UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PRELIMINARY DATA FROM A SERIES OF ARTIFICIAL RECHARGE EXPERIMENTS AT STANTON, TEXAS

By R. L. Bassett, E. P. Weeks, M. L. Ceazan, S. G. Perkins, D. C. Signor, D. L. Redinger, R. L. Malcolm, G. R. Aiken, E. M. Thurman, P. A. Avery, W. W. Wood, G. M. Thompson, and G. K. Stiles

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Units and Abbreviations

C/Co	Unitless ratio of measured concentration divided by the initial concentration
d	Day
h	Hour
kg	Kilogram
kW	Kilowatt
L	Liter
L/s	Liter per second
m	Meter
m^3	Cubic meter
m^2/d	Meter squared per day
m/d	Meter per day
m/km	Meter per kilometer
mg/L	Milligram per liter
mg C/L	Milligram of carbon per liter
min	Minute
mL	Milliliter
mm	Millimeter
nm	Nanometer
ng/L	Nanogram per liter
Pa	Pascal
TNTC	Too numerous to count
µg/L	Microgram per liter
µL	Microliter

Symbols

BCF, $CBrClF_2$	Bromochlorodifluoromethane
DBM, CBr_2F_2	Dibromodifluoromethane
DOC	Dissolved organic carbon
F-11, Freon-11	Trichlorofluoromethane
F-12, Freon-12, and CCl_2F_2	Dichlorodifluoromethane

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ABSTRACT

A series of artificial recharge experiments was conducted by the U.S. Geological Survey at an experimental site located in Stanton, Texas. Five tests were performed from March 1977 through December 1978 to: (1) Evaluate the hydraulic properties of the aquifer; (2) test sampling and monitoring equipment; (3) compare tracers for future use in hydrologic investigations; and (4) determine the radial and vertical distribution of hydraulic properties at the site. Suites of inorganic, and both volatile and non-volatile organic tracers were used in the tests, and comparative data were obtained from sampling points at several radial distances and depths from the injection well. Hydraulic data from aquifer tests and geologic data from core material also were obtained during the investigation.

INTRODUCTION

The U.S. Geological Survey has conducted a series of artificial-recharge experiments at several locations in the Southern High Plains of Texas (Brown and others, 1978). Artificial recharge is defined in this report as a process by which man adds water to an aquifer. This ongoing-research effort is directed toward defining the hydrologic and geochemical characteristics affecting the movement and quality of water that has been added to an aquifer.

A series of five tests was conducted from March 1977 through December 1978 at an experimental facility located within the city limits of Stanton, Tex. (fig. 1). The investigation, which consisted of both hydrologic and geochemical studies, began with a pumping test, followed by three single-well tracer-injection tests, and concluded with a two-well tracer test.

Data from these experiments are discussed in the following sections in chronological order and are referred to as: (1) March 1977 pumping test; (2) March 1978 injection test; (3) May 1978 injection test; (4) August 1978 injection test; and (5) December two-well test. The pumping test was performed to identify the hydraulic properties of the aquifer and to determine

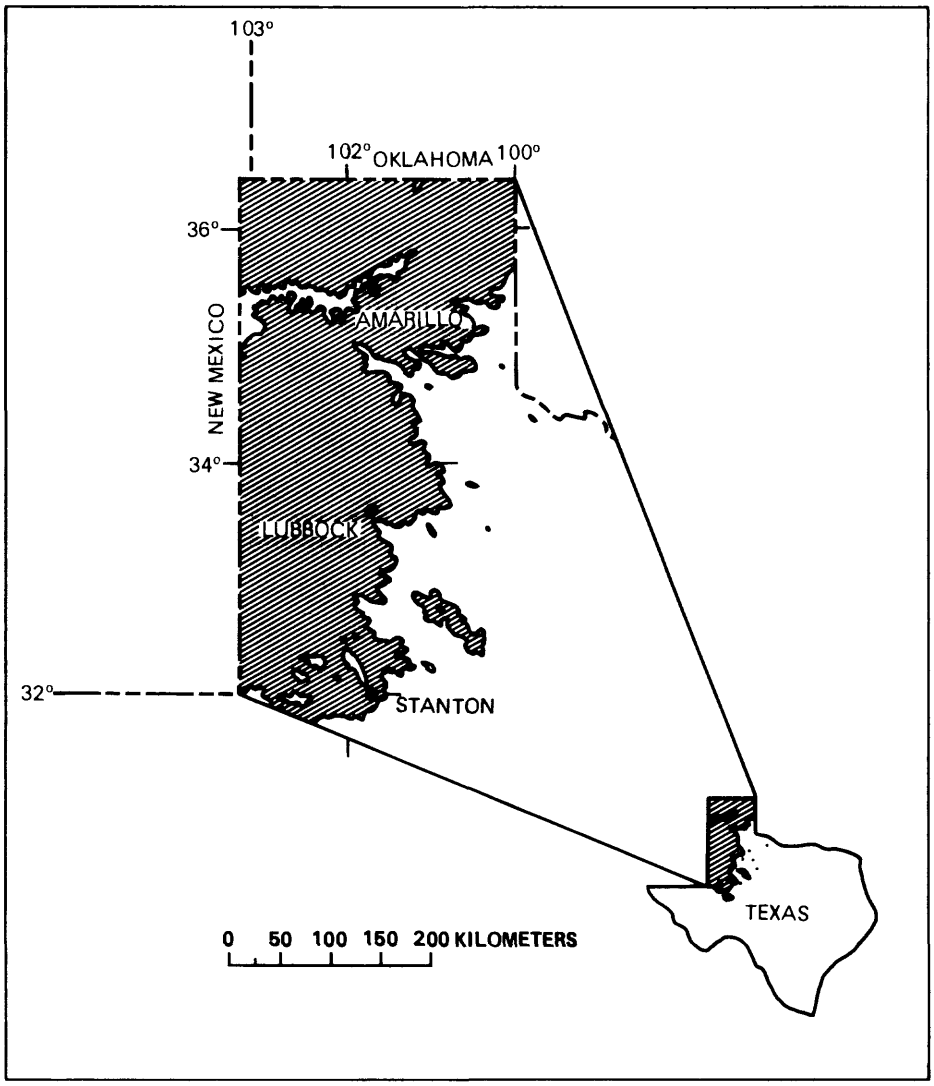

Figure 1.--Location of the Stanton, Tex. experimental site on the Southern High Plains of Texas.

well loss and efficiency of the injection well. The tracer-injection experiments had the following overall objectives: (1) Testing water-sampling apparatus and monitoring equipment for future investigations; (2) evaluating retention mechanisms for several ground-water tracers; and (3) determining vertical and radial velocity distributions and dispersion coefficients.

This report describes the sampling and monitoring equipment and presents data collected during the five tests. The report deals primarily with the performance of numerous tracers in an unconfined sand-and-gravel aquifer containing argillaceous and carbonaceous material. Only a few selected references by the authors on the tracers used in the Stanton experiments are listed below, as an extensive review of the literature on ground-water tracers is beyond the scope of this report. Davis and others (1980) present a review of commonly used ground-water tracers, as well as some preliminary data on fluorocarbon tracers. Thompson and Hays (1979) describe the use of trichlorofluoromethane (F-11) as an environmental tracer of ground-water movement. Wood and Ehrlich (1978) describe the use of yeast as a particulate tracer of ground-water movement for a previous test on well 1 at the Stanton test site. Dissolved organic carbon (DOC) has been used as an index of organic-contaminant movement from point sources into the ground water (Hughes and others, 1974). The differential movement and persistence of several organic solutes were determined useful in evaluating geochemical aspects of deep-waste storage by Leenheer and Malcolm (1976).

In each of the injection tests, both inorganic and organic compounds were used as tracers; the resultant data are presented in subsequent sections of the report. The operation of the research facility, the planning of the injection tests, and the selection of the inorganic tracers, were the responsibility of the U.S. Geological Survey Artificial-Recharge Project. Dr. Glenn Thompson of the University of Arizona was invited to cooperate in the tests because of his expertise in the analysis of volatile organics (fluorocarbons) used as ground-water tracers. Technical assistance in tracing and analyzing the movement of nonvolatile organic substances in the ground-water system was provided by the U.S. Geological Survey research project on organic geochemistry. Each research group had the responsibility of selecting, administering, and analyzing a group of tracers suitable for this geohydrologic environment. Tracers used in the geochemical studies are itemized in table 1; however, discussion of their analysis and the rationale for the selection, sequencing, and monitoring are deferred to the section on Analytical Methods, and to discussions of the individual tests.

