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Open-File Report 2005-1388

U.S. Department of the Interior
U.S. Geological Survey

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By Karen C. Rice,[1] Michele M. Monti,[2] and Matthew R. Ettinger[3]

[1] U.S. Geological Survey
[2] Virginia Department of Health
[3] Division of Consolidated Laboratory Services

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Conversion Factors and Abbreviated Water-Quality Units

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Vertical coordinate information is referenced to the North Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Abbreviated water-quality units: Chemical concentration is reported in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7,000 mg/L, the numerical value is the same as for concentrations in parts per million. Specific electrical conductance of water is reported in microsiemens per centimeter at 25 degrees Celsius (µS/cm).

Water-Quality Data from Ground- and Surface-Water Sites near Concentrated Animal Feeding Operations (CAFOs) and non-CAFOs in the Shenandoah Valley and Eastern Shore of Virginia, January–February, 2004

Karen C. Rice,[1] Michele M. Monti,[2] and Matthew R. Ettinger[3]

Abstract

Concentrated animal feeding operations (CAFOs) result from the consolidation of small farms with animals into larger operations, leading to a higher density of animals per unit of land on CAFOs than on small farms. The density of animals and subsequent concentration of animal wastes potentially can cause contamination of nearby ground and surface waters. This report summarizes water-quality data collected from agricultural sites in the Shenandoah Valley and Eastern Shore of Virginia. Five sites, three non-CAFO and two dairy-operation CAFO sites, were sampled in the Shenandoah Valley. Four sites, one non-CAFO and three poultry-operation CAFO sites were sampled on the Eastern Shore. All samples were collected during January and February 2004.

Water samples were analyzed for the following parameters and constituents: temperature, specific conductance, pH, and dissolved oxygen; concentrations of the indicator organisms *Escherichia coli* (*E. coli*) and enterococci; bacterial isolates of *E. coli*, enterococci, *Salmonella* spp., and *Campylobacter* spp.; sensitivity to antibiotics of *E. coli*, enterococci, and *Salmonella* spp.; arsenic, cadmium, chromium^{3+}, copper, nickel, and mercury; hardness, biological oxygen demand, nitrate, nitrite, ammonia, ortho-phosphate, total Kjeldahl nitrogen, chemical oxygen demand, total organic carbon, and dissolved organic carbon; and 45 dissolved organic compounds, which included a suite of antibiotic compounds.

Data are presented in tables 5-21 and results of analyses of replicate samples are presented in tables 22-28. A summary of the data in tables 5-8 and 18-21 is included in the report.

[1]U.S. Geological Survey
[2]Virginia Department of Health
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Introduction

Over the last two decades, the consolidation of small farms with animals into larger operations has resulted in the creation of concentrated animal feeding operations (CAFOs). The U.S. Environmental Protection Agency (USEPA) defines CAFOs as "point sources that require National Pollutant Discharge Elimination System (NPDES) permits for discharges or potential discharges. Once an operation is defined as a CAFO, the NPDES requirements for CAFOs apply with respect to all animals in confinement at the operation and all manure, litter, and process wastewater generated by those animals or the production of those animals, regardless of the type of animal." CAFOs are "animal feeding operations in which animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility" (U.S. Environmental Protection Agency, 2004). The number of animals (for example, more than 200 dairy cows, 300 beef cattle, 20,000 chickens, and so on) also determines whether the operation is a CAFO; CAFOs were once defined by "animal units" but under the CAFO Final Rule, the USEPA instead sets CAFO thresholds by determining the actual number of animals. Animal feeding operations below CAFO thresholds can be required to adhere to CAFO permitting requirements if the operation is adjacent to navigable waters and discharges directly or indirectly into those waters.

The proliferation of CAFOs has raised concerns about air pollution and ground- and surface-water pollution, including the risk of contamination of waters by microbial pathogens found in animal waste. The concentration of animals has resulted in a concentration of wastes that has been estimated at 1.6 billion tons per year (Cole and others, 1999). Other public health and ecological concerns related to CAFOs include

nutrient overload of waterways leading to algal blooms and resulting low dissolved oxygen concentrations, the possible increase in organisms such as *Pfiesteria piscicida* and *Pfiesteria shumwayae* that can cause fish kills, an increase in antibiotic-resistant organisms from the broad application of antimicrobials to farm animals, and questions about the quality of life in communities adjacent to CAFOs.

Research into human-health risks related to CAFOs has initially focused on occupational hazards for workers in these operations, such as gases, dust particulates, and endotoxins (Donham, 1990; Zuskin and others, 1991; Donham and others, 1995; Von Essen and Donham, 1999). More recently, psychological and physiological impacts on residents of nearby communities have been described (Wing and Wolf, 2000; Schiffman and others, 1995; Thu and others, 1997), as well as social and economic issues such as environmental justice and quality of life in these communities (Wing and others, 2000).

A concern for both human and ecological health is the chemical and microbiological contamination of ground and surface waters by runoff from land application of manure or from waste storage and treatment. Elevated concentrations of nutrients, metals, bacteria, and a number of other chemicals and pathogens are observed in ground and surface waters in many agricultural areas throughout the United States. Excess nutrients may be an important contributing factor for the growth and increase in dinoflagellates such as *Pfiesteria*. Many of the infectious organisms that cause illness in animals also can cause disease in humans and can survive in water. Among the most common pathogens that pose a human-health risk include *Salmonella* spp., *Escherichia coli* O157:H7 (*E. coli*), *Campylobacter* spp., *Listeria monocytogenes*, as well as viruses and protozoa such as *Cryptosporidium parvum* and *Giardia*. These organisms have been found in ground water in a number of communities.

Hog, dairy and beef cattle, and poultry operations are located throughout Virginia. Although the bulk of the poultry industry is concentrated in the northwestern part of the State, many of these operations also are in eastern counties. The Virginia Department of Health (VDH) is interested in the potential impact of these animal industries on the health of communities and waterways in the State. To investigate this potential impact, the U.S. Geological Survey (USGS), in cooperation with VDH, collected water-quality data from sites in the Shenandoah Valley and Eastern Shore of Virginia.

Purpose and Scope

This report describes the results of field and laboratory analyses of ground- and surface-water samples collected within 1.5 miles of CAFO and non-CAFO sites. The samples were collected in the Shenandoah Valley and the Eastern Shore of Virginia during January and February 2004.

Site Selection and Numbering

VDH began this project in 2001 with methods investigation and sampling site selection. VDH personnel searched permit files of the Virginia Department of Environmental Quality (DEQ) and nutrient management files of the Virginia Department of Conservation and Recreation (DCR) to identify all CAFOs in the State along with ambient water-quality monitoring data for bodies of water potentially impacted by these operations. A CAFO in the DEQ and DCR databases was defined on the basis of the USEPA's definition of hog, cattle, and poultry operations (U.S. Environmental Protection Agency, 2004). From these databases, VDH personnel selected three sites in the Shenandoah Valley and four sites on the Eastern Shore that were within 1.5 miles of CAFOs for the collection of samples of ground and surface waters. For comparison, three sites in the Shenandoah Valley and two sites on the Eastern Shore that were non-CAFO agricultural sites were selected using information from the Natural Resource Conservation Service, DEQ, and DCR files for ground- and surface-water sampling. All sites selected in the Shenandoah Valley were dairy operations. On the Eastern Shore, CAFO poultry operations were compared with non-CAFO sheep farms because non-CAFO poultry operations do not exist (figs. 1-2).

The numbering system for the sampling sites was as follows: sites were given a Roman numeral, starting with I for the first site selected; water samples collected were further designated with "GW" for ground water; "spring" for spring water; "A" for surface water collected upstream of the agricultural site; and "B" for surface water collected downstream of the agricultural site. Sites IV and V on the Eastern Shore, however, were mistakenly mislabeled from the onset, so that A and B were reversed; this mislabeling was retained to avoid confusion. One site had more than one well; in this case, the site identification for each well that was sampled included a descriptor such as "new" or "house," indicating the approximate location of the well at the site. All wells sampled were for agricultural supply or residential use.

Five sites were sampled in the Shenandoah Valley (fig. 1); sites II and VI are non-CAFO sites and sites I, III, and V are dairy-operation CAFO sites. A site IV was identified during initial site selection, but the site was dropped because of drought conditions and a lack of surface-water sampling locations. Of the four sites sampled on the Eastern Shore (fig. 2), site II is a non-CAFO site, and sites III, IV, and V are poultry-operation CAFO sites. Two sites (I and VI) on the Eastern Shore were identified during initial site selection; however, permission to sample the wells and surface water at the sites was not obtained from the landowners. Animal densities at all of the sampling sites are summarized in Table 1.

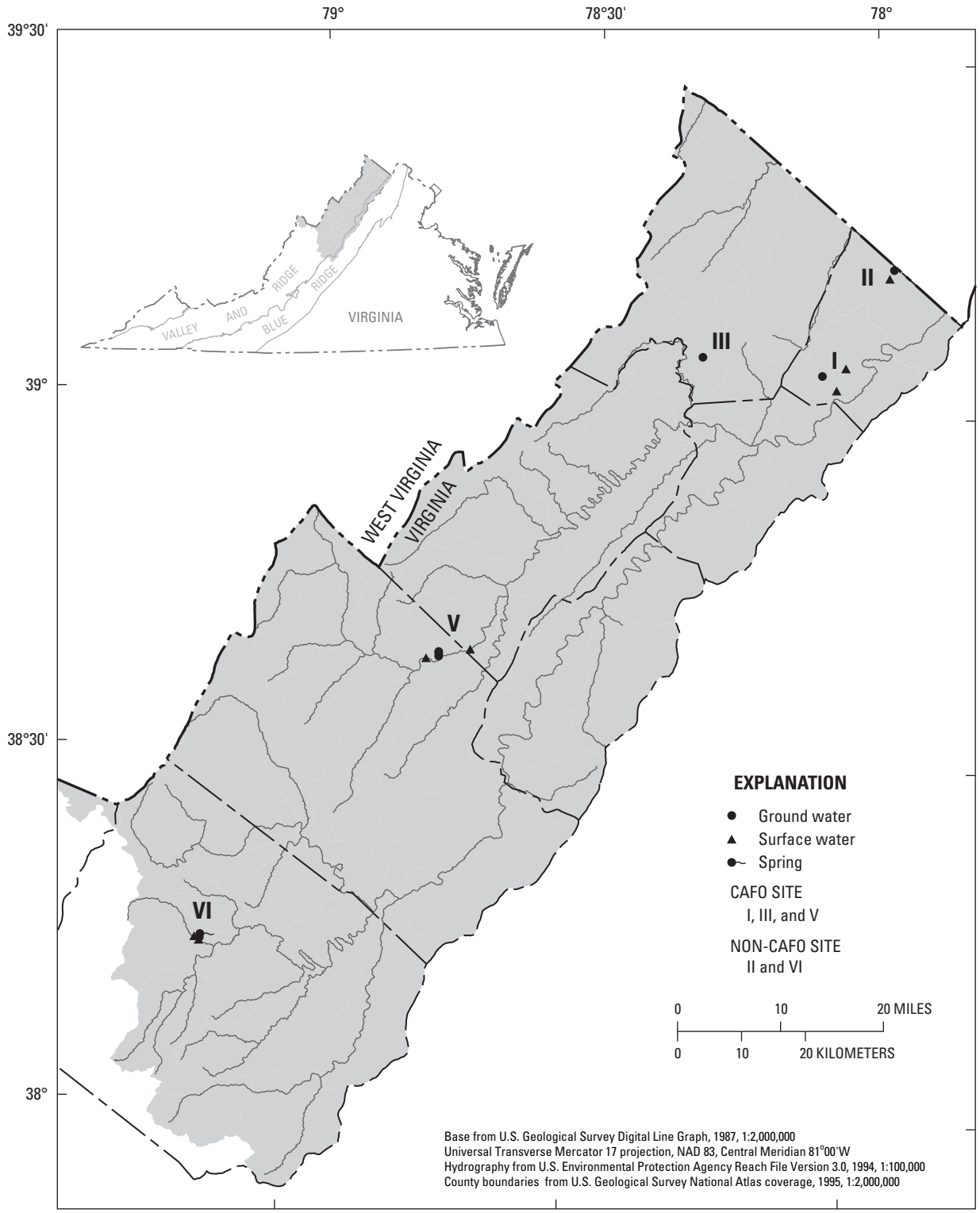

Figure 1. Locations of concentrated animal feeding operations (CAFO) and non-CAFO sites sampled in Shenandoah Valley, Va.

