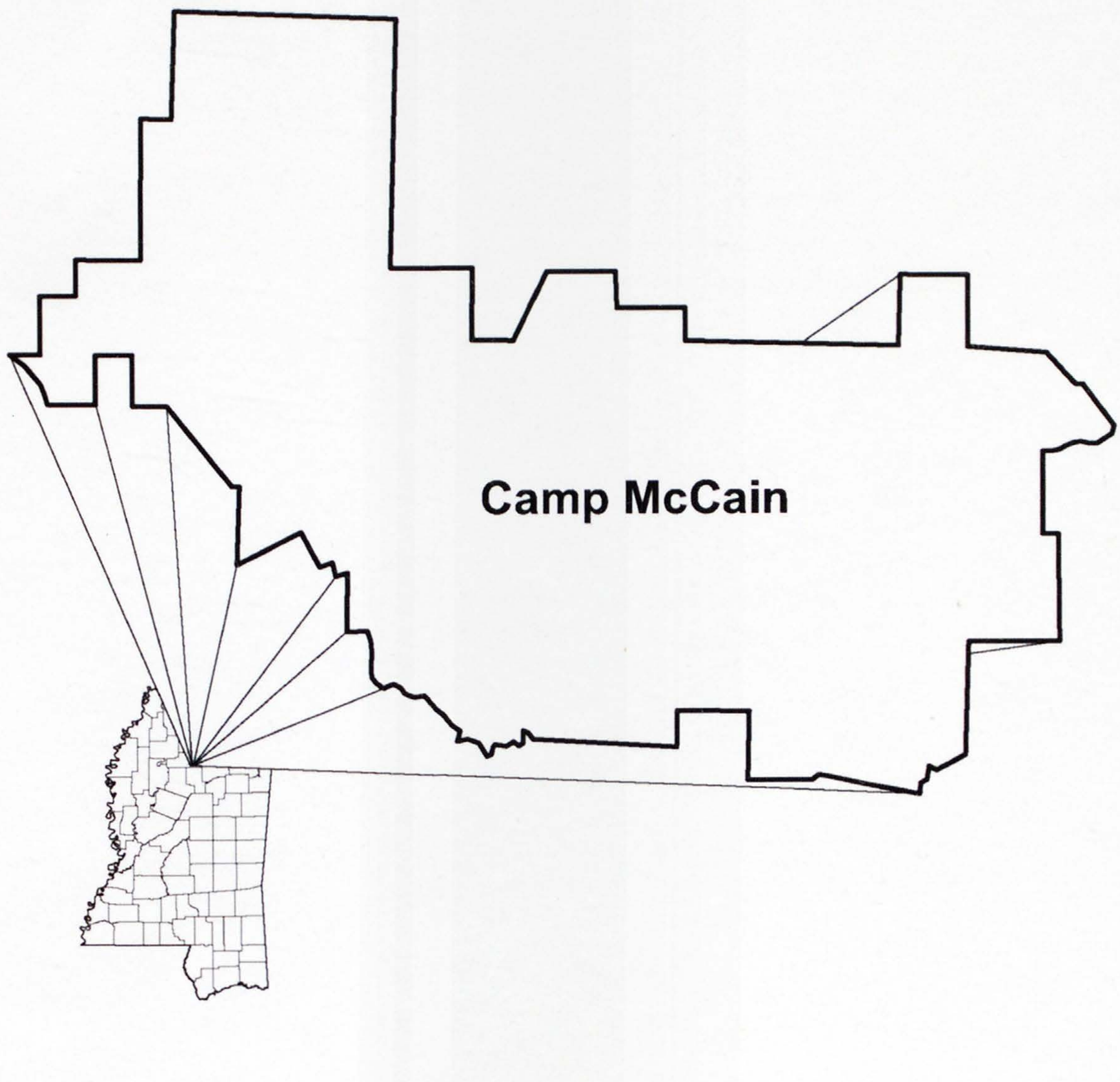
Quality of Water in the Unsaturated Zone at Camp McCain, Mississippi–2002-2004



Scientific Investigations Report 2004-5279

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

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By Larry J. Slack, Robert E. Lemire, and June E. Mirecki

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CONVERSION FACTORS, ABBREVIATIONS, AND ACRONYMS

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
gallon (gal)	3.785	liter (L)
gallon (gal)	3,785	milliliter (mL)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
bar	100	kilopascal (kPa)
micron	0.000001	meter (m)
inch per second (in/s)	2.54	centimeter per second (cm/s)

Chemical concentrations and water temperature are given only in metric units. Chemical concentration in water is given in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the solute mass (milligrams) per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million. Specific conductance is given in microsiemens per centimeter (µS/cm) at 25 degrees Celsius (° C).

CMLS	Camp McCain lysimeter site
CSLS	Camp Shelby lysimeter site
CSTS	Camp Shelby Training Site
DOD	Department of Defense
DP	Drive point (well)
FP	Firing point
LVUSWS	Large Volume Ultra Soil Water Sampler
MCAWW	Methods for Chemical Analysis of Water and Wastes
MCL	Maximum contaminant level
MDL	Method detection limit
MLRS	Multiple Launch Rocket System
MMD	Mississippi Military Department
MPF	Mortar firing point
MSARNG	Mississippi Army National Guard
NFM	National Field Manual
OP	Observation point
QALS	Quality-assurance/quality-control lysimeter site
RL	Reporting or quantification limit
STL	Severn Trent Laboratories, Inc.
STT	South tank trail
SVOC	Semi-volatile organic compound
USA-ERDC	U.S. Army Engineer Research and Development Center
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile organic compound

Quality of Water in the Unsaturated Zone at Camp McCain, Mississippi—2002-2004

By Larry J. Slack[1], Robert A. Lemire[2], and June E. Mirecki[3]

ABSTRACT

During 2002-2004, the U.S. Geological Survey collected water samples from lysimeters to determine the quality of water in the unsaturated zone at Camp McCain near Grenada in north-central Mississippi. The quality of water from the unsaturated zone at Camp McCain was generally good. The specific conductance of lab samples of water from the unsaturated zone varied greatly, ranging from 200 to 3,900 microsiemens per centimeter at 25 degrees Celsius. The pH was near neutral and typical of shallow ground water in the area, ranging from 6.1 to 7.9. Median concentrations of fluoride, potassium, sodium, and sulfate in water from the unsaturated zone at Camp McCain (0.45, 1.5, 245, and 185 milligrams per liter, respectively) were higher than median concentrations in water from background samples. Nutrient concentrations were low. Ammonia concentrations ranged from less than the detection limit to 0.28 milligrams per liter as N; nitrate plus nitrite, 0.021 to 6.9 milligrams per liter as N. All orthophosphate concentrations were less than the reporting limit.

Most trace-element concentrations in water from the unsaturated zone were low. Median concentrations of barium, beryllium, cadmium, cobalt, iron, lead, manganese, nickel, silver, and zinc (24, <0.01, <0.01, 0.29, <0.01, <0.01, 19, 5.0, <0.01, and 5.4 micrograms per liter, respectively) were less than or equal to median concentrations in background samples. Median concentrations of aluminum, antimony, arsenic, chromium, copper, molybdenum, selenium, thallium, tin, and vanadium (54, 1.0, 1.3, 2.1, 1.9, 6.5, 2.7, 0.016, 0.13, and 14 micrograms per liter, respectively) were higher than median concentrations in background samples.

No volatile organic compound and only one semi-volatile organic compound, bis(2-ethylhexl) phthalate, was detected at or above the reporting limit in water from the unsaturated zone. No explosives were detected at or above the method detection limit.

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INTRODUCTION

The Mississippi Military Department (MMD) continues to assume a strong leadership role in environmental and natural-resource stewardship in order to attain a balance between the environmental impacts, public and agency concerns, and the ability of the Mississippi Army National Guard (MSARNG) to meet their training mission readiness requirements (National Guard Mississippi, 2003; U.S. Army Center for Health Promotion and Preventive Medicine, 1999). Beginning with two major studies conducted in the early 1940's by Brown and Adams (1943) and Brown (1944), the MSARNG has funded and participated in numerous intensive hydrologic and environmental studies at Camp McCain and Camp Shelby, Mississippi (fig. 1). Since 1942, when Camp McCain was opened as a major training facility on a 42,000-acre site, it has kept its commitment to be "not the largest, but the best." The Camp McCain Training Site (CMTS) has a base population of 100 personnel; weekend troop populations range from 700 to 1,500 personnel. The CMTS has recently been upgraded to a Maneuver Training Center Light with authorization to house up to 10,000 soldiers (Mississippi Army National Guard, 2003).

Purpose and Scope

During 2002-2004, the U.S. Geological Survey (USGS), in partnership with the MSARNG, conducted an investigation to determine the quality of water in the unsaturated (soil zone above the water table) at Camp Shelby and Camp McCain (fig. 1). This report presents the results of the Camp McCain part of that study.

This report briefly describes the sampling site selection; lysimeter properties, installation, and operation; hydrogeology of the Camp McCain study area; and sampling and water-quality analyses at the CMTS. This information is integrated with data from a collaborative study of energetics transport and fate through the vadose zone (aeration zone within the unsaturated zone) near the central impact area at Camp Shelby (Mirecki, 2004; Slack, Mirecki, and Lemire, 2004). These studies will help the MSARNG develop a better understanding

Figure 1. Location of unsaturated-zone studies in Mississippi.

of the processes that affect transport, transformation, and fate of contaminants in the unsaturated zone. The studies will also help the MSARNG estimate the potential for future contamination of shallow ground water in adjacent areas; develop reasonable mitigation measures to reduce environmental impact; and help ensure the continued, uninterrupted training activities at Camp McCain and Camp Shelby.

Previous Investigations

Notable studies conducted near Camp McCain since the study by Brown and Adams (1943) are listed below. Selected Camp Shelby area reports and other pertinent reports are included that present information applicable to the Camp McCain area. These reports are as follows: "Final Environmental Impact Statement for Proposed Facilities at Camp Shelby," published by the Mississippi Military Department, National Guard Bureau (1990); "Final Environmental Impact Statement for Military Training Use of National Forest Lands at Camp Shelby, Mississippi," by the U.S. Department of Agriculture (1994); "Water Quality Investigations, Camp Shelby and Camp McCain, 1992-1998," by Pessoney and others (1998); "Training Range Site Characterization and Risk Screening, Camp Shelby, Mississippi, 7-23 September 1999," by the U.S. Army Center for Health Promotion and Preventive Medicine (1999); "Monitoring the Quality of Water in the Unsaturated Zone at Camp Shelby and Camp McCain, Mississippi," by Slack and Lemire (2003); "Final Environmental Assessment: Proposed Construction and Operation of a Wastewater Treatment Plant, Camp McCain Training Site, Mississippi," by the Mississippi Army National Guard (2003); "Quality of Water in the Unsaturated Zone at Camp Shelby, Mississippi," by Slack, Neely, Murphy, and Lemire (2004); and "Quality of Water in the Unsaturated Zone at Camp Shelby, Mississippi—2002-2004," by Slack, Mirecki, and Lemire (2004).

For more information on the Department of Defense sustainable range management and environmental restoration programs, the reader is referred to the agency's 2001 and 2002 annual reports (Department of Defense, 2001, 2003).

Site Selection

The principal criteria for site selection at Camp McCain were that the proposed site be located outside any areas deemed unsafe to the personnel installing the lysimeters or wells and collecting water samples, but near enough to the impact area to detect any shallow near-surface contamination associated with training activities. Captain Robert A. Lemire, the Natural and Cultural Resources Manager for the MSARNG, selected the initial set of lysimeter sites. In addition to using the general criteria listed above, Captain Lemire selected sites that were in areas with no known threatened or endangered species. Due to Captain Lemire being called to active service, the USGS selected tentative locations for the remaining set of lysimeter sites and submitted these locations to Mr. R. Brian Neely, Acting Natural and Cultural Resources Manager. These sites were selected to supplement the initial set of sites and more fully bracket the impact area.

The USGS installed six lysimeters (soil-water samplers) at shallow depths (3-7 feet (ft)) at selected locations at Camp McCain near Grenada, Miss., during 2002. Only lysimeters that produced sufficient water for water-quality analyses (and that have not been destroyed) are included in table 1 and figure 2. The naming convention used throughout this report for the Camp McCain lysimeter sites is CMLS, which is followed by a sequential site number, which is followed by approximate depth (in whole feet). For example, CMLS 1-3 is a lysimeter installed at site 1 to a depth of about 3 ft. Water samples, collected from two lysimeters installed for another study near Greenwood (fig. 1), in the Mississippi River Alluvial Plain near the eastern boundary of the Delta, were used for quality-control/quality-assurance purposes (to determine reference/background conditions). These two lysimeter sites are referred to as QALS 5 and QALS 11.