SITE DESCRIPTION AND MONITORING TECHNIQUES

The Stanton, Texas experimental-recharge facility consists of a deepened and enlarged playa lake, a water-treatment plant, four dual-purpose production-injection wells, an injection well, and numerous observation wells, piezometers, and water-quality samplers (fig. 2). The lake-storage facilities, treatment plant, and production-injection wells were constructed by the city of Stanton during 1968, using a grant from the U.S. Department of

Table 1.--*Summary of the tracers used in the four geochemical tests*

March 1978: Injection Test	
Experiment 1	Experiment 2
iodide	ethanol
ethanol	benzoate
$CBrClF_2$	Freon-12

May 1978: Injection Test
natural dissolved organic material
bromide
boron
Freon-12
$CBrClF_2$
CBr_2F_2

August 1978: Injection Test				
Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
boron	bromide	boron	bromide	Freon-12
bromide	ethanol	ethanol	chloride	Freon-11
copper	acetate	aniline	iodide	$CBrClF_2$
deuterium	phenolphthalein	CBr_2F_2	fluoride	
$CBrClF_2$	benzoate	ethylamine	yeast	
	Freon-12			

December 1978: Two Well Test
benzoate

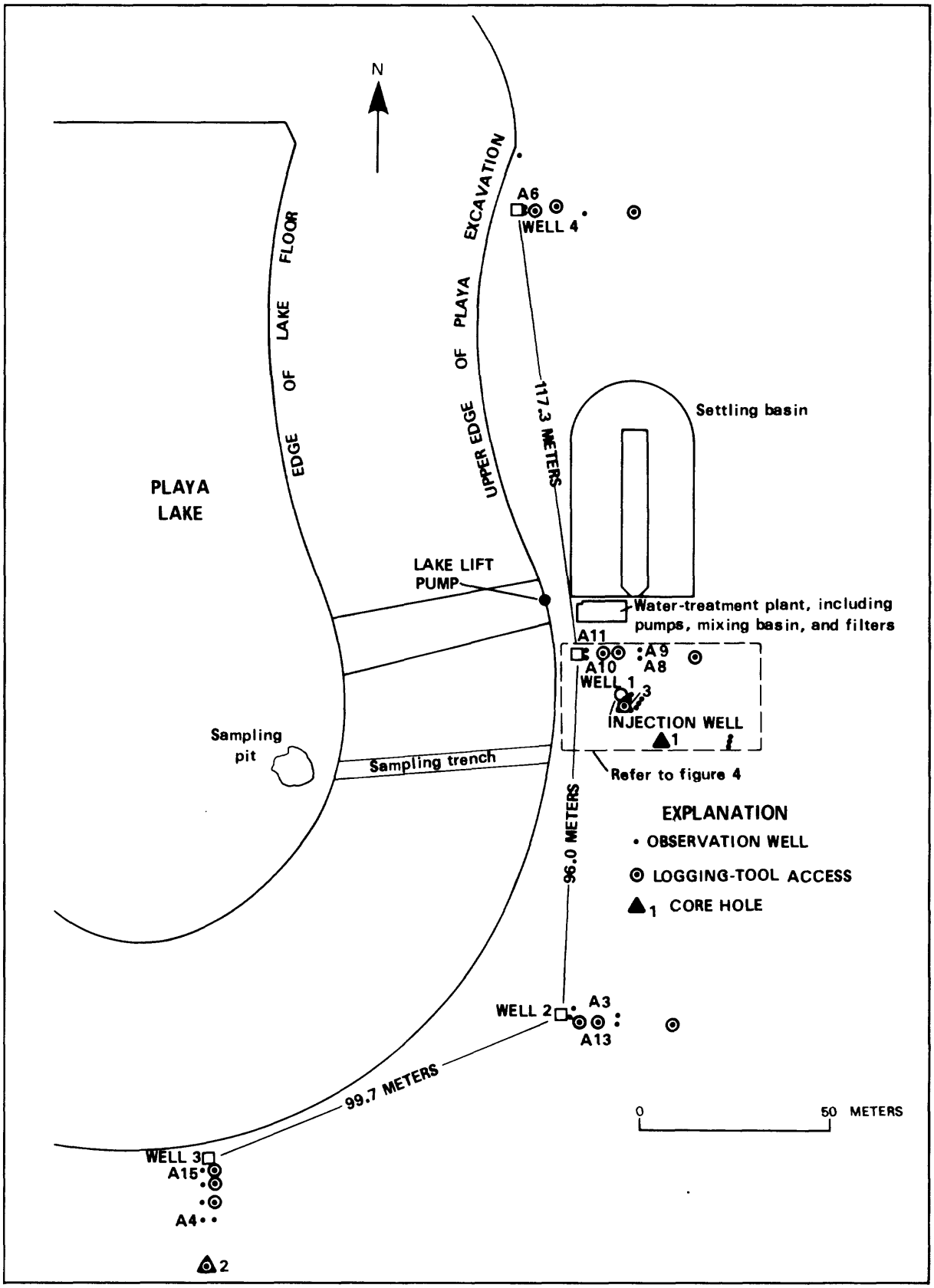

Figure 2.--Plan view of the arrangement of wells and physical plant at the Stanton, Tex. research site.

Housing and Urban Development. The playa was deepened and enlarged to alleviate periodic flooding of the town. The well systems were constructed to provide a municipal ground-water supply by treating and artificially recharging water that accumulated in the playa for later withdrawal. The High Plains Artificial-Recharge Research Project of the U.S. Geological Survey requested use of the facility for artificial-recharge experiments; this use was granted for 5 years (starting in 1970), and was later extended for another 5 years.

Storage and treatment facilities include the enlarged playa and associated stormwater collection system that drains into the lake; the lake-lift pump to move water from the lake to the treatment facility; chemical-feed pumps and a mixing basin for adding and mixing chemical flocculating agents; horseshoe-shaped settling basin; pick-up pump for removing water from the horseshoe basin; and three diatomaceous-earth filters (fig. 2). Ground-water and recharge pumpage facilities consist of four wells (fig. 2), drilled through the Ogallala Formation to the underlying Triassic red beds. These wells were drilled to a diameter of 0.75 m and were cased with 0.25-m casing, slotted from a depth of 21.3 m to total depth. The wells were gravel-packed to within 12.2 m of the land surface, and were cemented above that depth. Each well was equipped with a turbine pump powered by a 22.7-kW electric motor. Dual lines connect each well to the treatment plant, including a discharge line for pumping ground water, and a recharge line to transport water from the playa.

The U.S. Geological Survey drilled 17 observation wells and 13 logging-tool access holes within the area (fig. 2), not including those installed around the injection well constructed by the U.S. Geological Survey, described hereafter. Geologic data were obtained from three core holes (fig. 2), all installed by rotary wireline coring techniques. Rotary core hole 1 was cored from land surface to a depth of 43 m; however, core recovery in this hole was very poor. Rotary core hole 2 was cored from land surface to a depth of 50 m, at that site, with almost complete core recovery except for intervals from 9 to 13 m and from 25 to 27.5 m. The third core hole was cored in the interval from 30 m to 43 m, which includes the saturated portion of the Ogallala Formation at that location. Core recovery was almost complete.

Additional geologic information was obtained from a trench excavated in the lake bank, and a pit (fig. 2) in the lake floor. The trench was dug with a backhoe to a depth of 3.3 m. The trench was started at the lake floor, which consists of hard siliceous caliche that cannot be excavated with a backhoe, and was continued to the upper edge of the playa excavation, which is 7 m higher in altitude than the playa floor. By digging the trench into the sloping bank, it was possible to sample the top 7 m of material in a fresh open cut. The pit was excavated by blasting an opening in the siliceous layer with dynamite, and then excavating the loose rock and underlying unconsolidated material to a depth of 3.3 m with a backhoe.

Initial plans were to use one or more of the dual-purpose wells for injection experiments; however, long-term pump tests on well 1 and short-term tests on wells 2 through 4 indicated that all four wells were poorly developed and subject to hydraulic-head losses during withdrawal or injection. Attempts to further develop the wells were unsuccessful; consequently, a new injection well was drilled about 17 m from well 1. This well was drilled to a diameter of 0.3 m, using biodegradable drilling fluid. The well was completed with 0.25-m diameter wire-wound screen from a depth of 32 to 44 m, which spans the saturated thickness of the aquifer. Blank casing of 0.25-m diameter was cemented in place from a depth of 32 m to land surface. The well was developed by bailing, jetting, and swabbing to create a natural gravel pack.

