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# Dairy 2002

## Animal Disease Exclusion Practices on U.S. Dairy Operations, 2002



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Thomas E. Walton  
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# INTRODUCTION

## BIOSECURITY AND BIOCONTAINMENT

Biosecurity at the farm level results from implementing management practices designed to prevent the introduction of disease-causing agents onto an operation. Biocontainment is the result of implementing strategies designed to prevent the spread of disease agents between animal groups.<sup>5 14 16</sup> Strategies directed at both biosecurity and biocontainment are necessary to minimize potential impacts of disease.

Recognizing and understanding all aspects of potential biosecurity breaches are important when managing a successful biosecurity program. Generally, the issues that receive the most attention are: the process of introducing new animals onto the farm, including knowledge of their source and health history; isolating new animals from the main herd and testing them for appropriate diseases; designing strategic vaccination programs; and sanitation practices,

including milking procedures, disinfecting equipment, and manure management. However, many other key components of disease control are often overlooked. For example, minimizing stress helps animals better resist and combat disease. Animal stress can be reduced by providing a comfortable, clean environment, sufficient housing space, adequate bunk space, and by segregating cattle into appropriate age and/or size groups. Providing quality feed and water, maintaining a balanced ration with proper mineral levels, and providing transition diets help decrease nutritional stress and ensure optimal immune function for disease resistance. Managing and regulating visitor, service personnel, employee, and animal traffic also is an essential aspect of biosecurity. Finally, controlling animals' exposure to wildlife, insects, and wind-borne pathogens are other areas that must be considered in a comprehensive biosecurity program.<sup>5 7 8 13</sup>

## IMPORTANCE OF BIOSECURITY

Infectious diseases can have a devastating impact on the productivity of any dairy operation. Virtually every disease results in productivity losses, and in some cases these losses can be substantial, particularly on larger operations where more animals are at risk. Milk production and quality can decrease, resulting in immediate financial consequences. Reproductive efficiency can decline, compounding the financial strain by increasing days open and culling rates. As a result, calf numbers are negatively affected and replacement costs rise. Furthermore, treatment expenses, debilitated animals, and increased death losses certainly have financial implications, but also may limit animal marketing options. Finally, depending on the nature of the pathogen,

public health issues may arise, such as zoonoses spread by contact, antimicrobial resistance, drug residues, and impaired or reduced food safety.<sup>2 7 14</sup>

On a national level, biosecurity programs are crucial in keeping the country free from numerous animal diseases exotic to the United States. Due to the threat of bioterrorism and the recent international outbreaks of infectious diseases such as foot-and-mouth disease and bovine spongiform encephalopathy, strict import and trade bans have been implemented as components of the national biosecurity plan.<sup>1</sup> In addition, there are current and past eradication programs for many diseases familiar to producers, such as tuberculosis, brucellosis,



classical swine fever (hog cholera), and pseudorabies.<sup>5</sup> These programs include national-level biosecurity protections.

Whether motivation stems from risk of decreased productivity on individual farms or producer responsibility to exclude or eradicate disease on a national level, the net benefit of biosecurity is to increase profitability; disease is very costly at all levels, including to society in general.

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## BIOSECURITY DEVELOPMENT

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Developing a formal biosecurity plan is an exercise in risk assessment. As such, there are four steps to include in the assessment process:

1. Hazard identification
2. Exposure assessment
3. Risk characterization
4. Identification of mitigations

**Step 1.** The preliminary step in designing a biosecurity plan is to assess the specific risks for the operation. Wells (JDS 2000) suggests that the operation first identify its chief source of income. For example, on most dairies milk is the primary product. Diseases that cause decreased milk production and quality as well as early culling should have the highest priority. In contrast, dairies that market primarily animal semen or embryos should concentrate their biosecurity efforts against potential reproductive diseases, as well as diseases with international trade implications such as bovine leukosis virus and bluetongue virus.<sup>5 7</sup>

**Step 2.** Operations must identify which specific diseases are most likely to be hazards for their particular farm and identify the most probable means by which cattle would be exposed. Many factors must be considered, including geographic location; rodent, insect, and bird populations; wind and weather patterns; disease history; proximity to other livestock operations;

potential contact with wildlife; prospective visitors; off-farm animal travel; and the addition of new animals.<sup>2 7 14</sup>

**Step 3.** Once potential hazards have been assessed, the degree of risk must be characterized for that operation. This qualitative assessment can be done simultaneously with the exposure assessment. Operations that purchase replacement heifers have a higher risk of introducing infectious diseases to the premises than those that do not make off-site animal purchases. In addition, dairies that allow the same employees to work with calves, sick cows, and do milking chores have a higher potential risk of transferring disease agents between groups of animals on-farm than dairies that assign employees to one specific group of animals. The risk of transmitting *Mycobacterium avium*, subspecies paratuberculosis (Johne's disease) is increased on operations that feed pooled colostrum and/or unpasteurized pooled milk to calves. This risk is compounded if the colostrum comes from cows with unknown Johne's disease status. Another component of characterizing an operation's greatest risks is evaluating the potential means of control and how they will be implemented on the operation. Vaccine availability and efficacy for certain diseases also must be considered. Vaccination is relatively efficacious for diseases such as

infectious bovine rhinotracheitis but is not available generally for other diseases such as anaplasmosis and Johne's disease.

**Step 4.** All information attained from steps 1 through 3 should be assimilated into a final plan or mitigation. The mitigation should include the diseases of utmost importance, where control efforts are to be directed; a detailed plan to assess the current levels of disease on the operation (serologic or fecal testing, for example); and written strategies detailing what will be done to prevent the introduction or spread of these diseases.<sup>7</sup>

Numerous checklists and scorecards have been developed to aid in the analysis process. These assessments can serve as guidelines to help identify potential hazards and the degree of risk

for disease acquisition or transmission on an operation. Risk assessments are available for specific diseases or situations. For example, the New York State Cattle Health Assurance Program provides a risk assessment tailored to herd expansion biosecurity concerns, and a Johne's disease risk assessment is available from USDA's National Animal Health Monitoring System (NAHMS).

Data presented in this report are from the NAHMS Dairy 2002 study, which assessed the current practices on dairy operations that affect biosecurity and biocontainment. Dairy 2002 was designed to provide information to both participants and industry from operations in 21 major dairy States (see map). These States represented 83.0 percent of U.S. dairy operations and 85.7 percent of U.S. dairy

**Dairy 2002 Participating States**



cows. Phase I data were collected from December 31, 2001, through February 12, 2002, from 2,461 operations. For Phase II of the Dairy 2002 study, data were collected from 1,013 operations with 30 or more dairy cows. State and Federal veterinary medical officers (VMOs) and animal health technicians (AHTs) collected the data from February 25 through April 30, 2002. Data from both phases of collection are presented in this report. The methods used and a profile of responding operations can be found at the end of this report.

Further information on NAHMS studies and reports is available online at:  
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## TERMS USED IN THIS REPORT

**Cow:** Female dairy bovine that has calved at least once.

**Heifer:** Female dairy bovine that has not yet calved.

**Herd size:** Herd size is based on January 1, 2002, dairy cow inventory. Small herds are those with fewer than 100 head; medium herds are those with 100 to 499 head; and large herds are those with 500 or more head.

**Population estimates:** Estimates in this report are provided with a measure of precision called the standard error. A 95-percent confidence interval can be created with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population mean 95 out of 100 times. In the example to the 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.

### Regions:

**West:** California, Colorado, Idaho, New Mexico, Texas, Washington

**Midwest:** Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin

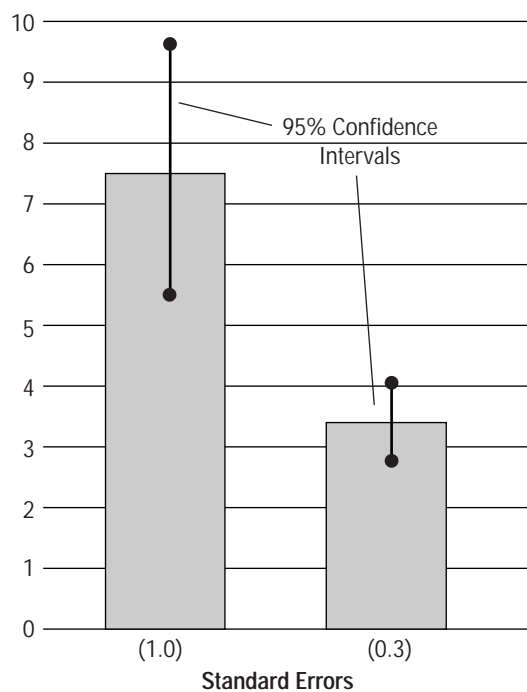
**Northeast:** New York, Pennsylvania, Vermont

**Southeast:** Florida, Kentucky, Tennessee, Virginia

**Sample profile:** Information that describes characteristics of the sites from which Dairy 2002 data were collected.

**Total inventory:** All dairy cattle present on the site on January 1, 2002.

Examples of a 95% Confidence Level



## SECTION 1:

## POPULATION ESTIMATES

## A. HERD ADDITION RISKS

## 1. Introduction of new animals

For most dairies, the greatest threat to biosecurity is the introduction of new animals. Different classes (life stages) of cattle brought onto the operation present different biosecurity risks. For example, animals that are lactating or have completed a lactation are more likely to introduce mastitis pathogens to the operation than are heifers. In general, virgin animals are less likely to bring reproductive pathogens onto the operation than other classes of animals.

In 2001, nearly half (45.7 percent) of all dairies brought either beef or dairy cattle onto their operations. Lactating dairy cows, bred dairy heifers, and dairy bulls were the classes of cattle added most commonly. Overall, 16.4 percent of operations added lactating dairy cows. Large and medium operations were more likely to add lactating dairy cows (21.7 and 22.7 percent of operations, respectively) than small operations

(14.4 percent of operations). Bred dairy heifers were introduced onto 15.8 percent of all operations, while more than half of large operations (54.4 percent) added bred dairy heifers in 2001. Large operations also were most likely to introduce dairy bulls (28.4 percent) compared to medium and small operations (17.7 and 11.9 percent of operations, respectively).<sup>11</sup>

In 2001, the West region reported the highest percentage of operations that introduced any beef or dairy cattle onto the premises (67.3 percent of operations). This is not surprising, as western dairies tend to be larger in size and more likely to be actively expanding their herds than dairies in other regions of the country. The West region also reported the highest percentage of operations that introduced bred dairy heifers (39.6 percent of operations).<sup>11</sup>

**a. Percentage of operations that brought the following classes of cattle onto the operation during 2001, by herd size**

Class of Cattle	Herd Size (Number of Dairy Cows)							
	Small		Medium		Large		All	
	(Less than 100)		(100-499)		(500 or More)		Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Unweaned calves (dairy or beef)	4.9	(0.9)	6.0	(1.1)	3.2	(1.1)	5.1	(0.7)
Dairy heifers (weaned but not bred)	5.8	(0.8)	9.0	(1.2)	13.2	(1.9)	6.7	(0.7)
Bred dairy heifers	10.4	(1.0)	28.9	(1.9)	54.4	(2.7)	15.8	(0.9)
Lactating dairy cows	14.4	(1.2)	22.7	(1.8)	21.7	(2.3)	16.4	(1.0)
Dry dairy cows	5.7	(0.8)	6.9	(1.1)	6.3	(1.0)	5.9	(0.6)
Beef heifers and cows	1.5	(0.4)	1.6	(0.4)	1.1	(0.3)	1.5	(0.3)
Dairy bulls (weaned)	11.9	(1.1)	17.7	(1.5)	28.4	(2.4)	13.7	(0.9)
Beef bulls (weaned)	2.1	(0.5)	2.9	(0.6)	2.7	(0.9)	2.3	(0.4)
Steers (weaned)	1.0	(0.3)	1.6	(0.5)	0.1	(0.1)	1.1	(0.3)
Any beef or dairy cattle	40.1	(1.7)	61.2	(2.0)	75.3	(2.3)	45.7	(1.4)