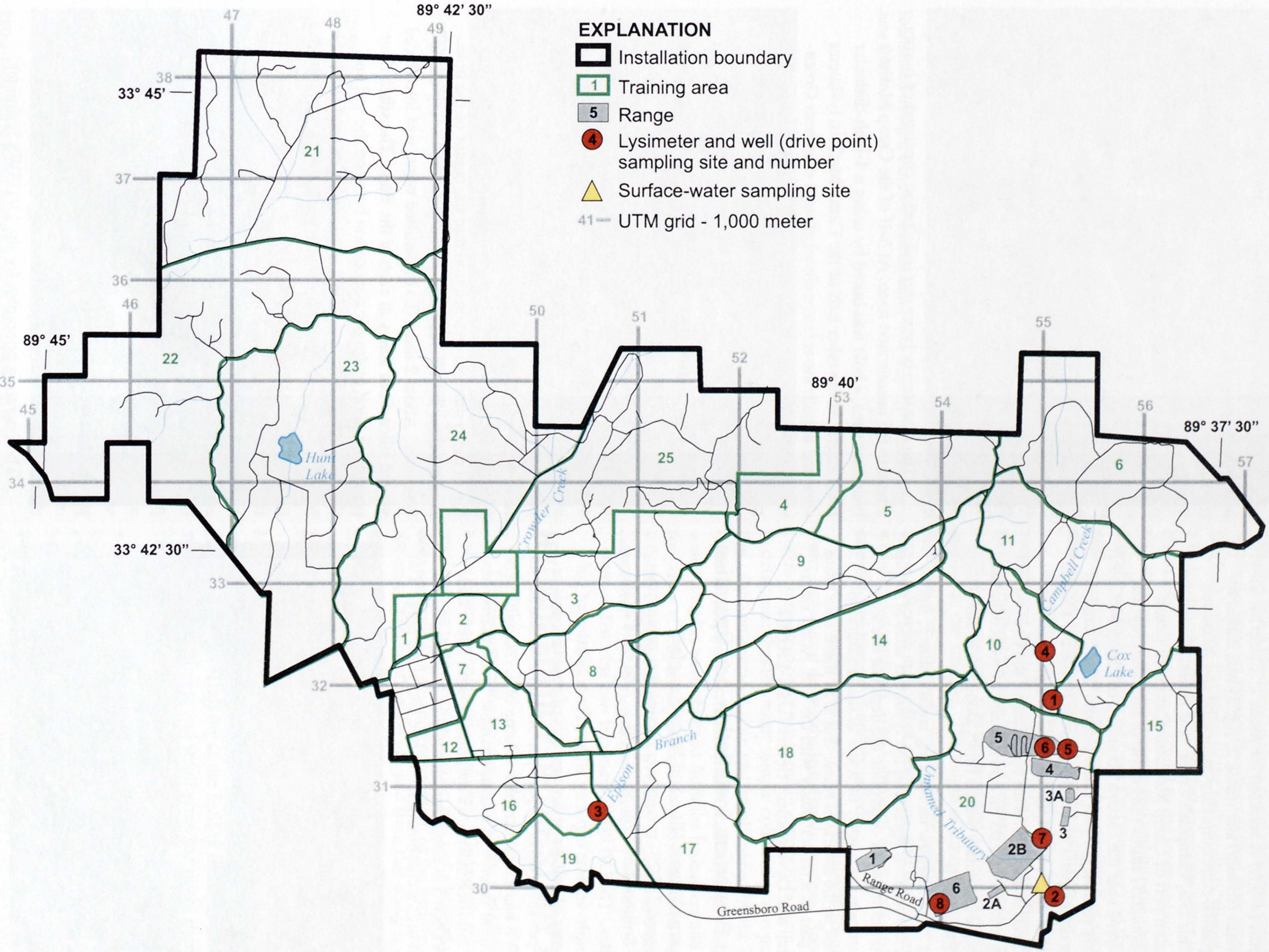


Figure 2. Location of selected sampling sites, Camp McCain, Mississippi.

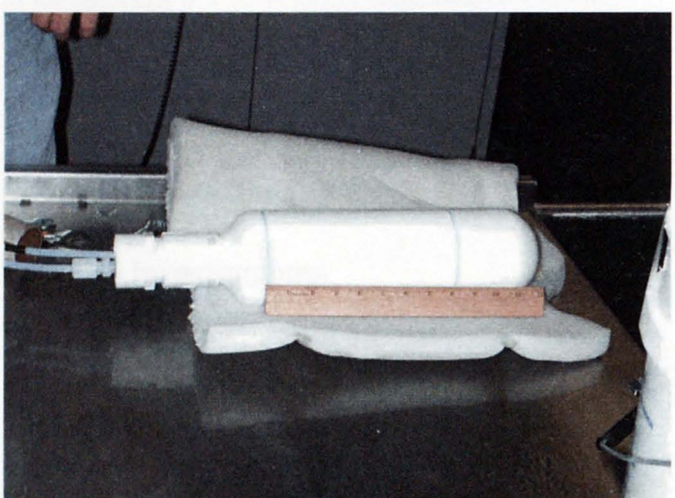
During 2003, four additional lysimeters were installed at shallow depths (4-6 ft) at selected locations at Camp McCain. A surface-water (stream) site (table 2; fig. 2) was added for additional quality-control/quality-assurance and reference purposes. This site, Campbell Creek near Elliott, drains the extreme eastern part of Camp McCain. Campbell Creek originates about 2.57 miles (mi) north of the sampling site, flows southward near the eastern boundary of Camp McCain, and ultimately discharges into Little Bogue. The Campbell Creek Basin drains parts of Training Areas 6, 10, 11, 15, and 20, and Ranges 2B, 3, 3A, 4, and 5. The sampling site on Campbell Creek is about 0.34 mi upstream of the Greensboro Rd. crossing and about 0.05 mi downstream of its confluence with an unnamed tributary which flows along the southwestern boundary of Range 2B.

During 2004, shallow monitoring wells (table 3; fig. 2) were installed at or near several of the lysimeter sites at Camp McCain in order to better determine the depth of the water table and compare the quality of water in the unsaturated zone with that in the saturated zone. Some of these sites were installed as part of a related study with the U.S. Army Engineer Research and Development Center (USA-ERDC).

Lysimeter Properties, Installation, and Operation

The "Large Volume Ultra Soil Water Sampler" (LVUSWS; model 1923) porous cup suction lysimeter, manufactured by Soilmoisture Equipment Corp., was used at all lysimeter sites. The LVUSWS lysimeter was selected because its large sample-volume capacity allows for collection of sufficient volumes of soil water for analysis of contaminants at microgram-per-liter (µg/L, or part-per-billion) concentrations. The LVUSWS has a total sampler volume of 1,730 milliliters (mL) and a total volume of retained sample in the glazed reservoir of 560 mL (Soilmoisture Equipment Corp., 1997, 2003).

The LVUSWS is composed entirely of 1 bar high-flow ceramic and uses a combination ceramic and glaze plug. The ceramic material has a high alumina content for very low adsorption characteristics, is lead-free, and has a moderate bubbling pressure (1 bar or 100 kPa). The lower one-third of the cup is glazed on the inside to retain the collected sample. The sampler has a 45 percent porosity, 2.5-micron maximum pore size, and 3.4 X 10^{-6} inch per second (in/s) maximum saturated hydraulic conductivity (Greg Hart, Soilmoisture Equipment Corp., oral commun., Jan. 7, 2004). The LVUSWS has a diameter of 4 inches and a length of about 14 inches to the top of the neck, and a total length of about 18 inches to the stainless steel or Teflon® compression fittings at the top of the stainless steel vacuum/pressure and sample recovery pipes. Two 1/4-inch outside diameter Teflon® tubes are attached to the stainless steel pipes and are used for drawing a vacuum and recovering samples.



Large Volume Ultra Soil Water Sampler. (Photograph by Larry J. Slack)

The first step in lysimeter installation consisted of boring a hole in the unsaturated zone. At half of the Camp McCain lysimeter sites, a hole was bored by using a 4-inch-diameter hand auger. At the other half of the Camp McCain lysimeter sites and at both the reference/background sites near Greenwood, Frank Adams (Geological Investigations Section, Natural Resources Conservation Service) drilled the hole using a rotary drilling rig with a 4 ½-inch-diameter auger. The hole was advanced incrementally by rotating the auger into the material; to minimize disturbance of the soil, the material surrounding the auger flight was withdrawn and sampled.

The remaining steps in lysimeter installation were similar at all sites. Bentonite (aluminum silicate clay with a high swelling capacity) chips or pellets were used to backfill the hole to the desired depth to isolate the LVUSWS from the soil below. About 2 inches of silica flour was placed on top of the bentonite. A lysimeter (suspended with a 1 ½ -inch-diameter polyvinyl chloride (PVC) pipe attached to an adapter at the top of the lysimeter) was inserted into the center of the hole. A silica-flour slurry was poured around and to the top of the lysimeter. About 2 liters (L) of distilled water was introduced via the silica-flour slurry at each of the sites. The silica flour provides a good hydraulic connection between the soil and the LVUSWS. Bentonite chips or pellets were used to fill the hole from the top of the lysimeter to land surface. The PVC pipe, serving as conduit for the Teflon® lines, terminates a few feet above land surface. Neoprene tubing was attached to the ends of the Teflon® tubes. Clamping rings are used to pinch off the neoprene tubing to maintain the vacuum drawn on the LVUSWS. A bell coupling is attached to the top of the PVC pipe to hold the excess tubing. At the top of the assembly, a PVC plug is screwed into the bell coupling. Between sampling trips, the bell coupling and plug are covered with a plastic "freezer" bag to minimize opportunities for air-blown contaminants reaching the neoprene tubing or traveling down the inside of the assembly and reaching the LVUSWS.

The operating principles for the LVUSWS lysimeter basically are the same as for any other porous cup suction

Technician using a 4-inch-diameter sand-type auger. (Photograph by June E. Mirecki)

Geologist using a rotary drilling rig. (Photograph by Larry J. Slack)

Silica-flour slurry being poured around and to the top of a lysimeter. (Photograph by Larry J. Slack)

lysimeter. The LVUSWS removes water from the soil by creating (via a pressure/vacuum pump) negative pressure inside the sampler greater than the negative pore pressure (soil suction) holding the water in the soil capillary spaces. Thus, a hydraulic gradient is created that causes the water to flow (from the less negative potential to the more negative potential) through the porous ceramic cup and into the sampler. Sample water is recovered from the lysimeter (via the pressure port of a pressure/vacuum pump) by creating a positive pressure on the sample, forcing it out the discharge tube.

Sampling procedures consisted of the following: A vacuum was applied to the LVUSWS. After sufficient time had passed to allow for an adequate volume of water to enter the sampler, the vacuum was released and a positive pressure was applied to the sampler. The length of time required between applying a vacuum and evacuating the sampler varied from site to site with antecedent conditions, and was determined on a trial-and-error basis. The volume of water collected from the sampler was measured and recorded.

The lysimeters were purged periodically to remove all water introduced during the installation process. Specific conductance and other water-quality properties were measured to determine that the water sample collected was representative of the unsaturated zone and uninfluenced by the installation of the lysimeters. After installation water was purged, water samples were obtained from the lysimeters and analyzed for physical properties, major ions, nutrients, trace elements, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and explosives.

HYDROGEOLOGY OF THE STUDY AREA

Delineation of the hydrogeology of the CMTS has been a significant part of previous studies. This report presents the results of an ongoing investigation that has a limited scope and does not present a detailed description of the hydrogeology of the area. The information gleaned from this study is meant to complement the information from other studies. Thus, the following discussion of the hydrogeology of the study area is meant as an overview, and largely is based on the information from other studies.

Camp McCain, at Elliott (near Grenada, in north-central Mississippi), is a Mississippi National Guard training site that covers 12,887 acres, including 185 acres of wetlands and 93 mi of streams. Training at the facility includes tank maneuvers, artillery training, and small arms and pistol training for National Guard troops.

One of the earliest studies of the geology and ground-water resources of the Camp McCain area was published by Brown and Adams (1943). Brown and Adams described Camp McCain as being "located in the north-central hills of Mississippi, where drainage is well developed and the long-term erosion cycle is advanced.... [Camp McCain] is built on a rather broad plain composed of at least two terraces of [Batupan Bogue] and its tributaries" (p. 11).

Brown and Adams (1943; pl. 1) described the surface geology in the vicinity of the lysimeter sites at Camp McCain as "cross-bedded and massive sand [with] thin beds of clay shale [in the] Meridian Sand member of the Tallahatta Formation." The Meridian Sand underlies the CMTS area; it is found from the surface to depths of 280 ft and ranges in thickness from about 8 to 230 ft. In many parts of the State, including Grenada County, the Meridian Sand directly overlies the uppermost sand of the Wilcox Group; the composite unit, the Meridian-upper Wilcox aquifer, is a major aquifer in the State (Newcome and Bettandorff, 1973).

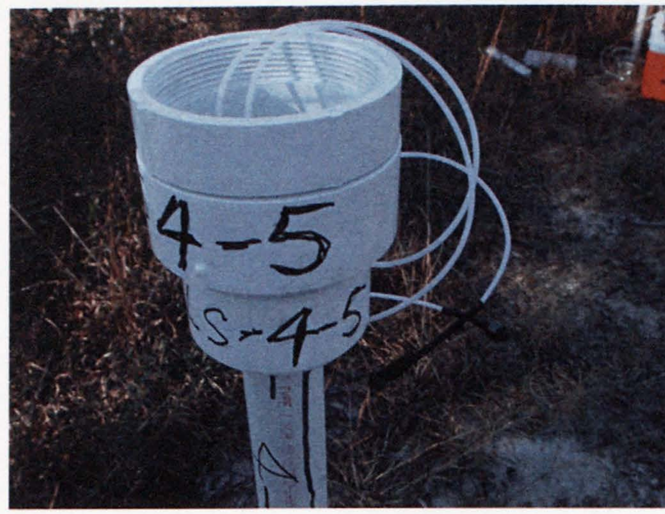
Soil information gathered during installation of lysimeters and shallow monitoring wells is consistent with that previously reported. Soils typically are made up of sand, sandy loam, and clay with low total organic carbon content (table 4). Soils typically have a light tan to reddish color, although some soils contain small amounts of black or brown organic material. Most of the soils at the lysimeter and monitoring well sites are well drained.

CAMP MCCAIN SAMPLING AND WATER-QUALITY RESULTS

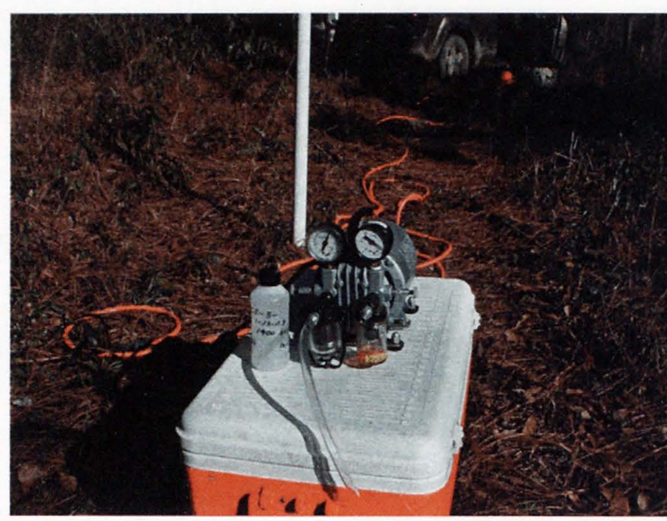
During 2002-2004, water-quality samples were collected from eight lysimeters and eight shallow monitoring wells at Camp McCain (tables 1, 3; fig. 2). Results of water-quality sampling are discussed in the following order: physical properties, major ions, nutrients, trace elements, VOCs, SVOCs, and explosives. All laboratory analyses were performed by Severn Trent Laboratories, Inc. (STL) in Arvada, Colo. Complete copies of the analytical reports furnished by STL are available at the USGS Mississippi District office. The STL analytical reports present executive summaries—detection highlights, methods summaries, method/analyst summaries, lot sample summaries, analytical results, quality control data association summaries, quality control sample results, and chain-of-custody information.