Groups of observation wells, piezometers, and water samplers were located at distances of 2, 5, and 30 m from the injection well. In each group, the observation well was bottomed in the Triassic red beds at depths ranging from 44.2 to 44.8 m. Each observation well was screened through the entire saturated thickness of the aquifer to obtain integrated water samples for the full depth. Four piezometers, consisting of 0.6-m long, 0.032-m diameter well points connected to land surface through 0.025-m diameter pipe, were installed in a second hole at each location to measure water levels at various depths. A third hole in each group was equipped with four water-sampling devices to obtain water samples at various depths within the aquifer. These samplers consist of polyethylene tubing fitted with a check valve, and are referred to as point samplers in this report. They are similar to the porous cup sampler described by Wood (1973), except the ceramic cup was replaced with a 0.50-m long, 50-mm diameter section of plastic well screen, and the tubing was packed in the well screen with clean sand or glass beads (fig. 3). In addition to the three sampling distances mentioned above, samples were obtained from a well screened from a depth of 41.5 to 42.7 m, located 10 m (well A8, fig. 2) from the injection well, and from a well (well A11, fig. 2) screened from a depth of 30.5 to 41.8 m, located 15 m from the injection well.

Depths and locations relative to the injection well of the various observation wells, piezometers, and samplers used in the injection-well experiments are shown in figure 4. The injection well and the observation wells I-1, I-4, and I-7 are bottomed in the Triassic red beds at depths ranging from 44.2 to 44.8 m. The preinjection and prepumping depth to water was about 32 m, and the wells are screened through the saturated part of the aquifer. Screened intervals also are shown in a cross-sectional view in figure 5, so the relative vertical positions of the screens can be compared. Altitudes of the screen positions are listed in table 2. A single-point electrical resistivity log made in well I-1, located 2 m from the injection well, also is shown in figure 5. In general, deflections of the log trace to the left indicate greater clay content of the sediments at that level and, by inference, less hydraulic conductivity.

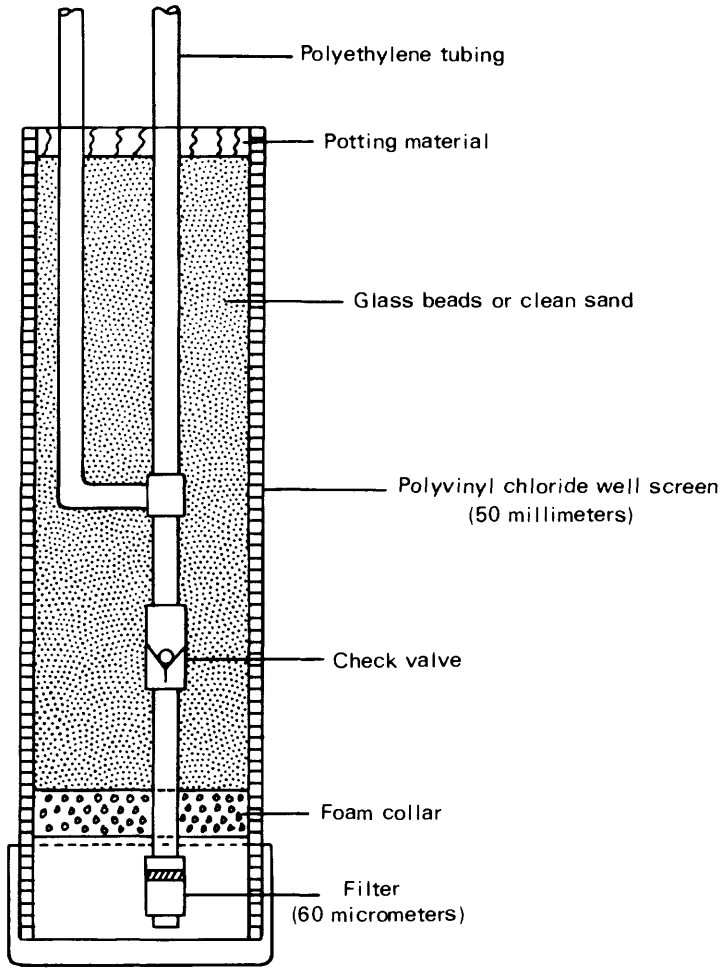

Figure 3.--Construction of the point samplers used in this investigation.

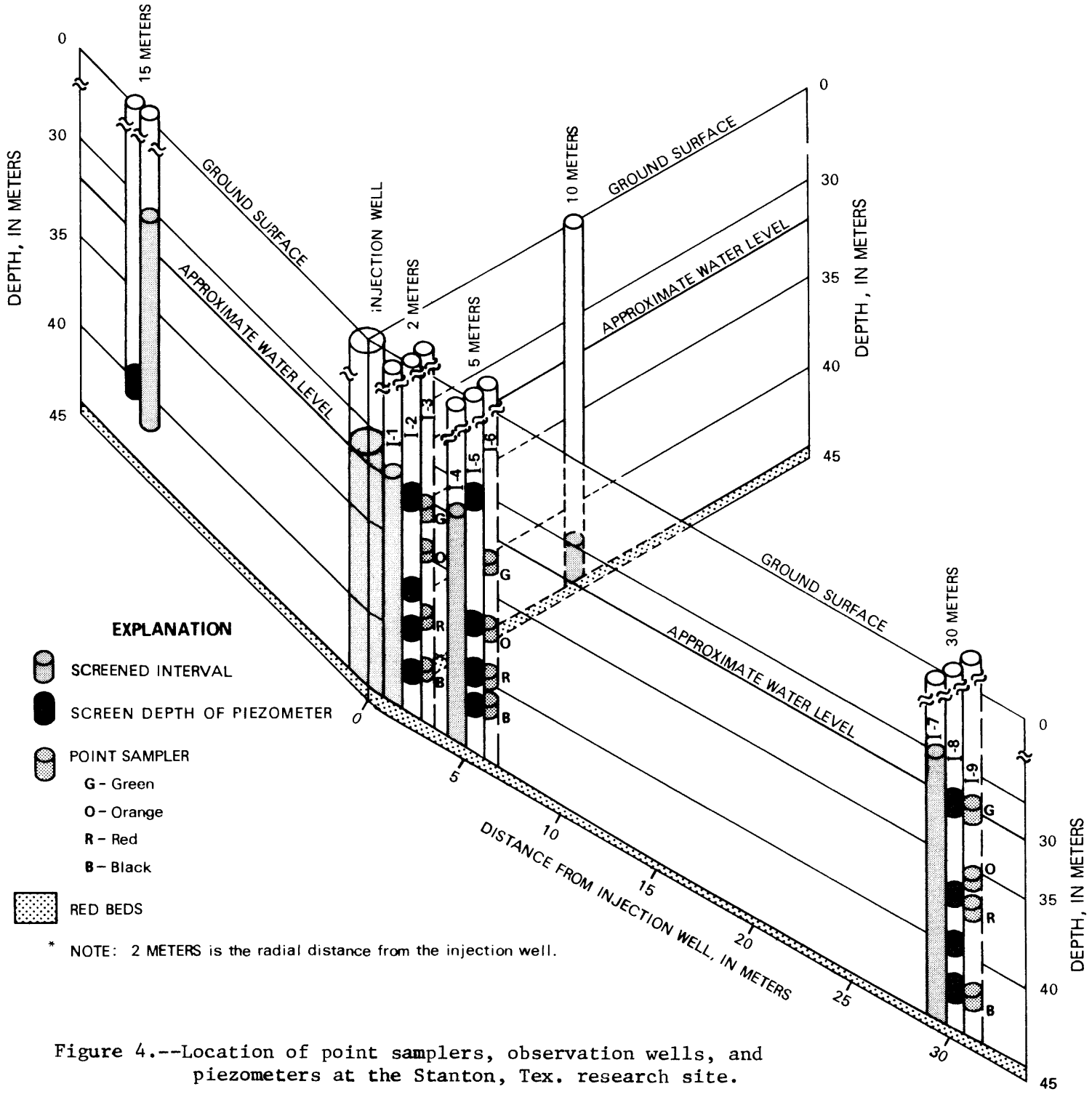

Figure 4.--Location of point samplers, observation wells, and piezometers at the Stanton, Tex. research site.