**b. Percentage of operations that brought the following classes of cattle onto the operation, by region**

Class of Cattle	Region							
	West		Midwest		Northeast		Southeast	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Unweaned calves (dairy or beef)	4.8	(1.5)	5.7	(1.0)	4.8	(1.2)	0.6	(0.5)
Dairy heifers (weaned but not bred)	11.2	(1.6)	6.1	(0.9)	7.4	(1.4)	4.0	(1.7)
Bred dairy heifers	39.6	(2.9)	13.5	(1.2)	13.0	(1.6)	19.2	(3.9)
Lactating dairy cows	15.2	(1.8)	15.7	(1.3)	18.6	(1.9)	15.7	(2.9)
Dry dairy cows	3.8	(0.9)	5.9	(0.9)	6.8	(1.2)	5.0	(1.5)
Beef heifers and cows	2.4	(0.8)	1.6	(0.5)	0.5	(0.3)	3.2	(1.6)
Dairy bulls (weaned)	24.8	(2.2)	13.1	(1.3)	11.1	(1.5)	15.7	(2.9)
Beef bulls (weaned)	5.6	(1.3)	1.8	(0.5)	2.0	(0.7)	4.1	(1.7)
Steers (weaned)	1.3	(0.5)	1.4	(0.4)	0.3	(0.2)	1.7	(1.4)
Any beef or dairy cattle	67.3	(3.1)	44.4	(1.9)	41.9	(2.5)	47.9	(4.2)

The number of new animals introduced onto the operation can help quantify the level of risk, all other factors being equal.

**c. For operations that brought dairy cows (lactating or dry) and bred dairy heifers onto the operation during 2001, number of *dairy cows* and *bred dairy heifers* brought onto the operations as a percentage of the January 1, 2002, dairy cow inventory, by herd size**

Class of Cattle	Herd Size (Number of Dairy Cows)							
	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Dairy cows	15.5	(1.4)	14.5	(1.4)	13.8	(1.6)	14.5	(0.9)
Bred dairy heifers	14.6	(2.2)	14.3	(2.4)	19.7	(1.4)	17.5	(1.1)

## 2. Quarantine practices

There are avenues to mitigate some of the risk associated with the introduction of new animals. Management procedures available include quarantine, screening animals to be added, testing source herds for disease agents, preventive treatments, and vaccination. Quarantining new animals is most effective for diseases with short incubation periods and diseases associated with overt clinical signs that can be detected by careful observation. It is recommended that all incoming cattle be isolated in a designated quarantine area for a minimum of 21 to 30 days, ideally off-site. At the very least, new animals should not be allowed nose-to-nose contact, common feeders or waterers, and shared air space with resident cattle.<sup>15</sup> The objective of quarantine is to eliminate the transfer of respiratory, gastrointestinal, reproductive, and mastitis pathogens, which is accomplished only if resident animals have no physical contact with new animals (including across the fence), and no contact with their secretions, fluids, manure, or pen runoff. It also is recommended that a maximum distance between groups of resident cattle and incoming cattle be maintained to reduce airborne disease transmission.

In addition, attention must be given to any traffic going from the quarantine area to the rest of the herd, as well as any equipment, utensils, or other items that might convey infectious materials from the quarantine area to the rest of the herd. Typically, it is recommended that nothing move from the quarantine area to other parts of the operation, that animal-care activities for quarantined animals be completed last, and that

external clothing such as coveralls and boots be left with quarantined animals or cleaned prior to returning to the rest of the herd. Appropriate hand hygiene also should be implemented. Finally, quarantine is of little use without adequate monitoring of the quarantined animals to detect signs of disease should they occur.

Only one in five operations (20.6 percent) that added new cattle quarantined them. Lactating dairy cows, dairy bulls, and dry dairy cows were least likely to be quarantined upon arrival on 9.5, 15.9, and 7.1 percent of operations, respectively.

**a. For operations that brought the following classes of cattle onto the operation during 2001, percentage of operations that quarantined any of the following classes of animals upon arrival at the operation**

Class of Cattle	Percent Operations	Standard Error
Unweaned calves (dairy or beef)	37.0	(7.3)
Dairy heifers (weaned but not bred)	23.9	(3.9)
Bred dairy heifers	19.6	(2.3)
Lactating dairy cows	9.5	(1.6)
Dry dairy cows	7.1	(2.2)
Beef heifers and cows	24.0	(8.5)
Dairy bulls (weaned)	15.9	(2.4)
Beef bulls (weaned)	23.6	(6.5)
Steers (weaned)	40.0	(11.4)
Any beef or dairy cattle	20.6	(1.6)

On average, 48.2 percent of weaned steers were quarantined for 41.3 days, while 78.6 percent of unweaned calves were quarantined for 49.2 days, and 20.2 percent of lactating dairy cows and 6.5 percent of dry cows were quarantined for 20.1 and 21.4 days, respectively.<sup>11</sup>

**b. For operations that brought the following classes of cattle onto the operation during 2001, operation average percentage of animals quarantined and, if quarantined, operation average number of days quarantined**

Class of Cattle	Percent Cattle Quarantined		Days Quarantined	
	Operation Average	Standard Error	Operation Average	Standard Error
Unweaned calves (dairy or beef)	78.6	(1.2)	49.2	(9.3)
Dairy heifers (weaned but not bred)	36.1	(1.0)	28.2	(6.0)
Bred dairy heifers	26.9	(3.3)	23.7	(4.0)
Lactating dairy cows	20.2	(3.8)	20.1	(4.1)
Dry dairy cows	6.5	(1.9)	21.4	(4.3)
Beef heifers and cows	31.1	(11.5)	31.1	(6.6)
Dairy bulls (weaned)	20.2	(3.3)	19.0	(2.5)
Beef bulls (weaned)	50.0	(14.6)	32.0	(12.9)
Steers (weaned)	48.2	(14.6)	41.3	(14.0)

### 3. Testing practices for disease detection in new arrivals

Testing individual cattle prior to purchase or importation onto the farm can be a useful method for preventing the introduction of disease. The success of this approach depends largely on the sensitivity of the test (ability of the test to correctly identify infected animals) and the prevalence of disease (if it exists) in the source herd. For example, if a high prevalence of *Mycobacterium paratuberculosis*, the causative agent of Johne's disease, exists in the source herd and the test being used to detect the agent has a low sensitivity, then there is a low-confidence level that a test-negative animal is truly not infected. Skin-fold testing, serologic, fecal, milk,

and ear-notch samples are common methods used to detect various diseases.

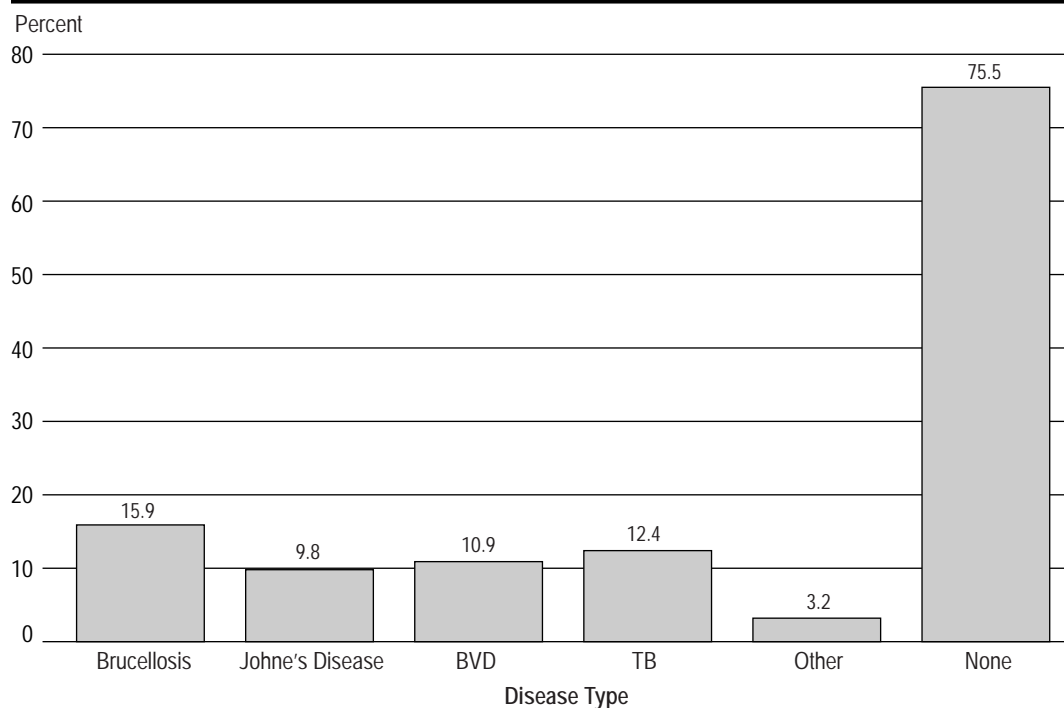
More than three-quarters of U.S. dairy operations (75.5 percent) did not require testing cattle before introducing them onto the farm.<sup>11</sup> Despite the increased industry awareness about biosecurity and Johne's disease, the percentage of operations that required testing remained approximately the same as compared to 1996, where 9.1 percent of the operations reported requiring testing for Johne's disease (Dairy '96 study).<sup>10</sup>



a. For operations that brought beef or dairy cattle onto the operation during 2001, percentage of operations by testing normally required by the operation, and by herd size

Test Type	Herd Size (Number of Dairy Cows)							
	Small		Medium		Large		All	
	(Less than 100)		(100-499)		(500 or More)		Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Brucellosis	13.1	(1.8)	19.5	(2.1)	29.9	(2.7)	15.9	(1.3)
<i>Mycobacterium paratuberculosis</i> (Johne's disease)	8.3	(1.4)	12.7	(1.9)	12.2	(1.9)	9.8	(1.1)
Bovine viral diarrhea (BVD)	8.6	(1.4)	15.6	(2.1)	15.0	(2.1)	10.9	(1.1)
Bovine tuberculosis (TB)	10.8	(1.5)	14.3	(1.7)	20.7	(2.3)	12.4	(1.1)
Other	2.8	(0.8)	4.3	(1.3)	3.5	(1.1)	3.2	(0.6)
None	78.8	(2.2)	70.6	(2.5)	61.2	(2.9)	75.5	(1.6)

Percent of Operations by Testing Normally Required Before Bringing Animals On-Farm



#### 4. Testing practices for udder health of incoming dairy cows

Milk samples, either from animals to be purchased or from the bulk tank of the herd of origin, may detect contagious mastitis pathogens. Milk sampling (for culture and somatic cell counts) is recommended as part of a complete biosecurity program and serves as a direct indication of udder health. Individual samples from lactating cows should be obtained before or immediately upon arrival. It is recommended that these animals be placed at the end of the milking rotation until a negative culture is obtained. In addition to milk cultures, somatic cell counts (SCCs) are fairly sensitive screening tools used before bringing dairy cows onto the operation to identify contagious mastitis pathogens.<sup>6</sup>

Overall, 26.8 percent of operations required an individual cow SCC. Similar percentages were reported across all herd sizes. Overall, herd-of-origin bulk tank SCCs were required by 16.6 percent of operations. Large operations were more likely to obtain herd-of-origin bulk tank SCCs compared to small operations (34.1 percent and 14.3 percent, respectively). Individual cow and herd bulk tank milk cultures were required by 11.0 and 10.6 percent of operations, respectively. Large operations were most likely to require a herd bulk tank milk culture.<sup>11</sup>

a. For operations bringing on dairy cows during 2001, percentage of operations that normally required testing or proof of udder health, by herd size

Test Type	Herd Size (Number of Dairy Cows)							
	Small		Medium		Large		All	
	(Less than 100)		(100-499)		(500 or More)		Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Individual cow milk somatic cell count	26.7	(3.7)	26.7	(4.0)	29.5	(5.2)	26.8	(2.8)
Herd bulk tank milk somatic cell count	14.3	(2.9)	19.2	(3.4)	34.1	(5.9)	16.6	(2.2)
Individual cow milk culture	10.7	(2.5)	10.6	(2.6)	18.8	(4.8)	11.0	(1.8)
Herd bulk tank milk culture	9.5	(2.4)	10.0	(2.6)	31.0	(6.0)	10.6	(1.8)

## 5. Vaccination practices required for incoming cattle

With many pathogens it is more important to have an accurate history (with or without test results) of the source herd than to have test information on the individual animals to be brought onto the operation.