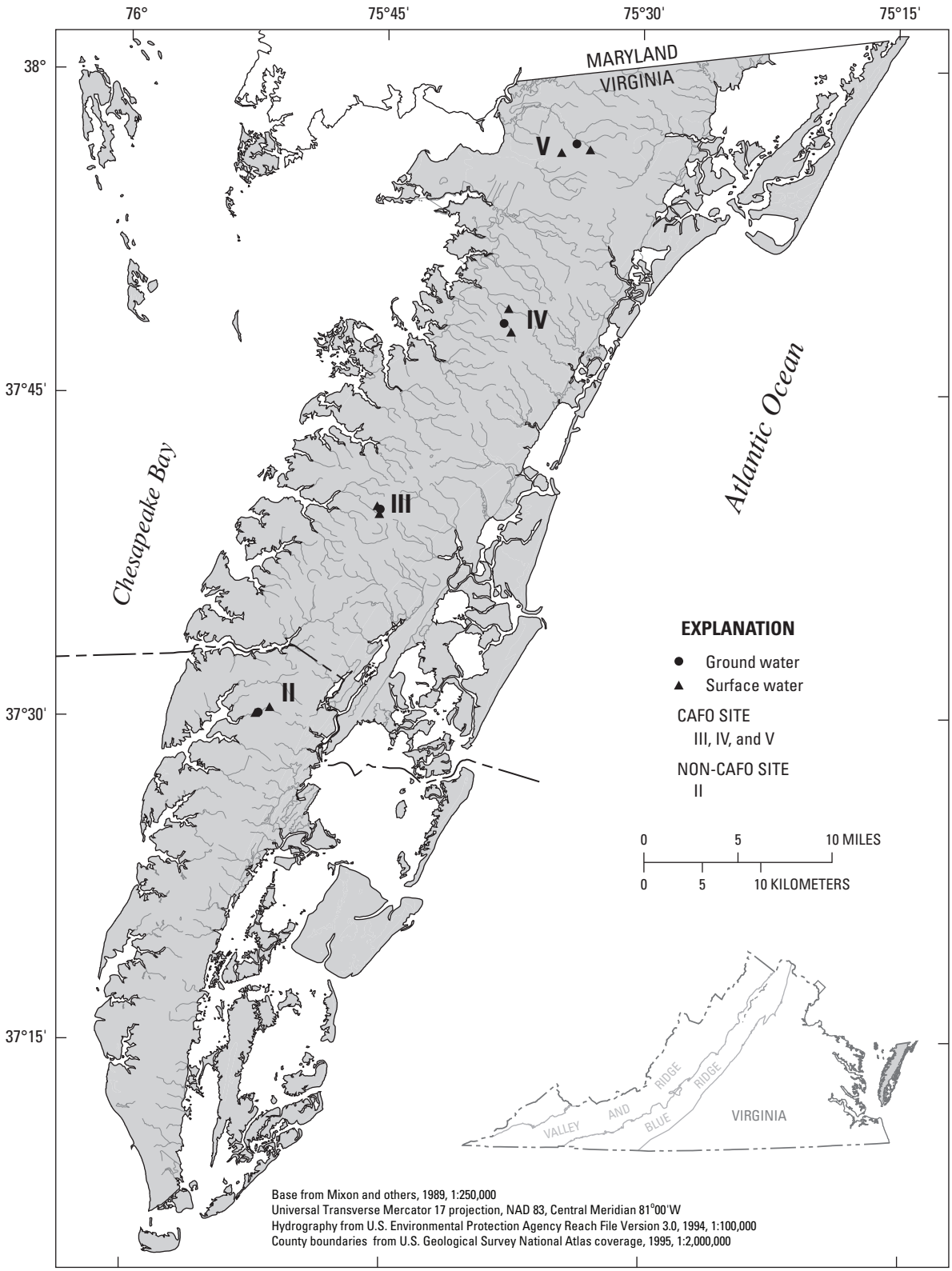

Figure 2. Locations of concentrated animal feeding operations (CAFO) and non-CAFO sites sampled on Eastern Shore, Va.

Table 1. Animal densities at sampling sites.

[CAFO, concentrated animal feeding operation]

CAFO Sites	Non-CAFO Sites
Shenandoah Valley	
I: 1650 dairy cows	II: 155 dairy cows
III: 240 dairy cows	VI: 350 non-confined dairy and beef cows
V: 410 dairy cows	
Eastern Shore	
III: 125,000 broiler chickens	
IV: 66,000 broiler chickens	II: fewer than 100 sheep
V: 60,000 broiler chickens	

Collection and Analysis of Samples

Water samples were analyzed for field water-quality parameters and in the laboratory for concentrations of the indicator organisms *E. coli* and enterococci. Bacterial isolates (a colony-forming unit) of *E. coli*, enterococci, *Salmonella* spp., and *Campylobacter* spp. were identified. Microbiological testing also included sensitivity to antibiotics to determine if resistance of *E. coli*, enterococci, or *Salmonella* spp. to antibiotics was present. Metal concentrations analyzed by the laboratory included arsenic, cadmium, chromium^{3+}, copper, nickel, and mercury. Nutrient concentrations and other laboratory chemical parameters included hardness, biological oxygen demand (BOD), nitrate (NO_3^-), nitrite (NO_2^-), ammonia (NH_3^+), ortho-phosphate (P), total Kjeldahl nitrogen (TKN), chemical oxygen demand (COD), total organic carbon (TOC), and dissolved organic carbon (DOC). In addition, water samples were analyzed by liquid chromatography/mass spectrometry for 45 dissolved organic compounds, which included a suite of antibiotic compounds and degradation products.

Field Data-Collection Methods

Surface-water samples were collected as grab samples; ground-water samples were collected directly from the spigot exiting the well; that is, the wells were not purged and the samples were drawn through existing equipment. The water-quality parameters temperature, specific conductance, pH, and dissolved oxygen were measured in the field with a YSI 610-D multiparameter meter. For surface-water samples, the probes were placed directly in the stream. For ground-water samples, the multiparameter meter probes were placed in a YSI flow-through chamber. Once the parameters had stabilized, usually within a couple of minutes, the field parameters were recorded and samples for laboratory analysis were collected.

Samples for microbiological testing of *E. coli* and enterococci concentrations were collected in a 100-mL screw-cap sterile bottle made of clear polystyrene plastic and preserved with sodium thiosulfate. Two 3.78-L (1-gallon) low-density polyethylene (LDPE) cubitainers were filled with sample water for analysis of the remaining microbiological pathogens (bacterial isolates and sensitivity to antibiotics of *E. coli*, enterococci, and *Salmonella* spp.). Samples for analysis of metal concentrations by inductively coupled plasma-mass spectrometry were collected in a 250-mL screw-cap bottle and preserved with 1:1 nitric acid (HNO_3); hardness was determined from this same sample bottle. Samples for nutrients and other chemical parameters were collected as follows: a 3.78-L cubitainer was filled with sample water for BOD and nutrient analyses; a 250-mL HDPE bottle with sulfuric acid (H_2SO_4) as a preservative was filled with sample water for TKN and COD analyses; two 40-mL clear glass vials with sufficient HCl preservative to bring the sample to pH less than 2.0 units were filled with sample water for TOC and DOC analyses.

Samples for analysis of antibiotic residue were collected using USGS protocols for the collection of samples for pesticide analysis (Shelton, 1994). Briefly, all processing equipment was precleaned with a Liquinox/tap-water solution, rinsed with tap water, rinsed with deionized water, rinsed with methanol, and allowed to air dry. Sample water was filtered through a 0.7-micrometer (μm) pore-size baked glass-fiber filter. The filter was rinsed with 100 mL of sample water before the samples were filtered into three 125-mL (4-oz) baked amber glass bottles. All water samples were transported on ice to the laboratories.

Laboratory Analysis Methods

Microbiological, metal, and nutrient samples were analyzed by the Division of Consolidated Laboratory Services (DCLS) of the Virginia Department of General Services, using the methods and detection limits identified in Table 2.

Table 2. Laboratory methods and detection limits for microbiological, metal, and nutrient samples.

[mL, milliliter; L, liter; µg/L, micrograms per liter; ppm, parts per million; mg/L, milligrams per liter; USEPA, U.S. Environmental Protection Agency; USFDA, U.S. Food and Drug Administration]

Parameter	Container size	Method	Reference for method	Detection limit, units
Microbiological				
Escherichia coli	100-mL bottle	SOP#2-121	USEPA Method 1103.1 Membrane Filter Test Method for *E. coli* in water	–[1]
Enterococci		SOP#2-122	USEPA Method 1600 Membrane Filter Test Method for enterococci in water	–[1]
Salmonella spp.	3.79-L cubitainer	SOP#2-470	USFDA, 1995, 1998	–[2]
Campylobacter spp.	3.79-L cubitainer	SOP#2-415	USFDA, 1995	–[2]
Metals				
Arsenic	250-mL bottle with HNO_3	USEPA 200.8	USEPA, 1994	5 µg/L
Cadmium				5 µg/L
Chromium^{3+}				10 µg/L
Copper				10 µg/L
Nickel				10 µg/L
Mercury				0.3 µg/L
Hardness				1.0 ppm
Nutrients				
Biological oxygen demand	1.89-L cubitainer	Standard Method 5210-B	Clesceri, Greenberg, and Eaton, 1998	2 mg/L
Nitrate	1.89-L cubitainer	USEPA 353.2	USEPA, 1983	0.04 mg/L
Nitrite	1.89-L cubitainer	USEPA 353.2	USEPA, 1983	0.01 mg/L
Ammonia	1.89-L cubitainer	USEPA 350.1	USEPA, 1983	0.04 mg/L
Ortho-phosphate	1.89-L cubitainer	USEPA 365.3	USEPA, 1983	0.02 ppm
Total Kjeldahl nitrogen	250-mL bottle with H_2SO_4	USEPA 351.2	USEPA, 1983	0.1 ppm
Chemical oxygen demand		ASTM D152-88	USEPA, 1983	5.0 mg/L
Total organic carbon	40-mL vial with HCl	Standard Method 5310-B	Clesceri, Greenberg, and Eaton, 1998	2 mg/L
Dissolved organic carbon	40-mL vial with HCl	Standard Method 5310-B	Clesceri, Greenberg, and Eaton, 1998	2 mg/L

[1]No limit for detection of *E. coli* and enterococci.

[2]A sample is considered positive when any *Salmonella* spp. or *Campylobacter* spp. are isolated; a sample is considered negative when no *Salmonella* spp. or *Campylobacter* spp. are isolated.

All microbiological techniques are designed to identify any culturable cells present in the sample. Each technique has limitations because of the variability of the distribution of pathogens in any sample. It is impossible to completely homogenize a sample of water. The DCLS used the membrane filtration technique for determining concentrations of *E. coli* and enterococci. For ground-water samples, where pathogen concentrations are expected to be low, 10-mL and 50-mL dilutions of the original sample were made. Of the original 100-mL sample, 10 mL were extracted with a pipette, placed in a filter cup and filtered, plated on growth media, and counted. Likewise, for a 50-mL dilution, 50 mL from the original 100 mL sample were pipetted out, filtered, and analyzed. For surface-water samples, where concentrations are expected to be higher, the dilutions used were 5 mL and 20 mL.

Dissolved organic compounds in water samples were analyzed by the USGS Organic Geochemistry Research Group in Lawrence, Kansas. Detection limits for these compounds are shown in Table 3. Analysis of these compounds indicates the amount of antibiotic residue in the samples.

Quality Assurance and Quality Control

For *E. coli*, the specificity of the medium used in the test is 9 percent false positive for marine and fresh water samples and 1 percent false negative for various environmental water samples. The ratio of false positive was calculated as the percentage of colonies that are not verified. The ratio of false negative was calculated as the percentage of verified colonies that do not react typically. The persistent positive of negative deviation of the result value has been reported to be -2 percent of the true value. The degree of agreement of repeated measurements of the same parameter is expressed quantitatively as the standard deviation or as the 95 percent confidence limits of the mean computed from the results of a series of controlled determinations.

