PURGEABLE ORGANIC COMPOUNDS IN GROUND WATER AT THE IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO--1988 AND 1989

by Larry J. Mann

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For readers who prefer to use metric units, factors for terms used in this report are listed below.

Multiply	By	To obtain
inch (in.)	25.40	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
gallon (gal)	3.785	liter

PURGEABLE ORGANIC COMPOUNDS IN GROUND WATER AT THE IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO--1988 and 1989

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ABSTRACT

Ground-water samples from 38 wells at the Idaho National Engineering Laboratory were analyzed for 36 purgeable organic compounds in 1988-89. The samples were collected and analyzed as a continuation of a water-quality program initiated in 1987. Thirty-six of the wells obtain water from the Snake River Plain aquifer and were equipped with dedicated or portable pumps. Water samples from one well that obtains water from the aquifer and one that obtains water from a perched ground-water zone were collected using a thief sampler.

Analyses of water from 22 wells indicated that the aquifer locally contained detectable concentrations of at least 1 of 19 purgeable organic compounds, mainly carbon tetrachloride, 1,1,1-trichloroethane, and trichloroethylene. Except for five wells, the maximum concentration of a specific compound in ground water was 6.4 µg/L (micrograms per liter) or less; the concentrations of most compounds were less than 0.2 µg/L. Water from four wells at and near the Test Area North contained from 44 to 29,000 µg/L of trichloroethylene. Water from a well that obtains water from a discontinuous perched ground-water zone at the Radioactive Waste Management Complex contained 1,400 µg/L of carbon tetrachloride, 940 µg/L of chloroform, 250 µg/L of 1,1,1-trichloroethane, and 1,100 µg/L of trichloroethylene.

Selected purgeable organic compounds, such as total xylene and methylene chloride, were detected in some ground-water samples and some blank samples consisting of boiled deionized water. Their presence in the blank samples suggests the compounds could have been inadvertently introduced into the ground-water samples during or subsequent to collection.

INTRODUCTION

The INEL (Idaho National Engineering Laboratory) includes about 890 mi^2 of the eastern Snake River Plain in southeastern Idaho (fig. 1). The INEL was established in 1949 and is used by the U.S. Department of Energy to test different types of nuclear reactors. The INEL is one of the main centers in the United States for developing peacetime uses of atomic energy, nuclear safety research, defense programs, and development of advanced energy concepts.

During June to November 1987, a reconnaissance-level sampling program was conducted to document the concentration of purgeable organic compounds in ground water at the INEL. Water samples were collected from 82 wells; 81 of these wells obtain water from the Snake River Plain aquifer and 1 well obtains water from a perched ground-water zone. Organic compounds historically have been used for degreasing, decontamination, and construction and maintenance activities in conjunction with the operation of nuclear reactors and the processing of nuclear fuel, and at reactor-support facilities. In addition, an estimated 88,400 gal of organic waste were disposed of prior to 1970 at the Subsurface Disposal Area at the RWMC (Radioactive Waste Management Complex; D.E. Kudera, EG&G Idaho, Inc., written commun., 1987). The buried waste included an estimated 24,400 gal of carbon tetrachloride. The remaining volume consisted of about 39,000 gal of lubricating oil used in machinery processes and about 25,000 gal of other organic compounds including trichloroethane, trichloroethylene, perchloroethylene, toluene, and benzene. In 1987, water samples from a disposal well at the TAN (Test Area North) facility contained 35,000 μg/L (micrograms per liter) of trichloroethylene and lesser amounts of other purgeable organic compounds (Mann and Knobel, 1987, table 2). The well has not been used to dispose of aqueous wastes since 1972 and has been used to monitor ground-water levels and the concentrations of selected radionuclides since 1985. Trichloroethylene and tetrachloroethylene were also in samples from production wells TAN-1 and -2.

In 1988 and 1989, 10 wells that were not sampled in 1987 were equipped with portable or dedicated submersible pumps to obtain water samples from