For some diseases, vaccinating animals before bringing them onto the operation may help decrease the risk of introducing disease agents and protect these newly introduced animals from disease agents endemic to the operation.

Vaccination can be an important component of biosecurity, but should not be relied upon as the main constituent of the biosecurity program. Proper vaccination can reduce the incidence of a particular disease in the herd but does not provide complete herd immunity. Other measures must be implemented to prevent and control the spread of disease. Furthermore, while new and improved vaccines are available for preventing an increasing number of diseases, vaccines are not available for every disease; nor is it advisable

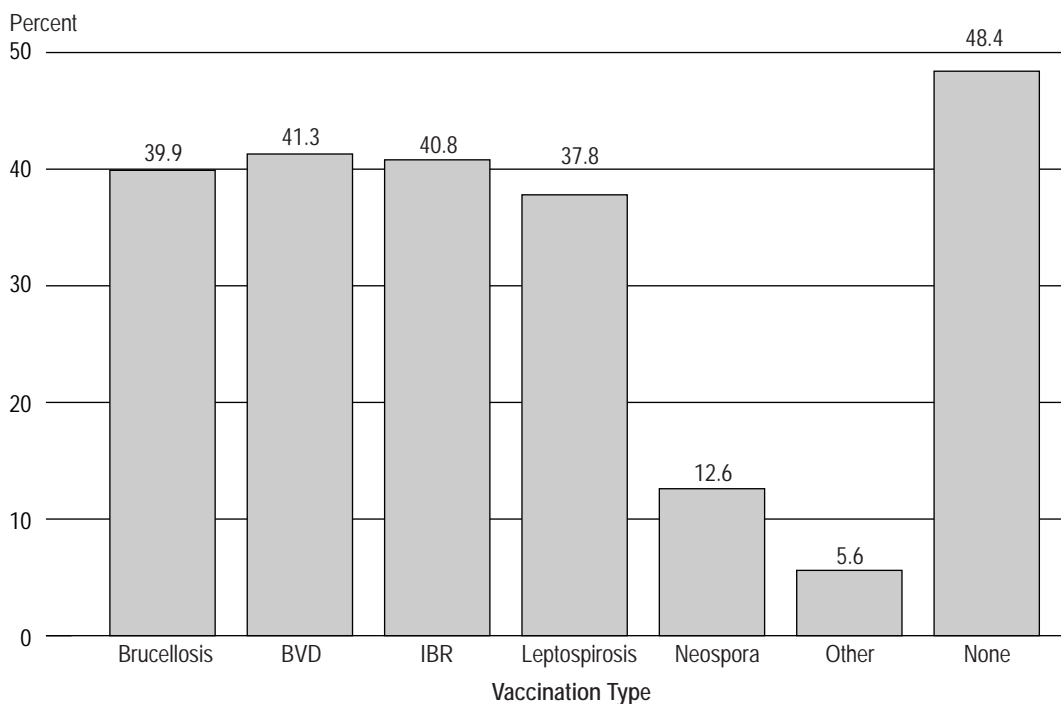
to vaccinate for every disease. However, routine vaccination for several common diseases is a widespread practice throughout the dairy industry, especially before bringing animals on-farm. Vaccinations for brucellosis, bovine viral diarrhea (BVD), infectious bovine rhinotracheitis (IBR), and leptospirosis are commonly required by operations before cattle are brought onto the premises.

Overall, 51.6 percent of operations required some type of vaccination of incoming cattle, while 48.4 percent of operations had no vaccination requirements for new animals. In general, a higher percentage of large and medium operations required vaccination of incoming cattle than did small operations. Immunization against brucellosis, BVD, IBR, and leptospirosis was required by approximately 40 percent of the operations. Neospora and “other” diseases were the least likely to have a vaccination requirement for cattle being brought onto an operation.<sup>11</sup>

a. For operations that brought beef or dairy cattle onto the operation during 2001, percentage of operations by vaccination normally required by the operations and by herd size

Vaccination Type	Herd Size (Number of Dairy Cows)							
	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Brucellosis	33.4	(2.5)	51.3	(2.7)	60.0	(3.1)	39.9	(1.9)
Bovine viral diarrhea (BVD)	36.2	(2.5)	51.2	(2.7)	53.9	(3.2)	41.3	(1.9)
Infectious bovine rhinotracheitis (IBR)	35.8	(2.6)	50.5	(2.7)	51.2	(3.2)	40.8	(1.9)
Leptospirosis	32.5	(2.5)	48.5	(2.7)	47.5	(3.2)	37.8	(1.8)
Neospora	11.1	(1.6)	15.5	(1.8)	16.1	(2.3)	12.6	(1.2)
Other	4.3	(0.8)	8.4	(1.4)	7.7	(1.5)	5.6	(0.7)
None	55.4	(2.7)	36.0	(2.7)	28.1	(3.0)	48.4	(2.0)

Percent of Operations by Vaccinations Required Before Bringing New Animals On Farm



## B. PHYSICAL CONTACT RISKS

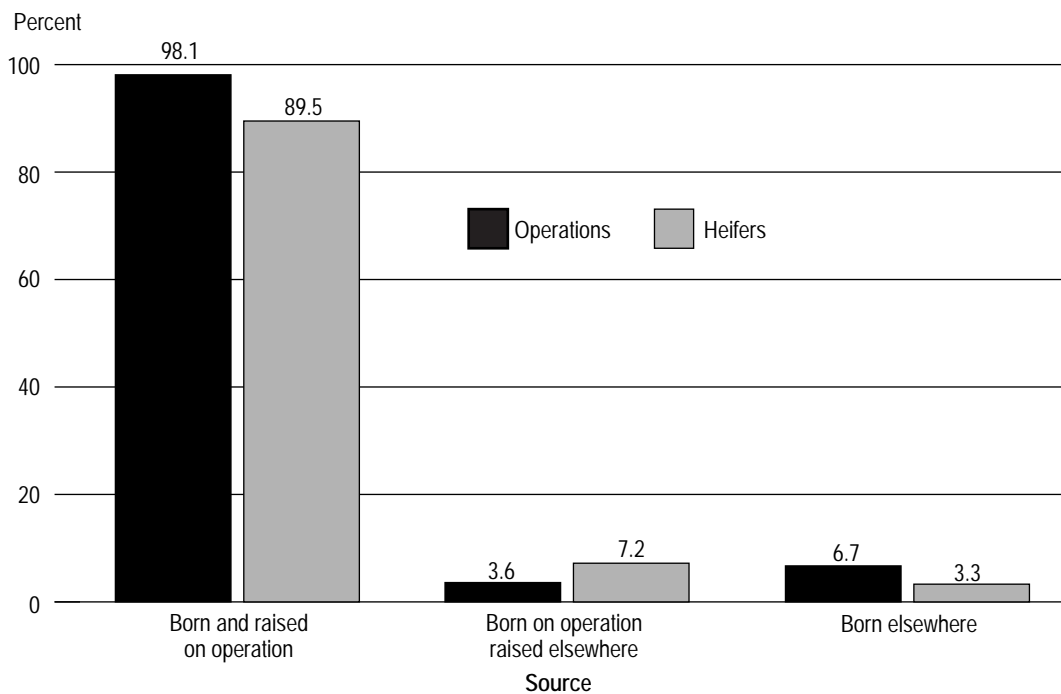
### 1. Off-site heifer rearing

As dairies get larger they often become more specialized. For example, it is increasingly more common that heifers born on the dairy are reared off-site. In some cases, heifers reared at these off-site locations are commingled with heifers

from other sources, which provides another way for pathogens to be transferred from one operation to another. On 3.6 percent of operations, representing 7.2 percent of heifers, some replacement heifers born on the operation were reared at an off-site location.<sup>11</sup>

**a. Percentage of operations and percentage of dairy heifer (dairy cow replacements and dairy heifer calves) inventory on January 1, 2002, by source of dairy heifers**

Source	Percent Operations	Standard Error	Percent Dairy Heifers	Standard Error
Heifers were born and raised on the operation	98.1	(0.3)	89.5	(1.0)
Heifers were born on the operation and raised somewhere else	3.6	(0.4)	7.2	(0.8)
Heifers were born elsewhere (off the operation)	6.7	(0.7)	3.3	(0.8)
Total			100.0	

**Percent of Operations and Percent of Dairy Heifer Inventory\* on January 1, 2002, by Source of Dairy Heifers**

\*Dairy cow replacements and dairy cow heifer calves



To decrease their exposure to environmental pathogens, dairy calves should be separated from dams and other cattle.

## 2. Physical contact with other dairy cattle

Physical contact (whether nose-to-nose, sniffing, touching, licking, or across a fence line) of unweaned calves with cattle of other age classes greatly increases the risk of calves contracting diseases such as salmonellosis, Johne's disease, and upper respiratory disease. The immune system of unweaned calves is less developed than that of older, healthy animals. Therefore, calves are more susceptible to disease. Ideally, to decrease their exposure to environmental pathogens, calves should be isolated immediately after birth in a clean, dry, well-ventilated facility away from dams and any other cattle.<sup>17</sup>

Preventing milk ingestion directly from the dam also is crucial. Milk from a cow infected with Johne's disease, *Mycoplasma*, *Salmonella*, *E. coli*, or bovine viral diarrhea can transmit these diseases to calves. For this reason, feeding unweaned calves pasteurized milk, milk replacer, or milk from known disease-free cows is recommended.<sup>3</sup>

The percentage of operations that reported physical contact between unweaned calves and weaned calves not yet of breeding age, bred heifers not yet calved, and adult cattle was 22.8, 13.3, and 15.4 percent, respectively. A lower

percentage of unweaned calves were actually in contact with these other age categories. Only 15.5, 11.1, and 11.8 percent, respectively, of unweaned calves had physical contact with weaned calves not yet of breeding age, bred heifers not yet calved, and adult cattle.<sup>11</sup>

**a. Percentage of operations (and percentage of dairy heifer calves born on these operations) where after separation from the mother, unweaned heifer calves had physical contact<sup>1</sup> with the following**

Age Group	Percent Operations	Standard Error	Percent Calves	Standard Error
Weaned calves not yet of breeding age	22.8	(1.2)	15.5	(0.9)
Bred heifers not yet calved	13.3	(0.9)	11.1	(0.8)
Adult cattle	15.4	(1.0)	11.8	(0.9)