For entercocci, the specificity of the medium used in the test is 6 percent false positive and 6.5 percent false negative for various environmental water samples. The ratio of false positive was calculated as the percentage of colonies that are not verified. The ratio of false negative was calculated as the percentage of verified colonies that do not react typically. The persistent positive or negative deviation of the results value is not significant.

Replicate samples were collected at sites V and VI in the Shenandoah Valley. Replicate samples were collected immediately after the first sample was collected, and the time of collection was set at five minutes after the first sample. The purpose of replicate samples is to evaluate any variability in the sampling and analysis processes.

Results and Summary

Concentrations of all of the dissolved organic compounds shown in Table 3 were below the detection limits at all sites sampled. Results of all of the other parameters analyzed for all samples are shown in Tables 5-21. Results of all replicate samples analyzed are shown in Tables 22-28. For a quick comparison of the ranges of concentrations of most of the parameters analyzed by the DCLS, refer to Table 4.

Acknowledgments

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Table 3 Laboratory method detection limits in micrograms per liter (µg/L) for dissolved organic compounds.

[* indicates a degradation product]

Beta Lactams	
Amoxicillin	0.20
Ampicillin	0.10
Cefotaxime	0.10
Cloxacillin	0.10
Oxacillin	0.10
Penicillin G	0.10
Penicillin V	0.10

Quinolines	
Ciprofloxacin	0.05
Clinafloxacin	0.05
Flumequine	0.05
Lomefloxacin	0.05
Norfloxacin	0.05
Ofloxacin	0.05
Oxolinic Acid	0.05
Sarafloxacin	0.05

Tetracyclines	
Chlorotetracycline	0.10
*Anhydro-chlorotetracycline	0.10
*Epi-anhydro-chlorotetracycline	0.10
*Epi-chlorotetracycline	0.10
*Iso-chlorotetracycline	0.10
*Iso-epi-chlorotetracycline	0.10
Demeclocycline	0.10
Doxycycline	0.10
Minocycline	0.20
Oxytetracycline	0.10
*Epi-oxytetracycline	0.10
Tetracycline	0.10
*Anhydro-tetracycline	0.20
*Epi-anhydro-tetracycline	0.10
*Epi-tetracycline	0.10

Macrolides	
Erythromycin	0.10
*Anhydro-erythromycin	0.05
Lincomycin	0.05
Ormetoprim	0.05
Roxithromycin	0.10
Trimethoprim	0.05
Tylosin	0.10
Virginiamycin	0.10

Sulfonamides	
Sulfachloropyridazine	0.05
Sulfadiazine	0.05
Sulfadimethoxine	0.05
Sulfamerazine	0.05
Sulfamethazine	0.05
Sulfamethoxazole	0.05
Sulfathiazole	0.05

Table 4. Summary of data in tables 5-8 and 18-21.

[Range of values for each parameter are given; when the value is listed as less than (<), all reported values were less than that value; GW, ground water; SW, surface water; °C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; mL, milliliter; µg/L, micrograms per liter; ppm, parts per million]

Parameter, unit	Shenandoah Valley		Eastern Shore	
	Non-CAFO sites	CAFO sites	Non-CAFO sites	CAFO sites
Water temperature, °C	4.1-12	2.3-11	3.3-15	0.11-15
Specific conductance, µS/cm	108-989	298-789	167-241	159-1000
Dissolved oxygen, mg/L	2.9-14	0.44-15	2.1-10	0.39-12
pH, units	6.38-7.82	6.87-8.17	5.91-9.09	6.19-9.56
Escherichia coli/100 mL, GW, 10-mL dilution	<10-10	<10	<10	<10
Enterococci/100 mL, GW, 10-mL dilution	<10	<10-50	<10	<10
Escherichia coli/100 mL, SW, 5-mL dilution	<20-80	60-120	20-40	<20-160
Enterococci/100 mL, SW, 5-mL dilution	<20-120	20-60	20-80	<20-80
Arsenic, µg/L	<5	<5	<5	<5
Cadmium, µg/L	<5	<5	<5	<5
Chromium^{3+}, µg/L	<10	<10	<10	<10
Copper, µg/L	<10-14	11-47	<10	<10-99
Nickel, µg/L	<10	<10	<10	<10
Mercury, µg/L	<0.3	<0.3-0.8	<0.3	<0.3
Hardness, ppm	49-519	6-371	42-95	33-96
Biological oxygen demand, mg/L	<2-2	<2	<2	<2-2
Nitrate, mg/L	0.56-13	2.5-15	<0.04-2	<0.04-8
Nitrite, mg/L	<0.01-0.05	<0.01-0.26	<0.01	<0.01
Ammonia, ppm	<0.04	<0.04-0.12	<0.04-0.12	<0.04-0.58
Ortho-phosphate, ppm	<0.02	<0.02-0.02	<0.02	<0.02-0.11
Total Kjeldahl nitrogen, ppm	<0.1-0.3	<0.1-0.3	0.1-0.5	0.2-1.4
Chemical oxygen demand, mg/L	<5	<5	<5-14	<5-28
Total organic carbon, mg/L	<2	<2	<2-5	<2-11
Dissolved organic carbon, mg/L	<2	<2	<2-5	<2-11

Tables 5-28

Table 5. Field parameters of samples collected from Shenandoah Valley, Va.

[Roman numeral refers to site location on Figure 1; GW, ground water; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; time is in military time units, Eastern Standard Time]

Site	Date	Time	Water temperature, ° C	Specific conductance, µS/cm	Dissolved oxygen,		pH, units
					mg/L	%	
I-A	01/13/04	0900	6.84	544	11.61	95.5	8.17
I-B	01/13/04	0915	4.78	494	11.97	93.4	8.01
I-GW	01/13/04	1030	10.75	649	4.59	41.5	7.19
II-GW	01/12/04	1515	12.35	833	6.99	65.6	7.03
II-B	01/12/04	1545	6.72	521	12.16	99.6	7.82
III-GW	01/13/04	1345	9.12	553	7.09	61.6	7.26
V-GW-new	02/19/04	1102	2.33	658	10.82	79.3	7.52
V-GW-house	02/19/04	1202	7.58	683	0.44	3.0	7.23
V-GW-silo	02/19/04	1134	7.08	789	3.98	33.0	6.87
V-A	02/19/04	1228	4.76	331	14.48	112.8	8.16
V-B	02/19/04	1258	4.88	298	14.56	113.7	8.01
VI-GW	02/17/04	1142	10.40	989	2.89	25.9	6.38
VI-spring	02/17/04	1223	10.97	502	10.02	90.9	6.83
VI-A	02/17/04	1353	4.35	108	13.71	105.9	7.03
VI-B	02/17/04	1312	4.14	126	14.22	109.0	6.96

Table 6. Field parameters of samples collected from Eastern Shore, Va.

[Roman numeral refers to site location on Figure 2; GW, ground water; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; time is in military time units, Eastern Standard Time]

Site	Date	Time	Water temperature, ° C	Specific conductance, µS/cm	Dissolved oxygen		pH, units
					mg/L	%	
II-A	01/20/04	1045	3.25	167	9.07	67.8	5.91
II-GW	01/20/04	1115	15.18	241	2.08	20.8	9.09
II-B	01/20/04	1145	4.17	189	10.07	77.2	7.27
III-GW	01/20/04	1445	12.10	214	0.39	3.7	9.56
III-A	01/20/04	1530	4.40	161	10.70	82.5	8.01
III-B	01/20/04	1600	3.84	212	11.97	91.0	7.73
IV-B	01/21/04	0815	2.72	183	8.28	61.1	6.87
IV-A	01/21/04	0845	0.11	159	10.48	71.6	6.91
IV-GW	01/21/04	0915	11.05	229	2.13	21.0	8.85
V-A	01/21/04	1115	1.24	168	8.66	61.3	6.89
V-B	01/21/04	1145	0.22	179	7.00	48.2	6.19
V-GW	01/21/04	1230	15.02	1,000	5.04	50.2	8.94

Table 7. Microbiological results for ground-water samples collected from Shenandoah Valley and Eastern Shore, Va.

[Virginia instantaneous water-quality standard for *E. coli* is 235 colony-forming units per 100 milliliters (units/100 mL); for enteroccoci, the standard is 61 colony-forming units/100 mL (9 VAC 25-260-170)]

Sample identification	Date	Time	*E. Coli*/100 mL		Enteroccoci/100 mL	
			10-mL dilution	50-mL dilution	10-mL dilution	50-mL dilution
Shenandoah Valley						
II-GW	1/12/04	1515	<10	<2	<10	<2
I-GW	1/13/04	1030	<10	<2	<10	<2
III-GW	1/13/04	1345	<10	<2	<10	<2
VI-GW	2/17/04	1142	<10	<2	<10	<2
VI-spring	2/17/04	1223	10	4	<10	2
V-GW-new	2/19/04	1102	No counts obtained because of media failure. Viable colonies picked and confirmed as *E. coli*		<10	6
V-GW-house	2/19/04	1202			50	<2
V-GW-silo	2/19/04	1134			<10	<2
Eastern Shore						
II-GW	1/20/04	1115	<10	<2	<10	<2
III-GW	1/20/04	1445	<10	<2	<10	2
IV-GW	1/21/04	0915	<10	<2	<10	<2
V-GW	1/21/04	1230	<10	<2	<10	2

Table 8. Microbiological results for surface-water samples collected from Shenandoah Valley and Eastern Shore, Va.

[Virginia instantaneous water-quality standard for *E. coli* is 235 colony-forming units per 100 milliliters (units/100 mL); for enteroccoci, the standard is 61 colony-forming units/100 mL (9 VAC 25-260-170)]

Sample identification	Date	Time	*E. coli*/100 mL		Enteroccoci/100 mL	
			5-mL dilution	20-mL dilution	5-mL dilution	20-mL dilution
Shenandoah Valley						
II-B	1/12/04	1545	80	105	120	60
I-A	1/13/04	0900	120	90	60	30
I-B	1/13/04	0915	60	55	40	35
VI-A	2/17/04	1353	<20	<5	<20	<5
VI-B	2/17/04	1312	<20	5	<20	<5
V-A	2/19/04	1228	No counts obtained because of media failure. Viable colonies picked and con-firmed as *E. coli*		20	80
V-B	2/19/04	1258			40	65
Eastern Shore						
II-A	1/20/04	1045	20	<5	80	25
II-B	1/20/04	1145	40	<5	20	55
III-A	1/20/04	1530	20	5	80	105
III-B	1/20/04	1600	<20	<5	<20	40
IV-A	1/21/04	0845	100	170	60	95
IV-B	1/21/04	0815	<20	15	40	20
V-A	1/21/04	1115	20	<5	60	25
V-B	1/21/04	1145	160	185	80	120

Table 9. Identification of bacterial isolates for samples collected from Shenandoah Valley, Va.