Physical Properties

The physical properties of water measured during this study are specific conductance and pH. District personnel used standard USGS techniques in making field determinations ("National Field Manual for the Collection of Water-Quality Data" (NFM), USGS Techniques of Water-Resources Investigations Book 9; Wilde, Radtke, Gibs, and Iwatsubo, 1998). The analytical method used by STL was MCAWW ("Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, 1979, EPA-600/4-79-020, March 1983 and subsequent revisions) 150.1 for pH and MCAWW 120.1 for specific conductance.



PVC lysimeter-tubing conduit, bell for housing excess tubing above land surface, and Teflon® pressure and recovery lines terminated in neoprene tubing. (Photograph by Larry J. Slack)



Vacuum pump. (Photograph by Larry J. Slack)

During 2002-2004, specific conductance and pH were measured in water samples from eight lysimeters and eight shallow monitoring wells at Camp McCain. Although each lysimeter and shallow monitoring well was evacuated several times prior to collection of water-quality samples, specific conductance values varied extensively. The specific conductance of water samples collected from the lysimeters at Camp McCain during 2002-2003 and analyzed by STL ranged from 200 to 3,900 microsiemens per centimeter (µS/cm) at 25 degrees Celsius (°C), with a median of 975 µS/cm (table 5). In contrast, the specific conductance of water collected from the lysimeters during June 2004 was much lower and ranged from 161 to 1,990 µS/cm, with a median of 455 µS/cm (table 6). The specific conductance of water collected from shallow monitoring wells during June 2004 ranged from 135 to 2,720 µS/cm, with a median of 279 µS/cm (table 7).

The variation in pH was much less than the variation in specific conductance. The pH of water samples collected from the lysimeters during 2002-2003 and analyzed by STL ranged from 6.1 to 7.9, with a median of 7.0 (table 5). In comparison, the pH of water collected from the lysimeters during June 2004 ranged from 5.6 to 8.1, with a median of 6.7 (table 6). Similarly, the pH of water collected from shallow monitoring wells during June 2004 ranged from 6.0 to 10.4, with a median of 6.4 (table 7).

Major Ions

The major ions analyzed in water collected during this study are calcium, chloride, fluoride, potassium, sodium, and sulfate. The analytical method for calcium, potassium, and sodium was SW846 ("Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, U.S. Environmental Protection Agency, 1986, and its updates) 6010B. The analytical method for chloride, fluoride, and sulfate was MCAWW 300.0A.

During 2002-2003, concentrations of several major ions from lysimeters at Camp McCain were high (compared to concentrations in reference/background samples) (tables 5, 8). Calcium concentrations ranged from 1.0 to 22 mg/L. Chloride concentrations ranged from 1.6 to 590 mg/L. Fluoride concentrations ranged from 0.24 to 1.7 mg/L. Potassium concentrations ranged from 0.5 to 5.9 mg/L. Sodium concentrations ranged from 39 to 850 mg/L. Sulfate concentrations ranged from 28 to 450 mg/L. The median concentration of chloride in water from the Camp McCain lysimeters (4.8 mg/L) was less than median concentration in water from background lysimeters (23 mg/L) (table 8). Median concentrations of fluoride, potassium, sodium, and sulfate in water from the Camp McCain lysimeters (0.45, 1.5, 245, and 185 mg/L, respectively) were higher than median concentrations in water from background lysimeters (0.39, 1.3, 85, and 96 mg/L, respectively).

Nutrients

The principal nutrients (elements or compounds essential for animal and plant growth) analyzed in water collected during this study are ammonia, nitrate plus nitrite, orthophosphate, total Kjeldahl nitrogen (ammonia plus organic nitrogen), and total phosphorus. The analytical method for ammonia was MCAWW 350.1; for nitrate plus nitrite, MCAWW 353.2; for orthophosphate, MCAWW 300.0A; for total Kjeldahl nitrogen, MCAWW 351.2; and for total phosphorus, MCAWW 365.3.

During 2002-2003, nutrient concentrations were low in samples from lysimeters at Camp McCain (table 5). Ammonia concentrations ranged from less than the detection limit to 0.28 mg/L as N. Nitrate plus nitrite concentrations ranged from 0.021 to 6.9 mg/L as N. Only one orthophosphate concentration was higher than the detection limit, and it was less than the reporting or quantification limit (RL). Total Kjeldahl nitrogen concentrations ranged from less than the detection limit to 1.4 mg/L. Total phosphorus concentrations ranged from less than the detection limit to 0.56 mg/L. The median concentration of nitrate plus nitrite in water from the Camp McCain lysimeters (0.14 mg/L) was much less than median concentration in background water from lysimeters (0.67 mg/L) (table 8). However, median concentrations of ammonia and total Kjeldahl nitrogen in water from the Camp McCain lysimeters (0.064 and 0.24 mg/L, respectively), although low, were higher than median concentrations in background water from lysimeters (0.048 and less than 0.01 mg/L, respectively) (table 8).

Trace Elements

Trace elements in water collected during this study were analyzed by two principal methods. Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, thallium, tin, vanadium, and zinc were analyzed by method SW846 6020 (inductively coupled plasma-mass spectrometry). Aluminum and iron were analyzed by method SW846 6010B (inductively coupled plasma-atomic emission spectroscopy).

During 2002-2003, concentrations of most trace elements were low in samples from lysimeters at Camp McCain (table 5). Median concentrations of barium, beryllium, cadmium, cobalt, iron, lead, manganese, nickel, silver, and zinc in water from the Camp McCain lysimeters (24, <0.01, <0.01, 0.29, <0.01, <0.01, 19, 5.0, <0.01, and 5.4 µg/L, respectively) were less than or equal to median concentrations in samples from the two background lysimeters (60, <0.01, 0.02, 0.87, <0.01, <0.01, 42, 19, 0.070, and 7.8 µg/L, respectively) (table 8). Median concentrations of aluminum, antimony, arsenic, chromium, copper, molybdenum, selenium, thallium, tin, and vanadium in water from the Camp McCain lysimeters (54, 1.0, 1.3, 2.1, 1.9, 6.5, 2.7, 0.016, 0.13, and 14 µg/L, respectively) were greater than median concentrations in samples from the two background lysimeters (34, 0.25, 0.51, 1.2, 0.89, 1.8, 0.88, <0.01, <0.01, and 12 µg/L, respectively) (table 8).

Volatile Organic Compounds

During July 2002, water samples for VOC analysis were collected from CMLS 1-3, CMLS 2-7, CMLS 3-4, and CMLS 4-3 at the CMTS. The analytical method was SW846 8260B (gas chromatography/mass spectroscopy). Analytes are listed in table 9. Few of the constituents were detected at or above the stated MDLs, and none were at or above the RL (table 10). The acetic acid, 2-ethylhexyl este concentration exceeded the MDL in two samples, but both concentrations were less than that at QALS 11 (a reference/background sample). Similarly, the methylene chloride concentration exceeded the MDL in two samples, but both concentrations were less than concentrations at QALS 5 and QALS 11 (reference/background samples). The toluene concentration (0.28µg/L) exceeded the MDL (0.26µg/L) in one sample, but barely. Three unknown VOCs were reported as tentatively identified compounds in samples from CMLS 1-3. Tetrahydrofuran was reported as a tentatively identified compound in all lysimeter samples, including the reference/background samples. It should be noted that tetrahydrofuran was not part of the target compound list and all concentrations were less than the RL. The trace amounts of tetrahydrofuran are believed to be contamination caused by the glue used in installing the lysimeters.

During August 2003, water samples for VOC analysis were collected from CMLS 5-4, CMLS 6-5, CMLS 7-6, CMLS 8-4, and at Campbell Creek. The analytes were the same as those selected during 2002. Few of the constituents were detected at or above the stated MDLs and none were at or above the RL (table 10). The acetone concentration (3.1 µg/L) exceeded the MDL at CMLS 8-4, but the concentration was less than the concentration in the stream sample (Campbell Creek, 5.2 µg/L). The toluene concentration was estimated to be 0.20 µg/L at CMLS 6-5, and 0.21 µg/L in Campbell Creek. As in the previous year, tetrahydrofuran was reported as a tentatively identified compound in all lysimeter samples, but was not detected in the surface-water sample—further indicating that tetrahydrofuran was likely a contaminant associated with the glue used in installing the lysimeters.

Semi-Volatile Organic Compounds

During July 2002, water samples for SVOC analysis were collected from CMLS 1-3, CMLS 2-7, CMLS 3-4, and CMLS 4-3 at the CMTS. The analytical method was SW846 8270C. Analytes are listed in table 11. Most of the target SVOCs were not detected in any of the samples. Few of the constituents were detected with concentrations at or above the stated MDLs. All concentrations were less than the RL (table 12). Unknown SVOCs were reported as tentatively identified compounds in samples from all lysimeter sites. The 1,1,2-trichloro-1-propene concentrations were estimated to be 23 µg/L at CMLS 4-3 and 24 µg/L at QALS 11 (the background/reference site), respectively.

During August 2003, water samples for SVOC analysis were collected from CMLS 5-4, CMLS 6-5, CMLS 7-6, CMLS 8-4, and Campbell Creek. The analytes were the same as those selected during 2002 (table 11). Most of the target SVOCs were not detected in any of the samples. A few of the SVOCs were detected with concentrations at or above the stated MDLs. Except for bis(2-ethylhexl) phthalate (22 µg/L at CMLS 7-6), all concentrations were less than the RL (table 12). Unknown SVOCs were reported as tentatively identified compounds in all the lysimeter samples and the Campbell Creek sample. As noted by the U.S. Environmental Protection Agency (2004), "The presence of contaminants does not necessarily indicate that water poses a health risk."

Explosives

During July 2002, water samples for explosives analyses were collected from CMLS 1-3, CMLS 2-7, CMLS 3-4, and CMLS 4-3 at the CMTS. The analytical method was SW846 8330 (high performance liquid chromatography). The analytes included the following: 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene 1,3-dinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, HMX, nitrobenzene, nitroglycerin, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, PETN, RDX, tetryl, 1,3,5-trinitrobenzene, and 2,4,6-trinitrotoluene. None of the constituents were detected at or above the stated MDLs.

During August 2003, water samples for explosives analyses were collected from CMLS 5-4, CMLS 6-5, CMLS 7-6, CMLS 8-4, and Campbell Creek. The analytes were the same as those selected during 2002. None of the constituents in the soil-water samples or in the Campbell Creek sample were detected at or above the stated MDLs.

SUMMARY

During 2002-2004, the U.S. Geological Survey, in partnership with the Mississippi Military Department/Mississippi Army National Guard and the U.S. Army Engineer Research and Development Center, conducted an investigation to determine the quality of water in the unsaturated zone at Camp McCain near Grenada in north-central Mississippi. The USGS and the USA-ERDC installed large volume, porous cup suction lysimeters (soil-water samplers) at shallow depths at selected locations at Camp McCain. Lysimeters installed for another study near Greenwood and a surface-water site were used for quality-control/quality-assurance purposes (to determine reference/background conditions). Shallow monitoring wells were installed at several of the lysimeter sites in order to better determine the depth of the water table and to compare the quality of water in the unsaturated zone with that from the saturated zone. Sites were located outside areas deemed unsafe, but near enough to the impact area to detect any shallow near-surface contamination associated with training activities. All laboratory analyses were performed by Severn Trent Laboratories, Inc. in Arvada, Colo.

The quality of water from the unsaturated zone at Camp McCain generally was good. The specific conductance of lab samples of water from the unsaturated zone varied greatly, ranging from 200 to 3,900 µS/cm. The pH was near neutral and typical of shallow ground water in the area, ranging from 6.1 to 7.9. Major ion concentrations were high (compared to reference samples). Calcium ranged from 1.0 to 22 mg/L; chloride, 1.6 to 590 mg/L; fluoride, 0.24 to 1.7 mg/L; potassium, 0.5 to 5.9 mg/L; sodium, 39 to 850 mg/L; and sulfate, 28 to 450 mg/L. Median concentrations of fluoride, potassium, sodium, and sulfate in water from the Camp McCain lysimeters (0.45, 1.5, 245, and 185 mg/L, respectively) were higher than median concentrations in water from background lysimeters. Nutrient concentrations were low. Ammonia concentrations ranged from less than the detection limit to 0.28 mg/L as N; nitrate plus nitrite, 0.021 to 6.9 mg/L as N. All orthophosphate concentrations were less than the reporting limit. Total Kjeldahl nitrogen concentrations ranged from less than the detection limit to 1.4 mg/L; and total phosphorus, less than the detection limit to 0.56 mg/L.

Most trace-element concentrations were low. Median concentrations of barium, beryllium, cadmium, cobalt, iron, lead, manganese, nickel, silver, and zinc in water from the Camp McCain lysimeters (24, <0.01, <0.01, 0.29, <0.01, <0.01, 19, 5.0, <0.01, and 5.4 µg/L, respectively) were less than or equal to median concentrations in samples from the two background lysimeters. Median concentrations of aluminum, antimony, arsenic, chromium, copper, molybdenum, selenium, thallium, tin, and vanadium in water from the Camp McCain lysimeters (54, 1.0, 1.3, 2.1, 1.9, 6.5, 2.7, 0.016, 0.13, and 14 µg/L, respectively) were greater than median concentrations in samples from the two background lysimeters.