<sup>1</sup>Physical contact is defined as nose-to-nose contact or sniffing, touching, licking each other, including through a fence

### 3. Physical contact with other animals

Direct physical contact between cattle of any age and other animal species, and indirect contact of cattle with food or water sources, are biosecurity concerns. Other animal species can be the source of a variety of diseases. For example, sheep can transmit malignant catarrhal fever (MCF), and dogs may spread neospora. In some areas of the country, populations of deer are infected with tuberculosis, a disease that can be transmitted to cattle.<sup>9</sup>

The highest percentages of operations reported contact between female dairy cattle (and/or their feed) and cats, dogs, and cervidae (the deer family), 87.8, 70.6, and 53.1 percent of operations, respectively.<sup>11</sup>

**a. Percentage of operations where the following animals had physical contact with female dairy cattle and/or contact with their feed, by region**

Animal Type	Region									
	West		Midwest		Northeast		Southeast		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Chickens or other poultry	6.2	(1.9)	6.5	(0.9)	7.2	(1.4)	9.8	(3.2)	6.8	(0.7)
Horses or other equine	7.0	(1.5)	12.1	(1.2)	15.9	(2.0)	13.6	(2.9)	12.8	(0.9)
Pigs	1.7	(0.8)	2.8	(0.6)	0.9	(0.6)	5.0	(2.0)	2.3	(0.4)
Sheep	0.2	(0.1)	1.5	(0.5)	1.5	(0.5)	0.7	(0.7)	1.3	(0.3)
Goats	1.6	(0.7)	2.4	(0.6)	4.2	(1.1)	2.1	(0.9)	2.8	(0.5)
Beef cattle	9.6	(2.2)	10.5	(1.1)	9.9	(1.5)	14.0	(3.2)	10.5	(0.8)
Exotic species (e.g., llamas, alpacas, emus, etc.)	0.8	(0.7)	0.4	(0.2)	1.0	(0.6)	0.1	(0.1)	0.6	(0.2)
Dogs	67.3	(2.8)	72.0	(1.7)	69.2	(2.3)	66.0	(3.8)	70.6	(1.2)
Cats	65.5	(3.0)	91.0	(1.1)	91.8	(1.3)	66.9	(4.3)	87.8	(0.8)
Deer or other members of the deer family (e.g., elk, moose, etc.)	21.6	(2.9)	51.4	(1.9)	62.8	(2.4)	68.7	(3.7)	53.1	(1.9)

During winter, deer had contact with pasture, hay, and water sources either sometimes or most of the time on 78.1, 55.1, and 39.7 percent of operations, respectively.

**b. For operations that reported that deer had physical contact with dairy cows, dairy heifers, or their feed, percentage of operations by frequency of deer access to the following during winter**

Areas Accessed by Deer	Frequency						
	No Access		Accessed Sometimes		Accessed Most of the Time		Total
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent
Pasture	21.9	(1.5)	21.4	(1.6)	56.7	(1.9)	100.0
Hay	44.9	(1.9)	16.9	(1.4)	38.2	(1.8)	100.0
Water sources used by cattle	60.3	(1.8)	13.8	(1.2)	25.9	(1.6)	100.0



In summer, deer had increased contact with cattle feed or water sources, and access to pasture, hay, and water sources sometimes or most of the time on 93.5, 69.7, and 58.9 percent of operations, respectively.<sup>11</sup>

**c. For operations that reported that deer had physical contact with dairy cows, dairy heifers, or their feed, percentage of operations by frequency of deer access to the following during summer**

Areas Accessed by Deer	No Access		Frequency Accessed Sometimes		Accessed Most of the Time		Total
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent
Pasture	6.5	(0.8)	24.2	(1.6)	69.3	(1.7)	100.0
Hay	30.3	(1.8)	21.0	(1.5)	48.7	(1.9)	100.0
Water sources used by cattle	41.1	(1.9)	19.7	(1.4)	39.2	(1.8)	100.0

## C. NEW-BORN CALF RISKS

### 1. Transmission of disease from dam to calf

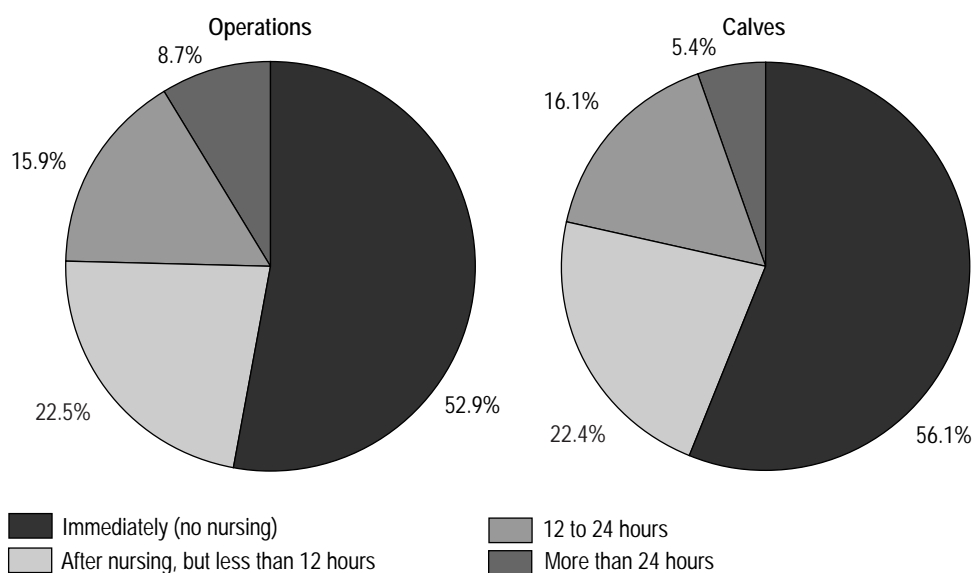
Separating calves immediately after calving is one method of limiting the transmission of disease agents from dams to calves. Over half of operations (52.9 percent) separated calves from

their dams immediately after birth and did not allow nursing. On approximately one in five operations (22.5 percent) calves were allowed to suckle but were removed from their dams before they were 12 hours old.<sup>11</sup>

a. Percentage of operations (and percentage of dairy heifer calves born during 2001 on these operations) by time following birth when newborn dairy heifer calves were normally separated from their mothers

Age (Hours)	Percent Operations	Standard Error	Percent Calves	Standard Error
Immediately (no nursing)	52.9	(1.3)	56.1	(1.2)
After nursing, but less than 12 hours	22.5	(1.1)	22.4	(1.1)
12 to 24 hours	15.9	(1.0)	16.1	(1.0)
More than 24 hours	8.7	(0.8)	5.4	(0.5)
Total	100.0		100.0	

Percent of Operations (and Percent of Dairy Heifer Calves\*) by Time Following Birth When Newborn Calves Were Separated from their Mothers



\*Dairy heifer calves born on these operations during 2001

## 2. Transmission of disease via pooled colostrum

Pooled colostrum can transmit diseases such as Johne's. Since the causative agent of Johne's disease can be found in colostrum, pooling colostrum from several cows can expose a larger number of calves to the agent than if the calves received only colostrum from their own dams or an individual cow.

Most large operations (70.6 percent) that hand-fed colostrum (as opposed to letting calves suckle dams) used pooled colostrum. A much smaller percentage of small operations (22.1 percent) and medium operations (37.4 percent) used pooled colostrum.<sup>11</sup>

### a. For operations that normally hand-fed colostrum, percentage of operations that pooled colostrum from more than one cow, by herd size

Herd Size (Number of Dairy Cows)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
22.1	(1.4)	37.4	(2.0)	70.6	(2.4)	27.0	(1.1)

## 3. Colostral transfer of immunity

Most of the information discussed thus far has focused on the aspects of biosecurity and biocontainment aimed at limiting the exposure of resident cattle to infectious disease agents. Beyond limiting exposure, efforts to increase the nonspecific and specific resistance of animals can help mitigate the risk of introducing a disease agent to a herd. Nonspecific resistance encompasses the health of natural barriers to infection, such as mucous membranes and skin, as well as nutritional support of the immune system and the passive transfer of antibodies to calves in the form of colostrum. Attempts to boost specific immunity to disease agents in cattle herds usually focus on vaccination.

The effectiveness of colostral transfer of immunity to calves is dependent upon antibody mass delivered to the calf, timing of feeding, and the health status of the calf. Antibody mass is a function of antibody concentration and the volume of colostrum delivered to the calf. The Bovine Alliance on Management and Nutrition's "Guide to Colostrum and Colostrum Management for Dairy Calves" suggests that 3 quarts of high quality colostrum be fed to calves by nipple bottle within 1 hour of birth and repeated in 12 hours; or that 4 quarts of high quality colostrum be fed by esophageal feeder within 1 hour of birth. The route of administration for colostrum also can affect the likelihood of adequate colostral transfer of antibodies.

Overall, 64.8 percent of operations (representing 63.5 percent of calves) hand-fed colostrum from a bucket or bottle. Nearly one in three operations (30.5 percent) reported allowing calves to suckle to receive their first feeding of colostrum. The

4.4 percent of operations that used esophageal feeders to deliver first colostrum accounted for 12.7 percent of calves, indicating that this practice was more common on larger operations.<sup>11</sup>

**a. Percentage of operations (and percentage of dairy heifer calves born during 2001 on these operations) by method used normally for first feeding of colostrum to newborn dairy heifers:**

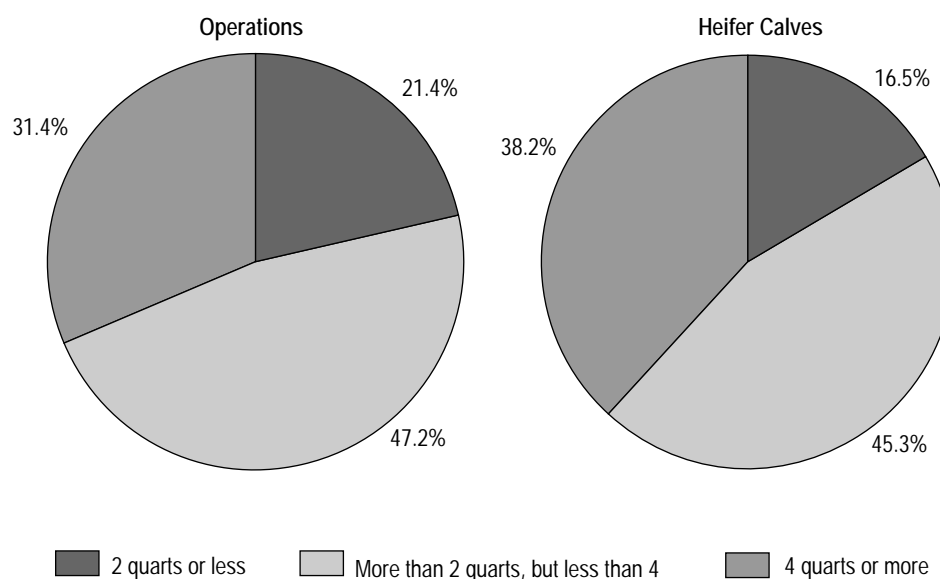
Method of Delivery	Percent Operations	Standard Error	Percent Calves	Standard Error
During first nursing	30.5	(1.2)	23.1	(1.0)
Hand-fed from bucket or bottle	64.8	(1.3)	63.5	(1.2)
Hand-fed using esophageal feeder	4.4	(0.5)	12.7	(0.9)
Did not get colostrum	0.3	(0.1)	0.7	(0.3)
Total	100.0		100.0	