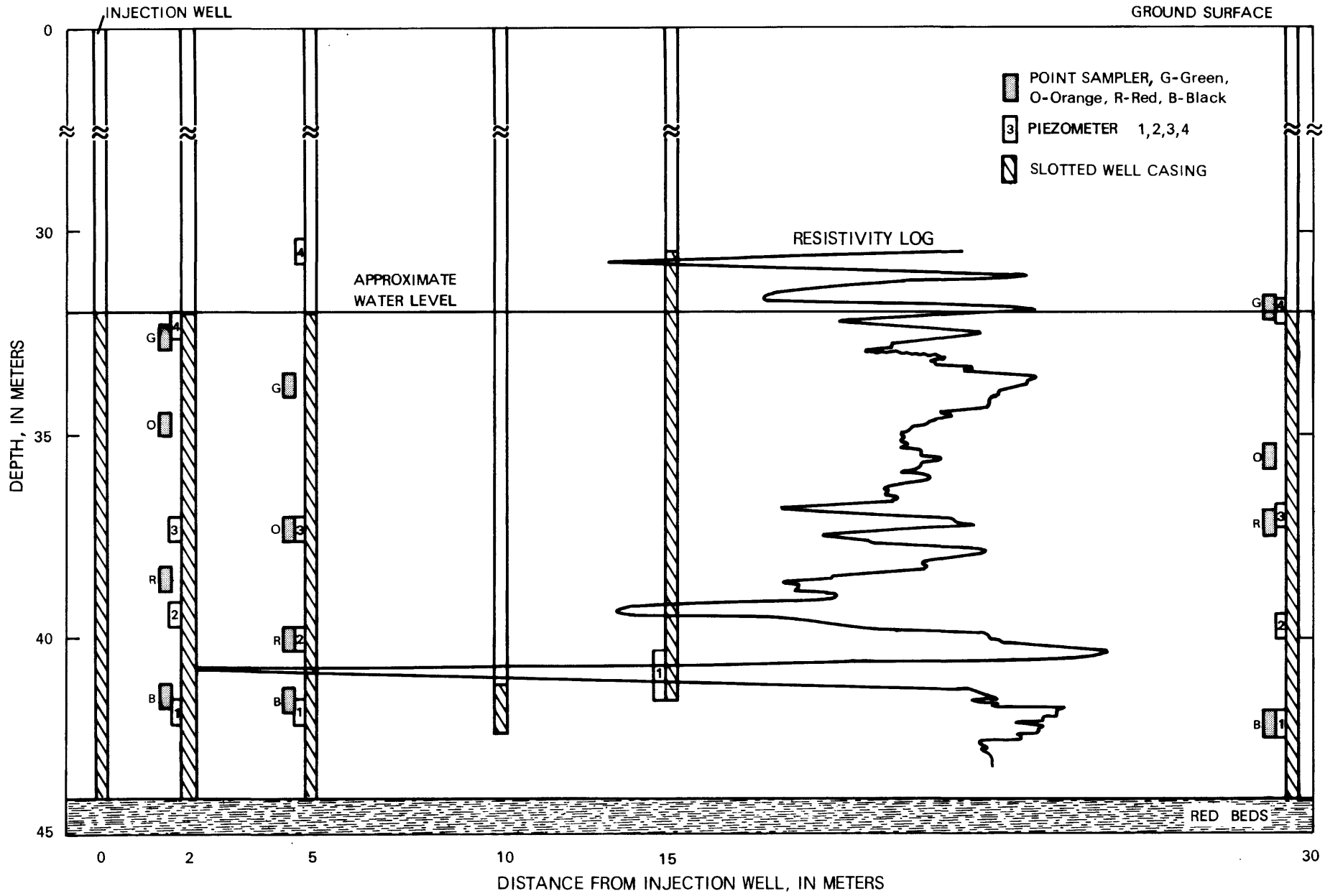

Figure 5.--Point-sampler arrangement, and resistivity log for the saturated part of the aquifer.

Table 2.--*Depth and type of sampling locations*

[p.s. = point sampler]

Radial distance from injection well (m)	Type of sampler	Range of vertical sampling (m)	Comments
2	Well	32.0-44.2	Integrated sample.
2	Black p.s.	41.3-41.9	
2	Red p.s.	38.4-39.0	
2	Orange p.s.	34.5-35.1	
2	Green p.s.	32.3-32.9	
5	Well	32.0-44.2	Integrated sample.
5	Black p.s.	41.5-42.1	
5	Red p.s.	40.0-40.6	Inoperable; an adjacent piezometer was used.
5	Piezometer	39.9-40.5	Screened piezometer tube.
5	Orange p.s.	37.2-37.8	
5	Green p.s.	33.5-34.1	Above the water table.
10	Well	41.5-42.7	Sampled only a small zone.
15	Well	30.5-41.8	Integrated sample.
30	Well	32.0-44.2	Integrated sample.
30	Black p.s.	42.1-42.7	
30	Red p.s.	37.1-37.7	
30	Orange p.s.	35.4-36.0	
30	Green p.s.	31.7-32.3	Above the water table.

Water samples from the fully penetrating observation wells at 2, 5, and 30 m were obtained using small-diameter gas-operated sample pumps (described by Signor, 1978). Intakes for these pumps were manifolded to draw water into the pump from points spaced 1.6 m apart through the full initially saturated thickness of the aquifer. Pumps were in continuous operation, and samples for chemical analysis were collected periodically from the pump outflow.

The point samplers were operated in the following manner: (1) Pressure was maintained in the lines by a 6,895-Pa check valve, which prevented water from entering the sampler before the start of the sampling sequence; and (2) water was drawn into the sampler by releasing pressure and applying a vacuum for 2 min at selected sampling times. Once water had been drawn through the sampler into the lines, the vacuum was removed and pressure was applied from a nitrogen-cylinder tank to bring the sample to land surface. All the samplers performed as intended except the inoperative red-coded point sampler at 5 m from the injection well. However, the green point sampler at 30 m was above or so near the water table that samples could not be obtained during any of the three tests. Both the 2-m and 5-m green samplers were sampled during the March test, but the water table had declined to the point that only the 2-m green sampler could be sampled during May. None of the green point samplers could be sampled during the August test because of additional declines in the water table between May and August 1978.

During the March 1978 test, the wells at 10 and 15 m were pumped using small-diameter bladder-type pumps designed by R. F. Middelburg of the U.S. Geological Survey. During the May 1978 and August 1978 tests, these wells, and the piezometer completed at the same distance and depth as the 5-m red sampler, were sampled using pumps that consisted of check-valve-equipped copper cylinders connected to the surface by two lengths of polyethylene tubing. Water enters these samplers because of hydrostatic pressure on the submerged check valve, and is expelled at surface by application of pressure from an air compressor. These samplers were operated by alternately applying and releasing pressure for 1-min intervals through a timer-equipped solenoid valve. In addition, point samples also were collected at several depths and times during the August 1978 test from the 15-m well, using a straddle-packer arrangement on one of the copper-tube pumps; these samples are footnoted in the appropriate tables.

Water levels were monitored in piezometers consisting of 25-mm diameter, 0.6-m long well screens emplaced in wells I-2, I-6, and I-8 at depths shown in the cross section (fig. 5). Water levels also were measured in observation wells A3, A6, A9, A10, and A14 (fig. 2). Pumping or injection rates into the production well were measured using inline propellor-driven Sparling* flowmeters. Periodic flowmeter traverses were made in the injection well

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*The use of trade names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

during injection tests to determine which zones being recharged. Periodic neutron soil-moisture logs were made in selected observation wells to monitor changes in water stored in the capillary fringe and the unsaturated zone caused by changes in the altitude of the water table.

With the exception of the yeast and fluorocarbons, all tracers were added to the injection stream with chemical-feed pumps during each of the experiments; fluorocarbon tracers were contained in pressurized cylinders. Their flow into the injection water was controlled by a needle valve in the connecting tubing.

During the August 14, 1978, pulse-injection test, the injection stream was diverted through a sample chamber containing the tracers, as shown in figure 6. The sample chamber operated as follows: Prior and subsequent to injection of the tracer-bearing pulse, valve 1 was opened, and valves 2 and 3 were closed, so flow bypassed the chamber. Immediately prior to the pulse-injection test, the chamber was filled with the tracer solution. To start the pulse, valve 1 was closed and valves 2 and 3 were opened simultaneously to divert the injection stream through the chamber, and thus create a pulse of tracer-tagged water in the stream. After 2 min, valves 2 and 3 were closed, and valve 1 reopened to avoid gradual flushing of tracer-bearing water from the chamber.

GEOLOGY

The Stanton, Texas research site is located on the southern edge of the Ogallala aquifer, which is the principal water-bearing formation in the region. The aquifer is wholly contained within the Ogallala Formation of Miocene age. The Ogallala Formation is underlain by red Triassic shales and sandstones, which form an impermeable lower boundary to the aquifer at a depth of 44 to 45 m below land surface (fig. 7).

The lithologic column from land surface to the base of the aquifer, as determined from examination of the trench and pit and of cores from test holes (fig. 2) is shown in figure 7. The keyed numbers along the column refer to tables 3, 4, and 5, where additional information is given about the mineralogy, porosity, or hydraulic conductivity at that point in the column.