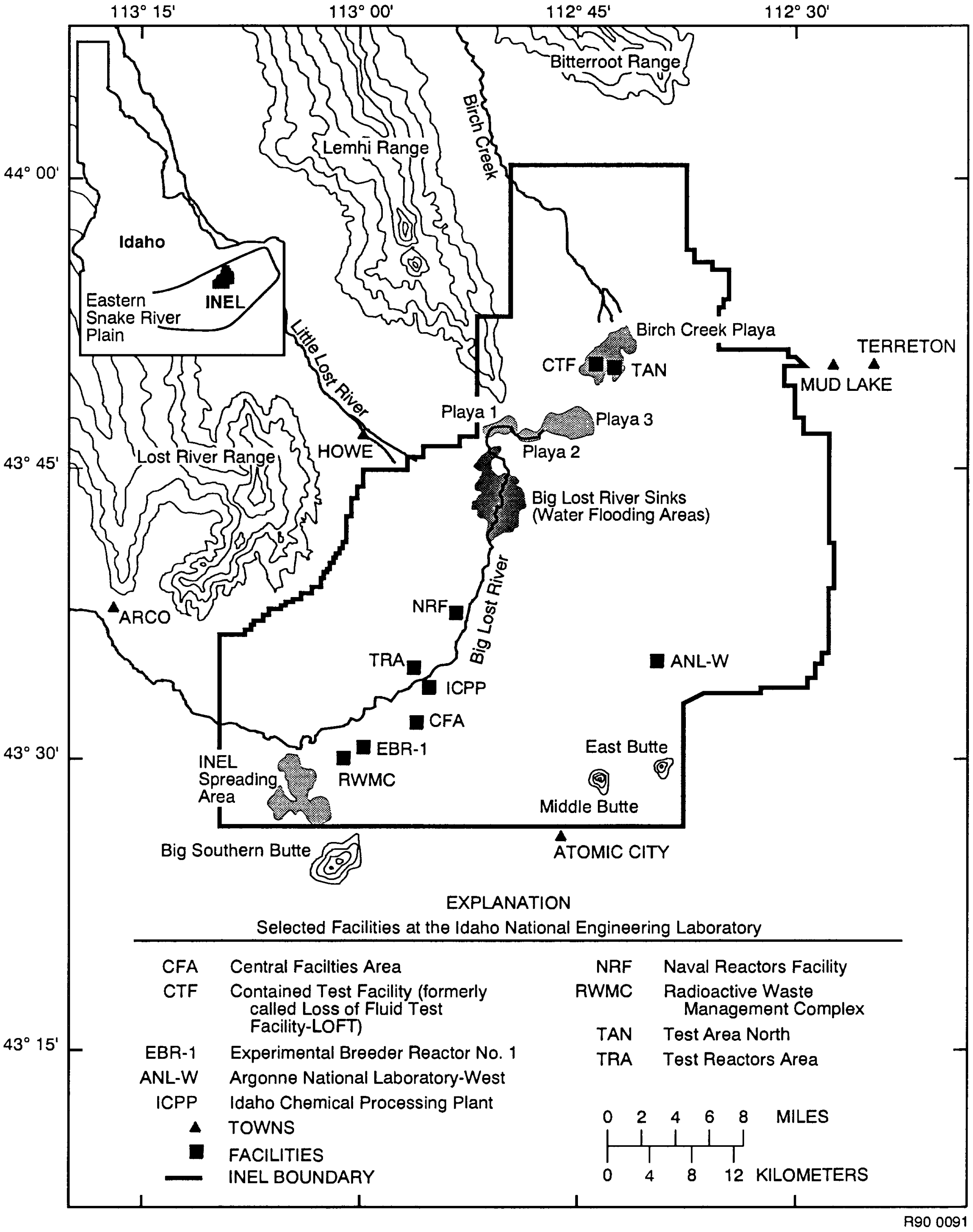

Figure 1.--Location of the Idaho National Engineering Laboratory and selected facilities.

the Snake River Plain aquifer; 1 well not sampled in 1987 was sampled with a thief sampler. Samples were also obtained from 27 wells that yielded water which contained purgeable organic compounds in 1987. Production wells TAN-1 and -2 were not sampled by the U.S. Geological Survey in 1988-89; samples were collected and analyzed by EG&G Idaho, Inc., the operating contractor for the U.S. Department of Energy.

This report describes the methods used to collect the water samples and the quality assurance instituted for the sampling program, and summarizes the concentrations of purgeable organic compounds detected in water samples collected in 1988-89 from 38 wells. Many of the wells were sampled several times during 1988-89; a total of 117 water samples were submitted to the laboratory for analysis of purgeable organic compounds. The sampling program was conducted by the U.S. Geological Survey in cooperation with the U.S. Department of Energy.