Nearly half of operations (47.2 percent) reported feeding more than 2 quarts but less than 4 quarts of colostrum at first feeding.<sup>11</sup>

**b. For operations that hand-fed colostrum, percentage of operations (and percentage of dairy heifer calves born during 2001 on these operations) by amount of colostrum normally fed by hand during the first 24 hours**

Amount	Percent Operations	Standard Error	Percent Calves	Standard Error
2 quarts or less	21.4	(1.4)	16.5	(1.1)
More than 2 quarts, but less than 4 quarts	47.2	(1.7)	45.3	(1.6)
4 quarts or more	31.4	(1.5)	38.2	(1.5)
Total	100.0		100.0	

**For Operations that Hand-fed Colostrum, Percent of Operations (and Percent of Dairy Heifer Calves\*) by Amount of Colostrum Fed by Hand During the First 24 Hours**



\*Dairy heifer calves born on these operations during 2001

As operation size increased so did the percentage of operations that measured colostrum immunoglobulin levels. While only 3.9 percent of operations that hand-fed colostrum or let calves get colostrum at first nursing measured

colostrum immunoglobulin, 28.6 percent of large operations did so compared to 8.6 and 1.5 percent of medium and small operations, respectively.<sup>11</sup>

**a. For operations that normally hand-fed colostrum or let calves get colostrum at first nursing, percentage of operations that measured colostrum immunoglobulin (Ig) levels, by herd size**

Herd Size (Number of Dairy Cows)								
Small (Less than 100)			Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error		Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
1.5	(0.4)		8.6	(1.1)	28.6	(2.4)	3.9	(0.4)

## D. VACCINATION

### 1. Vaccination practices

For most disease agents, vaccinating dairy heifers was more common on large operations than on medium and small operations. Vaccination varied by disease agent, with lows of 3.6 and 4.6 percent of operations vaccinating against neospora or Johne's disease, respectively.

Vaccinations against bovine viral diarrhea, infectious bovine rhinotracheitis, leptospirosis, and bovine respiratory syncytial virus were used most frequently on all operations, 71.5, 67.0, 65.1, 60.0, and 58.2 percent of operations, respectively.<sup>11</sup>

#### a. Percentage of operations that normally vaccinated dairy heifers for the following diseases, by herd size

Disease	Herd Size (Number of Dairy Cows)							
	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Bovine viral diarrhea (BVD)	67.5	(1.6)	83.3	(1.5)	88.2	(2.0)	71.5	(1.2)
Infectious bovine rhinotracheitis (IBR)	62.8	(1.6)	79.6	(1.7)	84.6	(2.1)	67.0	(1.3)
Parainfluenza Type 3 (PI3)	55.9	(1.7)	73.3	(1.8)	72.3	(2.6)	60.0	(1.3)
Bovine respiratory syncytial virus (BRSV)	53.9	(1.7)	70.8	(1.9)	76.5	(2.4)	58.2	(1.3)
<i>Hemophilus somnus</i>	29.0	(1.5)	39.1	(2.0)	38.0	(2.5)	31.4	(1.2)
Leptospirosis	61.3	(1.7)	76.4	(1.8)	79.9	(2.3)	65.1	(1.3)
<i>Salmonella</i>	14.2	(1.2)	22.3	(1.7)	42.0	(2.6)	16.8	(1.0)
<i>E. coli mastitis</i>	16.1	(1.2)	34.9	(2.0)	52.8	(2.7)	21.3	(1.0)
Clostridia	27.4	(1.4)	47.3	(2.0)	63.2	(2.7)	32.8	(1.1)
Brucellosis	47.8	(1.6)	58.6	(2.0)	74.4	(2.3)	51.0	(1.3)
<i>Mycobacterium paratuberculosis</i> (Johne's disease)	4.1	(0.7)	6.2	(1.1)	4.1	(0.9)	4.6	(0.5)
Neospora	3.0	(0.5)	4.8	(0.9)	9.2	(1.6)	3.6	(0.4)
Other	6.5	(0.7)	8.9	(1.2)	6.0	(1.2)	6.9	(0.6)
None	18.3	(1.4)	7.5	(1.1)	2.9	(0.7)	15.6	(1.1)

For dairy heifers, operations in the West region reported the highest percentage of vaccine usage across all vaccine types, with the exceptions of *Hemophilus somnus*, leptospirosis, and clostridia, where usage was similar for the West and Southeast regions. Clostridial vaccine was used

on the highest percentage of operations in the Southeast region. The Northeast region had the highest percentage of operations that administered no vaccines (23.3 percent), followed by the Midwest (14.7 percent), Southeast (6.1 percent), and the West (3.5 percent) regions.<sup>11</sup>

b. Percentage of operations that normally vaccinated dairy heifers for the following diseases, by region								
Disease	Region							
	West		Midwest		Northeast		Southeast	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Bovine viral diarrhea (BVD)	84.3	(2.4)	73.0	(1.7)	62.3	(2.5)	80.7	(3.8)
Infectious bovine rhinotracheitis (IBR)	79.2	(2.5)	68.4	(1.7)	58.3	(2.6)	75.6	(3.9)
Parainfluenza Type 3 (PI3)	69.4	(2.7)	61.6	(1.8)	53.1	(2.6)	63.0	(4.5)
Bovine respiratory syncytial virus (BRSV)	68.4	(3.0)	59.2	(1.8)	52.1	(2.6)	62.2	(4.4)
<i>Hemophilus somnus</i>	34.5	(2.9)	31.3	(1.7)	29.6	(2.1)	36.7	(4.2)
Leptospirosis	74.3	(2.6)	64.7	(1.8)	60.4	(2.5)	78.1	(3.4)
<i>Salmonella</i>	30.1	(2.8)	16.5	(1.4)	11.2	(1.6)	27.8	(4.1)
<i>E. coli</i> mastitis	39.8	(3.0)	21.8	(1.5)	13.7	(1.6)	25.4	(3.3)
Clostridia	61.1	(3.0)	33.6	(1.7)	14.0	(1.6)	71.8	(4.2)
Brucellosis	86.4	(2.1)	56.0	(1.9)	25.8	(2.1)	66.4	(4.1)
<i>Mycobacterium paratuberculosis</i> (Johne's disease)	7.1	(1.9)	5.2	(0.8)	2.3	(0.8)	4.7	(1.4)
Neospora	6.4	(1.2)	3.5	(0.6)	2.5	(0.7)	5.4	(1.5)
Other	6.6	(1.3)	4.8	(0.8)	12.4	(1.4)	4.3	(1.7)
None	3.5	(1.0)	14.7	(1.4)	23.3	(2.4)	6.1	(2.3)

For dairy cows, large operations reported the highest percentage of vaccine usage across all vaccine types, with the exception of parainfluenza, where the percentage was comparable to medium operations. A total of 17.2

percent of operations did not administer any vaccinations, with 20.7 percent, 7.5 percent, and 0.5 percent of small, medium, and large operations, respectively, administering no vaccinations.<sup>11</sup>

**c. Percentage of operations that normally vaccinated dairy cows for the following diseases, by herd size**

Disease	Herd Size (Number of Dairy Cows)							
	Small		Medium		Large		All	
	(Less than 100)		(100-499)		(500 or More)		Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Bovine viral diarrhea (BVD)	70.0	(1.6)	86.3	(1.4)	92.1	(1.5)	74.2	(1.2)
Infectious bovine rhinotracheitis (IBR)	65.1	(1.6)	82.0	(1.6)	85.3	(2.1)	69.3	(1.3)
Parainfluenza Type 3 (PI3)	58.2	(1.6)	74.6	(1.8)	74.3	(2.4)	62.2	(1.3)
Bovine respiratory syncytial virus (BRSV)	57.1	(1.7)	72.8	(1.8)	78.9	(2.2)	61.1	(1.3)
<i>Hemophilus somnus</i>	30.1	(1.5)	39.7	(2.0)	40.4	(2.5)	32.4	(1.2)
Leptospirosis	66.0	(1.6)	81.7	(1.6)	89.6	(1.8)	70.1	(1.3)
<i>Salmonella</i>	13.7	(1.2)	24.6	(1.8)	44.6	(2.7)	17.1	(1.0)
<i>E. coli</i> mastitis	24.1	(1.4)	52.2	(2.1)	74.1	(2.4)	31.7	(1.2)
Clostridia	19.8	(1.3)	38.3	(2.0)	58.8	(2.6)	25.0	(1.1)
Neospora	2.5	(0.5)	4.8	(0.9)	10.9	(1.9)	3.3	(0.4)
Other	6.8	(0.8)	8.6	(1.2)	5.9	(1.2)	7.2	(0.6)
None	20.7	(1.4)	7.5	(1.2)	0.5	(0.5)	17.2	(1.1)



For dairy cows, operations in the West region reported the highest percentage of vaccine usage for bovine viral diarrhea, infectious bovine rhinotracheitis, bovine respiratory syncytial virus, *E. coli*, and clostridia. The Northeast region had the lowest percentage of operations administering all types of vaccines, with the

exception of *Hemophilus somnus*, where the percentage of usage was similar to the other regions. The Northeast and Midwest regions reported the highest percentage of operations administering no vaccines, 19.1 percent and 18.3 percent, respectively.

**d. Percentage of operations that normally vaccinated dairy cows for the following diseases, by region**

Disease	Region							
	West		Midwest		Northeast		Southeast	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Bovine viral diarrhea (BVD)	81.9	(2.7)	75.4	(1.6)	68.9	(2.5)	75.2	(4.1)
Infectious bovine rhinotracheitis (IBR)	76.1	(2.8)	70.5	(1.7)	64.4	(2.5)	69.7	(4.2)
Parainfluenza Type 3 (PI3)	65.2	(3.0)	64.1	(1.7)	57.8	(2.6)	58.1	(4.5)
Bovine respiratory syncytial virus (BRSV)	67.2	(3.0)	62.4	(1.8)	57.1	(2.6)	57.8	(4.5)
<i>Hemophilus somnus</i>	35.8	(2.9)	31.6	(1.7)	32.7	(2.2)	34.1	(4.2)
Leptospirosis	80.1	(2.6)	69.1	(1.8)	67.9	(2.5)	76.6	(3.3)
<i>Salmonella</i>	30.6	(2.8)	17.1	(1.4)	11.0	(1.5)	25.9	(4.1)
<i>E. coli</i> mastitis	58.5	(3.0)	32.5	(1.7)	20.4	(1.7)	38.3	(4.0)
Clostridia	47.6	(3.0)	26.0	(1.5)	13.0	(1.5)	39.3	(4.4)
Neospora	6.4	(1.2)	3.4	(0.6)	1.9	(0.6)	4.8	(1.4)
Other	6.3	(1.3)	5.0	(0.8)	13.3	(1.6)	3.1	(1.5)
None	7.0	(2.0)	18.3	(1.5)	19.1	(2.3)	12.2	(2.6)