Few of the VOCs were detected at or above the stated MDLs and none were at or above the RL. A few of the SVOCs were detected with concentrations at or above the stated MDLs; except for bis(2-ethylhexl) phthalate (22 µg/L at CMLS 7-6), all concentrations were less than the RL. No explosives were detected at or above the stated MDLs.

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REFERENCES

Brown, G.F., 1944, Geology and ground-water resources of the Camp Shelby area: Mississippi State Geological Survey Bulletin 58, 72 p.

Brown, G.F., and Adams, R.W., 1943, Geology and ground-water supply at Camp McCain: Mississippi State Geological Survey Bulletin 55, 116 p.

Department of Defense, 2001. Annual report to Congress, 2001, Environmental quality program: Sustainable range management. Accessed on 12 June 2003 at *https://www.denix.osd.mil/denix/Public/News/OSD/EQ01/eqarc01_Sus-Range.pdf.*

Department of Defense, 2003. Annual Report to Congress, 2002, Defense Environmental Restoration Program: Army Restoration Status and Progress. Accessed on 12 June 2003 at *http://63.88.245.60/derparc_fy02/derp/FY02_Army.pdf*

Mirecki, J.E., 2004, Toward a sustainable range: Assessment of source, transport, and fate of munitions constituents on active army training ranges: Presentation at USGS Department of Defense Environmental Program Conference, May 3-7, 2004, Biloxi, MS, accessed July 1, 2004 at *http://dodesp.er.usgs.gov/events_conferences/presentations_biloxi2004.html.*

Mississippi Army National Guard, 2003, Final environmental assessment: Proposed construction and operation of a wastewater treatment plant, Camp McCain Training Site, Mississippi: accessed March 1, 2004, at *www.ngms.state.ms.us/cfmo/wwtp_cmts_6jan04.pdf*

Mississippi Military Department, National Guard Bureau, 1990, Final Environmental Impact Statement for Proposed Facilities at Camp Shelby, prepared by Weatherford and McDade, Ltd.

National Guard Mississippi, 2003. Camp Shelby, Mississippi: The Nation's most versatile training site. Accessed 12 June 2003 at *http://www.ngms.state.ms.us/campshelby/CSTS/DPTM/dptm.htm*

Newcome, Roy, Jr., and Bettandorff, J.M., 1973, Water for industrial development in Calhoun, Chickasaw, Choctaw, Grenada, Montgomery, Webster, and Yalobusha Counties, Mississippi: Mississippi Research and Development Center, 64 p.

Pessoney, G.F., and others, 1998, Water quality investigations, Camp Shelby and Camp McCain, 1992 – 1998: University of Southern Mississippi, Department of Biological Sciences, Hattiesburg, Mississippi.

Slack, L.J., and Lemire, R.A., 2003, Monitoring the quality of water in the unsaturated zone at Camp Shelby and Camp McCain, Mississippi [abs.], *in* Wilson, P.A., Abstracts with Programs, Thirty-third Annual Mississippi Water Resources Conference, Raymond, MS, April 23-24, 2003: Mississippi State, MS, Mississippi Water Resources Research Institute.

Slack, L.J., Mirecki, J.E., and Lemire, R.A., 2004, Quality of water in the unsaturated zone at Camp Shelby, Mississippi—2002-2004: U.S. Geological Survey Scientific Investigations Report 2004-5278, 42 p.

Slack, L.J., Neely, R.B., Murphy, L.O., and Lemire, R.A., 2004, Quality of water in the unsaturated zone at Camp Shelby, Mississippi: Presentation at USGS Department of Defense Environmental Program Conference, May 3-7, 2004, Biloxi, MS, accessed July 1, 2004 at *http://dodesp.er.usgs.gov/events_conferences/presentations_biloxi2004.html.*

Soilmoisture Equipment Corp., 1997, Operating instructions, 1920F1/1920F1K1 Pressure-Vacuum Soil Water Samplers: Soilmoisture Equipment Corp., Santa Barbara, CA.

Soilmoisture Equipment Corp., 2003, Ultra samplers, accessed January 7, 2004, at *http://www.soilmoisture.com/PDF%20Files/ultrasamplers.pdf*

U.S. Army Center for Health Promotion and Preventive Medicine, 1999, Training range site characterization and risk screening, Camp Shelby, Mississippi, 7-23 September 1999: Geohydrologic Study No. 38-EH-8879-99, 301 p.

U.S. Department of Agriculture, 1994, Final environmental impact statement for military training use of National Forest lands at Camp Shelby, Mississippi: Forest Service, Southern Region, Mississippi.

U.S. Environmental Protection Agency, 1979, Methods for chemical analysis of water and wastes: EPA-600/4-79-020, March 1983 and subsequent revisions.

U.S. Environmental Protection Agency, 1986, Test methods for evaluating solid waste, physical/chemical methods: Third Edition, November 1986 and its updates.

U.S. Environmental Protection Agency, 2004, Ground water and drinking water: Drinking water contaminants: assessed Aug. 4, 2004, at *http://www.epa.gov/safewater/hfacts.html*

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at *http://pubs.water.usgs.gov/twri9A*.

Wilde, F.D., Radtke, D.B., eds., 2004 [chapter sections variously dated], Field measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, accessed July 1, 2004, at *http://pubs.water.usgs.gov/twri9A6/*

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1998, Preparations for water sampling: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, accessed July 1, 2004, at *http://pubs.water.usgs.gov/twri9A1/*

TABLES

Table 1. Site information for selected lysimeters, Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site; QALS, quality-assurance/quality-control lysimeter site used to establish reference/background conditions. Note: sites destroyed or which produced insufficient water for water-quality analyses are omitted]

Site name (fig. 2)	Date constructed	County	Latitude	Longitude	Lysimeter depth, in feet below land surface
CMLS 1-3	05/14/02	Grenada	N 33° 41' 54.1"	W 89° 38' 30.1"	3.0
CMLS 2-7	05/13/02	Grenada	N 33° 40' 51.3"	W 89° 38' 29.0"	7.0
CMLS 3-4	05/13/02	Grenada	N 33° 41' 15.0"	W 89° 41' 23.6"	4.0
CMLS 4-3	05/14/02	Grenada	N 33° 42' 06.6"	W 89° 38' 33.3"	3.0
CMLS 5-4	07/07/03	Grenada	N 33° 41' 38.3"	W 89° 38' 27.1"	4.0
CMLS 6-5	07/07/03	Grenada	N 33° 41' 38.0"	W 89° 38' 32.8"	5.1
CMLS 7-6	07/07/03	Grenada	N 33° 41' 07.8"	W 89° 38' 33.6"	6.0
CMLS 8-4	07/07/03	Grenada	N 33° 40' 47.7"	W 89° 39' 08.2"	4.0
QALS 5	04/25/02	Carroll	N 33° 32' 28.0"	W 90° 05' 02.0"	5.0
QALS 11	04/25/02	Carroll	N 33° 32' 28.0"	W 90° 05' 02.0"	11.5

Table 2. Site information for Campbell Creek sampling site, Camp McCain, Mississippi

[USGS, U.S. Geological Survey; mi, miles; mi², square miles; ft, feet]

Site name	USGS station number	Latitude	Longitude	Remarks
Campbell Creek near Elliott	07285030	N 33° 40' 53.0"	W 89° 38' 30.0"	Site is at bridge crossing of Range Rd. about 2.57 mi downstream from headwaters, 0.2 mi southeast of Range 2B, 0.05 mi downstream of unnamed tributary which flows along southwestern boundary of Range 2B, and 0.25 mi north of Grenada-Montgomery County Line. Drainage area equals 2.71 mi². Low-flow sampling site is at drop structure, about 100 ft downstream of bridge.

Table 3. Site information for selected shallow monitoring wells, Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site. Each well terminates with a 3-foot drive point]

Well number (fig. 2)	Associated CMLS	Date constructed	Well depth (bottom of screen), in feet	Measuring point, in feet above land surface	Initial water level, in feet below land surface
1	1-3	04/21/04	5.2	2.00	2.36
2	2-7	04/21/04	11.7	1.35	5.92
3	3-4	04/21/04	7.0	1.04	3.18
4	4-3	04/21/04	7.2	1.81	3.87
5	5-4	04/22/04	8.6	2.59	5.51
6	6-5	04/22/04	12.0	1.18	9.08
7	7-6	04/22/04	10.0	2.54	7.81
8	8-4	04/22/04	7.4	0.25	4.91

Table 4. Drillers' logs of selected lysimeter sites and shallow monitoring wells, Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site; ft, feet]

Site name (fig. 2; tables 1, 3)	Depth, in feet	Description
CMLS 1-3	0.0-1.0	Sand-silt, wet, CL-ML, soft to firm, slightly plastic, brown with gray
	1.0-3.5	Clay, very silty, weak, wet-to-saturated, soft-to-very-soft, brown with gray
	3.5-4.5	Silt, moist, firm, very slight non plastic, gray
	4.5-7.0	Clay, very silty, slightly plastic, soft-to-firm, gray
	7.0-10.5	Clay, moist, firm, slight-to-moderately plastic, slightly sandy, brown with gray streaks to increasing gray
		[water level=3.1 ft below land surface]
CMLS 2-7	0.0-2.0	Clay, weak, soft, very silty, wet, CL-ML
	2.0-6.0	Gray silt, weak, dry, slightly clayey, ML
	6.0-7.5	Clay, soft-to-firm, moist, silty and sandy-fine grain
	7.5-8.0	Sand, 35 percent fines, damp, non slightly plastic, tan with gray streaks
		[water level=7.5 ft below land surface]
CMLS 3-4	0.0-1.5	Silt, very sandy, firm, moist, brown
	1.5-3.0	Clay, very sandy, slight plasticity, moist-to-wet at 2 ft. Brown, saturated at 2.5 ft
	3.0-4.0	Sand, very silty, slightly plastic, saturated, loose, brown
	4.0-8.0	Sand, 25-30 percent fines, increased coarseness with depth, saturated, brown.
	8.0-10.5	SP-SM, coarse grained, tan
		[water level=4.0 ft below land surface]
CMLS 5-4	0.0-3.7	Silty clay, light brown
		[water level=4.4 ft below land surface]
CMLS 6-5	0.0-1.8	Silty clay, light brown
	1.8-2.65	Same, with white clay streaks
	2.65-3.10	Silt with some sand (light brown)
	3.10-3.45	Silty clay with some very fine sand
	3.45-3.75	Silty clay with some fine sand
	3.75-4.30	Sandy silt
	4.3-4.6	Same as above
	4.6-5.0	Sand with some silt (light brown)
	5.0-5.4	Same as above
CMLS 7-6	0.0-0.7	Silty loam (light brrown)
	0.7-3.65	Silty clay (brown)
	3.65-4.0	Silty clay (light brown)
	4.0-4.75	Silty clay (streaks of gray)
	4.75-5.2	Same as above, getting moist
	5.2-5.6	Gray clay with some sand
	5.6-6.5	Same as above, very moist)

Table 4. Drillers' logs of selected lysimeter sites and shallow monitoring wells, Camp McCain, Mississippi--Continued

Site name (fig. 2; tables 1, 3)	Depth, in feet	Description
CMLS 8-4	0.0-0.5	Fill
	0.5-1.1	Fill
	1.1-1.4	Silty clay (with some sand)
	1.4-1.8	Same as above (light brown to tan)
	1.8-2.1	Same as above
	2.1-2.4	Same as above
	2.4-2.85	Same as above (gray)
	2.85-4.1	Same as above
Well 1	0-0.6	Silty clay
	0.6-2.1	Silty clay
	2.1-2.9	Silty clay with fine sand
	2.9-3.3	Silty clay (wet)
		[water level=2.36 ft below land surface]
Well 2	0.0-0.45	Brown silty loam
	0.45-0.95	Light brown silty dlacy
	0.95-2.2	Light gray silty clay with brown weathered streaks
	2.2-3.3	Same as above, with some moisture
	3.3-4.0	Gray silty clay with brown mottling and no moisture
	4.0-5.5	Gray silty clay. Getting more plastic
	5.5-6.1	Gray silty clay, very small amount of sand
	6.1-7.0	Gray silty clay with fine sand, not moist
	7.0-7.5	Same as above
	7.5-8.3	Clay, with sand streaks, moist
	8.3-8.8	Sand (yellow tan), with clay, wet
	8.8-9.7	Coarse sand, hit water
		[water level=5.92 ft below land surface]
Well 3	0.0-0.5	Light brown sandy loam
	0.50-0.85	Brown sandy loam with some clay
	0.85-1.70	Same as above
	1.70-2.65	Gray sand, getting wet
	2.65-3.35	Brown sand, saturated
	3.35-3.55	Brown sand, saturated (hole collapsed)
		[water level=3.18 ft below land surface]
Well 4	0.0-0.65	Light brown loam with clay
	0.65-1.10	Gray clay with brown motteling
	1.10-2.35	Silty gray clay
	2.35-3.4	Silty gray clay
	3.4-3.8	Silty gray clay (slightly moist)
	3.8-4.1	Gray-brown silty clay
	4.1-5.9	Gray-bown silty clay, getting damp
	5.9-7.2	Sandy clay, brown
		[water level=3.87 ft below land surface]

Table 4. Drillers' logs of selected lysimeter sites and shallow monitoring wells, Camp McCain, Mississippi--Continued