Geohydrologic Setting

The eastern Snake River Plain is a northeast-trending structural basin about 200 mi long and 50 to 70 mi wide. The plain is underlain by a layered sequence of basaltic lava flows and cinder beds intercalated with alluvium and lakebed deposits. Individual flows range from 10 to 50 ft in thickness, although the average thickness may be from 20 to 25 ft (Mundorff and others, 1964, p. 143). The sedimentary deposits consist mainly of lenticular beds of sand, silt, and clay with lesser amounts of gravel. Locally, rhyolitic lava flows and tuffs are exposed at the land surface or occur at depth. The basaltic lava flows and intercalated sedimentary deposits combine to form the Snake River Plain aquifer, which is the main source of ground water on the plain. The depth to water in the aquifer ranges from about 200 ft below land surface in the northern part of the INEL to more than 900 ft in the southern part.

The INEL obtains its entire water supply from the aquifer. Aqueous chemical and radioactive wastes generated at the INEL were discharged to ponds and wells from 1952 to 1983. Since 1983, most of the aqueous wastes have been discharged to unlined infiltration ponds. Many of the waste constituents enter the aquifer indirectly following percolation from the ponds through the unsaturated zone; prior to 1984, much of the waste was injected directly into the aquifer through deep wells.

Previous Investigations

The U.S. Geological Survey has conducted geologic, hydrologic, and water-quality investigations at the INEL since it was selected as a reactor testing area in 1949. Ground-water quality studies routinely include selected common ions, trace elements, and radionuclides. Organic compounds in ground water were investigated in 1980 by Leenheer and Bagby (1982) and in 1987 by Mann and Knobel (1987).

METHODS AND QUALITY ASSURANCE

The methodology used in sampling for purgeable organic compounds generally followed guidelines established by the U.S. Geological Survey's Organic Substances Task Group (W.L. Bradford, U.S. Geological Survey, written commun., 1985). Field methods and quality assurance practices are outlined in following sections.

Sample Containers

Baked 40-milliliter amber glass vials with inert septum caps, supplied by the U.S. Geological Survey's National Water Quality Laboratory in Arvada, Colorado, were used to collect the water samples. The vials are specialty containers cleaned in compliance with U.S. Environmental Protection Agency Federal Regulations 40-136 and 40-141. Four vials were collected at each site and care was taken to exclude air bubbles from the samples. The samples were protected from direct sunlight and were sealed and chilled at about 4 degrees Celsius to minimize the loss of purgeable organic compounds through the septum cap during transport to the laboratory.

Sampling Locations and Decontamination Procedures

Water samples were collected from 8 production wells equipped with sample delivery lines at the well head; 2 production wells equipped with water spigots located downstream from pressure tanks; and 26 ground-water quality monitoring wells equipped with dedicated or portable submersible pumps. Water samples from one unused well that obtains water from the aquifer and one well that obtains water from a perched ground-water zone were collected with thief samplers. The production wells are equipped with dedicated pumps and supply lines and did not require decontamination. To divert excess flow and facilitate sample collection, monitoring wells equipped with dedicated pumps were fitted with a portable discharge line about 2.5 ft long. The discharge line was 1.5 in. I.D. (inside diameter) galvanized-steel pipe equipped with a brass valve to control the flow rate. A galvanized T-joint was inserted into the line between the well head and the control valve, and a series of galvanized pipes, a brass valve to control the flow rate of the sampling port, and galvanized connectors were attached to the T-joint to reduce the diameter so that a 9/32 in. I.D. stainless steel delivery pipe could be attached as the sampling point. The 9/32 in. I.D. stainless-steel pipe was bent 90 degrees to facilitate sample collection. All fittings and pipes were rinsed with deionized water before installation at the well head. Subsequent flushing by several hundred to thousands of gallons of water pumped from the well ensured the portable discharge line was as clean of purgeable organic compounds as reasonably possible. The thief samplers used for sampling two wells were washed with hot water and detergent and rinsed with deionized water prior to use. A detailed discussion of techniques used for obtaining samples from wells that represent aquifer water chemistry is presented by Claassen (1982).

Sample Collection

To ensure that water representative of the Snake River Plain aquifer was sampled, a volume of water equivalent to a minimum of three well-bore volumes was pumped from each well; at some wells, 5 to 10 well-bore volumes were pumped prior to collecting the samples. The diameter of the well bore, rather than the volume of the casing, was used to calculate the minimum volume because of the potentially large difference between the two. In addition, temperature, specific conductance, and pH were monitored during pumping, using methods described by Wood (1981). When these properties of the water stabilized, which suggested that a steady-state water quality had been reached, a water sample was collected using the following protocol:

1. Field person responsible for collecting the water sample wore disposable vinyl gloves and stood where neither the field person nor the sample could be contaminated.