## E. PRODUCER FAMILIARITY WITH DISEASE

### 1. Knowledge of specific diseases

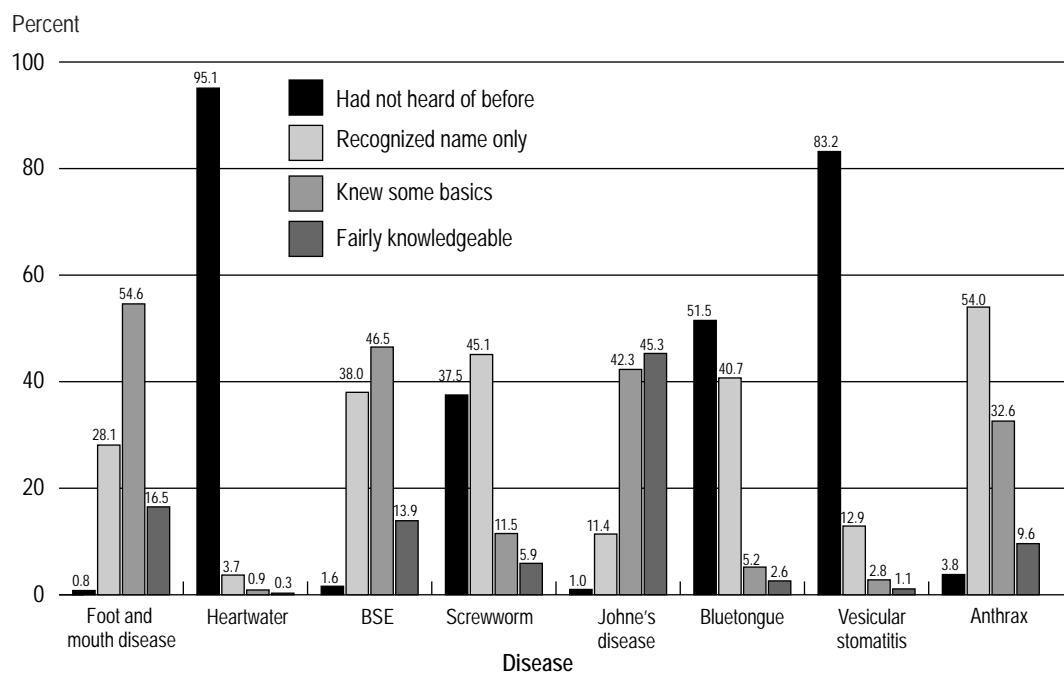
Being familiar with various diseases is important when formulating a biosecurity plan and may help limit the spread of a disease agent should it be introduced into the herd.

Producer familiarity with diseases varied greatly by disease agent. While most producers reported at least knowing some basics about foot-and-mouth disease, bovine spongiform encephalopathy, and Johne's disease, the majority of producers were essentially unfamiliar with heartwater, screwworm, bluetongue, and vesicular stomatitis.<sup>12</sup>

#### a. For operations with 30 or more dairy cows, percentage of operations by level of familiarity with specific cattle diseases

Disease	Had Not Heard of Before		Recognized Name Only		Knew Some Basics		Fairly Knowledgeable		Total
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	
Foot and mouth disease (FMD)	0.8	(0.3)	28.1	(1.9)	54.6	(2.1)	16.5	(1.5)	100.0
Heartwater	95.1	(0.8)	3.7	(0.7)	0.9	(0.3)	0.3	(0.2)	100.0
Bovine spongiform encephalopathy (BSE)	1.6	(0.5)	38.0	(2.1)	46.5	(2.2)	13.9	(1.5)	100.0
Screwworm	37.5	(2.2)	45.1	(2.2)	11.5	(1.2)	5.9	(1.0)	100.0
Johne's disease (paratuberculosis)	1.0	(0.3)	11.4	(1.4)	42.3	(2.1)	45.3	(2.1)	100.0
Bluetongue	51.5	(2.1)	40.7	(2.0)	5.2	(0.8)	2.6	(0.6)	100.0
Vesicular stomatitis	83.2	(1.4)	12.9	(1.3)	2.8	(0.5)	1.1	(0.3)	100.0
Anthrax	3.8	(0.8)	54.0	(2.2)	32.6	(2.0)	9.6	(1.2)	100.0

Percent of Operations by Level of Familiarity with Specific Cattle Diseases\*



\*For operations with 30 or more dairy cows

## 2. Disease information sources

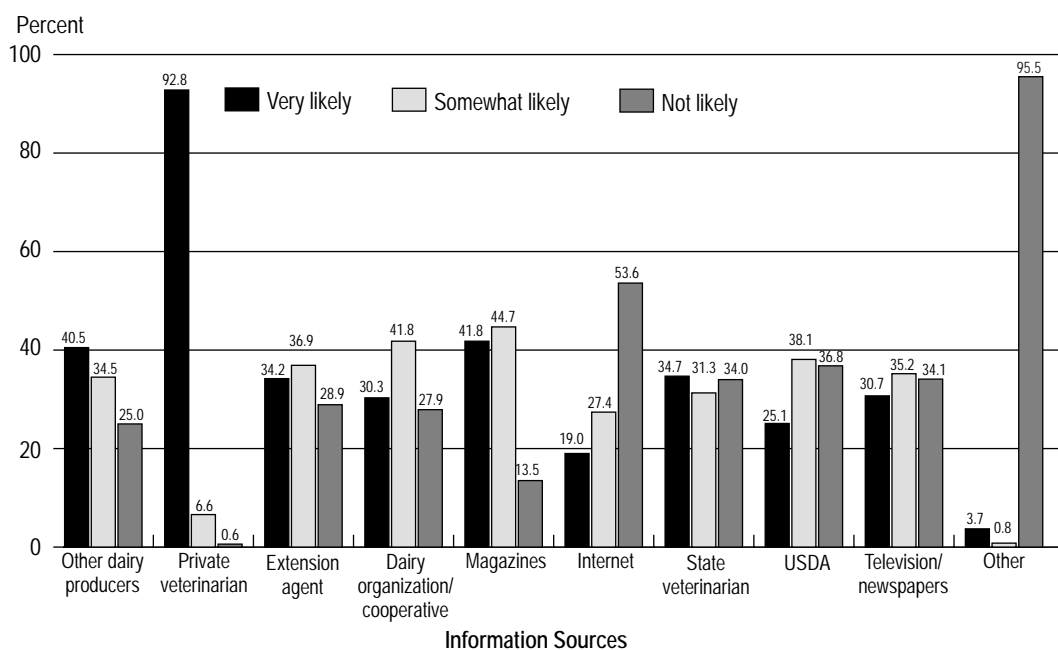
The introduction of a foreign animal disease into the United States could be catastrophic. Knowing where producers would turn for information should a foreign animal disease be introduced is critical to planning for the control of such an outbreak.

Most dairy producers (92.8 percent) reported that they would very likely contact their private veterinary practitioner for disease information if a foreign animal disease occurred in the United States. Other disease information sources would be used to some extent, but it appears that the most critical link to the producer would be the private veterinary practitioner.<sup>12</sup>

a. For operations with 30 or more dairy cows, percentage of operations by likelihood of using the following information sources if an outbreak of foreign animal disease occurred in the United States (e.g., foot-and-mouth disease)

Information Source	Very Likely		Somewhat Likely		Not Likely		Total
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	
Other dairy producers	40.5	(2.1)	34.5	(2.0)	25.0	(1.9)	100.0
Private veterinarian	92.8	(1.1)	6.6	(1.1)	0.6	(0.3)	100.0
Extension agent	34.2	(2.0)	36.9	(2.1)	28.9	(2.0)	100.0
Dairy organizations or cooperative	30.3	(1.9)	41.8	(2.1)	27.9	(1.9)	100.0
Magazines	41.8	(2.1)	44.7	(2.1)	13.5	(1.5)	100.0
Internet	19.0	(1.6)	27.4	(1.9)	53.6	(2.1)	100.0
State veterinarian	34.7	(2.1)	31.3	(2.0)	34.0	(2.1)	100.0
U.S. Department of Agriculture	25.1	(1.8)	38.1	(2.2)	36.8	(2.1)	100.0
Television/newspapers	30.7	(2.1)	35.2	(2.0)	34.1	(2.0)	100.0
Other	3.7	(0.9)	0.8	(0.3)	95.5	(1.0)	100.0

**Percent of Operations by Likelihood of Using the Following Information Sources if an Outbreak of Foreign Animal Disease Occurred\***



\*For operations with 30 or more dairy cows

Most dairy producers (97.9 percent) reported that if they suspected a foreign animal disease on their operation they would contact their veterinarian. Less than half of producers (43.9 percent) would contact the State Veterinarian's office.<sup>12</sup> These responses highlight the continuing need to educate veterinary practitioners about how to identify and handle suspected foreign diseases on livestock operations.

**b. For operations with 30 or more dairy cows, percentage of operations that would contact the following resources if an animal on the operation was suspected of having foot-and-mouth disease or another foreign animal disease**

Resource Contact	Percent Operations	Standard Error
Extension agent/university	25.4	(1.8)
State veterinarian	43.9	(2.2)
U.S. Department of Agriculture	25.5	(1.8)
Private veterinarian	97.9	(0.7)
Feed company or milk cooperative representative	28.0	(1.9)
Other	3.3	(0.7)

## F. USE OF SPECIFIC DISEASE MANAGEMENT PRACTICES

### 1. Disease prevention management practices

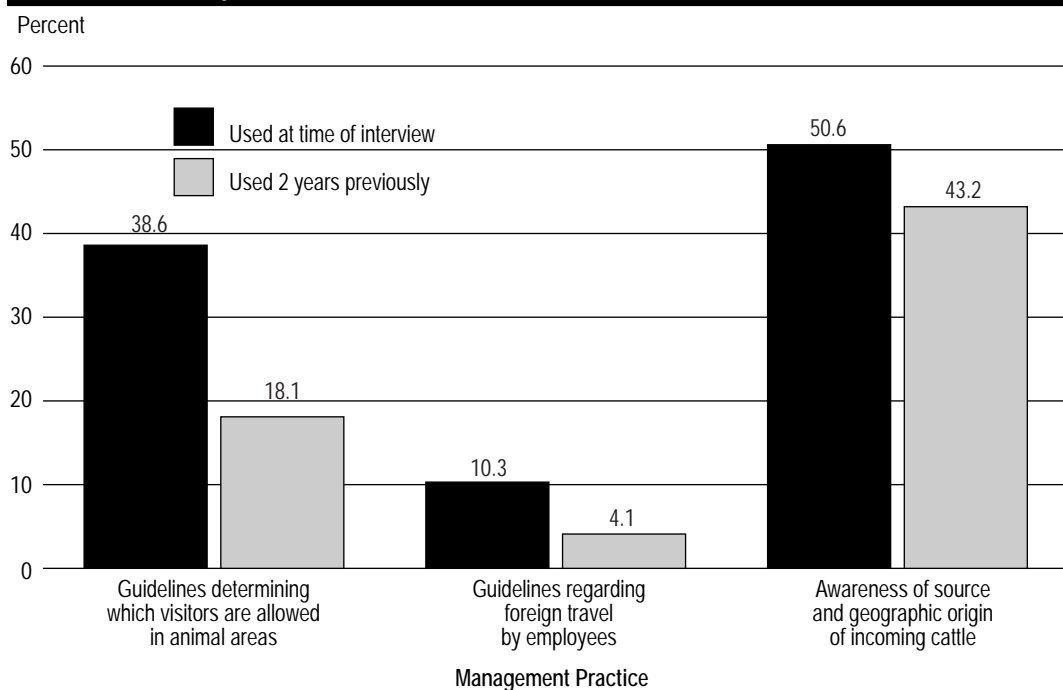
Employees or visitors also can introduce disease agents to a dairy operation. Established policies or guidelines pertaining to visitors and foreign travel by employees indicate a planned approach for dealing with the risk of disease introduction by these routes. The U.S. population is increasingly mobile. People often visit parts of the world that have very different animal health statuses than the United States, which presents a significant risk of inadvertent or intentional introduction of disease agents onto an operation.