Site name (fig. 2; tables 1, 3)	Depth, in feet	Description
Well 5	0.0-0.8	Silty loam
	0.8-1.2	Brown sandy loam
	1.2-4.5	Brown silty clay
	4.5-6.0	Brown silty clay with sand, wet
	6.0-7.3	Sandy, silty clay, saturated
	7.3-8.6	Sandy, silty clay, wet
		[water level=5.51 ft below land surface]
Well 6	0.0-0.70	Silty clay
	0.70-2.65	Silty clay, tan and brown
	2.65-3.40	Silty clay with sand (darker brown)
	3.40-6.30	Coarse sand with some clay (damp)
	6.30-7.30	Coarse sandy clay (brown)
	7.30-7.85	Damp red sand
	7.85-8.35	Sandy clay (red)
	8.35-9.0	Coarse sand with clay (red)
	9.0-9.4	Sandy clay (red mixed with tan)
	9.4-9.6	Coarse sand with clay
	9.6-10.6	Fine sand with silty clay, slightly moist
	10.6-11.5	Fine sand with silty clay, wet
		[water level=9.08 ft below land surface]
Well 7	0.0-0.8	Light brown silty loam
	0.8-1.65	Brown silty loam with some clay
	1.65-2.40	Light bown loam with gray clay steaks
	2.4-4.5	Gray silty clay with light brown mottling, slighly moist
	4.5-6.5	Gray silty clay with dark brown mottling, moist
	6.5-8.3	Gray clay with fine sand (very moist)
	8.3-8.7	Damp medium-to-coarse sand
	8.7-9.0	Very damp medium-to-coarse sand
	9.0-10.0	Wet (saturated)
		[water level=7.81 ft below land surface]
Well 8	0.0-0.4	Silty loam (light brown)
	0.4-0.8	Silty clay (red)
	0.8-1.6	Clay with fine sand (light red color)
	1.6-2.3	Brown clay with fine sand
	2.3-3.5	Silty gray clay, moist
	3.5-4.5	Silty light red clay, with fine sand
	4.5-6.0	Silty clay, light brown, damp
	6.0-6.7	Blue-gray clay
	6.7-7.4	Blue-gray clay
		[water level=4.91 ft below land surface]

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site; µg/L, micrograms per liter; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; 0, less than method detection limit; B, method blank contamination; J, estimated result (less than the reporting limit); L, interferences present; Q, elevated reporting limit; **bold**, median value]