2. The outside of the sample delivery line was rinsed thoroughly with well water.

3. The sample delivery line was inserted to the bottom of the sample vial and a minimum of three vial volumes was allowed to overflow.

4. The vial was lowered gently; care was taken to ensure that air bubbles did not form in the vial.

5. The vial immediately was capped and inspected for air bubbles; if bubbles were detected, the vial was drained, reflushed, and refilled.

6. The exterior of the vial was dried, sealed with laboratory film, labeled, and stored in an ice chest.

7. Steps 3 through 6 were repeated until the required number of vials was collected successfully.

8. The vials were transferred to a secured refrigerator until they could be transported to the U.S. Geological Survey's National Water Quality Laboratory for analysis. Samples were transported in a sealed ice chest by overnight-delivery mail and usually were received by the laboratory a few days after collection. Quality control procedures for the laboratory require a maximum holding

time--the time from the date of sampling to date of analysis--of 14 days (Jones, 1987, p. 5); all samples were analyzed within 14 days after collection.

The ground-water samples were collected in accordance with a draft quality assurance plan which was implemented in 1988 and finalized in June 1989. Conditions at the well during sample collection were recorded in a field logbook and a chain-of-custody record was used to track samples from the time of collection until delivery to the U.S. Geological Survey's National Water Quality Laboratory, Arvada, Colorado. The quality assurance plan, field logbooks, and chain-of-custody records are available for inspection at the U.S. Geological Survey Project Office at the INEL.

Quality Assurance

A detailed description of the overall quality assurance practices and of the internal quality control used by the National Water Quality Laboratory is provided by Friedman and Erdmann (1982) and Jones (1987). Additional quality assurance instituted for this sampling program included: 10 blind replicates--duplicate samples with a different sample identification number sent to the same laboratory; 8 blank samples containing deionized water that had been boiled for a minimum of 12 minutes and 2 equipment blanks consisting of a deionized-water rinsate of field equipment. Ground-water and quality-assurance samples were analyzed by the National Water Quality Laboratory using a method that conforms to the U.S. Environmental Protection Agency's method 524 (Feltz and others, 1985; and Wershaw and others, 1987). The reporting level for most analyses was 0.2 μg/L; a reporting level is the lowest measured concentration of a constituent that may be reliably reported using a given analytical method (Feltz and others, 1985). The reporting level for one analysis was 100 μg/L, owing to the large concentrations of purgeable organic compounds.

Some of the blank samples contained small concentrations of one or more of the following compounds: methylene chloride; 1,2-dichloroethane; bromoform; dibromochloromethane; chloroform; toluene; and total xylene. Some of these compounds are common environmental contaminants and frequently occur in small concentrations in deionized water (L.D. Becker, U.S. Geological Survey, oral commun., 1987).

An equipment blank, consisting of a deionized-water rinsate of a new common garden hose contained 0.7 μg/L of toluene, 0.2 μg/L of benzene, 0.3 μg/L of ethylbenzene, 0.3 μg/L of methylene chloride, 0.2 μg/L of total styrene, and 4.3 μg/L of total xylene. On the basis of these analyses, the use of common garden hoses to divert water from the well to the point of sample collection was not considered a viable procedure.

Other of these compounds may have been contained in or inadvertently introduced into the deionized water during handling in the field or laboratory. However, those compounds of primary interest--carbon tetrachloride, 1,1,1-trichloroethane, and trichloroethylene--were not detected in the blank samples.

PURGEABLE ORGANIC COMPOUNDS IN GROUND WATER

Thirty-six wells that obtain water from the Snake River Plain aquifer at the INEL and that are equipped with dedicated pumps or could be pumped with a portable submersible pump were sampled for purgeable organic compounds. Well NRF-5, which obtains water from the aquifer, and well 92, which obtains water from a shallow, discontinuous perched ground-water zone at the RWMC, were sampled with a thief sampler. The 36 purgeable organic compounds for which analyses were performed are shown in table 1; the locations of wells that were sampled are shown on figure 2. The concentrations of selected purgeable organic compounds are shown in table 2 at the end of this report; only those compounds detected in water from one or more wells at concentrations equal to or greater than the reporting level of 0.2 μg/L are shown in table 2.