At the time of the Dairy 2002 interview, 38.6 percent of dairy producers had guidelines that determined which visitors were allowed in animal areas. This is in contrast to only 18.1 percent of producers with such guidelines 2 years previously. Although only 10.3 percent of dairy operations had guidelines regarding foreign travel by employees, this was an increase from the 4.1 percent of producers with such guidelines 2 years previously.<sup>12</sup>

#### a. For operations with 30 or more dairy cows, percentage of operations that used the following management practices to prevent foreign animal disease, at the time of the interview and 2 years previously

Management Practice	Used at Time of Interview		Used 2 Years Previously	
	Percent	Standard Error	Percent	Standard Error
Guidelines determining which visitors are allowed in animal areas	38.6	(2.0)	18.1	(1.6)
Guidelines regarding foreign travel by employees	10.3	(1.2)	4.1	(0.9)
Awareness of source and geographic origin of incoming cattle	50.6	(2.2)	43.2	(2.1)

**Percent of Operations Using the Following Practices to Prevent Foreign Animal Disease, at the Time of Interview and 2 Years Previously\***



\*For operations with 30 or more dairy cows

A biosecurity plan is best implemented when it is documented in writing, and reviewed and adjusted periodically. In the absence of written documentation, one has to rely on periodic education programs and retention of the programs' concepts in the interim for the biosecurity plan to be effective, whereas written documentation can be referred to anytime a question arises.

Only 5.1 percent of dairy operations had written procedures specifically designed to prevent the introduction and spread of disease, other than those pertaining to milking procedures.<sup>12</sup>

**b. For operations with 30 or more dairy cows, percentage of operations that had written procedures specifically related to preventing the introduction and spread of disease (other than milking procedures)**

Percent Operations	Standard Error
5.1	(0.8)

Employee training is critical to the success of any on-farm programs whether they are directed at quality assurance or animal health management. For a plan to be successful, all members of the team have to understand and support the plan. Creating that understanding and support of the plan are often dependent upon effective training programs.

Overall, 42.1 percent of dairy operations with employees and 30 or more dairy cows trained employees in procedures designed to prevent the introduction and spread of disease.<sup>12</sup>

**c. For operations with 30 or more dairy cows and with employees, percentage of operations that trained employees in procedures designed to prevent the introduction and spread of disease, by herd size**

Herd Size (Number of Dairy Cows)								
Small (Less than 100)			Medium (100-499)		Large (500-or More)		All Operations	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
	35.0	(4.5)	48.5	(3.3)	50.9	(4.2)	42.1	(2.7)

A number of policies and practices can be implemented to decrease the risk of introducing disease agents. The actual implementation of these policies and practices is dependent upon the individual goals of the dairy operation; the level of concern about specific pathogens; and the perceived effectiveness of each policy or practice with regard to risk mitigation for the disease agents of concern. Policies include placing restrictions on employee ownership of animals and whether visitors and outside vehicles are allowed on the operation. If visitors are allowed on the operation the risk of disease transmission can be reduced by providing clean outerwear (boots and coveralls) and by requiring footbaths. While footbaths create awareness of biosecurity, the effectiveness of footbaths, as most often implemented, is questionable. All disinfectants

commonly used in footbaths are inactivated by the presence of organic material. To maintain footbath effectiveness, organic materials should be cleaned from footwear prior to using the footbath, and the footbath should be cleaned and recharged frequently.

Insect control can help reduce the likelihood of introducing arthropod-borne diseases to the operation and potentially decrease the transfer of fecal-associated organisms such as *Salmonella* from one animal or group of animals to another. Rodent and bird control also can help decrease the movement of pathogens among groups of animals. In addition, it is possible that insects, rodents, and birds serve as reservoirs for periodic or continuous reintroduction of disease agents.



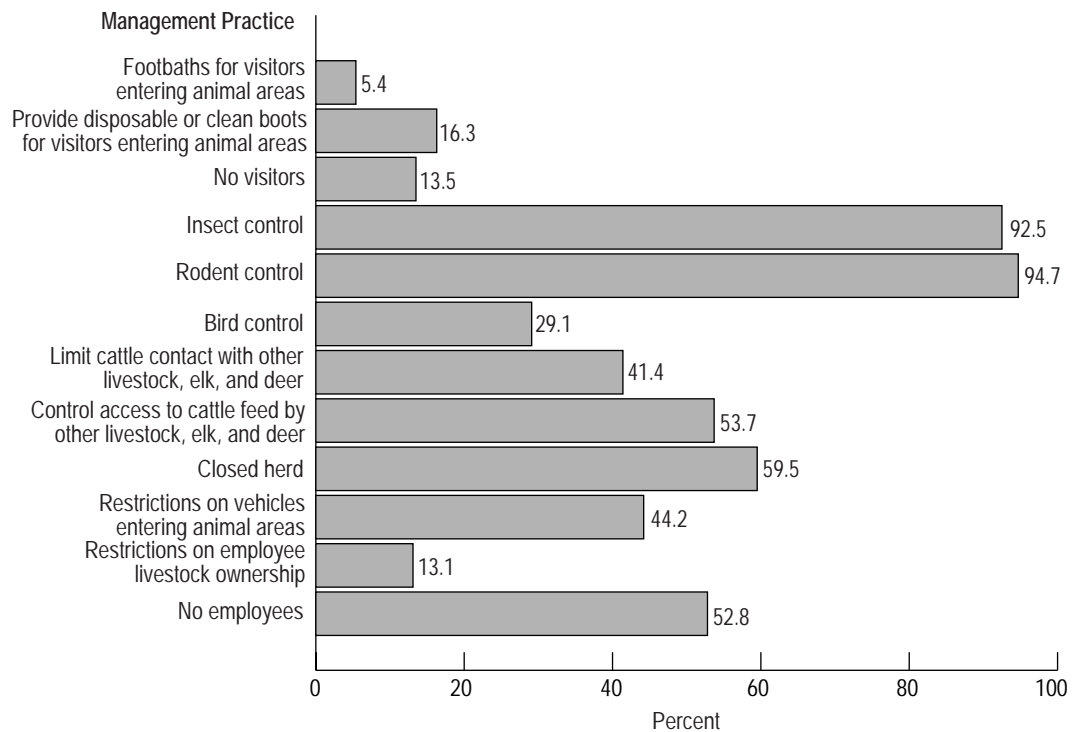
Overall, only 13.5 percent of operations had a “no visitor” policy, and few operations required footbaths (5.4 percent) or provided disposable boots for visitors (16.3 percent). Most operations, regardless of size, had insect- and rodent-control programs (92.5 percent and 94.7 percent of operations, respectively). Less than one in three dairy operations (29.1 percent) had a bird-control program. Restrictions on employee ownership of

livestock were more common on large and medium operations (39.3 percent and 29.1 percent, respectively) than on small operations (6.3 percent). However, the majority of small operations (67.8 percent) had no employees. Regardless of size, approximately 4 out of 10 operations restricted vehicles from accessing animal areas.<sup>12</sup>

**d. For operations with 30 or more dairy cows, percentage of operations that used the following management practices to prevent disease during the 12 months prior to the Dairy 2002 interview, by herd size**

Management Practice	Herd Size (Number of Dairy Cows)							
	Small		Medium		Large		All Operations	
	(Less than 100)		(100-499)		(500-or More)			
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Footbaths for visitors entering animal areas	3.9	(1.0)	9.3	(1.7)	11.3	(1.9)	5.4	(0.8)
Provide disposable or clean boots for visitors entering animal areas	11.2	(1.7)	29.0	(2.8)	35.2	(3.9)	16.3	(1.4)
No visitors	15.4	(2.0)	8.3	(1.5)	10.8	(2.8)	13.5	(1.5)
Insect control	93.8	(1.3)	88.7	(2.1)	92.8	(2.0)	92.5	(1.1)
Rodent control	96.0	(1.1)	91.7	(1.9)	88.6	(2.7)	94.7	(0.9)
Bird control	25.2	(2.4)	38.8	(3.0)	42.1	(4.0)	29.1	(1.9)
Limit cattle contact with other livestock, elk, and deer	36.4	(2.7)	53.7	(3.0)	58.9	(4.1)	41.4	(2.1)
Control access to cattle feed by other livestock, elk, and deer	52.1	(2.7)	58.7	(2.9)	52.0	(4.2)	53.7	(2.1)
Closed herd	64.5	(2.7)	47.6	(3.1)	38.4	(4.2)	59.5	(2.1)
Restrictions on vehicles entering animal area	43.1	(2.7)	48.4	(3.1)	40.3	(4.2)	44.2	(2.1)
Restrictions on employee livestock ownership	6.3	(1.2)	29.1	(2.7)	39.3	(4.0)	13.1	(1.1)
No employees	67.8	(2.5)	15.8	(2.4)	1.0	(0.6)	52.8	(2.0)

**Percent of Operations that Used the Following Practices to Prevent Disease During the 12 Months Prior to the Interview**



For operations with 30 or more dairy cows

Using equipment for both manure handling and feeding is a biosecurity concern, especially for transferring disease agents such as *Salmonella* and *Mycobacteria*. Equipment is costly, and it may not be feasible for some operations to incur the expense of allocating equipment specifically to feed handling or manure handling, especially for smaller operations. If equipment is used for handling both manure and feed, preventive steps (such as disinfecting or cleaning equipment between uses) reduce the likelihood that feces and pathogens will contaminate feed sources.

More than half of operations (58.8 percent) reported using the same equipment for handling both feedstuffs and manure. Among operations that did use equipment for both purposes, 54.2 percent reported that they washed equipment with water or steam between uses but did not use any disinfectants. No procedures were in place for cleaning equipment between uses on 15.2 percent of operations.<sup>12</sup>

**e. For operations with 30 or more dairy cows, percentage of operations that ever used the same equipment to handle manure and feed cattle**

Percent Operations	Standard Error
58.8	(2.1)

**f. For operations with 30 or more dairy cows that ever used the same equipment to handle manure and cattle feed, percentage of operations by procedure that best describes what is usually done with equipment after handling manure**

Procedure	Percent Operations	Standard Error
Washed equipment with water or steam only	54.2	(2.9)
Chemically disinfected only	0.0	(--)
Washed equipment and chemically disinfected	5.7	(1.5)
Other	24.9	(2.5)
No procedures	15.2	(2.2)
Total	100.0	

Using equipment to handle both feedstuffs and manure can contribute to the on-farm spread of disease agents. Sharing equipment with neighboring livestock enterprises can introduce new disease agents onto the operation.

Overall, 38.0 percent of operations reported sharing equipment with other livestock operations in the preceding 12 months.<sup>12</sup>

**g. For operations with 30 or more dairy cows, percentage of operations that shared any heavy equipment (tractors, feeding equipment, manure spreaders, trailers, etc.) with other livestock operations**

Percent Operations	Standard Error
38.0	(2.1)



Using the same equipment to handle both feed and manure can contribute to on-farm spread of disease.

# SUMMARY

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Biosecurity and biocontainment are an integration of many practices, each of which is unique to an operation. There are risk assessments and biosecurity-hazard-analysis procedures available for constructing a biosecurity plan to improve the health of cattle and protect people and their food supply. These assessments and procedures serve as useful guides to customize a strategy for a given operation by considering the nature of the operation, possible modes of exposure, potential risks, the degree of risk an operation faces, and the feasibility of implementing necessary biosecurity measures. Although specific diseases should be targeted, more often than not control efforts directed at one disease also decrease the occurrence of other diseases transmitted in a similar way. The most effective biosecurity plans are incorporated as ongoing management principles, rather than one-time actions executed after disease is already present.