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 7-6	09/03/03	Aluminum	360		µg/L	100	20
CMLS 4-3	08/01/02	Aluminum	100		µg/L	100	20
CMLS 2-7	09/03/02	Aluminum	65	J	µg/L	100	20
CMLS 6-5	09/03/03	Aluminum	60	J	µg/L	100	20
CMLS 5-4	09/03/03	Aluminum	57	J	µg/L	100	20
CMLS 4-3	09/03/02	Aluminum	55	J	µg/L	100	20
CMLS 2-7	08/01/02	Aluminum	53	J	µg/L	100	20
CMLS 1-3	09/03/02	Aluminum	37	J	µg/L	100	20
CMLS 8-4	09/03/03	Aluminum	31	J	µg/L	100	20
CMLS 1-3	08/01/02	Aluminum	29	J	µg/L	100	20
CMLS 3-4	09/09/02	Aluminum	28	B J	µg/L	100	20
CMLS 3-4	08/01/02	Aluminum	22	J	µg/L	100	20
			54				
CMLS 8-4	08/25/03	Ammonia as N	0.28		mg/L	0.1	0.038
CMLS 3-4	08/29/02	Ammonia as N	0.23		mg/L	0.1	0.015
CMLS 2-7	08/06/02	Ammonia as N	0.098	J	mg/L	0.1	0.015
CMLS 7-6	08/25/03	Ammonia as N	0.073	J	mg/L	0.1	0.038
CMLS 2-7	08/28/02	Ammonia as N	0.070	J	mg/L	0.1	0.015
CMLS 4-3	08/06/02	Ammonia as N	0.068	J	mg/L	0.1	0.015
CMLS 1-3	08/06/02	Ammonia as N	0.059	J	mg/L	0.1	0.015
CMLS 3-4	08/06/02	Ammonia as N	0.041	J	mg/L	0.1	0.015
CMLS 4-3	08/28/02	Ammonia as N	0.039	J	mg/L	0.1	0.015
CMLS 1-3	08/28/02	Ammonia as N	0.027	J	mg/L	0.1	0.015
CMLS 5-4	08/20/03	Ammonia as N	0	J	mg/L	0.1	0.038
CMLS 6-5	08/20/03	Ammonia as N	0	J	mg/L	0.1	0.038
			0.064				
CMLS 7-6	09/03/03	Antimony	6.3	B	µg/L	2	0.024
CMLS 8-4	09/03/03	Antimony	5.6	B	µg/L	2	0.024
CMLS 1-3	08/01/02	Antimony	3.6		µg/L	2	0.040
CMLS 1-3	09/03/02	Antimony	1.8	J	µg/L	2	0.040
CMLS 3-4	09/09/02	Antimony	1.4	J	µg/L	2	0.040
CMLS 3-4	08/01/02	Antimony	1.3	J	µg/L	2	0.040
CMLS 5-4	09/03/03	Antimony	0.73	B J	µg/L	2	0.024
CMLS 6-5	09/03/03	Antimony	0.44	B J	µg/L	2	0.024
CMLS 4-3	08/01/02	Antimony	0.38	J	µg/L	2	0.040
CMLS 2-7	08/01/02	Antimony	0.29	J	µg/L	2	0.040
CMLS 2-7	09/03/02	Antimony	0.24	J	µg/L	2	0.040
CMLS 4-3	09/03/02	Antimony	0.14	J	µg/L	2	0.040
			1.0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 7-6	09/03/03	Arsenic	19		µg/L	5	0.12
CMLS 8-4	09/03/03	Arsenic	11		µg/L	5	0.12
CMLS 3-4	09/09/02	Arsenic	2.9	J	µg/L	5	0.061
CMLS 1-3	08/01/02	Arsenic	2.3	J	µg/L	5	0.061
CMLS 3-4	08/01/02	Arsenic	1.9	J	µg/L	5	0.061
CMLS 2-7	09/03/02	Arsenic	1.5	J	µg/L	5	0.061
CMLS 1-3	09/03/02	Arsenic	1.0	J	µg/L	5	0.061
CMLS 2-7	08/01/02	Arsenic	0.97	J	µg/L	5	0.061
CMLS 4-3	08/01/02	Arsenic	0.89	J	µg/L	5	0.061
CMLS 6-5	09/03/03	Arsenic	0.77	J	µg/L	5	0.12
CMLS 5-4	09/03/03	Arsenic	0.54	J	µg/L	5	0.12
CMLS 4-3	09/03/02	Arsenic	0.21	J	µg/L	5	0.061
			1.3				
CMLS 5-4	09/03/03	Barium	80		µg/L	1	0.081
CMLS 6-5	09/03/03	Barium	31		µg/L	1	0.081
CMLS 4-3	09/03/02	Barium	30		µg/L	1	0.057
CMLS 8-4	09/03/03	Barium	28		µg/L	1	0.081
CMLS 2-7	08/01/02	Barium	25		µg/L	1	0.057
CMLS 2-7	09/03/02	Barium	25		µg/L	1	0.057
CMLS 1-3	09/03/02	Barium	22		µg/L	1	0.057
CMLS 3-4	09/09/02	Barium	13		µg/L	1	0.057
CMLS 1-3	08/01/02	Barium	12		µg/L	1	0.057
CMLS 4-3	08/01/02	Barium	12		µg/L	1	0.057
CMLS 7-6	09/03/03	Barium	11		µg/L	1	0.081
CMLS 3-4	08/01/02	Barium	9.3		µg/L	1	0.057
			24				
CMLS 1-3	08/01/02	Beryllium	0	J	µg/L	1	0.028
CMLS 1-3	09/03/02	Beryllium	0	J	µg/L	1	0.028
CMLS 2-7	08/01/02	Beryllium	0	J	µg/L	1	0.028
CMLS 2-7	09/03/02	Beryllium	0	J	µg/L	1	0.028
CMLS 3-4	08/01/02	Beryllium	0	J	µg/L	1	0.028
CMLS 3-4	09/09/02	Beryllium	0	J	µg/L	1	0.028
CMLS 4-3	08/01/02	Beryllium	0	J	µg/L	1	0.028
CMLS 4-3	09/03/02	Beryllium	0	J	µg/L	1	0.028
CMLS 5-4	09/03/03	Beryllium	0	J	µg/L	1	0.032
CMLS 6-5	09/03/03	Beryllium	0	J	µg/L	1	0.032
CMLS 7-6	09/03/03	Beryllium	0	J	µg/L	1	0.032
CMLS 8-4	09/03/03	Beryllium	0	J	µg/L	1	0.032
			0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 7-6	09/03/03	Cadmium	0.20	J	µg/L	1	0.051
CMLS 8-4	09/03/03	Cadmium	0.19	J	µg/L	1	0.051
CMLS 1-3	08/01/02	Cadmium	0.036	J	µg/L	1	0.022
CMLS 1-3	09/03/02	Cadmium	0	J	µg/L	1	0.022
CMLS 2-7	08/01/02	Cadmium	0	J	µg/L	1	0.022
CMLS 2-7	09/03/02	Cadmium	0	J	µg/L	1	0.022
CMLS 3-4	08/01/02	Cadmium	0	J	µg/L	1	0.022
CMLS 3-4	09/09/02	Cadmium	0	J	µg/L	1	0.022
CMLS 4-3	08/01/02	Cadmium	0	J	µg/L	1	0.022
CMLS 4-3	09/03/02	Cadmium	0	J	µg/L	1	0.022
CMLS 5-4	09/03/03	Cadmium	0	J	µg/L	1	0.051
CMLS 6-5	09/03/03	Cadmium	0	J	µg/L	1	0.051
			0				
CMLS 8-4	09/03/03	Calcium	22		mg/L	0.2	0.076
CMLS 3-4	08/01/02	Calcium	6.9		mg/L	0.2	0.031
CMLS 2-7	09/03/02	Calcium	6.7	B	mg/L	0.2	0.031
CMLS 3-4	09/09/02	Calcium	6.5		mg/L	0.2	0.031
CMLS 2-7	08/01/02	Calcium	5.7		mg/L	0.2	0.031
CMLS 1-3	09/03/02	Calcium	4.8	B	mg/L	0.2	0.031
CMLS 1-3	08/01/02	Calcium	3.4		mg/L	0.2	0.031
CMLS 4-3	09/03/02	Calcium	2.9	B	mg/L	0.2	0.031
CMLS 5-4	09/03/03	Calcium	2.8		mg/L	0.2	0.076
CMLS 7-6	09/03/03	Calcium	2.7		mg/L	0.2	0.076
CMLS 6-5	09/03/03	Calcium	1.4		mg/L	0.2	0.076
CMLS 4-3	08/01/02	Calcium	1.0		mg/L	0.2	0.031
			4.1				
CMLS 8-4	09/03/03	Chloride	590	B Q	mg/L	150	11
CMLS 7-6	09/03/03	Chloride	42	B	mg/L	3	0.22
CMLS 6-5	09/03/03	Chloride	10	B	mg/L	3	0.22
CMLS 2-7	08/06/02	Chloride	9.7		mg/L	3	0.10
CMLS 2-7	08/27/02	Chloride	8.0		mg/L	3	0.10
CMLS 5-4	09/03/03	Chloride	5.6	B	mg/L	3	0.22
CMLS 3-4	08/06/02	Chloride	4.0		mg/L	3	0.10
CMLS 4-3	08/27/02	Chloride	3.8		mg/L	3	0.10
CMLS 4-3	08/06/02	Chloride	3.6		mg/L	3	0.10
CMLS 3-4	08/27/02	Chloride	3.2		mg/L	3	0.10
CMLS 1-3	08/06/02	Chloride	2.1	J	mg/L	3	0.10
CMLS 1-3	08/27/02	Chloride	1.6	J	mg/L	3	0.10
			4.8				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 2-7	09/03/02	Chromium	3.9		µg/L	2	0.24
CMLS 3-4	09/09/02	Chromium	2.9		µg/L	2	0.24
CMLS 7-6	09/03/03	Chromium	2.9	B	µg/L	2	0.13
CMLS 2-7	08/01/02	Chromium	2.6	B	µg/L	2	0.24
CMLS 4-3	08/01/02	Chromium	2.4	B	µg/L	2	0.24
CMLS 8-4	09/03/03	Chromium	2.3	B	µg/L	2	0.13
CMLS 4-3	09/03/02	Chromium	1.8	J	µg/L	2	0.24
CMLS 3-4	08/01/02	Chromium	1.3	B J	µg/L	2	0.24
CMLS 5-4	09/03/03	Chromium	1.3	B J	µg/L	2	0.13
CMLS 6-5	09/03/03	Chromium	1.3	B J	µg/L	2	0.13
CMLS 1-3	08/01/02	Chromium	1.2	B J	µg/L	2	0.24
CMLS 1-3	09/03/02	Chromium	0.89	J	µg/L	2	0.24
			2.1				
CMLS 8-4	09/03/03	Cobalt	0.98	J	µg/L	1	0.017
CMLS 6-5	09/03/03	Cobalt	0.67	J	µg/L	1	0.017
CMLS 5-4	09/03/03	Cobalt	0.55	J	µg/L	1	0.017
CMLS 2-7	08/01/02	Cobalt	0.37	J	µg/L	1	0.015
CMLS 4-3	09/03/02	Cobalt	0.31	J	µg/L	1	0.015
CMLS 2-7	09/03/02	Cobalt	0.30	J	µg/L	1	0.015
CMLS 7-6	09/03/03	Cobalt	0.28	J	µg/L	1	0.017
CMLS 4-3	08/01/02	Cobalt	0.22	J	µg/L	1	0.015
CMLS 3-4	08/01/02	Cobalt	0.21	J	µg/L	1	0.015
CMLS 3-4	09/09/02	Cobalt	0.21	J	µg/L	1	0.015
CMLS 1-3	08/01/02	Cobalt	0.20	J	µg/L	1	0.015
CMLS 1-3	09/03/02	Cobalt	0.17	J	µg/L	1	0.015
			0.29				
CMLS 8-4	09/03/03	Copper	5.7		µg/L	2	0.17
CMLS 7-6	09/03/03	Copper	5.4		µg/L	2	0.17
CMLS 6-5	09/03/03	Copper	2.9		µg/L	2	0.17
CMLS 2-7	09/03/02	Copper	2.2		µg/L	2	0.63
CMLS 3-4	09/09/02	Copper	2.1		µg/L	2	0.63
CMLS 1-3	09/03/02	Copper	2.0		µg/L	2	0.63
CMLS 1-3	08/01/02	Copper	1.8	J	µg/L	2	0.63
CMLS 2-7	08/01/02	Copper	1.7	J	µg/L	2	0.63
CMLS 3-4	08/01/02	Copper	1.7	J	µg/L	2	0.63
CMLS 5-4	09/03/03	Copper	1.2	J	µg/L	2	0.17
CMLS 4-3	08/01/02	Copper	0.89	J	µg/L	2	0.63
CMLS 4-3	09/03/02	Copper	0.68	J	µg/L	2	0.63
			1.9				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 7-6	09/03/03	Fluoride	1.7		mg/L	1	0.11
CMLS 8-4	09/03/03	Fluoride	0.85	J G	mg/L	2	0.22
CMLS 2-7	08/06/02	Fluoride	0.73	J	mg/L	1	0.03
CMLS 2-7	08/27/02	Fluoride	0.62	J	mg/L	1	0.03
CMLS 3-4	08/06/02	Fluoride	0.55	J	mg/L	1	0.03
CMLS 3-4	08/27/02	Fluoride	0.53	J	mg/L	1	0.03
CMLS 4-3	08/27/02	Fluoride	0.36	J	mg/L	1	0.03
CMLS 1-3	08/06/02	Fluoride	0.34	J	mg/L	1	0.03
CMLS 1-3	08/27/02	Fluoride	0.34	J	mg/L	1	0.03
CMLS 4-3	08/06/02	Fluoride	0.31	J	mg/L	1	0.03
CMLS 6-5	09/03/03	Fluoride	0.29	J	mg/L	1	0.11
CMLS 5-4	09/03/03	Fluoride	0.24	J	mg/L	1	0.11
			0.45				
CMLS 7-6	09/03/03	Iron	260		µg/L	100	19
CMLS 2-7	09/03/02	Iron	60	J	µg/L	100	13
CMLS 4-3	08/01/02	Iron	39	J	µg/L	100	13
CMLS 2-7	08/01/02	Iron	20	J	µg/L	100	13
CMLS 4-3	09/03/02	Iron	17	J	µg/L	100	13
CMLS 1-3	08/01/02	Iron	0	J	µg/L	100	13
CMLS 1-3	09/03/02	Iron	0	J	µg/L	100	13
CMLS 3-4	08/01/02	Iron	0	J	µg/L	100	13
CMLS 3-4	09/09/02	Iron	0	J	µg/L	100	13
CMLS 5-4	09/03/03	Iron	0	J	µg/L	100	19
CMLS 6-5	09/03/03	Iron	0	J	µg/L	100	19
CMLS 8-4	09/03/03	Iron	0	J	µg/L	100	19
			0				
CMLS 7-6	09/03/03	Lead	0.30	J	µg/L	1	0.19
CMLS 6-5	09/03/03	Lead	0.19	J	µg/L	1	0.19
CMLS 1-3	08/01/02	Lead	0	J	µg/L	1	0.15
CMLS 1-3	09/03/02	Lead	0	J	µg/L	1	0.15
CMLS 2-7	08/01/02	Lead	0	J	µg/L	1	0.15
CMLS 2-7	09/03/02	Lead	0	J	µg/L	1	0.15
CMLS 3-4	08/01/02	Lead	0	J	µg/L	1	0.15
CMLS 3-4	09/09/02	Lead	0	J	µg/L	1	0.15
CMLS 4-3	08/01/02	Lead	0	J	µg/L	1	0.15
CMLS 4-3	09/03/02	Lead	0	J	µg/L	1	0.15
CMLS 5-4	09/03/03	Lead	0	J	µg/L	1	0.19
CMLS 8-4	09/03/03	Lead	0	J	µg/L	1	0.19
			0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 8-4	09/03/03	Manganese	95	B	µg/L	1	0.100
CMLS 2-7	08/01/02	Manganese	45		µg/L	1	0.061
CMLS 5-4	09/03/03	Manganese	44	B	µg/L	1	0.100
CMLS 3-4	08/01/02	Manganese	29		µg/L	1	0.061
CMLS 3-4	09/09/02	Manganese	25		µg/L	1	0.061
CMLS 6-5	09/03/03	Manganese	22	B	µg/L	1	0.100
CMLS 1-3	08/01/02	Manganese	15		µg/L	1	0.061
CMLS 4-3	09/03/02	Manganese	15		µg/L	1	0.061
CMLS 2-7	09/03/02	Manganese	13		µg/L	1	0.061
CMLS 4-3	08/01/02	Manganese	9.6		µg/L	1	0.061
CMLS 1-3	09/03/02	Manganese	8.2		µg/L	1	0.061
CMLS 7-6	09/03/03	Manganese	7.2	B	µg/L	1	0.100
			19				
CMLS 7-6	09/03/03	Molybdenum	210	B	µg/L	2	0.040
CMLS 8-4	09/03/03	Molybdenum	110	B	µg/L	2	0.040
CMLS 1-3	08/01/02	Molybdenum	22	B	µg/L	2	0.023
CMLS 3-4	09/09/02	Molybdenum	14	B	µg/L	2	0.023
CMLS 1-3	09/03/02	Molybdenum	11	B	µg/L	2	0.023
CMLS 3-4	08/01/02	Molybdenum	6.8	B	µg/L	2	0.023
CMLS 2-7	09/03/02	Molybdenum	6.2	B	µg/L	2	0.023
CMLS 2-7	08/01/02	Molybdenum	5.6	B	µg/L	2	0.023
CMLS 6-5	09/03/03	Molybdenum	5.0	B	µg/L	2	0.040
CMLS 5-4	09/03/03	Molybdenum	3.5	B	µg/L	2	0.040
CMLS 4-3	08/01/02	Molybdenum	2.5	B	µg/L	2	0.023
CMLS 4-3	09/03/02	Molybdenum	0.57	B J	µg/L	2	0.023
			6.5				
CMLS 2-7	08/01/02	Nickel	8.8		µg/L	2	0.25
CMLS 8-4	09/03/03	Nickel	6.9		µg/L	2	0.15
CMLS 4-3	09/03/02	Nickel	6.8		µg/L	2	0.25
CMLS 3-4	09/09/02	Nickel	5.7		µg/L	2	0.25
CMLS 5-4	09/03/03	Nickel	5.5		µg/L	2	0.15
CMLS 2-7	09/03/02	Nickel	5.4		µg/L	2	0.25
CMLS 6-5	09/03/03	Nickel	4.6		µg/L	2	0.15
CMLS 4-3	08/01/02	Nickel	4.0		µg/L	2	0.25
CMLS 7-6	09/03/03	Nickel	2.9		µg/L	2	0.15
CMLS 1-3	09/03/02	Nickel	2.6		µg/L	2	0.25
CMLS 1-3	08/01/02	Nickel	2.1		µg/L	2	0.25
CMLS 3-4	08/01/02	Nickel	1.9	J	µg/L	2	0.25
			5.0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 8-4	08/25/03	Nitrate plus nitrite as N	6.9		mg/L	0.1	0.012
CMLS 6-5	08/20/03	Nitrate plus nitrite as N	3.9		mg/L	0.1	0.012
CMLS 7-6	08/25/03	Nitrate plus nitrite as N	0.59		mg/L	0.1	0.012
CMLS 1-3	08/06/02	Nitrate plus nitrite as N	0.19		mg/L	0.1	0.012
CMLS 2-7	08/06/02	Nitrate plus nitrite as N	0.16		mg/L	0.1	0.012
CMLS 2-7	08/28/02	Nitrate plus nitrite as N	0.15		mg/L	0.1	0.012
CMLS 1-3	08/28/02	Nitrate plus nitrite as N	0.12		mg/L	0.1	0.012
CMLS 5-4	08/20/03	Nitrate plus nitrite as N	0.086	J	mg/L	0.1	0.012
CMLS 4-3	08/06/02	Nitrate plus nitrite as N	0.047	J	mg/L	0.1	0.012
CMLS 4-3	08/28/02	Nitrate plus nitrite as N	0.028	J	mg/L	0.1	0.012
CMLS 3-4	08/06/02	Nitrate plus nitrite as N	0.026	J	mg/L	0.1	0.012
CMLS 3-4	08/29/02	Nitrate plus nitrite as N	0.021	J	mg/L	0.1	0.012
			0.14				
CMLS 7-6	09/03/03	pH	7.9		pH units	0.1	
CMLS 3-4	08/06/02	pH	7.4		pH units	0.1	
CMLS 8-4	09/03/03	pH	7.4		pH units	0.1	
CMLS 1-3	08/06/02	pH	7.1		pH units	0.1	
CMLS 2-7	08/06/02	pH	7.1		pH units	0.1	
CMLS 2-7	08/27/02	pH	7.0		pH units	0.1	
CMLS 3-4	08/27/02	pH	7.0		pH units	0.1	
CMLS 1-3	08/27/02	pH	6.9		pH units	0.1	
CMLS 6-5	09/03/03	pH	6.6		pH units	0.1	
CMLS 4-3	08/06/02	pH	6.4		pH units	0.1	
CMLS 5-4	09/03/03	pH	6.3		pH units	0.1	
CMLS 4-3	08/27/02	pH	6.1		pH units	0.1	
			7.0				
CMLS 7-6	09/03/03	Phosphate as P, ortho	0.23	B J	mg/L	0.5	0.11
CMLS 1-3	08/06/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 1-3	08/27/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 2-7	08/06/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 2-7	08/27/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 3-4	08/06/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 3-4	08/27/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 4-3	08/06/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 4-3	08/27/02	Phosphate as P, ortho	0		mg/L	0.5	0.04
CMLS 5-4	09/03/03	Phosphate as P, ortho	0		mg/L	0.5	0.11
CMLS 6-5	09/03/03	Phosphate as P, ortho	0		mg/L	0.5	0.11
CMLS 8-4	09/03/03	Phosphate as P, ortho	0	L	mg/L	1.0	0.22
			0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 8-4	09/03/03	Potassium	5.9	B	mg/L	3	0.46
CMLS 3-4	08/01/02	Potassium	2.5	J	mg/L	3	0.49
CMLS 3-4	09/09/02	Potassium	1.9	J	mg/L	3	0.49
CMLS 1-3	08/01/02	Potassium	1.7	J	mg/L	3	0.49
CMLS 2-7	08/01/02	Potassium	1.5	J	mg/L	3	0.49
CMLS 2-7	09/03/02	Potassium	1.5	J	mg/L	3	0.49
CMLS 7-6	09/03/03	Potassium	1.5	B J	mg/L	3	0.46
CMLS 6-5	09/03/03	Potassium	1.3	B J	mg/L	3	0.46
CMLS 5-4	09/03/03	Potassium	1.1	B J	mg/L	3	0.46
CMLS 1-3	09/03/02	Potassium	0.7	J	mg/L	3	0.49
CMLS 4-3	08/01/02	Potassium	0.6	J	mg/L	3	0.49
CMLS 4-3	09/03/02	Potassium	0.5	J	mg/L	3	0.49
			1.5				
CMLS 7-6	09/03/03	Selenium	4.2	J	µg/L	5	0.24
CMLS 2-7	09/03/02	Selenium	3.4	J	µg/L	5	0.19
CMLS 3-4	09/09/02	Selenium	3.2	J	µg/L	5	0.19
CMLS 2-7	08/01/02	Selenium	3.0	J	µg/L	5	0.19
CMLS 3-4	08/01/02	Selenium	2.9	J	µg/L	5	0.19
CMLS 8-4	09/03/03	Selenium	2.8	J	µg/L	5	0.24
CMLS 1-3	08/01/02	Selenium	2.5	J	µg/L	5	0.19
CMLS 1-3	09/03/02	Selenium	2.0	J	µg/L	5	0.19
CMLS 4-3	09/03/02	Selenium	1.6	J	µg/L	5	0.19
CMLS 4-3	08/01/02	Selenium	0.98	J	µg/L	5	0.19
CMLS 6-5	09/03/03	Selenium	0.64	J	µg/L	5	0.24
CMLS 5-4	09/03/03	Selenium	0.50	J	µg/L	5	0.24
			2.7				
CMLS 2-7	08/01/02	Silver	0.53	B J	µg/L	5	0.012
CMLS 1-3	08/01/02	Silver	0.34	B J	µg/L	5	0.012
CMLS 3-4	08/01/02	Silver	0.30	B J	µg/L	5	0.012
CMLS 4-3	08/01/02	Silver	0.26	B J	µg/L	5	0.012
CMLS 3-4	09/09/02	Silver	0.051	J	µg/L	5	0.012
CMLS 1-3	09/03/02	Silver	0	J	µg/L	5	0.012
CMLS 2-7	09/03/02	Silver	0	J	µg/L	5	0.012
CMLS 4-3	09/03/02	Silver	0	J	µg/L	5	0.012
CMLS 5-4	09/03/03	Silver	0	J	µg/L	5	0.058
CMLS 6-5	09/03/03	Silver	0	J	µg/L	5	0.058
CMLS 7-6	09/03/03	Silver	0	J	µg/L	5	0.058
CMLS 8-4	09/03/03	Silver	0	J	µg/L	5	0.058
			0				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 8-4	09/03/03	Sodium	850		mg/L	5	1.1
CMLS 1-3	08/01/02	Sodium	360		mg/L	5	1.5
CMLS 1-3	09/03/02	Sodium	330		mg/L	5	1.5
CMLS 3-4	08/01/02	Sodium	330		mg/L	5	1.5
CMLS 3-4	09/09/02	Sodium	300		mg/L	5	1.5
CMLS 7-6	09/03/03	Sodium	270		mg/L	5	1.1
CMLS 2-7	08/01/02	Sodium	220		mg/L	5	1.5
CMLS 2-7	09/03/02	Sodium	220		mg/L	5	1.5
CMLS 4-3	09/03/02	Sodium	65		mg/L	5	1.5
CMLS 5-4	09/03/03	Sodium	58		mg/L	5	1.1
CMLS 4-3	08/01/02	Sodium	49		mg/L	5	1.5
CMLS 6-5	09/03/03	Sodium	39		mg/L	5	1.1
			245				
CMLS 8-4	09/03/03	Specific conductance	3,900		μS/cm	2	
CMLS 1-3	08/06/02	Specific conductance	1,400		μS/cm	2	
CMLS 3-4	08/06/02	Specific conductance	1,400		μS/cm	2	
CMLS 1-3	08/27/02	Specific conductance	1,200		μS/cm	2	
CMLS 7-6	09/03/03	Specific conductance	1,200		μS/cm	2	
CMLS 2-7	08/06/02	Specific conductance	1,000		μS/cm	2	
CMLS 3-4	08/27/02	Specific conductance	950		μS/cm	2	
CMLS 2-7	08/27/02	Specific conductance	770		μS/cm	2	
CMLS 4-3	08/27/02	Specific conductance	310		μS/cm	2	
CMLS 5-4	09/03/03	Specific conductance	300		μS/cm	2	
CMLS 4-3	08/06/02	Specific conductance	290		μS/cm	2	
CMLS 6-5	09/03/03	Specific conductance	200		μS/cm	2	
			975				
CMLS 1-3	08/27/02	Sulfate	450	Q	mg/L	100	4.0
CMLS 8-4	09/03/03	Sulfate	430	Q	mg/L	250	11.0
CMLS 1-3	08/06/02	Sulfate	390	Q	mg/L	50	2.0
CMLS 2-7	08/06/02	Sulfate	230	Q	mg/L	50	2.0
CMLS 3-4	08/06/02	Sulfate	230	Q	mg/L	50	2.0
CMLS 2-7	08/27/02	Sulfate	210	Q	mg/L	25	1.0
CMLS 3-4	08/27/02	Sulfate	160	Q	mg/L	25	1.0
CMLS 7-6	09/03/03	Sulfate	140	Q	mg/L	25	1.1
CMLS 4-3	08/27/02	Sulfate	110	Q	mg/L	25	1.0
CMLS 4-3	08/06/02	Sulfate	100	Q	mg/L	25	1.0
CMLS 5-4	09/03/03	Sulfate	63	Q	mg/L	25	1.1
CMLS 6-5	09/03/03	Sulfate	28		mg/L	5	0.22
			185				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 8-4	09/03/03	Thallium	0.072	J	µg/L	1	0.012
CMLS 1-3	08/01/02	Thallium	0.040	J	µg/L	1	0.015
CMLS 3-4	08/01/02	Thallium	0.025	J	µg/L	1	0.015
CMLS 7-6	09/03/03	Thallium	0.020	J	µg/L	1	0.012
CMLS 3-4	09/09/02	Thallium	0.018	J	µg/L	1	0.015
CMLS 2-7	08/01/02	Thallium	0.016	J	µg/L	1	0.015
CMLS 5-4	09/03/03	Thallium	0.016	J	µg/L	1	0.012
CMLS 1-3	09/03/02	Thallium	0	J	µg/L	1	0.015
CMLS 2-7	09/03/02	Thallium	0	J	µg/L	1	0.015
CMLS 4-3	08/01/02	Thallium	0	J	µg/L	1	0.015
CMLS 4-3	09/03/02	Thallium	0	J	µg/L	1	0.015
CMLS 6-5	09/03/03	Thallium	0	J	µg/L	1	0.012
			0.016				
CMLS 1-3	08/01/02	Tin	1.7	J	µg/L	10	0.05
CMLS 7-6	09/03/03	Tin	1.3	B J	µg/L	10	0.24
CMLS 8-4	09/03/03	Tin	0.70	B J	µg/L	10	0.24
CMLS 2-7	08/01/02	Tin	0.40	J	µg/L	10	0.05
CMLS 1-3	09/03/02	Tin	0.16	B J	µg/L	10	0.05
CMLS 3-4	09/09/02	Tin	0.15	B J	µg/L	10	0.05
CMLS 3-4	08/01/02	Tin	0.11	J	µg/L	10	0.05
CMLS 2-7	09/03/02	Tin	0	J	µg/L	10	0.05
CMLS 4-3	08/01/02	Tin	0	J	µg/L	10	0.05
CMLS 4-3	09/03/02	Tin	0	J	µg/L	10	0.05
CMLS 5-4	09/03/03	Tin	0	J	µg/L	10	0.24
CMLS 6-5	09/03/03	Tin	0	J	µg/L	10	0.24
			0.13				
CMLS 8-4	08/25/03	Total Kjeldahl nitrogen	1.4		mg/L	0.5	0.083
CMLS 7-6	08/25/03	Total Kjeldahl nitrogen	1.0		mg/L	0.5	0.083
CMLS 1-3	08/06/02	Total Kjeldahl nitrogen	0.58		mg/L	0.5	0.14
CMLS 2-7	08/28/02	Total Kjeldahl nitrogen	0.31	J	mg/L	0.5	0.14
CMLS 1-3	08/28/02	Total Kjeldahl nitrogen	0.29	J	mg/L	0.5	0.14
CMLS 5-4	08/20/03	Total Kjeldahl nitrogen	0.25	J	mg/L	0.5	0.083
CMLS 6-5	08/20/03	Total Kjeldahl nitrogen	0.22	J	mg/L	0.5	0.083
CMLS 2-7	08/06/02	Total Kjeldahl nitrogen	0	J	mg/L	0.5	0.14
CMLS 3-4	08/06/02	Total Kjeldahl nitrogen	0	J	mg/L	0.5	0.14
CMLS 3-4	08/29/02	Total Kjeldahl nitrogen	0	J	mg/L	0.5	0.14
CMLS 4-3	08/06/02	Total Kjeldahl nitrogen	0	J	mg/L	0.5	0.14
CMLS 4-3	08/28/02	Total Kjeldahl nitrogen	0	J	mg/L	0.5	0.14
			0.24				