Analyses of water from 22 wells indicated that the Snake River Plain aquifer locally contained detectable concentrations of at least 1 of 19 purgeable organic compounds (table 2). The most prevalent compounds were

Table 1.--Purgeable organic compounds for which water samples were analyzed and their maximum contaminant levels

[Analyses were performed by the U.S. Geological Survey's National Water Quality Laboratory using an analytical method that conforms to U.S. Environmental Protection Agency method 524 (Feltz and others, 1985). Reporting level for all compounds is 0.2 micrograms per liter (Feltz and others, 1985). Maximum contaminant level: **A** indicates that total trihalomethanes--which includes bromoform, chloroform, dibromochloromethane, and dichlorobromomethane--in community water systems serving 10,000 or more persons cannot exceed 100 micrograms per liter (U.S. Environmental Protection Agency, 1987, p. 530); -- indicates that a maximum contaminant level has not been established or proposed for that compound; other maximum contaminant levels--values in parentheses are proposed maximum contaminant levels--are from J. Rodin (U.S. Environmental Protection Agency, written commun., 1989); units are micrograms per liter.]

Compound	Maximum contaminant level	Compound	Maximum contaminant level
Benzene	5.0	Cis-1,3-Dichloropropene	--
Bromoform	**A**	Trans-1,3-Dichloropropene	--
Carbon tetrachloride	5.0	1,3-Dichloropropene	--
Chlorobenzene	(100)	Ethylbenzene	(70)
Chloroethane	--	Methyl bromide	--
2-Chloroethyl vinyl ether	--	Styrene	(5.0)
Chloroform	**A**	Methylene chloride	--
Chloromethane	--	1,1,2,2-Tetrachloroethane	--
Dibromochloromethane	**A**	Tetrachloroethylene	(5.0)
Dichlorobromomethane	**A**	Toluene	(2,000)
1,2-Dichlorobenzene	(600)	Trichlorofluoromethane	--
1,3-Dichlorobenzene	--	1,1,1-Trichloroethane	200
1,4-Dichlorobenzene	75	1,1,2-Trichloroethane	--
Dichlorodifluoromethane	--	Trichloroethylene	5.0
1,2-Dibromoethylene	--	Vinyl chloride	2.0
1,1-Dichloroethane	--	Xylenes, mixed	(10,000)
1,2-Dichloroethane	5.0		
1,1-Dichloroethylene	7.0		
1,2-trans-Dichloroethylene	(70)		
1,2-Dichloropropane	(5.0)		