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
II-B	1	1/12/04	1545	*E. coli* 1–82.2%	Positive	Positive	Not Tested with 20 E	Positive	Positive	Negative
	2			*E. coli* 1–99.1%	Negative	Negative	Not Tested with 20 E	Positive	Positive	Positive
	3			*E. coli* 1–99.1%	Positive	Positive	Not Tested with 20 E	Positive	Positive	Positive
	4			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp.–97.5%			
	5			*E. coli* 1–82.2%	Positive	Positive	*Salmonella* spp.–97.5%			
	6			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp.–97.5%			
	7			*E. coli* 1–82.2%	Negative	Negative	Not *Salmonella* spp. Not Tested			
	8			*E. coli* 1–96.5%	Positive	Positive	*Enterobacter cloacae*–91.0% Not Tested			
	9			*E. coli* 1–66.6%; *Kluyvera* spp.–32.4%	Positive	Positive	*Salmonella* spp.–97.5%			
	10			*E. coli* 1–99.6%	Positive	Positive	*Salmonella* spp.–97.5%			
II-GW	1	1/12/04	1515				Not Tested with 20 E			Negative
	2						Not Tested with 20 E			
	3						Not Tested with 20 E			
	4						Not Tested with 20 E			
	5						Not Tested with 20 E			
	6						*Enterobacter* spp. Not Tested			
	7						*Hafnia alvei*–99.4% Not Tested			
	8						Not *Salmonella* spp. Not Tested			
	9						*Enterobacter* spp. Not Tested			
	10						Not Tested with 20 E			
I-A	1	1/13/04	0900	*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp.–99.9%	Positive	Positive	Positive
	2			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp.–99.9%			
	3			*E. coli* 1–97.7%	Positive	Positive	Not Tested with 20 E			
	4			*E. coli* 1–97.7%	Positive	Positive				
	5			*E. coli* 1–66.6%; *Kluyvera* spp.–32.4%	Positive	Positive				
	6			*E. coli* 1–97.7%	Positive	Positive				
	7			*E. coli* 1–90.5%	Positive	Positive				
	8			*E. coli* 1–96.5%	Positive	Positive				

Table 9. Identification of bacterial isolates for samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	9			*E. coli* 1–96.5%	Positive	Positive				
	10			*E. coli* 1–96.5%						
I-B	1	1/13/04	0915	*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp. –99.9%	Positive	Positive	Positive
	2			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp. –99.9%			Negative
	3			*E. coli* 1–90.4%; *E. coli* 2–9.5%	Positive	Positive	*Enterobacter* spp. Not Tested			
	4			*E. coli* 1–82.0%; *Kluyvera* spp.–16.6%	Positive	Positive	*Salmonella* spp. –99.9%			
	5			*E. coli* 1–66.6%; *Kluyvera* spp.–32.4%	Not enterococci		*Salmonella* spp. –99.9%			
	6			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp. –99.9%			
	7			*E. coli* 1–90.4%; *E. coli* 2–9.5%	Positive	Positive	*Salmonella* spp. –99.9%			
	8			*E. coli* 1–96.5%	Positive	Positive	*Salmonella* spp. –99.9%			
	9			*E. coli* 1–66.6%; *Kluyvera* spp.–32.4%	Positive	Positive	*Salmonella* spp. –99.9%			
	10			*E. coli* 1–96.5%			*Salmonella* spp. –99.9%			
I-GW	1	1/13/04	1030							
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
III-GW	1	1/13/04	1345							Negative
	2									
	3									
	4									
	5									
	6									
	7									
	8									

Table 9. Identification of bacterial isolates for samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	9									
	10									
VI-GW	1	2/17/04	1142				Not *Salmonella* spp. Not Tested			
	2						*Hafnia alvei*–99.2%			
	3						*Hafnia alvei*–99.2%			
	4						Not *Salmonella* spp. Not Tested			
	5						Not *Salmonella* spp. Not Tested			
	6						Not *Salmonella* spp. Not Tested			
	7						Not *Salmonella* spp.			
	8									
	9									
	10									
VI-B	1	2/17/04	1312	*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			Negative
	2						Not *Salmonella* spp. Not Tested			
	3						Not *Salmonella* spp. Not Tested			
	4									
	5									
	6									
	7									
	8									
	9									
	10									
VI-spring	1	2/17/04	1223	*E. coli* 1–96.5%	Positive	Positive	Not *Salmonella* spp. Not Tested			
	2			*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			
	3			*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			
	4						Not *Salmonella* spp. Not Tested			
	5						Not *Salmonella* spp. Not Tested			
	6									
	7									
	8									
	9									
	10									
V-A	1	2/19/04	1228	Not *E. coli* Not Tested	Positive	Positive	*Salmonella* spp.–97.5%			Negative

Table 9. Identification of bacterial isolates for samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	2			*E. coli* 1–99.1%	Negative	Negative	*Salmonella* spp.–97.5%			
	3				Negative	Negative	*Salmonella* spp–97.5%			
	4				Negative	Negative	*Salmonella* spp.–97.5%			
	5				Not enterococci		Not *Salmonella* spp. Not Tested			
	6				Not enterococci		*Salmonella* spp.–97.5%			
	7				Not enterococci		*Salmonella* spp.–97.5%			
	8				Not enterococci		*Salmonella* spp. –97.5%			
	9				Not enterococci		*Salmonella* spp. –97.5%			
	10				Not enterococci		*Salmonella* spp. –97.5%			
V-B	1	2/19/04	1258	Not *E. coli* Not Tested	Negative	Negative				Negative
	2			Not *E. coli* Not Tested	Negative	Negative				
	3			Not *E. coli* Not Tested	Positive	Positive				
	4			*E. coli* 1–97.7%	Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7				Negative	Negative				
	8				Negative	Negative				
	9				Positive	Negative				
	10				Negative	Negative				
V-GW-new	1	2/19/04	1102		Negative	Positive				
	2				Positive	Positive				
	3				Positive	Positive				
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-GW-house	1	2/19/04	1202		Negative	Positive				Negative
	2				NG	NG				
	3				NG	NG				
	4				Not enterococci					
	5									
	6									
	7									
	8									
	9									
	10									

Table 9. Identification of bacterial isolates for samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
V-GW-silo	1	2/19/04	1134		Negative	Positive				Negative
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

Table 10. Identification of bacterial isolates for samples collected from Eastern Shore, Va.

[a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
II-A	1	1/20/04	1045	*E. coli* 1–96.5%	Positive	Positive				Negative
	2				Positive	Positive				
	3				Positive	Positive				
	4				Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7									
	8									
	9									
	10									
II-B	1	1/20/04	1145	*E. coli* 1–90.4%; *E. coli* 2–9.5%	Positive	Positive				
	2			*E. coli* 1–96.5%	Positive	Positive				
	3				Positive	Positive				
	4				Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7				Positive	Positive				
	8				Positive	Positive				
	9				Positive	Positive				
	10				Positive	Positive				
II-GW	1	1/20/04	1115							
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
III-A	1	1/20/04	1530	*E. coli* 1–82.0%; *Kluyvera* spp.–16.6%	Positive	Positive	*Sal.* spp.–55.5%; *Hafnia alvei* –44.2% Low Discrimination Not Tested			Negative
	2			*E. coli* 1–97.7%	Positive	Positive				
	3				Positive	Positive				
	4				Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7				Positive	Positive				
	8				Positive	Positive				

Table 10. Identification of bacterial isolates for samples collected from Eastern Shore, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	9				Positive	Positive				
	10				Positive	Positive				
III-B	1	1/20/04	1600		Positive	Positive				
	2				Not enterococci					
	3				Not enterococci					
	4				Not enterococci					
	5				Not enterococci					
	6				Not enterococci					
	7				Not enterococci					
	8				Not enterococci					
	9									
	10									
III-GW	1	1/20/04	1445		Positive	Positive				
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
IV-A	1	1/21/04	0845	*E. coli* 1–99.1%	Positive	Positive				Negative
	2			*E. coli* 1–96.5%	Positive	Positive				
	3			*E. coli* 1–96.5%	Positive	Positive				
	4			*E. coli* 1–96.5%	Positive	Positive				
	5			*E. coli* 1–96.5%	Positive	Positive				
	6			*E. coli* 1–96.5%	Positive	Positive				
	7			*E. coli* 1–96.5%	Positive	Positive				
	8			*E. coli* 1–96.5%	Positive	Positive				
	9			*E. coli* 1–96.5%	Positive	Positive				
	10			*E. coli* 1–96.5%	Positive	Positive				
IV-B	1	1/21/04	0815	*E. coli* 1–96.5%	Positive	Positive	Not Tested with 20 E			
	2			*E. coli* 1–90.4%; *E. coli* 2–9.5%	Positive	Positive	Not Tested with 20 E			
	3			*E. coli* 1–96.5%	Positive	Positive				
	4				Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7									

Table 10. Identification of bacterial isolates for samples collected from Eastern Shore, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	8									
	9									
	10									
IV-GW	1	1/21/04	0915							
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-A	1	1/21/04	1115	*E. coli* 1–96.5%	Positive	Positive	*Edwardsiella tarda* Not Tested	Positive	Positive	Positive
	2				Positive	Positive	Not *Salmonella* spp. Not Tested	Positive	Positive	Positive
	3				Positive	Positive	*Kluyvera* spp.–94.2% Not Tested			Negative
	4				Positive	Negative	Not Tested with 20 E			
	5				Positive	Positive				
	6				Positive	Positive				
	7				Positive	Positive				
	8				Positive	Positive				
	9									
	10									
V-B	1	1/21/04	1145	Not *E. coli* Not Tested	Positive	Positive				Negative
	2			Not *E. coli* Not Tested	Positive	Positive				
	3			Not *E. coli* Not Tested	Positive	Positive				
	4			Not *E. coli* Not Tested	Positive	Positive				
	5			Not *E. coli* Not Tested	Positive	Positive				
	6			Not *E. coli* Not Tested	Positive	Positive				
	7			Not *E. coli* Not Tested	Positive	Positive				
	8			Not *E. coli* Not Tested	Positive	Positive				

Table 10. Identification of bacterial isolates for samples collected from Eastern Shore, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR Test	Lap Test	Identification	Oxidase	Catalase	Gram stain
	9			Not *E. coli* Not Tested	Positive	Positive				
	10			Not *E. coli* Not Tested	Positive	Positive				
V-GW	1	1/21/04	1230		Negative	Negative				Negative
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

Table 11. Antibiotic zone size interpretation guidelines.

<, less than or equal to; >, greater than or equal to]

Antibiotic	Controls		Isolates		
	E. coli ATCC # 25922	*Staphylococcus aureus* ATCC # 25923	Resistant	Intermediate	Susceptible
Amikacin	19–26	20–26	< 14	15–16	> 17
Bacitracin		12–22	< 8	9–12	> 13
Ceftiofur	26–31	37–31	< 17	18–20	> 21
Ciprofloxacin	30–40	22–30	< 15	16–20	> 21
Clindamycin		24–30	< 14	15–20	> 21
Erythromycin		22–30	< 13	14–22	> 23
Gentamicin	19–26	19–27	< 12	13–14	> 15
Neomycin	17–23	18–26	< 12	13–16	> 17
Penicillin		26–37	< 14		> 15
Spectinomycin	21–25	13–17	< 10	11–13	> 14
Streptomycin	12–20	14–22	< 11	12–14	> 15
Tetracycline	18–25	24–30	< 14	15–18	> 19
Tilmicosin		17–21	< 10	11–13	> 14
Trimethoprim	21–28	19–26	< 10	11–15	> 16
Vancomycin		17–21	< 14	15–16	> 17

Table 12. Antibiotic sensitivities for *E. coli* for samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-B	1	1/12/04	1545	22	S	23	S	21	S	19	S	20	S	17	S	21	S	25	S
	2			21	S	24	S	22	S	17	S	20	S	14	I	20	S	25	S
	3			22	S	24	S	17	S	17	S	21	S	15	S	19	S	27	S
	4			20	S	26	S	21	S	18	S	20	S	15	S	19	S	24	S
	5			22	S	26	S	22	S	19	S	20	S	16	S	20	S	25	S
	6			20	S	24	S	20	S	16	I	20	S	12	I	21	S	24	S
	7			22	S	24	S	21	S	16	I	21	S	15	S	7.5	R	25	S
	8			21	S	23	S	20	S	17	S	19	S	15	S	20	S	26	S
	9			21	S	23	S	21	S	18	S	20	S	14	I	20	S	24	S
	10			21	S	24	S	20	S	18	S	20	S	14	I	19	S	21	S
II-GW	1	1/12/04	1515																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
I-A	1	1/13/04	0900	21	S	24	S	20	S	18	S	20	S	15	S	20	S	23	S
	2			20	S	22	S	20	S	17	S	20	S	14	I	19	S	24	S
	3			20	S	24	S	20	S	16	I	19	S	16	S	20	S	20	S
	4			20	S	22	S	20	S	18	S	20	S	13	I	19	S	20	S
	5			19	S	23	S	20	S	18	S	19	S	13	I	20	S	20	S
	6			19	S	23	S	20	S	20	S	20	S	12	I	20	S	20	S
	7			22	S	25	S	20	S	18	S	19	S	15	S	20	S	23	S
	8			21	S	23	S	21	S	19	S	19	S	15	S	21	S	24	S
	9			21	S	24	S	20	S	17	S	22	S	15	S	18	I	22	S
	10			23	S	24	S	20	S	17	S	20	S	15	S	19	S	23	S
I-B	1	1/13/04	0915	22	S	27	S	22	S	17	S	20	S	13	I	20	S	25	S
	2			21	S	25	S	22	S	19	S	21	S	16	S	12	R	25	S
	3			22	S	26	S	20	S	19	S	20	S	14	I	20	S	24	S