The sediments in this column are primarily alluvial material derived by erosion of the southern extensions of the Rocky Mountains in New Mexico. The sediments range from well-sorted subangular-to-angular argillaceous sands to poorly-sorted gravels, with occasional pebbles having diameters as much as 40+ mm. Zones of calcium carbonate caliche occur in the upper part of the column, commonly associated with colloidal silica leached from the aggrading soil profile. One such zone occurs from about 6 to 7 m; it is extremely hard and difficult to penetrate during drilling. Several relatively impermeable clay lenses are present in the section, but are not continuous enough to be stratigraphic markers. The sediments are grossly inhomogenous, and hydraulic conductivities vary widely through the section.

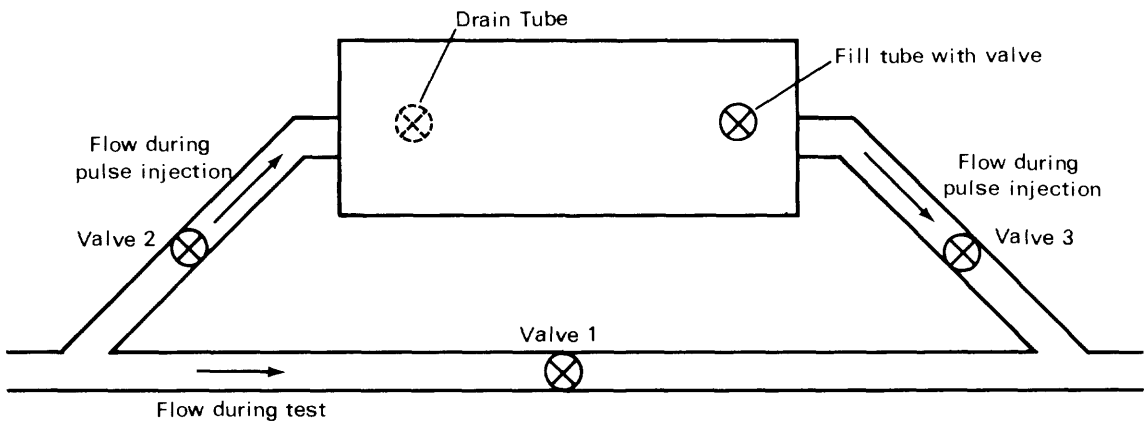

Figure 6.--Bypass chamber used to produce a virtually instantaneous pulse of tracer-tagged water in the injection stream. (Valve 1 is open during bypass flow, and valves 2 and 3 are open during pulse injection.)

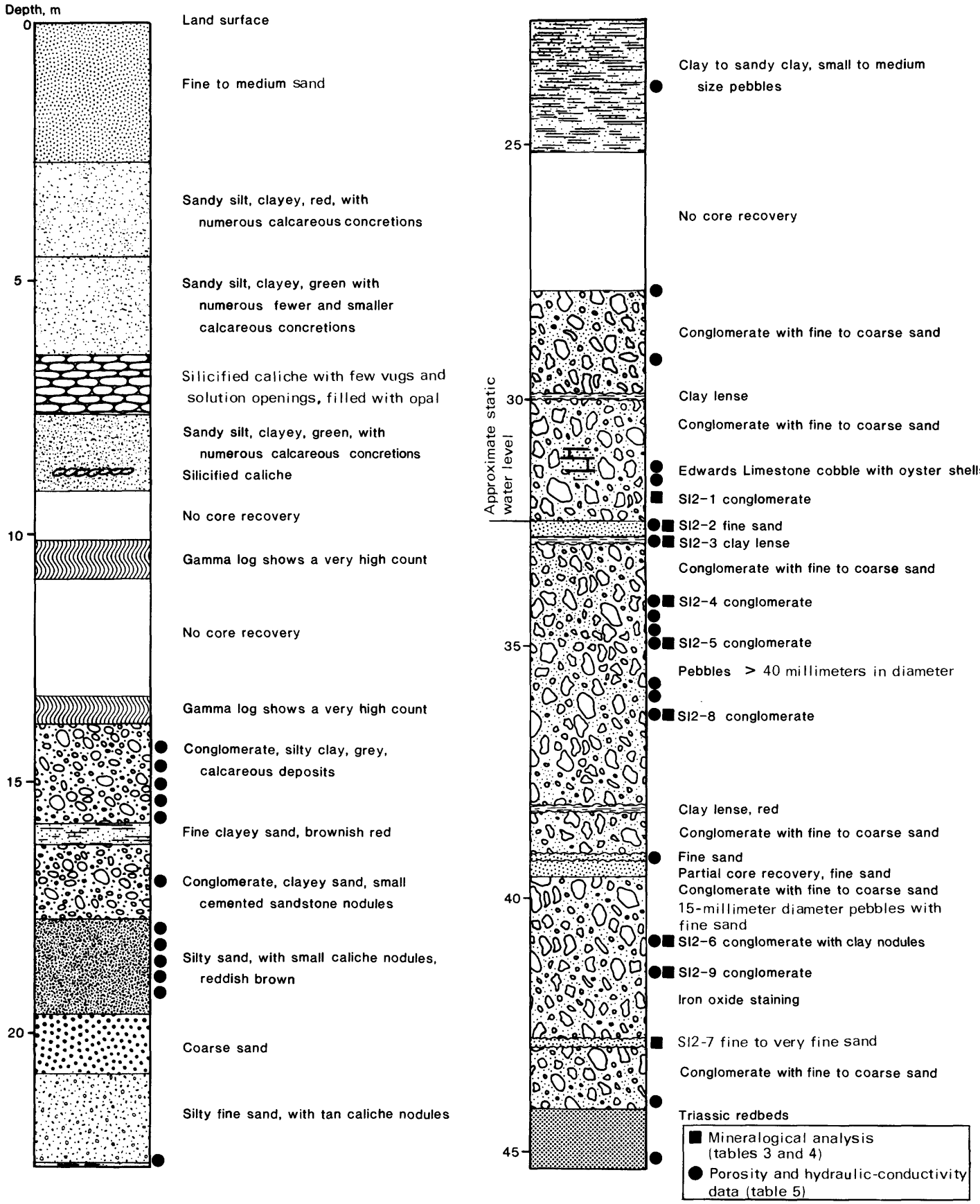

Figure 7.--Lithologic column from the Stanton, Tex. site with point locations of mineralogical analyses, porosity, and hydraulic-conductivity determinations.

Table 3.--*Mineralogy of the lithologic column as determined from cores taken from the area adjacent to the injection well*

Depth (m)	Percentage of $CaCO_3$ from average CO_3	Mineral percentage					Clay-mineral percentage of the clay fraction			
		Quartz	Calcite	Feldspar	Plagioclase	Clay minerals	Kaolinite	Chlorite	Illite	Smectite and mixed layer
14.6-14.8	54.1	23	62	2	4	5	---	---	---	---
14.8-14.0	38.4	---	---	---	---	---	---	---	---	---
15.4-15.6	29.4	36	48	4	9	5	---	---	---	---
15.6-15.7	25.6	---	---	---	---	---	---	---	---	---
16.0-16.2	7.2	57	13	0	8	10	9	0	9	82
16.9-17.1	14.9	57	25	5	9	10	---	---	---	---
17.7-17.8	10.0	56	22	6	9	10	9	0	9	82
17.8-18.0	7.5	---	---	---	---	---	---	---	---	---
18.4-18.6	11	60	18	4	15	10	---	---	---	---
18.6-18.8	8.7	---	---	---	---	---	---	---	---	---
19.2-19.4	----	57	12	6	9	13	6	0	19	75
22.7-22.9	3.8	66	8	6	9	10	---	---	---	---
24.4-24.6	8.5	64	17	9	9	5	14	0	14	71
28.5-28.7	25.2	---	---	---	---	---	---	---	---	---
30.0-30.2	20.7	34	32	2	4	25	8	0	8	84
32.0-32.2	57.8	17	63	1	2	5	---	---	---	---
32.5-32.6	----	---	---	---	---	---	15	0	10	75

Table 3.--*Mineralogy of the lithologic column as determined from cores taken from the area adjacent to the injection well*--Continued

Depth (m)	Percentage of $CaCO_3$ from average CO_3	Mineral percentage					Clay-mineral percentage of the clay fraction			
		Quartz	Calcite	Feldspar	Plagioclase	Clay minerals	Kaolinite	Chlorite	Illite	Smectite and mixed layer
32.9-33.0	----	---	---	---	---	---	10	0	10	80
33.3-33.4	----	31	6	<1	<1	60	15	0	7	78
34.5-34.7	----	---	---	---	---	---	10	0	5	85
34.9-35.1	35	34	49	3	4	5	---	---	---	---
35.1-35.2	45.7	16	55	2	2	10	---	---	---	---
35.2-35.4	----	---	---	---	---	---	15	---	10	75
36.1-36.3	48	23	62	3	5	5	---	---	---	---
36.3-36.5	20	46	35	7	7	10	---	---	---	---
36.8-37.0	----	---	---	---	---	---	15	---	10	75
39.5-39.7	67	9	73	0	1	5	---	---	---	---
41.2-41.3	26	40	37	4	1	10	---	---	---	---
41.2-41.4	----	---	---	---	---	---	15	0	25	60
41.8-42.0	----	---	---	---	---	---	10	0	15	75
43.3-43.4	----	---	---	---	---	---	15	0	15	75
44.4-44.5	28	36	44	2	9	10	---	---	---	---
45.5-45.6	6	23	12	4	3	55	---	---	---	---
45.6-45.8	3.3	---	---	---	---	---	---	---	---	---