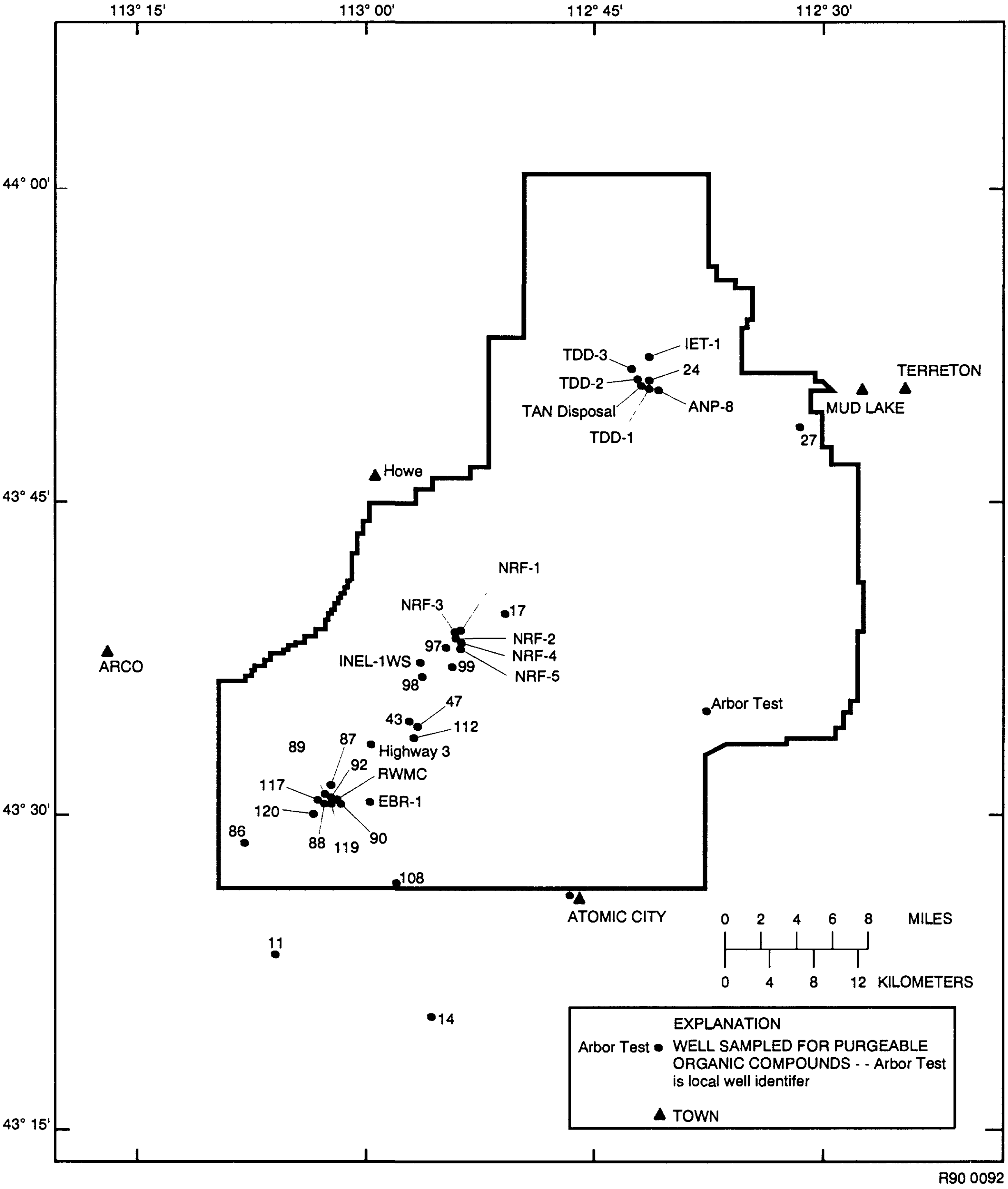

Figure 2.--Locations of wells sampled for purgeable organic compounds, 1988 and 1989.

carbon tetrachloride, 1,1,1-trichloroethane, and trichloroethylene. Chloroform, tetrachloroethylene, dichlorodifluoromethane, toluene, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2-dichloroethane, 1,2-trans-dichloroethylene, 1,1,2-trichloroethane, benzene, bromoform, methylene chloride, 1,4-dichlorobenzene, total xylene, trichlorofluoromethane, 1,2-dichloropropane, ethylbenzene, 1,2-dichlorobenzene, and vinyl chloride also were [redacted] detected in some ground water samples.

Except for five wells, the maximum concentration of a specific compound in ground water was 6.4 μg/L or less; the concentrations of most compounds were less than the reporting level of 0.2 μg/L. Water from four wells at and near the TAN contained from 44 to 29,000 μg/L of trichloroethylene. Water from a well that obtains water from a discontinuous perched ground-water zone at the RWMC contained 1,400 μg/L of carbon tetrachloride, 250 μg/L of 1,1,1-trichloroethane, 1,100 μg/L of trichloroethylene, and 940 μg/L of chloroform.

Selected purgeable organic compounds, such as total xylene and methylene chloride, were detected in some ground-water samples and some blank samples prepared from boiled deionized water. Their presence in the blank samples suggests the compounds could have been inadvertently introduced into the ground-water samples during or subsequent to collection.

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Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 1, Chap. D2, 24 p.

Table 2.--Concentrations of selected purgeable organic compounds in ground water

[Analyses by U.S. Geological Survey's National Water Quality Laboratory, Arvada, Colorado, using a method that conforms to the U.S. Environmental Protection Agency's method 524. Concentrations are shown in ug/L (micrograms per liter); <0.2 indicates the concentration was less than the reporting level of 0.2 ug/L. Well identifier: see figure[redacted] 2 [redacted] for location of wells. Blank - indicates sample vial contained boiled deionized water. Remarks: Replicate - indicates a second sample submitted for analysis using a different identifier. To convert gal/min (gallon per minute) to liter per second, multiply by 0.06308.]