## **Where to find more information on biosecurity**

### **Web sites:**

[www.aphis.usda.gov/vs/](http://www.aphis.usda.gov/vs/)  
[www.oie.int/](http://www.oie.int/)  
[www.biosecuritycenter.org/nbrctoc.htm](http://www.biosecuritycenter.org/nbrctoc.htm)  
<http://nyschap.vet.cornell.edu/>  
[www.cce.cornell.edu/issues/cceresponds/biosecurity/index](http://www.cce.cornell.edu/issues/cceresponds/biosecurity/index)  
[www.DQACenter.org/](http://www.DQACenter.org/)  
[www.dairybusiness.com](http://www.dairybusiness.com)  
[www.vetsci.psu.edu/Ext/Biosecurity/BioMain.htm](http://www.vetsci.psu.edu/Ext/Biosecurity/BioMain.htm)  
[www.vetmed.ucdavis.edu/vetext/IINF-DA/More\\_Biosecurity](http://www.vetmed.ucdavis.edu/vetext/IINF-DA/More_Biosecurity)  
[www.dairyinfo](http://www.dairyinfo)

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Veterinary Clinics of North America Food Animal Practice, Biosecurity of Cattle Operations, Volume 18, March 2002.

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# SECTION II: METHODS

## A. NEEDS ASSESSMENT

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NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs assessment phase. The objective of the needs assessment for the NAHMS Dairy 2002 study was to conduct a national survey to collect information from U.S. dairy producers and other commodity specialists about what they perceived to be the most important dairy health and productivity issues. A driving force of the needs assessment was the desire of NAHMS researchers to receive as much input as possible from a variety of producers, as well as from industry experts and representatives, veterinarians, extension specialists, universities, and dairy organizations.

Focus-group meetings were held at various locations across the United States to help determine the focus of the study:

Birmingham, AL    October 21, 2000  
United States Animal Health Association (USAHA)

Kansas City, MO    October 31, 2000  
American Feed Industry Association (AFIA)  
Dairy Nutrition Committee

Teleconference    December 15, 2000  
Bovine Association of Management and Nutrition (BAMN)

San Antonio, TX    February 4, 2001  
American Farm Bureau Federation  
Dairy Advisory Committee

Riverdale, MD    February 16, 2001  
Government Perspective Meeting  
APHIS, FSIS, FDA, and ARS

In addition, a short survey asking for rankings of major dairy issues was provided via multiple data collection modes. There were 155 surveys completed via the Web, 90 by hard copy, and 1 via telephone.

The focus-group meeting input was merged with survey results to determine Dairy 2002 study objectives.

## B. SAMPLING AND ESTIMATION

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### 1. State selection

The preliminary selection of States to be included in the study was done in January 2001 using the National Agricultural Statistics Service (NASS), USDA January 28, 2000, Cattle 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 United States. The initial review of States identified 20 major States with 84 percent of the milk cow inventory and 81 percent of the operations with milk cows (dairy herds). The States were: CA, FL, ID, IL,

IN, IA, KY, MI, MN, MO, NM, NY, OH, PA, TN, TX, VT, VA, WA, and WI.

A memo identifying these 20 States was provided in February 2001 to the USDA:APHIS:VS CEAH Director and, in turn, the VS Regional Directors. Regional Directors sought input from their respective States about being included or excluded from the study. By midyear, Colorado was included, based on the State's interest.

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**2. Operation selection**

The list sampling frame was provided by NASS. Within each State a stratified random sample was selected. The size indicator was the number of milk cows for each operation. NASS selected a sample of dairy producers in each State for making the NASS January 1 cattle estimates. The list sample from the January 2001 survey was used as the screening sample. Producers reporting one or more milk cows on January 1,

2001, were included in the sample for contact in January 2002. Due to the predicted large workload, the sample was reduced in 2 States (KY and PA), for a final screening sample of 3,876 operations for Phase I data collection. For Phase II data collection, operations with 30 or more dairy cows on January 1, 2002, that participated in Phase I were invited to continue in the study.

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**3. Population inferences**

Inferences for Phase I cover the population of dairy producers with at least 1 milk cow in the 21 participating States. As of January 1, 2002, these States accounted for 85.7 percent (7,799,000 head) of milk cows in the United States and 83.0 percent (80,910) of operations with milk cows in the United States. (see Appendix II for respective data on individual States.) All respondent data were statistically weighted to reflect the population from which they were selected. The inverse of the 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.

For operations eligible for Phase II data collection (those with 30 or more dairy cows) weights were adjusted for operations that did not want to continue to the study's second phase. This weight was adjusted again for nonresponse to Phase II data collection. The 21-State target population of operations with 30 or more dairy cows represented 97.3 percent of dairy cows and 74.3 percent of dairy operations in the 21 States (see Appendix II).



**C. DATA COLLECTION**

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1. Phase I:

General Dairy Management Report, December 31, 2001, to February 12, 2002. NASS enumerators administered the General Dairy Management Report. The interview took slightly over 1 hour.
2. Phase II:

VS Initial Visit, February 25 to April 30, 2002. Federal and State veterinary medical officers (VMOs) or animal health technicians (AHTs) collected the data from producers during an interview lasting approximately 1 hour.

**D. DATA ANALYSIS**

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1. Validation and estimation

a. Phase I: General Dairy Management Report

Initial data entry and validation for the General Dairy Management Report 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. Phase II: VS Initial Visit Questionnaires

After completing the VS initial-visit questionnaires, data collectors sent them to the State NAHMS coordinators, who manually reviewed them for accuracy and then sent them to CEAH. Data entry and validations were completed using SAS.

## 2. Response rates

### a. Phase I: General Dairy Management Report – Screening Questionnaire

Of the 3,876 operations in the screening sample, 410 operations had no milk cows on January 1, 2002, and were therefore ineligible for the NAHMS Dairy 2002 study. Of these 3,466 dairy operations, 2,461 participated in the initial phase of the study. This phase occurred from December 31, 2001, to February 12, 2002, and included the administration of a questionnaire by NASS enumerators.

a. Phase I: General Dairy Management Report – Screening Questionnaire		
Response Category	Number Operations	Percent Operations
No milk cows on Jan. 1, 2002	227	5.9
Out of business	183	4.7
Refusal	821	21.2
Survey complete and VMO consent	1,438	37.1
Survey complete, refused VMO consent	905	23.3
Survey complete, ineligible for VMO	118	3.0
Out of scope (prison, research farm, etc.)	45	1.2
Unknown (code 8)	2	0.1
Inaccessible	137	3.5
Total	3,876	100.0

### b. Phase II

VS initial visit response categories are shown below for all 1,438 producers with 30 or more dairy cows turned over to VS. Of these, 1,013 producers participated.

#### b. Phase II:

VS Initial Visit response categories are shown below for all 1,438 producers with 30 or more dairy cows turned over to VS. Of these, 1,013 producers participated.

Response Category	Number Operations	Percent Operations
Survey completed	1,013	70.4
Producer not contacted	76	5.3
Poor time of year or no time	161	11.2
Did not want anyone on operation	4	0.3
Bad experience with government veterinarians	0	0.0
Did not want to do another survey or divulge information	136	9.5
Told NASS they did not want to be contacted	6	0.4
Ineligible (no dairy cows)	14	1.0
Other reason	28	1.9
Total	1,438	100.0

# APPENDIX I: SAMPLE PROFILE

## A. RESPONDING SITES

1a. Number of responding operations, by herd size		
	Phase I: General Dairy Management Report	Phase II: VS Initial Visit
Herd Size (Dairy Cow Inventory, January 1, 2002)	Number of Responding Operations	Number of Responding Operations
Less than 100	1,131	400
100 to 499	820	392
500 or more	510	221
Total	2,461	1,013

1b. Number of responding operations, by region		
	Phase I: General Dairy Management Report	Phase II: VS Initial Visit
Region	Number of Responding Operations	Number of Responding Operations
West	525	208
Midwest	1,085	448
Northeast	596	278
Southeast	255	79
Total	2,461	1,013

# APPENDIX II: U.S. MILK COW POPULATION AND OPERATIONS

U.S. Milk Cow Population and Operations							
		Number of Milk Cows on January 1, 2002 <sup>1</sup> (Thousand Head)			Number of Operations 2001		
Region	State	Milk cows on operations with 1 or more head	Milk cows on operations with 30 or more head	30 or more head percent	Operations with 1 or more head	Operations with 30 or more head	30 or more head percent
West	California	1,620	1,618.4	99.9	2,500	2,200	88.0
	Colorado	93	92.0	98.9	800	220	27.5
	Idaho	377	375.5	99.6	1,000	770	66.5
	New Mexico	290	289.4	99.8	500	165	33.0
	Texas	315	311.9	99.0	2,100	1,150	54.8
	Washington	247	246.3	99.7	1,000	665	66.5
	Total	2,942	2,933.5	99.7	7,900	5,170	65.4
Midwest	Illinois	115	111.6	97.0	1,900	1,420	74.7
	Indiana	154	140.1	90.0	2,900	1,400	48.3
	Iowa	205	194.8	95.0	3,500	2,680	76.6
	Michigan	299	284.1	95.0	3,300	2,250	68.2
	Minnesota	500	480.0	96.0	7,800	6,700	85.9
	Missouri	140	133.0	95.0	3,700	2,100	56.8
	Ohio	260	234.0	90.0	5,200	2,800	53.8
	Wisconsin	1,280	1,232.6	96.3	19,100	15,950	83.5
	Total	2,953	2,810.2	95.2	47,400	35,300	74.5
Northeast	New York	675	661.5	98.0	7,300	6,000	82.2
	Pennsylvania	588	564.5	96.0	10,300	8,500	82.5
	Vermont	154	150.9	98.0	1,600	1,410	88.1
	Total	1,417	1,376.9	97.3	19,200	15,910	82.9
Southeast	Florida	152	151.4	99.6	510	220	43.1
	Kentucky	125	115.0	92.0	2,900	1,600	55.2
	Tennessee	90	87.7	97.5	1,500	870	58.0
	Virginia	120	116.4	97.0	1,500	1,010	67.3
	Total	487	470.5	96.6	6,410	3,700	57.7
Total (21 States)		7,799.0 (85.7% of U.S.)	7,591.1 (85.7% of U.S.)	97.3	80,910 (83.0% of U.S.)	60,080 (86.9% of U.S.)	74.3
Total U.S. (50 States)		9,105.6	8,859.7	97.3	97,460	69,140	70.9

<sup>1</sup> Source: NASS April 2004 Cattle Final Estimates, 1999-2003—(revised January 1, 2002, number of milk cows and number of operations in 2001 with milk cows). An operation is any place having one or more head of milk cows, excluding cows used to nurse calves, on hand at anytime during the year.

## APPENDIX III: STUDY OBJECTIVES AND RELATED OUTPUTS

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1. Describe baseline dairy cattle health and management practices and trends in dairy farm health management.

- Part I: Reference of Dairy Health and Management in the United States, 2002
- Part II: Changes in the United States Dairy Industry, 1991-2002
- Part III: Reference of Dairy Cattle Health and Health Management Practices in the United States, 2002
- Colostrum and bST info sheets, December 2002
- Mycoplasma and HBS info sheets, June 2003

2. Describe strategies to prevent and reduce Johne's disease.

- Johne's Disease on United States Dairy Operations, 2002, expected summer 2004

3. Evaluate management factors associated with the presence of certain food safety pathogens.

- Milking Procedures, *E. coli*, *Salmonella* and *Campylobacter*, and Food Safety Pathogens Bulk Tank info sheets, December 2003

4. Describe the preparedness of producers to respond to foreign animal diseases, such as foot-and-mouth disease.

- **Animal Disease Exclusion Practices on U.S. Dairy Operations, 2002, August 2004**

5. Describe waste handling systems.

- Interpretive report, expected summer 2004