Table 4.--*Mineralogy of the heavy minerals present in the cores obtained from an area adjacent to the injection well as determined by X-ray diffraction*

[Minerals are expressed as a percentage of the heavy-mineral fraction]

Mineralogy	Depth (m)						
	16.0-16.2	20.0-20.1	24.2-24.4	30.0-30.2	31.9-32.0	36.3-36.5	41.2-41.4
Total heavy-mineral percentage	0.9	0.5	1.0	0.6	0.5	0.9	6.0
Magnetite	40	29	62	41	34	39	19
Hematite	5	7	7	7	11	4	6
Ilmenite	6	2	4	1	2	2	----
Leucoxene	3	8	3	3	7	2	1
Rutile	----	<1	----	----	----	----	----
Limonite	25	15	13	25	25	16	59
Carbonates + anhydrite	2	3	2	8	5	11	4
Serite + celestite	1	1	<1	----	2	5	<1
Monazite	1	----	----	1	----	<1	----
Apatite	1	<1	1	1	1	1	----
Microcrystalline phosphates	2	4	3	3	1	2	----
Quartz + feldspars	4	3	1	1	3	7	1
Chert	<1	<1	----	<1	1	1	<1
Muscovite	----	1	----	<1	2	----	----
Phlogopite	----	2	----	----	----	----	<1

Table 4.--*Mineralogy of the heavy minerals present in the cores obtained from an area adjacent to the injection well as determined by X-ray diffraction*--Continued

Mineralogy	Depth (m)						
	16.0-16.2	20.0-20.1	24.2-24.4	30.0-30.2	31.9-32.0	36.3-36.5	41.2-41.4
Biotite	----	----	----	----	1	----	----
Chlorite	----	----	----	----	----	----	1
Hornblende	----	----	----	----	----	----	1
Oxy-hornblende	1	----	----	----	----	----	----
Tourmaline	----	2	<1	1	<1	----	<1
Zoisite	----	1	----	----	<1	----	----
Epidote	3	3	1	1	----	<1	1
Garnet	1	1	1	1	----	1	----
Zircon	1	----	2	----	<1	<1	----
Unidentified	5	16	1	5	<1	5	7

Table 5.--*Porosity and hydraulic-conductivity data determined from core samples from an area adjacent to the injection well*

Sample number	Porosity (percent)	Hydraulic conductivity (m/d)
SI2-1	26.5	8.2×10^{-2}
SI2-2	27.8	2.1×10^{-1}
SI2-3	----	3.1×10^{-5}
SI2-4	24.0	2.4×10^{-2}
SI2-5	28.7	3.3×10^{-1}
SI2-8	25.5	1.4×10^{-1}
SI2-6	28.2	3.6×10^{-1}
SI2-9	21.3	1.2×10^{-2}
SI2-7	30.9	8.2×10^{-2}

HYDROLOGY

The regional ground-water flow system in the Southern High Plains has been discussed by Cronin (1964), and will not be described in detail here. The Ogallala aquifer underlies the entire Southern High Plains. Ground water occurs under unconfined (water-table) conditions throughout most of the area. The hydraulic gradient averages between 1.3 and 3.0 m/km.

At the Stanton experimental site, the regional flow system is affected by recharge from the excavated playa lake, and by pumpage of ground water for irrigation and domestic use. The hydraulic gradient at the site slopes from the point of recharge below the lake toward the southeast, even when the lake is dry. Apparently, deep percolation in the unsaturated zone continues during those periods, maintaining recharge to the ground-water reservoir. A perched ground-water zone occurs at a depth of about 18 m throughout the site. Percolation from this perched zone may provide an additional source of recharge during periods when the lake is dry.

The average depth to the regional water table at the Stanton site was about 33.5 m below land surface during 1970-78. Measured water-level depths have ranged from about 32.0 to 36.0 m, but there are no apparent long-term trends in water levels. Depth to water in the injection well and the saturated thickness of the aquifer immediately prior to the start of the various pumping and injection tests are tabulated below:

Date	Depth to water (m)	Saturated thickness (m)
[1/] June 1973	32.9	11.1
[1/] July 1976	32.8	11.2
Mar. 1977	31.7	12.3
Mar. 1978	33.3	10.7
May 1978	33.2	10.8
Aug. 1978	35.2	8.8
Dec. 1978	34.3	9.7

[1/] Depth to water measured in well 1, located 17 m west of the injection well.

In addition to the seasonal variations, water levels fluctuate diurnally in response to changes in atmospheric pressure. These daily fluctuations average about 30 mm, but can be as large as 300 mm when a major barometric-pressure change occurs.

A number of laboratory analyses of porosity and of hydraulic conductivity were made on cores obtained while drilling observation well I-2. The depths, porosity, and hydraulic conductivity values for these cores are listed in table 5. Porosity values are relatively uniform with depth, but the hydraulic-conductivity values show great variability. This variation is consistent with the variations in the injection loss with depth in the injection well, although the injection losses are affected by well-bore plugging as well as by variations in hydraulic conductivity of the aquifer materials.

ANALYTICAL METHODS

General

Precautions were taken during this investigation to insure that the water samples represented the natural environment as accurately as possible. Some constituents present in water are unstable, and change before they can be analyzed in the laboratory. Measurement of these constituents was done either at the well site or the samples were preserved for future analysis according to accepted methods. Alkalinity and pH were measured immediately after sample collection, according to the methods of Wood (1973). The alkalinity titration was performed automatically by using a syringe pump that delivered the acid into the water sample; a strip-chart recorder was used to plot the titration curve. Bromide and iodide were monitored at the well site with Orion specific-ion electrodes and an Orion 701 digital meter. Specific conductance and water temperature were measured at the well site, and samples to be used for complete chemical analyses were filtered and acidified according to the methods of Wood (1973) and Brown and others (1970). Boron was analyzed in the laboratory according to the dianthrimide method using an ultraviolet visible spectrophotometer, and bromide was determined both by the catalytic-oxidation technique and the specific-ion-electrode method (Brown and others, 1970; Orion Research, Inc., 1977). All other inorganic analyses were performed in a U.S. Geological Survey central laboratory according to standard methods (Brown and others, 1970).

The yeast analysis was performed at the well site using standard techniques. Known volumes obtained from serial dilutions of the samples were filtered through membrane filters, as described by the American Public Health Association and others (1971). Filters were placed on absorbent pads saturated with M-Green Yeast and Mold Broth (BBL no. 11286) and incubated at 30°C for 36 hours. Colonies were counted under low magnification.

Fluorocarbon-Compound Analysis

All the fluorocarbon measurements were made at the test site to prevent tracer loss by volatilization. Two methods of analysis were used: A method for concentrations in the nanogram per liter (part per trillion) range, and a method for concentration in the milligram per liter (part per million) range.

The instrumentation for determining fluorocarbon concentrations in the nanogram per liter range is shown schematically in figure 8; it consists basically of two parts: (1) A sample-handling system that removes the tracer from a 5- to 25-mL water sample by gas stripping and concentrates it in a trapping loop for injection into a chromatographic system; and (2) a Varian 3700 series gas chromatograph equipped with an electron-capture detector for measurement of the gas sample stripped out of the water. The description of the analytical procedure is given by Thompson (1976) and Thompson and Hayes (1979).

During the final August experiment, tracer analyses were performed by a more conventional chromatographic technique. During the August test, tracers were measured by direct injection of 1-μL water samples onto a single column attached directly to the detector; thus, the tracers were chromatographically separated from each other and from the water. The limit of detection for most tracers by this method is in the microgram per liter range. This method was used because extremely high sensitivity was not needed, and it is more rapid than the sample-stripping technique. The chromatographic column packing used for the direct-injection procedure was 100-120 mesh proapack Q (Alltech, Inc., Arlington Heights, Ill.), and the column dimensions were 1 mm ID x 1 m long.

During the injection of the fluorocarbons, a problem developed with time that caused large variations in the input concentration. The reasons for this fluctuation are suspected to be pressure changes in the injection vessels and the main flow line, and interaction of the tracers with organic matter inside the injection plumbing. Fluorocarbon concentrations in the flow stream remained anomalously large even after addition of the fluorocarbons had ceased. The variation is shown in figures 9 through 11. Because of the large fluctuations in input concentrations, initial injection concentrations (C_0) during the August 1978 tests were computed as average concentration throughout their respective injection periods.