Table 12. Antibiotic sensitivities for *E. coli* for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	4			22	S	25	S	20	S	18	S	20	S	13	I	20	S	24	S
	5			21	S	29	S	23	S	18	S	20	S	16	S	20	S	30	S
	6			23	S	26	S	20	S	18	S	21	S	16	S	12	R	25	S
	7			23	S	27	S	20	S	20	S	21	S	14	I	20	S	25	S
	8			23	S	26	S	21	S	7.5	R	14	S	10	R	7.5	R	29	S
	9			24	S	28	S	21	S	19	S	25	S	15	S	19	S	30	S
	10			22	S	26	S	21	S	17	S	21	S	16	S	20	S	26	S
I-GW	1	1/13/04	1030																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
III-GW	1	1/13/04	1345																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-A	1	2/17/04	1353																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		

Table 12. Antibiotic sensitivities for *E. coli* for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	8																		
	9																		
	10																		
VI-B	1	2/17/04	1312	23	S	27	S	23	S	17	S	23	S	15	S	15	I	25	S
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-GW	1	2/17/04	1142																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-spring	1	2/17/04	1223	22	S	27	S	23	S	19	S	23	S	15	S	22	S	29	S
	2			22	S	27	S	22	S	19	S	23	S	16	S	20	S	25	S
	3			20	S	25	S	21	S	18	S	21	S	14	I	19	S	25	S
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 12. Antibiotic sensitivities for *E. coli* for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
V-A	1	2/19/04	1228																
	2			20	S	26	S	21	S	19	S	22	S	15	S	19	S	26	S
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-B	1	2/19/04	1258																
	2																		
	3																		
	4			22	S	25	S	10	R	20	S	13	I	7.5	R	7.5	R	26	S
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new	1	2/19/04	1102																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-house	1	2/19/04	1202																
	2																		
	3																		

Table 12. Antibiotic sensitivities for *E. coli* for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-silo	1	2/19/04	1134																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 13. Antibiotic sensitivities for *E. coli* for samples collected from Eastern Shore, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-A	1	1/20/04	1045	24	S	33	S	17	S	12	I	21	S
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
II-B	1	1/20/04	1145	25	S	34	S	18	S	17	S	18	I
	2			25	S	36	S	17	S	16	S	18	I
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
II-GW	1	1/20/04	1115										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
III-A	1	1/20/04	1530	24	S	32	S	10	R	7.5	R	7.5	R
	2			24	S	32	S	10	R	7.5	R	7.5	R
	3												
	4												

Table 13. Antibiotic sensitivities for *E. coli* for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5												
	6												
	7												
	8												
	9												
	10												
III-B	1	1/20/04	1600										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
III-GW	1	1/20/04	1445										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
IV-A	1	1/21/04	0845	23	S	30	S	15	I	13	I	16	I
	2			23	S	27	S	17	S	14	I	20	S
	3			23	S	29	S	18	S	15	S	20	S
	4			24	S	30	S	17	S	16	S	20	S
	5			25	S	29	S	17	S	14	I	19	S
	6			24	S	32	S	17	S	14	I	21	S
	7			23	S	30	S	17	S	14	I	22	S
	8			24	S	30	S	17	S	14	I	22	S

Table 13. Antibiotic sensitivities for *E. coli* for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	9			23	S	31	S	17	S	15	S	21	S
	10			26	S	39	S	18	S	13	I	19	S
IV-B	1	1/21/04	0815	26	S	32	S	15	I	13	I	19	S
	2			25	S	28	S	16	I	15	S	19	S
	3			24	S	32	S	17	S	15	S	20	S
	4												
	5												
	6												
	7												
	8												
	9												
	10												
IV-GW	1	1/21/04	0915										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
V-A	1	1/21/04	1115	26	S	35	S	18	S	16	S	21	S
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
V-B	1	1/21/04	1145										
	2												

Table 13. Antibiotic sensitivities for *E. coli* for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
V-GW	1	1/21/04	1230										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												

Table 14. Antibiotic sensitivities for enterococci for samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-B	1	1/12/04	1545	14	R	15	S	12	R	7.5	R	15	S	14	I	21	S	18	S	7.5	R	27	S	15	S	34	S
	2																										
	3			13	R	12	I	20	I	7.5	R	15	S	11	R	24	S	18	S	7.5	R	25	S	13	I	32	S
	4			14	R	15	S	15	R	7.5	R	16	S	16	I	24	S	14	S	7.5	R	26	S	15	S	36	S
	5			7.5	R	16	S	7.5	R	7.5	R	10	R	7.5	R	18	S	9	R	7.5	R	25	S	10	R	26	S
	6			7.5	R	14	S	7.5	R	7.5	R	7.5	R	7.5	R	17	S	9	R	7.5	R	22	S	7.5	R	23	S
	7																										
	8			12	R	12	I	14	R	7.5	R	13	I	11	R	23	S	11	I	9	R	22	S	13	I	30	S
	9			13	R	13	S	15	R	7.5	R	15	I	15	I	24	S	18	S	7.5	R	23	S	13	I	33	S
	10			11	R	13	S	22	S	7.5	R	12	R	12	R	25	S	17	S	10	R	19	S	11	I	29	S
II-GW	1	1/12/04	1515																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
I-A	1	1/13/04	0900	7.5	R	14	S	7.5	R	7.5	R	11	R	7.5	R	19	S	13	I	7.5	R	23	S	11	I	23	S
	2			8	R	19	S	12	R	7.5	R	10	R	10	R	22	S	11	I	7.5	R	7.5	R	10	R	33	S
	3			7.5	R	19	S	7.5	R	7.5	R	9	R	9	R	20	S	10	R	7.5	R	7.5	R	9	R	36	S
	4			7.5	R	14	S	7.5	R	7.5	R	9	R	9	R	17	S	7.5	R	7.5	R	20	S	7.5	R	26	S
	5			8	R	16	S	7.5	R	7.5	R	10	R	10	R	18	S	10	R	7.5	R	21	S	16	S	26	S
	6			15	I	15	S	7.5	R	8	R	17	S	17	S	19	S	16	S	11	R	26	S	13	I	36	S
	7			10	R	18	S	7.5	R	7.5	R	14	I	14	I	25	S	11	I	7.5	R	7.5	R	13	I	34	S
	8			11	R	14	S	16	R	7.5	R	11	R	10	R	23	S	14	S	7.5	R	22	S	7.5	R	28	S
	9			7.5	R	12	I	7.5	R	7.5	R	7.5	R	7.5	R	19	S	9	R	7.5	R	19	S	7.5	R	26	S
	10																										
I-B	1	1/12/04	0915	10	R	13	S	11	R	7.5	R	13	I	11	R	24	S	15	S	7.5	R	19	S	11	I	30	S
	2			7.5	R	17	S	7.5	R	7.5	R	8	R	8	R	17	S	11	I	7.5	R	20	S	9	R	20	S
	3			12	R	12	I	7.5	R	7.5	R	15	S	15	I	19	S	12	I	7.5	R	7.5	R	10	R	21	S
	4			14	R	13	S	7.5	R	7.5	R	15	S	15	I	19	S	13	I	7.5	R	7.5	R	10	R	7.5	R
	5																										
	6			11	R	13	S	7.5	R	7.5	R	14	I	12	R	18	S	16	S	7.5	R	25	S	15	S	32	S
	7			15	I	15	S	9	R	7.5	R	15	S	16	I	20	S	17	S	7.5	R	24	S	15	S	31	S

Table 14. Antibiotic sensitivities for enterococci for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	8			12	R	14	S	10	R	7.5	R	14	I	14	I	17	S	13	I	7.5	R	22	S	12	I	30	S
	9			13	R	15	S	20	I	8	R	15	S	13	I	24	S	12	I	11	R	21	S	13	I	43	S
	10																										
I-GW	1	1/13/04	1030																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
III-GW	1	1/13/04	1345																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-A	1	2/17/04	1353																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-B	1	2/17/04	1312																								
	2																										
	3																										
	4																										
	5																										

Table 14. Antibiotic sensitivities for enterococci for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6																										
	7																										
	8																										
	9																										
	10																										
VI-GW	1	2/17/04	1142																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-spring	1	2/17/04	1223	15	I	8	R	21	S	7.5	R	14	I	11	R	25	S	16	S	7.5	R	21	S	14	S	30	S
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-A	1	2/19/04	1228	13	R	7.5	R	7.5	R	7.5	R	7.5	R	16	I	18	S	13	I	7.5	R	7.5	R	13	I	22	S
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-B	1	2/19/04	1258																								
	2																										

Table 14. Antibiotic sensitivities for enterococci for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	3			7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	10	R	30	S
	4			7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	10	R	33	S
	5			11	R	7.5	R	7.5	R	7.5	R	13	I	7.5	R	7.5	R	16	S	7.5	R	7.5	R	7.5	R	30	S
	6			10	R	7.5	R	7.5	R	7.5	R	7.5	R	18	S	7.5	R	7.5	R	7.5	R	7.5	R	11	I	33	S
	7																										
	8																										
	9																										
	10																										
V-GW-new	1	2/19/04	1102																								
	2			13	R	11	I	12	R	7.5	R	15	S	15	I	23	S	12	I	7.5	R	20	S	12	I	24	S
	3			13	R	12	I	7.5	R	7.5	R	13	I	16	I	22	S	11	I	7.5	R	20	S	12	I	23	S
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-house	1	2/19/04	1202																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-silo	1	2/19/04	1134																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										

Table 15. Antibiotic sensitivities for enterococci for samples collected from Eastern Shore, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Bacitracin		Ceftiofur		Ciprofloxacin		Clindamycin		Erythromycin		Neomycin		Penicillin		Streptomycin		Tetracycline		Vancomycin	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-A	1	1/20/04	1045	10	I	12	R	21	S	7.5	R	23	S	14	I	20	S	10	R	15	I	15	I
	2			16	S	7.5	R	7.5	R	7.5	R	7.5	R	10	R	16	S	7.5	R	19	S	15	I
	3			12	I	7.5	R	11	R	9	R	15	I	17	S	17	S	7.5	R	7.5	R	20	S
	4			9	I	7.5	R	18	I	7.5	R	20	I	13	I	18	S	8	R	20	S	16	I
	5			9	I	7.5	R	18	I	7.5	R	18	I	13	I	16	S	9	R	16	I	16	I
	6			9	I	7.5	R	17	I	7.5	R	23	S	15	I	15	S	10	R	20	S	18	S
	7																						
	8																						
	9																						
	10																						
II-B	1	1/20/04	1145	12	I	17	R	16	I	7.5	R	21	I	12	R	25	S	7.5	R	22	S	20	S
	2			9	I	7.5	R	15	R	7.5	R	15	I	8	R	17	S	7.5	R	20	S	15	I
	3			15	S	27	S	20	I	7.5	R	20	I	14	I	18	S	7.5	R	23	S	21	S
	4			17	S	36	S	18	I	28	S	32	S	17	S	37	S	7.5	R	25	S	25	S
	5			19	S	27	S	25	S	7.5	R	24	S	13	I	37	S	7.5	R	25	S	20	S
	6			14	S	7.5	R	14	R	7.5	R	15	I	16	I	19	S	7.5	R	7.5	R	19	S
	7			17	S	7.5	R	21	S	7.5	R	16	I	10	R	14	R	7.5	R	15	I	16	I
	8			14	S	7.5	R	21	S	7.5	R	27	S	16	I	23	S	7.5	R	7.5	R	20	S
	9			15	S	7.5	R	19	I	7.5	R	18	I	15	I	20	S	7.5	R	7.5	R	17	S
	10			13	S	7.5	R	20	S	7.5	R	21	I	16	I	21	S	7.5	R	7.5	R	19	S
II-GW	1	1/20/04	1115																				
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						
III-A	1	1/20/04	1530	13	S	20	I	13	R	31	S	19	I	15	I	23	S	9	R	7.5	R	20	S
	2			11	I	8	R	19	I	7.5	R	15	I	10	R	18	S	7.5	R	17	I	17	S
	3			9	I	7.5	R	17	I	7.5	R	15	I	9	R	17	S	7.5	R	21	S	15	I
	4			9	I	15	R	20	I	7.5	R	16	S	13	I	24	S	10	R	25	S	20	S
	5			11	I	16	R	18	I	7.5	R	20	I	11	R	23	S	7.5	R	20	S	17	S

