- Collected sera banked July 2001

3) Collect on-farm information about foodborne pathogens, such as *Salmonella*, Toxoplasma, and Yersinia.

- Part I: Reference of Swine Health and Management in the United States, 2000, August 2001
- Part II: Reference of Swine Health and Health Management in the United States, 2000, March 2002
- Info sheets and interpretive reports, expected 2003

4) Describe the adoption level of good production practices and provide information on the decision-making process related to antibiotics.

- Part II: Reference of Swine Health and Health Management in the United States, 2000, March 2002
- Changes in the U.S. Pork Industry, 1990-2000, expected Winter 2002
- Info sheets, March 2002

5) Assess industry progress on environmental issues and target future efforts for developing guidelines and educational programs for producers.

- Part I: Reference of Swine Health and Management in the United States, 2000, August 2001
- Part II: Reference of Swine Health and Health Management in the United States, 2000, March 2002
- **Part III Reference of Swine Health and Environmental Management in the United States, 2000, September 2002**
- Changes in the U.S. Pork Industry, 1990-2000, expected Winter 2002

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