Nonvolatile Organic-Compound Analysis

Dissolved organic carbon (DOC) was determined within 12 h of sample collection during each test. DOC was determined at the well site using a Beckman 915 Carbon Analyzer, which has a DOC detection limit of 3 mg/L and a precision of 0.25 mg/L, during the March and August tests. During the May test, on-site DOC determinations were made using a Technicon DOC Analyzer,

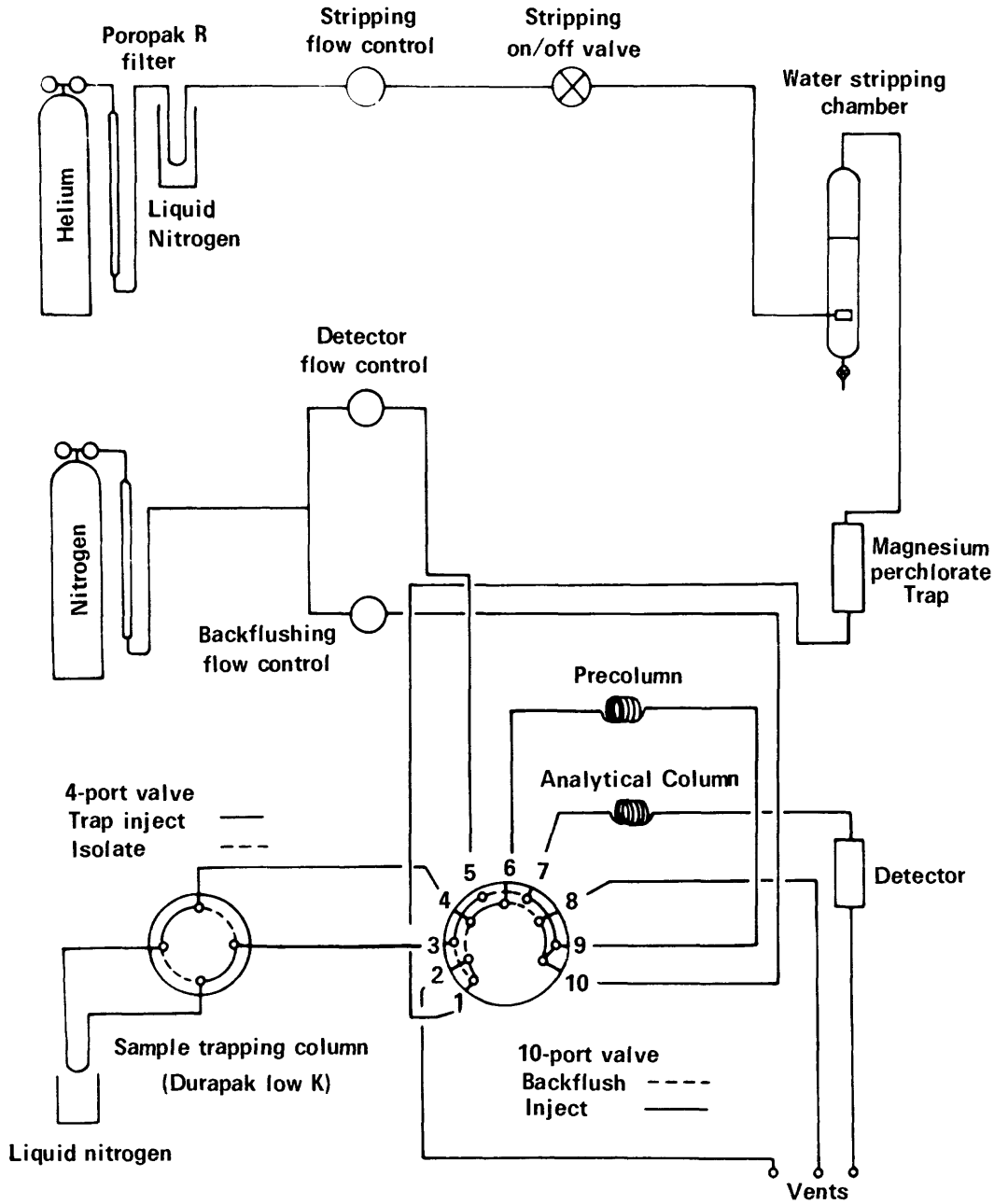

Figure 8.--Stripping, concentration, and analytical system for fluorocarbons in the nanogram per liter range. (After Thompson, 1976.)

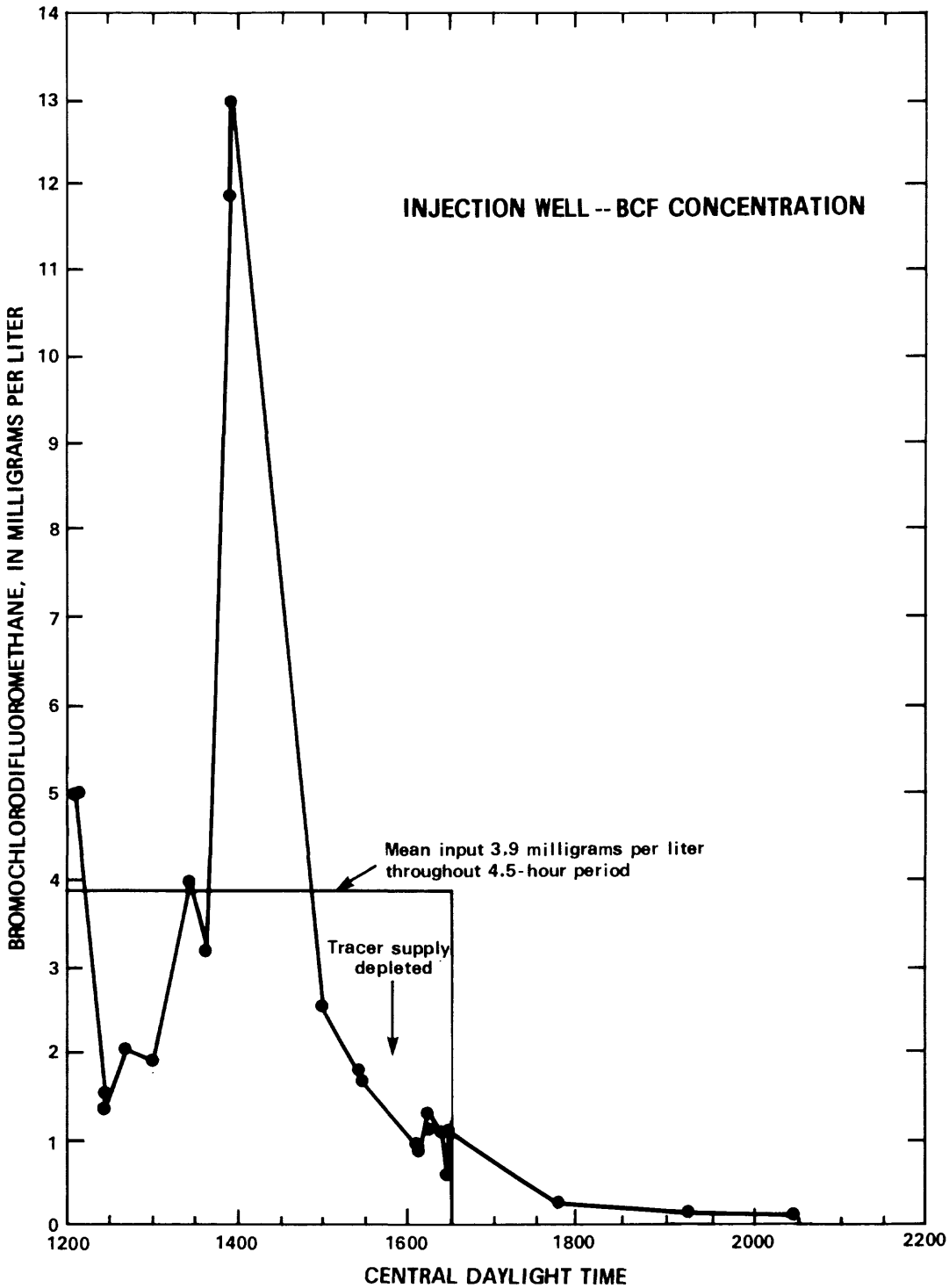

Figure 9.--Variation of input concentration with time of the fluorocarbon bromochlorodifluoromethane during the first tracer experiment, August 8, 1978.