Well identifier	Date sampled	Carbon tetra-chloride	Chloro-form	1,1,1-Tri-chloro-ethane	Tri-chloro-ethylene	Tetra-chloro-ethylene	Dichloro-difluoro-methane	Toluene	1,1-Di-chloro-ethane	1,1-Di-chloro-ethylene	Remarks
11	09/13/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.7	<0.2	<0.2	
14	09/14/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.0	<0.2	<0.2	
		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2	Replicate
17	12/14/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
24	01/14/88	<0.2	1.3	24	1,600	120	<0.2	<0.2	2.1	11	1,2-Dichloroethane, 0.8; 1,2-trans-Dichloroethylene, 48
	02/28/89	<0.2	1.0	12	1,400	64	<0.2	<0.2	1.5	9	1,2-Dichloroethane, 0.5; 1,2-trans-Dichloroethylene, 11; 1,1,2-Trichloroethane, 0.3
27	07/20/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2	Total xylene, 0.5
		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Equipment blank (portable pump)
43	06/21/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
47	09/30/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
86	06/22/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
87	04/06/88	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/22/88	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/18/88	0.6	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	01/04/89	0.7	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/05/89	0.6	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	07/11/89	0.8	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/26/89	0.8	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Benzene, 0.2
88	04/05/88	2.5	0.5	0.6	1.1	0.2	0.4	<0.2	<0.2	<0.2	
		2.3	0.5	0.6	1.0	<0.2	0.4	<0.2	<0.2	<0.2	Replicate
	06/24/88	4.1	0.6	0.8	1.2	0.2	<0.2	<0.2	<0.2	<0.2	
		4.1	0.6	0.8	1.2	0.2	<0.2	<0.2	1.0	<0.2	Replicate: Bromoform, 1.0
	09/29/88	1.9	0.4	0.4	0.9	<0.2	0.2	<0.2	<0.2	<0.2	
	01/04/89	2.3	0.4	0.4	1.0	<0.2	0.3	<0.2	<0.2	<0.2	
	04/04/89	2.2	0.4	0.4	1.0	<0.2	<0.2	<0.2	<0.2	<0.2	
	07/12/89	1.0	0.4	0.2	0.5	<0.2	1.0	<0.2	<0.2	<0.2	
		1.1	0.4	0.2	0.6	0.2	1.1	<0.2	<0.2	<0.2	Replicate

Table 2.--Concentrations of selected purgeable organic compounds in ground water--Continued

Well identifier	Date sampled	Carbon tetra- chloride	Chloro- form	1,1,1-Tri- chloro- ethane	Tri- chloro- ethylene	Tetra- chloro- ethylene	Dichloro- difluoro- methane	Toluene	1,1-Di- chloro- ethane	1,1-Di- chloro- ethylene	Remarks
89	02/01/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8	<0.2	
	04/05/88	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	
	06/24/88	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	
	10/18/88	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	
	01/04/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Replicate
	04/04/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	
90	04/06/88	0.7	<0.2	<0.2	0.3	<0.2	0.3	<0.2	<0.2	<0.2	
	06/22/88	1.0	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/18/88	0.7	<0.2	0.2	0.3	<0.2	1.6	<0.2	<0.2	<0.2	
		0.8	<0.2	0.2	0.3	<0.2	1.1	<0.2	<0.2	<0.2	Replicate
	01/18/89	0.9	<0.2	0.2	0.4	<0.2	0.2	<0.2	<0.2	<0.2	
		0.9	<0.2	0.2	0.4	<0.2	0.3	<0.2	<0.2	<0.2	Replicate
	04/05/89	0.8	<0.2	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	
	07/11/89	1.0	<0.2	0.3	0.4	<0.2	0.4	<0.2	<0.2	<0.2	
92	04/06/88	1,400	940	250	1,100	120	0.3	0.3	22	2.6	Thief sample from perched ground-water zone. 1,2-Dichloroethane, 1.6; Benzene 0.2; Trichlorofluoromethane, 0.4; 1,2-Dichloropropane, 12; 1,2-trans-Dichloroethylene, 1.7
97	09/26/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	11/30/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
98	11/29/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
99	11/30/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
108	09/05/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
112	09/28/88	<0.2	<0.2	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
		<0.2	<0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Replicate
117	02/01/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/05/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/27/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Methylene chloride, 1.7
	10/17/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	01/12/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/03/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
119	02/01/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/05/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/27/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/17/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Table 2.--Concentrations of selected purgeable organic compounds in ground water--Continued