Table 15. Antibiotic sensitivities for enterococci for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Bacitracin		Ceftiofur		Ciprofloxacin		Clindamycin		Erythromycin		Neomycin		Penicillin		Streptomycin		Tetracycline		Vancomycin	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6			9	I	18	I	12	R	7.5	R	19	I	13	I	24	S	7.5	R	16	I	18	S
	7			10	I	17	R	17	I	7.5	R	19	I	12	R	21	S	7.5	R	20	S	19	S
	8			8	R	14	R	18	I	7.5	R	13	R	11	R	22	S	7.5	R	23	S	18	S
	9			9	I	13	R	17	I	7.5	R	13	R	11	R	19	S	7.5	R	18	I	17	S
	10			8	R	17	R	18	I	7.5	R	16	I	13	I	25	S	7.5	R	24	S	17	S
III-B	1	1/20/04	1600	14	S	7.5	R	14	R	7.5	R	15	I	7.5	R	18	S	7.5	R	21	S	14	R
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						
III-GW	1	1/20/04	1445	12	I	7.5	R	20	I	7.5	R	16	I	10	R	17	S	7.5	R	20	S	16	I
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						
IV-A	1	1/21/04	0845	16	S	10	R	21	S	7.5	R	21	I	14	I	21	S	7.5	R	23	S	22	S
	2			17	S	7.5	R	23	S	7.5	R	19	I	12	R	15	S	7.5	R	19	S	16	I
	3			10	I	19	I	19	I	7.5	R	19	I	10	R	27	S	7.5	R	25	S	19	S
	4			14	S	7.5	R	21	S	7.5	R	20	I	13	I	20	S	7.5	R	23	S	22	S
	5			16	S	10	R	21	S	7.5	R	19	I	13	I	19	S	7.5	R	21	S	21	S
	6			14	S	9	R	20	I	7.5	R	20	I	13	I	19	S	7.5	R	23	S	21	S
	7			16	S	10	R	21	S	7.5	R	20	I	13	I	21	S	7.5	R	22	S	21	S
	8			15	S	9	R	20	I	7.5	R	20	I	13	I	20	S	7.5	R	24	S	20	S
	9			11	I	16	R	18	I	7.5	R	18	I	10	R	26	S	7.5	R	24	S	18	S
	10			14	S	10	R	20	I	7.5	R	19	I	14	I	21	S	7.5	R	25	S	21	S

Table 15. Antibiotic sensitivities for enterococci for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Bacitracin		Ceftiofur		Ciprofloxacin		Clindamycin		Erythromycin		Neomycin		Penicillin		Streptomycin		Tetracycline		Vancomycin	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
IV-B	1	1/21/04	0815	17	S	20	I	19	I	7.5	R	23	S	10	R	18	S	7.5	R	24	S	16	I
	2			11	I	7.5	R	20	I	12	R	7.5	R	16	I	19	S	7.5	R	20	S	17	S
	3			12	I	7.5	R	20	I	14	R	7.5	R	15	I	16	S	7.5	R	21	S	20	S
	4			12	I	7.5	R	17	I	7.5	R	19	I	13	I	20	S	7.5	R	18	I	17	S
	5			13	S	7.5	R	20	I	7.5	R	7.5	R	16	I	20	S	7.5	R	7.5	R	19	S
	6			16	S	21	S	18	I	7.5	R	21	I	8	R	19	S	7.5	R	21	S	16	I
	7																						
	8																						
	9																						
	10																						
IV-GW	1	1/21/04	0915																				
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						
V-A	1	1/21/04	1115	15	S	7.5	R	21	S	7.5	R	10	R	7.5	R	21	S	7.5	R	7.5	R	21	S
	2			14	S	7.5	R	22	S	11	R	10	R	16	I	22	S	7.5	R	26	S	20	S
	3			13	S	7.5	R	18	I	9	R	30	S	12	R	20	S	7.5	R	25	S	22	S
	4																						
	5			10	I	7.5	R	14	R	17	I	18	I	16	I	21	S	7.5	R	7.5	R	19	S
	6			11	I	19	I	15	R	7.5	R	19	I	12	R	25	S	7.5	R	22	S	19	S
	7			9	I	7.5	R	18	I	7.5	R	15	I	7.5	R	18	S	7.5	R	22	S	15	I
	8			11	I	7.5	R	13	R	7.5	R	16	I	12	R	16	S	7.5	R	25	S	17	S
	9																						
	10																						
V-B	1	1/21/04	1145	13	S	23	S	13	R	23	S	12	R	15	I	28	S	7.5	R	9	R	18	S
	2			12	I	7.5	R	12	R	16	I	17	I	15	I	7.5	R	7.5	R	7.5	R	17	S
	3			11	I	7.5	R	10	R	21	S	11	R	16	I	26	S	7.5	R	8	R	19	S
	4			12	I	21	S	11	R	21	S	11	R	16	I	25	S	7.5	R	7.5	R	20	S
	5			16	S	7.5	R	20	I	7.5	R	14	I	18	S	25	S	10	R	7.5	R	20	S

Table 15. Antibiotic sensitivities for enterococci for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Bacitracin		Ceftiofur		Ciprofloxacin		Clindamycin		Erythromycin		Neomycin		Penicillin		Streptomycin		Tetracycline		Vancomycin	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6			15	S	7.5	R	20	I	7.5	R	19	I	13	I	16	S	7.5	R	20	S	20	S
	7			11	I	20	I	10	R	16	I	12	R	16	I	26	S	7.5	R	7.5	R	19	S
	8			12	I	24	S	12	R	22	S	13	R	12	R	25	S	7.5	R	7.5	R	18	S
	9			13	S	23	S	12	R	23	S	11	R	17	S	26	S	7.5	R	7.5	R	19	S
	10			12	I	25	S	12	R	22	S	11	R	16	I	27	S	7.5	R	7.5	R	20	S
V-GW	1	1/21/04	1230																				
	2																						
	3																						
	4																						
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						

Table 16. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-B	1	1/12/04	1545																
	2																		
	3																		
	4			20	S	23	S	22	S	20	S	20	S	14	I	20	S	25	S
	5			21	S	24	S	20	S	20	S	21	S	14	I	20	S	24	S
	6			20	S	23	S	21	S	20	S	20	S	14	I	19	S	24	S
	7																		
	8																		
	9			20	S	24	S	20	S	21	S	20	S	14	I	20	S	25	S
	10			21	S	24	S	22	S	19	S	20	S	14	I	20	S	25	S
II-GW	1	1/12/04	1515																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
I-A	1	1/13/04	0900	23	S	23	S	24	S	23.5	S	23	S	14	I	20	S	26	S
	2			22	S	23	S	22	S	22	S	23	S	13	I	15	I	23	S
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
I-B	1	1/13/04	0915	23	S	26	S	20	S	20	S	20	S	14	I	20	S	25	S
	2			21	S	25	S	21	S			20	S	14	I	20	S	24	S
	3																		
	4			23	S	26	S	23	S	21	S	23	S	14	I	21	S	27	S

Table 16. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5			22	S	22	S	20	S	20	S	19	S	13	I	17	I	24	S
	6			22	S	24	S	21	S	20	S	18	S	14	I	14	R	24	S
	7			22	S	22	S	20	S	20	S	18	S	14	I	17	I	25	S
	8			22	S	26	S	23	S	20	S	25	S	14	I	18	I	26	S
	9			21	S	24	S	19	S	19	S	21	S	14	I	19	S	25	S
	10			22	S	24	S	21	S	22	S	22	S	14	I	20	S	25	S
I-GW	1	1/13/04	1030																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
III-GW	1	1/13/04	1345																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-A	1	2/17/04	1353																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		

Table 16. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	10																		
VI-B	1	2/17/04	1312																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-GW	1	2/17/04	1142																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-spring	1	2/17/04	1223																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-A	1	2/19/04	1228	22	S	21	S	21	S	18	S	20	S	13	I	19	S	22	S
	2			21	S	24	S	21	S	19	S	17	S	12	I	18	I	22	S
	3			21	S	24	S	19	S	18	S	17	S	12	I	19	S	21	S
	4			22	S	22	S	19	S	19	S	18	S	12	I	18	I	20	S
	5																		

Table 16. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6			22	S	22	S	19	S	18	S	18	S	12	I	19	S	20	S
	7			21	S	22	S	20	S	18	S	18	S	11	R	18	I	22	S
	8			22	S	23	S	20	S	19	S	17	S	12	I	20	S	22	S
	9			21	S	23	S	21	S	20	S	17	S	11	R	18	I	21	S
	10			21	S	23	S	20	S	18	S	18	S	11	R	18	I	21	S
V-B	1	2/19/04	1258																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new	1	2/19/04	1102																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-house	1	2/19/04	1202																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 16. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
V-GW-silo	1	2/19/04	1134																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		

Table 17. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Eastern Shore, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
II-A	1	1/20/04	1045										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
II-B	1	1/20/04	1145										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
II-GW	1	1/20/04	1115										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
III-A	1	1/20/04	1530										
	2												
	3												
	4												
	5												

Table 17. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6												
	7												
	8												
	9												
	10												
III-B	1	1/20/04	1600										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
III-GW	1	1/20/04	1445										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
IV-A	1	1/21/04	0845										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												

Table 17. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
IV-B	1	1/21/04	0815										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
IV-GW	1	1/21/04	0915										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
V-A	1	1/21/04	1115										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
V-B	1	1/21/04	1145										
	2												
	3												
	4												
	5												
	6												

Table 17. Antibiotic sensitivities for *Salmonella* spp. for samples collected from Eastern Shore, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Ceftiofur		Ciprofloxacin		Neomycin		Streptomycin		Tetracycline	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	7												
	8												
	9												
	10												
V-GW	1	1/21/04	1230										
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												

Table 18. Metal concentrations in water samples collected from Shenandoah Valley, Va.

[ppm, parts per million; µg/L, micrograms per liter; < less than]

Sample identification	Date	Time	Hardness, ppm	Chromium, µg/L	Nickel, µg/L	Copper, µg/L	Arsenic, µg/L	Cadmium, µg/L	Mercury, µg/L
II-B	1/12/04	1545	318	< 10	< 10	< 10	<5	<5	<0.3
II-GW	1/12/04	1515	406	< 10	< 10	< 10	<5	<5	<.3
I-A	1/13/04	0900	300	< 10	< 10	< 10	<5	<5	<.3
I-B	1/13/04	0915	268	< 10	< 10	< 10	<5	<5	<.3
I-GW	1/13/04	1030	330	< 10	< 10	< 10	<5	<5	.8
III-GW	1/13/04	1345	319	< 10	< 10	13.7	<5	<5	<.3
VI-A	2/17/04	1353	49	< 10	< 10	< 10	<5	<5	<.3
VI-B	2/17/04	1312	56	< 10	< 10	< 10	<5	<5	<.3
VI-GW	2/17/04	1142	519	< 10	< 10	< 10	<5	<5	<.3
VI-spring	2/17/04	1223	275	< 10	< 10	< 10	<5	<5	<.3
V-A	2/19/04	1228	158	< 10	< 10	< 10	<5	<5	<.3
V-B	2/19/04	1258	136	< 10	< 10	< 10	<5	<5	<.3
V-GW-new	2/19/04	1102	6	< 10	< 10	11	<5	<5	<.3
V-GW-house	2/19/04	1202	329	< 10	< 10	47.3	<5	<5	<.3
V-GW-silo	2/19/04	1134	371	< 10	< 10	36.8	<5	<5	<.3

Table 19. Metal concentrations in water samples collected from Eastern Shore, Va.

[ppm, parts per million; µg/L, micrograms per liter; < less than]

Sample identification	Date	Time	Hardness, ppm	Chromium, µg/L	Nickel, µg/L	Copper, µg/L	Arsenic, µg/L	Cadmium, µg/L	Mercury, µg/L
II-A	1/20/04	1045	42	< 10	< 10	< 10	<5	<5	<0.3
II-B	1/20/04	1145	55	< 10	< 10	< 10	<5	<5	<.3
II-GW	1/20/04	1115	95	< 10	< 10	< 10	<5	<5	<.3
III-A	1/20/04	1530	48	< 10	< 10	< 10	<5	<5	<.3
III-B	1/20/04	1600	77	< 10	< 10	< 10	<5	<5	<.3
III-GW	1/20/04	1445	92	< 10	< 10	< 10	<5	<5	<.3
IV-A	1/21/04	0845	44	< 10	< 10	< 10	<5	<5	<.3
IV-B	1/21/04	0815	54	< 10	< 10	< 10	<5	<5	<.3
IV-GW	1/21/04	0915	96	< 10	< 10	< 10	<5	<5	<.3
V-A	1/21/04	1115	45	< 10	< 10	< 10	<5	<5	<.3
V-B	1/21/04	1145	44	< 10	< 10	< 10	<5	<5	<.3
V-GW	1/21/04	1230	33	< 10	< 10	99	<5	<5	<.3

Table 20. Inorganic non-metal concentrations in water samples collected from Shenandoah Valley, Va.