Table 5. Inorganic water-quality data (physical properties, major ions, nutrients, and trace elements) for selected lysimeters, Camp McCain, Mississippi--Continued

Site name (fig. 2; table 1)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
CMLS 4-3	08/28/02	Total phosphorus	0.56	Q	mg/L	0.10	0.026
CMLS 2-7	08/28/02	Total phosphorus	0.53		mg/L	0.05	0.013
CMLS 1-3	08/28/02	Total phosphorus	0.18		mg/L	0.05	0.013
CMLS 3-4	08/06/02	Total phosphorus	0.18	Q	mg/L	0.10	0.026
CMLS 7-6	08/25/03	Total phosphorus	0.14	B	mg/L	0.05	0.019
CMLS 3-4	08/29/02	Total phosphorus	0.084		mg/L	0.05	0.013
CMLS 6-5	08/20/03	Total phosphorus	0.072	B	mg/L	0.05	0.019
CMLS 8-4	08/25/03	Total phosphorus	0.065	B	mg/L	0.05	0.019
CMLS 5-4	08/20/03	Total phosphorus	0.031	B J	mg/L	0.05	0.019
CMLS 2-7	08/06/02	Total phosphorus	0.018	J	mg/L	0.05	0.013
CMLS 1-3	08/06/02	Total phosphorus	0	J	mg/L	0.05	0.013
CMLS 4-3	08/06/02	Total phosphorus	0	J	mg/L	0.05	0.013
			0.078				
CMLS 7-6	09/03/03	Vanadium	36		µg/L	5	0.069
CMLS 4-3	08/01/02	Vanadium	19		µg/L	5	0.070
CMLS 2-7	09/03/02	Vanadium	18		µg/L	5	0.070
CMLS 6-5	09/03/03	Vanadium	17		µg/L	5	0.069
CMLS 2-7	08/01/02	Vanadium	16		µg/L	5	0.070
CMLS 8-4	09/03/03	Vanadium	14		µg/L	5	0.069
CMLS 4-3	09/03/02	Vanadium	13		µg/L	5	0.070
CMLS 3-4	09/09/02	Vanadium	11		µg/L	5	0.070
CMLS 1-3	08/01/02	Vanadium	9.6		µg/L	5	0.070
CMLS 3-4	08/01/02	Vanadium	9.0		µg/L	5	0.070
CMLS 1-3	09/03/02	Vanadium	8.1		µg/L	5	0.070
CMLS 5-4	09/03/03	Vanadium	6.3		µg/L	5	0.069
			14				
CMLS 3-4	09/09/02	Zinc	11		µg/L	10	2.3
CMLS 4-3	09/03/02	Zinc	11		µg/L	10	2.3
CMLS 4-3	08/01/02	Zinc	8.9	J	µg/L	10	2.3
CMLS 8-4	09/03/03	Zinc	6.7	J	µg/L	10	1.2
CMLS 6-5	09/03/03	Zinc	6.4	J	µg/L	10	1.2
CMLS 1-3	09/03/02	Zinc	5.7	J	µg/L	10	2.3
CMLS 5-4	09/03/03	Zinc	5.0	J	µg/L	10	1.2
CMLS 7-6	09/03/03	Zinc	4.3	J	µg/L	10	1.2
CMLS 2-7	09/03/02	Zinc	3.8	J	µg/L	10	2.3
CMLS 2-7	08/01/02	Zinc	3.3	J	µg/L	10	2.3
CMLS 3-4	08/01/02	Zinc	3.3	J	µg/L	10	2.3
CMLS 1-3	08/01/02	Zinc	2.4	J	µg/L	10	2.3
			5.4				

Table 6. Specific conductance and pH of water collected from lysimeters during June 2004, Camp McCain, Mississippi

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; CMLS, Camp McCain lysimeter site; **bold**, median value]

Site name (fig. 2)	Date	Specific conductance (µS/cm)
CMLS 8-4	06/28/04	1,990
CMLS 7-6	06/28/04	1,060
CMLS 3-4	06/28/04	641
CMLS 1-3	06/28/04	587
CMLS 6-5	06/28/04	322
CMLS 2-7	06/28/04	294
CMLS 4-3	06/28/04	189
CMLS 5-4	06/28/04	161
		455

Site name (fig. 2)	Date	pH
CMLS 7-6	06/28/04	8.1
CMLS 6-5	06/28/04	7.5
CMLS 1-3	06/28/04	6.8
CMLS 5-4	06/28/04	6.8
CMLS 3-4	06/28/04	6.6
CMLS 2-7	06/28/04	6.5
CMLS 4-3	06/28/04	6.4
CMLS 8-4	06/28/04	5.6
		6.7

Table 7. Specific conductance and pH of water collected from shallow monitoring wells during June 2004, Camp McCain, Mississippi

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; **bold**, median value]

Well number (fig. 2)	Date	Specific conductance (µS/cm)
8	06/28/04	2,720
7	06/28/04	446
6	06/28/04	350
3	06/28/04	279
5	06/28/04	278
4	06/28/04	266
2	06/28/04	223
1	06/28/04	135
		279

Well number (fig. 2)	Date	pH
8	06/28/04	10.4
7	06/28/04	7.9
6	06/28/04	6.8
5	06/28/04	6.4
1	06/28/04	6.3
4	06/28/04	6.2
2	06/28/04	6.1
3	06/28/04	6.0
		6.4

Table 8. Median values for inorganic water-quality data for selected lysimeters, Camp Shelby, Camp McCain, and Greenwood, Mississippi–2002-2004

[CSLS, Camp Shelby lysimeter site; CMLS, Camp McCain lysimeter site; QALS, quality-assurance/quality-control lysimeter site near Greenwood. µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; 0, less than the reporting limit]

Parameter	Median value			Units
	CSLS	CMLS	QALS	
Physical property				
pH	6.3	7.0	6.2	pH units
Specific conductance	220	975	390	µS/cm
Major ion				
Calcium	1.9	4.1	4.1	mg/L
Chloride	5.1	4.8	23	mg/L
Fluoride	0.29	0.45	0.39	mg/L
Potassium	0.90	1.5	1.3	mg/L
Sodium	36	245	85	mg/L
Sulfate	52	185	96	mg/L
Nutrient				
Ammonia as N	0.028	0.064	0.048	mg/L
Nitrate plus nitrite as N	0.018	0.14	0.67	mg/L
Phosphate as P, ortho	0	0	0	mg/L
Total Kjeldahl nitrogen	0.087	0.24	0	mg/L
Total phosphorus	0.34	0.078	0.19	mg/L
Trace element				
Aluminum	76	54	34	µg/L
Antimony	0.21	1.0	0.25	µg/L
Arsenic	0.95	1.3	0.51	µg/L
Barium	64	24	60	µg/L
Beryllium	0	0	0	µg/L
Cadmium	0	0	0.02	µg/L
Chromium	0.87	2.1	1.2	µg/L
Cobalt	1.1	0.29	0.87	µg/L
Copper	0.68	1.9	0.89	µg/L
Iron	19	0	0	µg/L
Lead	0	0	0	µg/L
Manganese	100	19	42	µg/L
Molybdenum	1.2	6.5	1.8	µg/L
Nickel	3.1	5.0	19	µg/L
Selenium	0.61	2.7	0.88	µg/L
Silver	0.064	0	0.070	µg/L
Thallium	0	0.016	0	µg/L
Tin	0.19	0.13	0	µg/L
Vanadium	8.0	14	12	µg/L
Zinc	6.5	5.4	7.8	µg/L

Table 9. Volatile organic compounds included in analytical method SW846 8260B

[µg/L, micrograms per liter; NA, not applicable or not reported]