Well identifier	Date sampled	Carbon tetra- chloride	Chloro- form	1,1,1-Tri- chloro- ethane	Tri- chloro- ethylene	Tetra- chloro- ethylene	Dichloro- difluoro- methane	Toluene	1,1-Di- chloro- ethane	1,1-Di- chloro- ethylene	Remarks
	01/12/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/03/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
120	02/01/88	1.9	0.2	<0.2	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/05/88	1.5	<0.2	0.4	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/27/88	2.1	0.2	0.5	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	Bromoform, 1.0
	10/18/88	1.1	<0.2	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	
	01/12/89	0.7	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/04/89	0.8	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	07/12/89	1.0	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
ANP-8	12/13/89	<0.2	<0.2	<0.2	6.4	3.7	<0.2	<0.2	<0.2	<0.2	
Arbor Test	02/15/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Atomic City	05/18/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EBR I	10/28/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/28/88	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	Replicate
Highway 3	05/18/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	5.2	<0.2	<0.2	
	11/01/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
IET 1	03/01/89	<0.2	<0.2	<0.2	0.3	0.7	<0.2	<0.2	<0.2	<0.2	1,4-Dichlorobenzene, 0.8
NRF-1	12/19/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
NRF 2	05/23/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	Total xylene, 0.5
	12/21/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
NRF-3	12/19/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
NRF-4	12/19/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
NRF-5	12/21/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	Thief sample
RWMC	02/18/88	1.2	<0.2	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	
		1.1	<0.2	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	Replicate
	04/06/88	1.1	<0.2	0.4	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	07/21/88	1.4	<0.2	0.4	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/28/88	1.0	<0.2	<0.2	0.5	0.2	<0.2	<0.2	<0.2	<0.2	
	11/28/88	1.1	<0.2	0.3	0.5	0.2	<0.2	<0.2	<0.2	<0.2	
	12/28/88	1.5	<0.2	0.4	0.7	0.2	<0.2	<0.2	<0.2	<0.2	
	01/18/89	1.5	<0.2	0.3	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	
	02/16/89	1.5	<0.2	0.4	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	
	03/23/89	1.4	<0.2	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/25/89	1.3	<0.2	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	05/24/89	1.3	<0.2	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/20/89	1.3	<0.2	0.3	0.5	0.2	<0.2	<0.2	<0.2	<0.2	

Table 2.--Concentrations of selected purgeable organic compounds in ground water--Continued

Well identifier	Date sampled	Carbon tetra- chloride	Chloro- form	1,1,1-Tri- chloro- ethane	Tri- chloro- ethylene	Tetra- chloro- ethylene	Dichloro- difluoro- methane	Toluene	1,1-Di- chloro- ethane	1,1-Di- chloro- ethylene	Remarks
	07/11/89	1.5	<0.2	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	08/29/89	1.3	<0.2	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	
	09/28/89	1.4	<0.2	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	
	10/26/89	1.6	<0.2	0.4	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	
TAN Disposal	01/11/88	<0.2	0.3	0.7	26,000	100	<0.2	1.0	1.7	25	Pumped at 20 gal/min; 1,2-trans-Dichloroethylene, 15,000 1,2-Dichloroethane, 0.4; Benzene, 0.5; Ethylbenzene, 0.4; 1,2-Dichlorobenzene, 4.6; 1,4-Dichlorobenzene, 0.4; Vinyl chloride, 26; Total xylene, 2.0
		<0.2	0.4	1.3	29,000	120	<0.2	1.1	1.8	25	Pumped at 37 gal/min; 1,2-trans-Dichloroethylene, 13,000 1,2-Dichloroethane, 0.5; Benzene, 0.6; Ethylbenzene, 0.5; 1,2-Dichlorobenzene, 5.1; 1,4-Dichlorobenzene, 0.6; Vinyl chloride, 27; Total xylene, 2.4
	03/07/89	<100	<100	<100	24,000	<100	<100	<100	<100	<100	1,2-trans-Dichloroethylene, 13,000
TDD-1	03/02/89	<0.2	<0.2	0.3	44	9.2	<0.2	<0.2	0.3	<0.2	1,2-trans-Dichloroethylene, 0.9
TDD-2	03/06/89	<0.2	0.4	0.3	180	11	<0.2	<0.2	<0.2	<0.2	1,2-trans-Dichloroethylene, 1.2
TDD-3	12/13/89	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	Pumped sample
	12/13/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	Bailer sample; Total xylene, 0.3
INEL-1WS	12/14/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Blank	01/05/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	<0.2	<0.2	
	02/01/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	Total xylene, 0.2
	02/18/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	04/07/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	05/18/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
	06/24/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.3	<0.2	<0.2	Methylene chloride, 1.4; Total xylene, 0.9
	06/29/88	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1,2-Dichloroethane, 0.8; Bromoform, 2.8; Dibromochloromethane, 0.3
	10/03/88	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	
Equipment blank (garden hose)	12/14/89	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	<0.2	Benzene, 0.2; Ethylbenzene, 0.3; Methylene chloride, 0.3; Total styrene, 0.2; Total xylene, 4.3