[BOD, biologica
TOC, total organic carbon; DOC, dissolved organic carbon; < less than]

Sample identification	Date	Time	BOD, mg/L	Nitrate, mg/L	Nitrite, mg/L	Ammonia, ppm	Ortho-phosphate, ppm	TKN, ppm	COD, mg/L	TOC, mg/L	DOC, mg/L
II-B	1/12/04	1545	2	3.32	0.05	<0.04	<.02	0.3	<5	2.2	<2
II-GW	1/12/04	1515	<2	13.3	.04	<.04	<.02	<.1	<5	<2	<2
I-A	1/13/04	0900	<2	1.76	.01	<.04	<.02	.2	<5	<2	<2
I-B	1/13/04	0915	<2	5.6	.02	<.04	<.02	.3	<5	<2	<2
I-GW	1/13/04	1030	<2	15.22	<.01	<.04	<.02	.1	<5	<2	<2
III-GW	1/13/04	1345	<2	8.64	<.01	<.04	<.02	.1	<5	<2	<2
VI-A	2/17/04	1353	<2	0.56	<.01	<.04	<.02	.1	<5	<2	<2
VI-B	2/17/04	1312	<2	0.62	<.01	<.04	<.02	.1	<5	<2	<2
VI-GW	2/17/04	1142	<2	11.97	<.01	<.04	<.02	<.1	<5	<2	<2
VI-spring	2/17/04	1223	<2	1.28	<.01	<.04	<.02	<.1	<5	<2	<2
V-A	2/19/04	1228	<2	2.5	<.01	<.04	.02	<.1	<5	<2	<2
V-B	2/19/04	1258	<2	2.53	<.01	<.04	.02	.3	<5	<2	<2
V-GW-new	2/19/04	1102	<2	6.72	.06	<.04	<.02	<.1	<5	<2	<2
V-GW-house	2/19/04	1202	<2	10.02	.26	.12	<.02	<.1	<5	<2	<2
V-GW-silo	2/19/04	1134	<2	12.21	<.01	<.04	<.02	<.1	<5	<2	<2

Table 21. Inorganic non-metal concentrations in water samples collected from Eastern Shore, Va.

[BOD, b
demand; TOC, total organic carbon; DOC, dissolved organic carbon; < less than]

Sample identification	Date	Time	BOD, mg/L	Nitrate, mg/L	Nitrite, mg/L	Ammonia, ppm	Ortho-phosphate, ppm	TKN, ppm	COD, mg/L	TOC, mg/L	DOC, mg/L
II-A	1/20/04	1045	<2	0.69	<0.01	<0.04	<0.02	0.4	12.04	4.8	4.5
II-B	1/20/04	1145	<2	2.06	<.01	<.04	<.02	.5	13.59	5.4	5.4
II-GW	1/20/04	1115	<2	<.04	<.01	.12	<.02	.1	<5	<2	<2
III-A	1/20/04	1530	2	2.6	<.01	.04	<.02	.5	5.66	3.2	3.1
III-B	1/20/04	1600	<2	5	<.01	<.04	<.02	.4	<5	3	2.8
III-GW	1/20/04	1445	<2	<.04	<.01	.16	<.02	.2	<5	<2	<2
IV-A	1/21/04	0845	2	1.7	<.01	.07	<.02	.5	10.64	5.8	5.2
IV-B	1/21/04	815	<2	7.5	<.01	.4	<.02	.6	18.35	6.8	7.6
IV-GW	1/21/04	915	<2	<.04	<.01	.32	.06	.7	<5	<2	<2
V-A	1/21/04	1115	<2	1.3	<.01	.08	<.02	.8	28.07	11.2	10.9
V-B	1/21/04	1145	<2	1.03	<.01	.15	<.02	.2	15.95	7.7	7.4
V-GW	1/21/04	1230	<2	<.04	<.01	.58	.11	1.4	<5	3.7	3.3

Table 22. Microbiological results for replicate ground- and surface-water samples collected from Shenandoah Valley, Va.

[Virginia instantaneous water-quality standard for *E. coli* is 235 colony-forming units per 100 milliliters (units/100 mL); for enteroccoci, the standard is 61 colony-forming units/100 mL (9 VAC 25-260-170)]

Sample identification	Date	Time	*E. coli*/100 mL		Enteroccoci/100 mL	
			10-mL dilution	50-mL dilution	10-mL dilution	50-mL dilution
Ground Water						
VI-spring	2/17/04	1223	10	4	<10	2
VI-spring replicate	2/17/04	1228	<10	4	<10	<2
V-GW-new	2/19/04	1102	No counts obtained because of media failure. Viable colonies picked and confirmed as *E. coli*		<10	6
V-GW-new replicate	2/19/04	1107			<10	<2
V-GW-house	2/19/04	1202			50	<2
V-GW-house replicate	2/19/04	1207			10	<2
V-GW-silo	2/19/04	1134			<10	2
V-GW-silo replicate	2/19/04	1139			<10	<2

Sample identification	Date	Time	*E. coli*/100 mL		Enteroccoci/100 mL	
			5-mL dilution	20-mL dilution	5-mL dilution	20-mL dilution
Surface Water						
VI-A	2/17/04	1353	<20	<5	<20	<5
VI-A replicate	2/17/04	1358	<20	5	20	55
VI-B	2/17/04	1312	<20	5	<20	<5
VI-B replicate	2/17/04	1317	<20	5	20	10
V-A	2/19/04	1228	No counts obtained because of media failure. Viable colonies picked and confirmed as *E. coli*		20	80
V-A replicate	2/19/04	1233			40	100
V-B	2/19/04	1258			40	65
V-B replicate	2/19/04	1303			100	35

Table 23. Identification of bacterial isolates for replicate samples collected from Shenandoah Valley, Va.

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR test	Lap test	Identification	Oxidase	Catalase	Gram stain
VI-B	1	2/17/04	1312	*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			Negative
	2						Not *Salmonella* spp. Not Tested			
	3						Not *Salmonella* spp. Not Tested			
	4									
	5									
	6									
	7									
	8									
	9									
	10									
VI-B replicate	1	2/17/04	1317	*E. coli* 1–96.5%	Positive	Positive	Not *Salmonella* spp. Not Tested			Negative
	2				Not enterococci on primary plate		Not *Salmonella* spp. Not Tested			
	3						*Hafnia alvei*–99.2%			
	4						Not *Salmonella* spp. Not Tested			
	5						Not *Salmonella* spp. Not Tested			
	6						Not *Salmonella* spp. Not Tested			
	7									
	8									
	9									
	10									
VI-GW	1	2/17/04	1142							
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
VI-GW replicate	1	2/17/04	1147							
	2									
	3									

Table 23. Identification of bacterial isolates for replicate samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR test	Lap test	Identification	Oxidase	Catalase	Gram stain
	4									
	5									
	6									
	7									
	8									
	9									
	10									
VI-spring	1	2/17/04	1223	*E. coli* 1–96.5%	Positive	Positive	Not *Salmonella* spp. Not Tested			
	2			*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			
	3			*E. coli* 1–96.5%			Not *Salmonella* spp. Not Tested			
	4						Not *Salmonella* spp. Not Tested			
	5						Not *Salmonella* spp. Not Tested			
	6									
	7									
	8									
	9									
	10									
VI-spring replicate	1	2/17/04	1228	*E. coli* 1–96.5%						
	2			*E. coli* 1– 96.5%						
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-A	1	2/19/04	1228	Not *E. coli* Not Tested	Positive	Positive	*Salmonella* spp. –97.5%			Negative
	2			*E. coli* 1– 99.1%	Negative	Negative	*Salmonella* spp. –97.5%			
	3				Negative	Negative	*Salmonella* spp. –97.5%			
	4				Negative	Negative	*Salmonella* spp. –97.5%			

Table 23. Identification of bacterial isolates for replicate samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR test	Lap test	Identification	Oxidase	Catalase	Gram stain
	5				Not enterococci		Not *Salmonella* spp. Not Tested			
	6				Not enterococci		*Salmonella* spp. –97.5%			
	7				Not enterococci		*Salmonella* spp. –97.5%			
	8				Not enterococci		*Salmonella* spp. –97.5%			
	9				Not enterococci		*Salmonella* spp. –97.5%			
	10				Not enterococci		*Salmonella* spp. –97.5%			
V-A replicate	1	2/19/04	1233	*E. coli* 1–96.5%	Negative	Negative	*Salmonella* spp. –99.9%			Negative
	2			*E. coli* 1–99.1%	Negative	Negative	*Salmonella* spp. –99.9%			
	3			*E. coli* 1–99.1%	Positive	Positive	*Salmonella* spp. –99.9%			
	4			*E. coli* 1–96.5%	Negative	Negative	*Salmonella* spp. –99.9%			
	5				Negative	Negative	*Salmonella* spp. –99.9%			
	6				Negative	Negative	*Salmonella* spp. –99.9%			
	7				Negative	Negative	*Salmonella* spp. –99.9%			
	8				Not enterococci		*Salmonella* spp. –99.9%			
	9				Not enterococci		*Salmonella* spp. –99.9%			
	10				Negative	Negative	*Serratia oderifera* 1			
V-B	1	2/19/04	1258	Not *E. coli* Not Tested	Negative	Negative				Negative
	2			Not *E. coli* Not Tested	Negative	Negative				
	3			Not *E. coli* Not Tested	Positive	Positive				
	4			*E. coli* 1–97.7%	Positive	Positive				
	5				Positive	Positive				
	6				Positive	Positive				
	7				Negative	Negative				
	8				Negative	Negative				
	9				Positive	Negative				
	10				Negative	Negative				
V-B replicate	1	2/19/04	1303		Negative	Negative				Negative
	2				Not enterococci					

Table 23. Identification of bacterial isolates for replicate samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR test	Lap test	Identification	Oxidase	Catalase	Gram stain
	3				Not enterococci					
	4				Not enterococci					
	5				Negative	Negative				
	6				Negative	Negative				
	7				Not enterococci					
	8				Not enterococci					
	9				Not enterococci					
	10				Not enterococci					
V-GW-new	1	2/19/04	1102		Negative	Positive				
	2				Positive	Positive				
	3				Positive	Positive				
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-GW-new replicate	1	2/19/04	1107							
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-GW-house	1	2/19/04	1202		Negative	Positive				Negative
	2				NG	NG				
	3				NG	NG				
	4				Not enterococci on primary plate					
	5									
	6									
	7									
	8									
	9									
	10									

Table 23. Identification of bacterial isolates for replicate samples collected from Shenandoah Valley, Va.—Continued

[a blank row indicates that 10 viable colonies were not available to analyze; NG, no growth]

Sample identification	Colony number	Date	Time	*E. coli*	Enterococci		*Salmonella* spp.	*Campylobacter* spp.		
				Identification	PYR test	Lap test	Identification	Oxidase	Catalase	Gram stain
V-GW-house replicate	1	2/19/04	1207		NG	NG				
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-GW-silo	1	2/19/04	1134		Negative	Positive				Negative
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
V-GW-silo replicate	1	2/19/04	1139							Negative
	2						Not *Salmonella* spp.			
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
VI-A	1	2/17/04	1353																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-A replicate	1	2/17/04	1358	22	S	25	S	21	S	18	S	23	S	15	S	20	S	30	S
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-B	1	2/17/04	1312	23	S	27	S	23	S	17	S	23	S	15	S	15	I	25	S
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-B replicate	1	2/17/04	1317	23	S	25	S	23	S	19	S	20	S	16	S	20	S	29	S
	2																		
	3																		
	4																		
	5																		