Parameter	Units	Reporting limit	Method detection limit
1,1,1,2-Tetrachloroethane	µg/L	1	0.28
1,1,1-Trichloroethane	µg/L	1	0.32
1,1,2,2-Tetrachloroethane	µg/L	1	0.50
1,1,2-Trichloroethane	µg/L	1	0.41
1,1-Dichloroethane	µg/L	1	0.29
1,1-Dichloroethene	µg/L	1	0.31
1,1-Dichloropropene	µg/L	1	0.29
1,2,3-Trichlorobenzene	µg/L	1	0.62
1,2,3-Trichloropropane	µg/L	1	0.76
1,2,4-Trichlorobenzene	µg/L	1	0.63
1,2,4-Trimethylbenzene	µg/L	1	0.30
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	2	0.49
1,2-Dibromoethane (EDB)	µg/L	1	0.46
1,2-Dichlorobenzene	µg/L	1	0.30
1,2-Dichloroethane	µg/L	1	0.43
1,2-Dichloroethene (total)	µg/L	1	0.54
1,2-Dichloropropane	µg/L	1	0.38
1,3,5-Trimethylbenzene	µg/L	1	0.31
1,3-Dichlorobenzene	µg/L	1	0.30
1,3-Dichloropropane	µg/L	1	0.37
1,4-Dichlorobenzene	µg/L	1	0.31
1-Chlorohexane	µg/L	1	0.38
2,2-Dichloropropane	µg/L	5	0.37
2-Butanone (MEK)	µg/L	5	2.40
2-Chlorotoluene	µg/L	1	0.23
2-Hexanone	µg/L	5	1.80
4-Chlorotoluene	µg/L	1	0.26
4-Isopropyltoluene	µg/L	1	0.32
4-Methyl-2-pentanone	µg/L	5	1.80
Acetic acid, 2-ethylhexyl este	µg/L	NA	NA
Acetone	µg/L	10	2.90
Benzene	µg/L	1	0.27
Bromobenzene	µg/L	1	0.32
Bromochloromethane	µg/L	1	0.39
Bromodichloromethane	µg/L	1	0.35
Bromoform	µg/L	1	0.46
Bromomethane	µg/L	2	0.28
Carbon tetrachloride	µg/L	1	0.35
Chlorobenzene	µg/L	1	0.24
Chloroethane	µg/L	2	0.26

Table 9. Volatile organic compounds included in analytical method SW846 8260B--Continued

Parameter	Units	Reporting limit	Method detection limit
Chloroform	μg/L	1	0.29
Chloromethane	μg/L	2	0.26
cis-1,2-Dichloroethene	μg/L	1	0.33
cis-1,3-Dichloropropene	μg/L	1	0.31
Dibromochloromethane	μg/L	1	0.37
Dibromomethane	μg/L	1	0.40
Dichlorodifluoromethane	μg/L	2	0.44
Ethylbenzene	μg/L	1	0.51
Hexachlorobutadiene	μg/L	1	0.37
Isopropylbenzene	μg/L	1	0.30
Methyl tert-butyl ether	μg/L	5	0.88
Methylene chloride	μg/L	5	0.86
m-Xylene & p-Xylene	μg/L	2	0.52
Naphthalene	μg/L	1	0.78
n-Butylbenzene	μg/L	1	0.41
n-Propylbenzene	μg/L	1	0.33
o-Xylene	μg/L	1	0.24
sec-Butylbenzene	μg/L	1	0.34
Styrene	μg/L	1	0.28
tert-Butylbenzene	μg/L	1	0.29
Tetrachloroethene	μg/L	1	0.27
Tetrahydrofuran	μg/L	NA	NA
Toluene	μg/L	1	0.26
trans-1,2-Dichloroethene	μg/L	0.5	0.25
trans-1,3-Dichloropropene	μg/L	1	0.36
Trichloroethene	μg/L	1	0.24
Trichlorofluoromethane	μg/L	2	0.43
Vinyl acetate	μg/L	2	0.91
Vinyl chloride	μg/L	1	0.26

Table 10. Volatile organic compounds detected at Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site; μg/L, micrograms per liter; B, method blank contamination; J, estimated result (less than the reporting limit); T, tentatively identified compound; NA, not applicable or not reported]

Site name (fig. 2, 3; table 1, 2)	Date	Parameter	Results	Remarks	Units	Reporting limit	Method detection limit
Campbell Creek	08/20/03	1,1-Dichloroethene	0.27	J	μg/L	1	0.23
CMLS 5-4	08/20/03	1,2,4-Trimethylbenzene	0.83	J	μg/L	1	0.15
QALS 11	07/23/02	Acetic acid, 2-ethylhexyl este	3.32	T	μg/L	NA	NA
CMLS 2-7	07/24/02	Acetic acid, 2-ethylhexyl este	1.72	T	μg/L	NA	NA
CMLS 3-4	07/24/02	Acetic acid, 2-ethylhexyl este	1.42	T	μg/L	NA	NA
Campbell Creek	08/20/03	Acetone	5.2	J	μg/L	10	2.50
CMLS 8-4	08/25/03	Acetone	3.1	J	μg/L	10	2.50
QALS 11	07/23/02	Methylene chloride	2.8	J B	μg/L	10	1.70
CMLS 3-4	07/24/02	Methylene chloride	0.96	J B	μg/L	5	0.86
CMLS 4-3	07/24/02	Methylene chloride	1.2	J B	μg/L	5	0.86
QALS 5	07/24/02	Methylene chloride	1.2	J B	μg/L	5	0.86
CMLS 7-6	08/25/03	Methylene chloride	0.25	J B	μg/L	5	0.21
CMLS 8-4	08/25/03	Methylene chloride	0.26	J B	μg/L	5	0.21
CMLS 5-4	08/20/03	m-Xylene & p-Xylene	1.8	J	μg/L	2	0.27
CMLS 5-4	08/20/03	o-Xylene	0.53	J	μg/L	1	0.15
CMLS 2-7	07/24/02	Toluene	0.28	J	μg/L	1	0.26
Campbell Creek	08/20/03	Toluene	0.21	J	μg/L	1	0.15
CMLS 6-5	08/20/03	Toluene	0.20	J	μg/L	1	0.15
CMLS 1-3	07/24/02	Unknown	1.4		μg/L	NA	NA
CMLS 1-3	07/24/02	Unknown	1.5		μg/L	NA	NA
CMLS 1-3	07/24/02	Unknown	1.6		μg/L	NA	NA

Note: Tetrahydrofuran was a tentatively detected compound in all lysimeter samples, but was not detected in any of the shallow ground-water samples or in any surface-water samples; hence, it was considered likely to be a contaminant associated with the glue used in installation of the lysimeters--and is excluded from this table.

Table 11. Semi-volatile organic compounds included in analytical method SW846 8270C

[µg/L, micrograms per liter; NA, not applicable or not reported]

Parameter	Units	Reporting limit	Method detection limit
1-Propene, 1,1,2-trichloro-	µg/L	NA	NA
1,2,4-Trichlorobenzene	µg/L	10	1.5
1,2-Dichlorobenzene	µg/L	10	1.6
1,3-Dichlorobenzene	µg/L	10	1.7
1,4-Dichlorobenzene	µg/L	10	1.8
2,4,5-Trichlorophenol	µg/L	10	1.3
2,4,6-Trichlorophenol	µg/L	10	1.3
2,4-Dichlorophenol	µg/L	10	1.7
2,4-Dimethylphenol	µg/L	10	2.9
2,4-Dinitrophenol	µg/L	50	18
2,4-Dinitrotoluene	µg/L	10	2.6
2,6-Dinitrotoluene	µg/L	10	1.6
2-Chloronaphthalene	µg/L	10	1.1
2-Chlorophenol	µg/L	10	1.8
2-Methylnaphthalene	µg/L	10	1.5
2-Methylphenol	µg/L	10	2.1
2-Nitroaniline	µg/L	50	1.8
2-Nitrophenol	µg/L	10	1.8
3,3'-Dichlorobenzidine	µg/L	50	8.4
3-Methylphenol & 4-Methylphenol	µg/L	10	2.1
3-Penten-2-one, 4-methyl-	µg/L	NA	NA
3-Nitroaniline	µg/L	50	7.6
4,6-Dinitro-2-methylphenol	µg/L	50	18
4-Bromophenyl phenyl ether	µg/L	10	1.5
4-Chloro-3-methylphenol	µg/L	10	2.0
4-Chloroaniline	µg/L	10	2.5
4-Chlorophenyl phenyl ether	µg/L	10	1.2
4-Nitroaniline	µg/L	50	2.1
4-Nitrophenol	µg/L	50	18
Acenaphthene	µg/L	10	1.0
Acenaphthylene	µg/L	10	1.0
Anthracene	µg/L	10	1.6
Benzo(a)anthracene	µg/L	10	1.2
Benzo(a)pyrene	µg/L	10	1.4
Benzo(b)fluoranthene	µg/L	10	2.2
Benzo(ghi)perylene	µg/L	10	1.7
Benzo(k)fluoranthene	µg/L	10	2.0
Benzoic acid	µg/L	50	12
Benzyl alcohol	µg/L	10	2.7

Table 11. Semi-volatile organic compounds included in analytical method SW846 8270C--Continued

Parameter	Units	Reporting limit	Method detection limit
bis(2-Chloroethoxy)methane	µg/L	10	1.3
bis(2-Chloroethyl) ether	µg/L	10	1.8
bis(2-Chloroisopropyl) ether	µg/L	10	1.5
bis(2-Ethylhexyl) phthalate	µg/L	10	3.1
Butyl benzyl phthalate	µg/L	10	1.6
Carbazole	µg/L	10	1.2
Chrysene	µg/L	10	1.7
Dibenz(a,h)anthracene	µg/L	10	1.3
Dibenzofuran	µg/L	10	5.0
Diethyl phthalate	µg/L	10	1.1
Dimethyl phthalate	µg/L	10	5.0
Di-n-butyl phthalate	µg/L	10	1.1
Di-n-octyl phthalate	µg/L	10	1.5
Fluoranthene	µg/L	10	1.5
Fluorene	µg/L	10	1.3
Hexachlorobenzene	µg/L	10	1.7
Hexachlorobutadiene	µg/L	10	1.7
Hexachlorocyclopentadiene	µg/L	50	5.0
Hexachloroethane	µg/L	10	2.2
Indeno(1,2,3-cd)pyrene	µg/L	10	1.2
Isophorone	µg/L	10	2.3
Naphthalene	µg/L	10	1.2
Nitrobenzene	µg/L	10	2.5
N-Nitrosodimethylamine	µg/L	10	2.1
N-Nitrosodi-n-propylamine	µg/L	10	1.6
N-Nitrosodiphenylamine	µg/L	10	1.5
Pentachlorophenol	µg/L	50	11
Phenanthrene	µg/L	10	1.3
Phenol	µg/L	10	1.4
Pyrene	µg/L	10	2.0

Table 12. Semi-volatile organic compounds detected at Camp McCain, Mississippi

[CMLS, Camp McCain lysimeter site; QALS, quality-assurance/quality-control lysimeter site used to establish reference/background conditions; J, estimated result (less than the reporting limit); B, method blank contamination; µg/L, micrograms per liter]

Site name (fig. 2, 3; tables 1, 2)	Date	Parameter	Results	Remarks	Units
CMLS 4-3	08/15/02	1-Propene, 1,1,2-trichloro-	23	J	µg/L
CMLS 8-4	08/18/03	1-Propene, 1,1,2-trichloro-	19	J	µg/L
QALS 11	07/23/02	1-Propene, 1,1,2-trichloro-	24	J	µg/L
CMLS 7-6	08/18/03	bis(2-Ethylhexyl) phthalate	22		µg/L
CMLS 8-4	08/18/03	3-Penten-2-one, 4-methyl-	6.1	J	µg/L
Campbell Creek	08/11/03	Benzyl alcohol	2.8	J B	µg/L
CMLS 1-3	07/24/02	Unknown	6	J	µg/L
CMLS 1-3	07/24/02	Unknown	6.2	J	µg/L
CMLS 1-3	07/24/02	Unknown	11	J	µg/L
CMLS 1-3	07/24/02	Unknown	21	J	µg/L
CMLS 1-3	07/24/02	Unknown	22	J	µg/L
CMLS 1-3	07/24/02	Unknown	28	J	µg/L
CMLS 2-7	07/24/02	Unknown	4.7	J	µg/L
CMLS 2-7	07/24/02	Unknown	25	J	µg/L
CMLS 2-7	07/24/02	Unknown	27	J	µg/L
CMLS 2-7	07/24/02	Unknown	33	J	µg/L
CMLS 3-4	08/15/02	Unknown	11	J	µg/L
CMLS 3-4	08/15/02	Unknown	23	J	µg/L
CMLS 3-4	08/15/02	Unknown	25	J	µg/L
CMLS 4-3	08/15/02	Unknown	5.5	J	µg/L
CMLS 4-3	08/15/02	Unknown	7.9	J	µg/L
CMLS 4-3	08/15/02	Unknown	19	J	µg/L
CMLS 5-4	08/11/03	Unknown	17	J	µg/L
CMLS 5-4	08/11/03	Unknown	28	J	µg/L
CMLS 6-5	08/12/03	Unknown	8.6	J	µg/L
CMLS 6-5	08/12/03	Unknown	26	J	µg/L
CMLS 7-6	08/18/03	Unknown	5.8	J	µg/L
CMLS 7-6	08/18/03	Unknown	9.4	J	µg/L
CMLS 7-6	08/18/03	Unknown	14	J	µg/L
CMLS 7-6	08/18/03	Unknown	15	J	µg/L
CMLS 7-6	08/18/03	Unknown	23	J	µg/L
CMLS 7-6	08/18/03	Unknown	43	J	µg/L
CMLS 8-4	08/18/03	Unknown	5	J	µg/L
CMLS 8-4	08/18/03	Unknown	6	J	µg/L
CMLS 8-4	08/18/03	Unknown	18	J	µg/L
CMLS 8-4	08/18/03	Unknown	24	J	µg/L
CMLS 8-4	08/18/03	Unknown	31	J	µg/L
CMLS 8-4	08/18/03	Unknown	70	J	µg/L

Table 12. Semi-volatile organic compounds detected at Camp McCain, Mississippi--Continued

Site name (fig. 2, 3; tables 1, 2)	Date	Parameter	Results	Remarks	Units
QALS 11	07/23/02	Unknown	3.9	J	µg/L
QALS 11	07/23/02	Unknown	5.3	J	µg/L
QALS 11	07/23/02	Unknown	16	J	µg/L
QALS 11	07/23/02	Unknown	25	J	µg/L
Campbell Creek	08/11/03	Unknown	4.2	J	µg/L
Campbell Creek	08/11/03	Unknown	4.4	J	µg/L
Campbell Creek	08/11/03	Unknown	6	J	µg/L
Campbell Creek	08/11/03	Unknown	40	J	µg/L

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