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	6																		
	7																		
	8																		
	9																		
	10																		
VI-GW	1	2/17/04	1142																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-GW replicate	1	2/17/04	1147																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-spring	1	2/17/04	1223	22	S	27	S	23	S	19	S	23	S	15	S	22	S	29	S
	2			22	S	27	S	22	S	19	S	23	S	16	S	20	S	25	S
	3			20	S	25	S	21	S	18	S	21	S	14	I	19	S	25	S
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
VI-spring replicate	1	2/17/04	1228	22	S	26	S	22	S	20	S	23	S	14	I	20	S	26	S
	2			22	S	27	S	22	S	19	S	24	S	14	I	20	S	27	S
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-A	1	2/19/04	1228																
	2			20	S	26	S	21	S	19	S	22	S	15	S	19	S	26	S
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-A replicate	1	2/19/04	1233	24	S	28	S	22	S	20	S	23	S	16	S	21	S	26	S
	2			23	S	26	S	22	S	18	S	23	S	15	S	20	S	26	S
	3			21	S	23	S	19	S	17	S	20	S	15	S	19	S	26	S
	4			22	S	28	S	22	S	18	S	22	S	15	S	21	S	28	S
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-B	1	2/19/04	1258																
	2																		
	3																		
	4			22	S	25	S	10	R	20	S	13	I	7.5	R	7.5	R	26	S

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-B replicate	1	2/19/04	1303																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new	1	2/19/04	1102																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new replicate	1	2/19/04	1107																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	10																		
V-GW-house	1	2/19/04	1202																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-house replicate	1	2/19/04	1207																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-silo	1	2/19/04	1134																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-silo replicate	1	2/19/04	1139																
	2																		
	3																		
	4																		

Table 24. Antibiotic sensitivities for *E. coli* for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony Number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
VI-A	1	2/17/04	1353																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-A replicate	1	2/17/04	1358																								
	2			9	R	12	I	7.5	R	7.5	R	12	R	11	R	16	S	18	S	7.5	R	19	S	15	S	29	S
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-B	1	2/17/04	1312																								
	2																										
	3																										
	4																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-B replicate	1	2/17/04	1317	7.5	R	13	S	9	R	7.5	R	12	R	12	R	19	S	12	I	7.5	R	20	S	11	I	25	S
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-GW	1	2/17/04	1142																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	9																										
	10																										
VI-GW replicate	1	2/17/04	1147																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-spring	1	2/17/04	1223	15	I	8	R	21	S	7.5	R	14	I	11	R	25	S	16	S	7.5	R	21	S	14	S	30	S
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
VI-spring replicate	1	2/17/04	1228																								

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-A	1	2/19/04	1228	13	R	7.5	R	7.5	R	7.5	R	7.5	R	16	I	18	S	13	I	7.5	R	7.5	R	13	I	22	S
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-A replicate	1	2/19/04	1233																								
	2																										
	3			10	R	13	S	10	R	13	R	13	I	12	R	18	S	13	I	7.5	R	19	S	7.5	R	27	S
	4																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-B	1	2/19/04	1258																								
	2																										
	3			7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	10	R	30	S
	4			7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	7.5	R	10	R	33	S
	5			11	R	7.5	R	7.5	R	7.5	R	13	I	7.5	R	7.5	R	16	S	7.5	R	7.5	R	7.5	R	30	S
	6			10	R	7.5	R	7.5	R	7.5	R	7.5	R	18	S	7.5	R	7.5	R	7.5	R	7.5	R	11	I	33	S
	7																										
	8																										
	9																										
	10																										
V-B replicate	1	2/19/04	1303																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	8																										
	9																										
	10																										
V-GW-new	1	2/19/04	1102																								
	2			13	R	11	I	12	R	7.5	R	15	S	15	I	23	S	12	I	7.5	R	20	S	12	I	24	S
	3			13	R	12	I	7.5	R	7.5	R	13	I	16	I	22	S	11	I	7.5	R	20	S	12	I	23	S
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-new replicate	1	2/19/04	1107																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
V-GW-house	1	2/19/04	1202																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-house replicate	1	2/19/04	1207																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-silo	1	2/19/04	1134																								
	2																										
	3																										

Table 25. Antibiotic sensitivities for enterococci for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Bacitracin		Ceftiofur		Clindamycin		Gentamicin		Neomycin		Penicillin		Spectinomycin		Streptomycin		Tetracycline		Tilmicosin		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
V-GW-silo replicate	1	2/19/04	1139																								
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										

Table 26. Antibiotic sensitivities for *Salmonella* spp. for replicate samples collected from Shenandoah Valley, Va.

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
VI-A	1	2/17/04	1353																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-A replicate	1	2/17/04	1358																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-B	1	2/17/04	1312																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-B replicate	1	2/17/04	1317																
	2																		
	3																		
	4																		
	5																		
	6																		

Table 26. Antibiotic sensitivities for *Salmonella* spp. for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	7																		
	8																		
	9																		
	10																		
VI-GW	1	2/17/04	1142																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-GW replicate	1	2/17/04	1147																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-spring	1	2/17/04	1223																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
VI-spring replicate	1	2/17/04	1228																
	2																		

Table 26. Antibiotic sensitivities for *Salmonella* spp. for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-A	1	2/19/04	1228	22	S	21	S	21	S	18	S	20	S	13	I	19	S	22	S
	2			21	S	24	S	21	S	19	S	17	S	12	I	18	I	22	S
	3			21	S	24	S	19	S	18	S	17	S	12	I	19	S	21	S
	4			22	S	22	S	19	S	19	S	18	S	12	I	18	I	20	S
	5																		
	6			22	S	22	S	19	S	18	S	18	S	12	I	19	S	20	S
	7			21	S	22	S	20	S	18	S	18	S	11	R	18	I	22	S
	8			22	S	23	S	20	S	19	S	17	S	12	I	20	S	22	S
	9			21	S	23	S	21	S	20	S	17	S	11	R	18	I	21	S
	10			21	S	23	S	20	S	18	S	18	S	11	R	18	I	21	S
V-A replicate	1	2/19/04	1333	20	S	23	S	20	S	19	S	19	S	12	I	12	R	22	S
	2			22	S	26	S	19	S	19	S	22	S	13	I	20	S	24	S
	3			22	S	24	S	20	S	20	S	20	S	14	I	16	I	26	S
	4			21	S	24	S	21	S	19	S	19	S	13	I	21	S	26	S
	5			22	S	23	S	22	S	19	S	19	S	13	I	19	S	26	S
	6			22	S	25	S	20	S	20	S	20	S	13	I	20	S	25	S
	7			21	S	26	S	21	S	20	S	21	S	14	I	16	I	25	S
	8			20	S	24	S	22	S	19	S	19	S	13	I	10	R	25	S
	9			22	S	24	S	21	S	21	S	19	S	13	I	18	I	26	S
	10																		
V-B	1	2/19/04	1258																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		

Table 26. Antibiotic sensitivities for *Salmonella* spp. for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	9																		
	10																		
V-B replicate	1	2/19/04	1303																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new	1	2/19/04	1102																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-new replicate	1	2/19/04	1107																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-house	1	2/19/04	1202																
	2																		
	3																		
	4																		

Table 26. Antibiotic sensitivities for *Salmonella* spp. for replicate samples collected from Shenandoah Valley, Va.—Continued

[Antibiotic disc zone size given in millimeters; R, resistant; I, intermediate; S, susceptible; a blank row indicates that 10 viable colonies were not available to analyze]

Sample identification	Colony number	Date	Time	Amikacin		Ceftiofur		Gentamicin		Neomycin		Spectinomycin		Streptomycin		Tetracycline		Trimethoprim	
				Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide	Zone size	Guide
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-house replicate	1	2/19/04	1207																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-silo	1	2/19/04	1134																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
V-GW-silo replicate	1	2/19/04	1139																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		

Table 27. Metal concentrations in replicate samples collected from Shenandoah Valley, Va.

[ppm, parts per million; µg/L, micrograms per liter; < less than]

Sample identification	Date	Time	Hardness, ppm	Chromium, µg/L	Nickel, µg/L	Copper, µg/L	Arsenic, µg/L	Cadmium, µg/L	Mercury, µg/L
VI-A	2/17/04	1353	49	< 10	< 10	< 10	<5	<5	<0.3
VI-A replicate	2/17/04	1358	49	< 10	< 10	< 10	<5	<5	<.3
VI-B	2/17/04	1312	56	< 10	< 10	< 10	<5	<5	<.3
VI-B replicate	2/17/04	1317	55	< 10	< 10	< 10	<5	<5	<.3
VI-GW	2/17/04	1142	519	< 10	< 10	< 10	<5	<5	<.3
VI-GW replicate	2/17/04	1147	505	< 10	< 10	< 10	<5	<5	<.3
VI-spring	2/17/04	1223	275	< 10	< 10	< 10	<5	<5	<.3
VI-spring replicate	2/17/04	1228	286	< 10	< 10	< 10	<5	<5	<.3
V-A	2/19/04	1228	158	< 10	< 10	< 10	<5	<5	<.3
V-A replicate	2/19/04	1233	153	< 10	< 10	< 10	<5	<5	<.3
V-B	2/19/04	1258	136	< 10	< 10	< 10	<5	<5	<.3
V-B replicate	2/19/04	1303	140	< 10	< 10	< 10	<5	<5	<.3
V-GW-new	2/19/04	1102	6	< 10	< 10	11	<5	<5	<.3
V-GW-new replicate	2/19/04	1107	6	< 10	< 10	11	<5	<5	<.3
V-GW-house	2/19/04	1202	329	< 10	< 10	47.3	<5	<5	<.3
V-GW-house replicate	2/19/04	1207	340	< 10	< 10	88.9	<5	<5	<.3
V-GW-silo	2/19/04	1134	371	< 10	< 10	36.8	<5	<5	<.3
V-GW-silo replicate	2/19/04	1139	379	< 10	< 10	21.3	<5	<5	<.3

Table 28. Inorganic non-metal concentrations in replicate samples collected from Shenandoah Valley, Va.

[BOD, b
demand; TOC, total organic carbon; DOC, dissolved organic carbon; < less than]

Sample identification	Date	Time	BOD, mg/L	Nitrate, mg/L	Nitrite, mg/L	Ammonia, ppm	Ortho-phosphate, ppm	TKN, ppm	COD, mg/L	TOC, mg/L	DOC, mg/L
VI-A	2/17/04	1353	<2	0.56	<0.01	<0.04	<0.02	0.1	<5	<2	<2
VI-A replicate	2/17/04	1358	<2	.56	<.01	<.04	<.02	<.1	<5	<2	<2
VI-B	2/17/04	1312	<2	.62	<.01	<.04	<.02	.1	<5	<2	<2
VI-B replicate	2/17/04	1317	<2	.61	<.01	<.04	<.02	.1	<5	<2	<2
VI-GW	2/17/04	1142	<2	11.97	<.01	<.04	<.02	<.1	<5	<2	<2
VI-GW replicate	2/17/04	1147	<2	12.03	<.01	<.04	<.02	<.1	<5	<2	<2
VI-spring	2/17/04	1223	<2	1.28	<.01	<.04	<.02	<.1	<5	<2	<2
VI-spring replicate	2/17/04	1228	<2	1.08	<.01	<.04	<.02	<.1	<5	<2	<2
V-A	2/19/04	1228	<2	2.5	<.01	<.04	.02	<.1	<5	<2	<2
V-A replicate	2/19/04	1233	<2	2.35	<.01	<.04	.02	.1	<5	<2	<2
V-B	2/19/04	1258	<2	2.53	<.01	<.04	.02	.3	<5	<2	<2
V-B replicate	2/19/04	1303	<2	2.32	<.01	<.04	.02	.1	<5	<2	<2
V-GW-new	2/19/04	1102	<2	6.72	.06	<.04	<.02	<.1	<5	<2	<2
V-GW-new replicate	2/19/04	1107	<2	6.75	.06	<.04	<.02	.1	<5	<2	<2
V-GW-house	2/19/04	1202	<2	10.02	.26	.12	<.02	<.1	<5	<2	<2
V-GW-house replicate	2/19/04	1207	<2	10.01	.26	.12	<.02	<.1	<5	<2	<2
V-GW-silo	2/19/04	1134	<2	12.21	<.01	<.04	<.02	<.1	<5	<2	<2
V-GW-silo replicate	2/19/04	1139	<2	12.26	<.01	<.04	<.02	<.1	<5	<2	<2