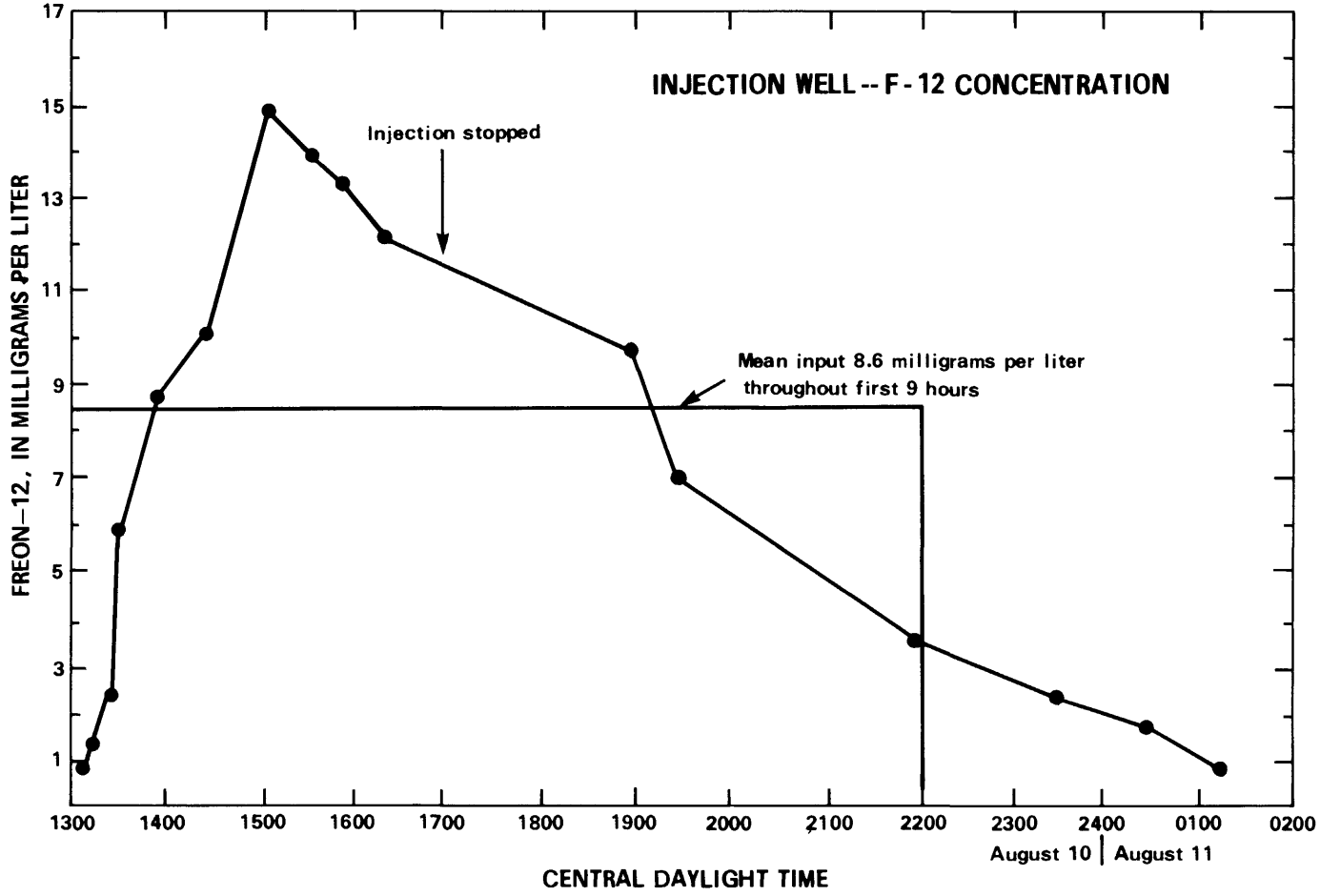

Figure 10.--Variation of input concentration with time of the fluorocarbon dichlorodifluoromethane during the second tracer experiment, August 10-11, 1978.
(Dots represent measured values.)

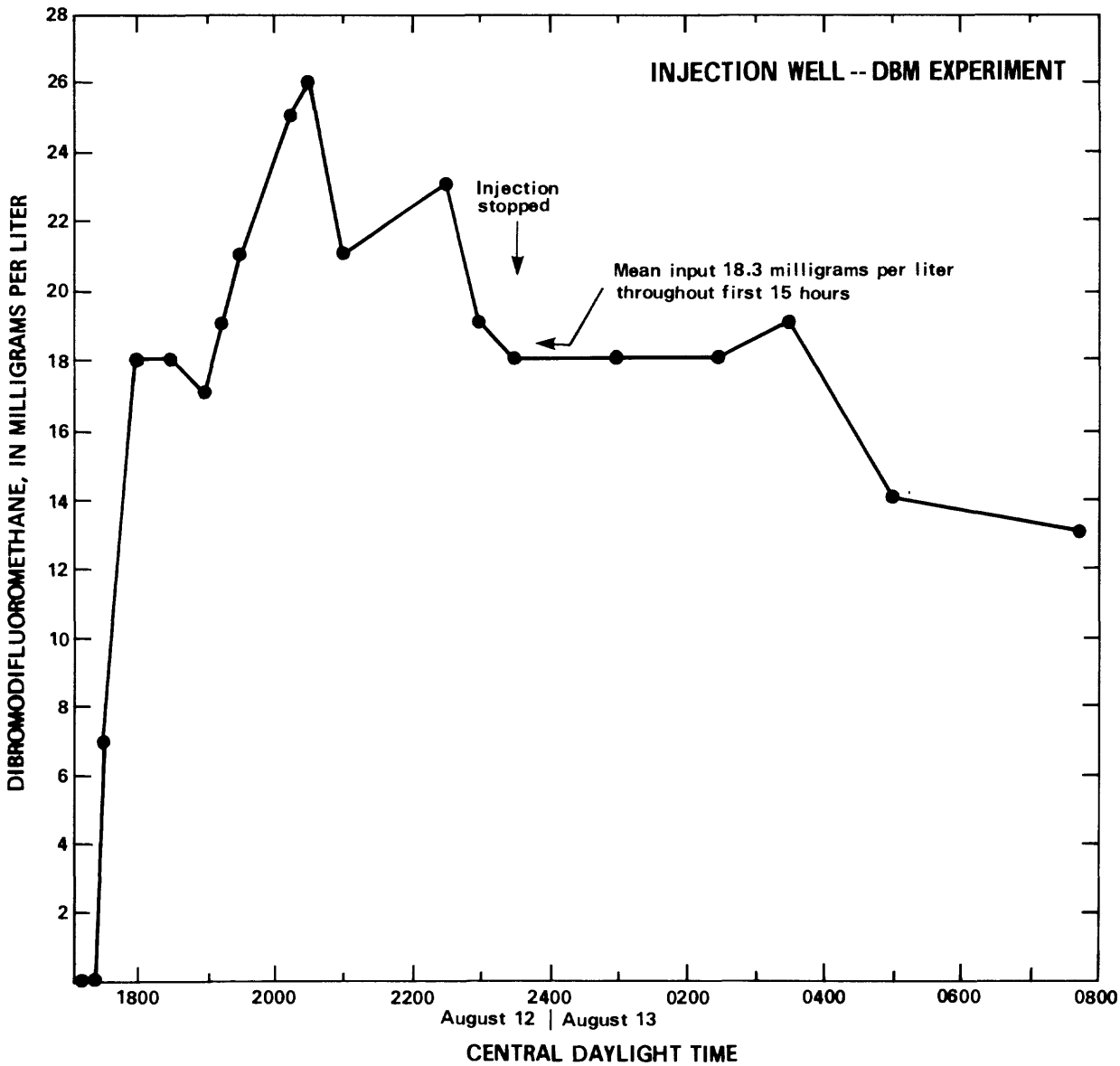

Figure 11.--Variation of input concentration with time of the fluorocarbon dibromodifluoromethane during the third tracer experiment, August 12-13, 1978.
(Dots represent measured values.)

which has a detection limit of 0.1 mg/L and an accuracy of ± 0.02 mg/L. The on-site DOC measurements for the May test were verified in the laboratory using the Beckman 915 Carbon Analyzer.

Phenolphthalein was analyzed at the well site at a pH of 12 and a wavelength of 560 nm using a Beckman Model DB spectrophotometer. Benzoate and aniline concentrations were measured in the laboratory by direct aqueous injection of 200-μL samples into a Varian 8500 liquid chromatograph, fitted with a μ Bondapack C18 column. Both compounds were detected at 221 nm on a Varichrome spectrophotometer, with sodium phosphate buffered to pH 7 as the mobile phase. Ethylamine was determined by direct-injection gas chromatography. Ethanol during the March test was calculated as the difference between DOC and benzoate. Ethanol and ethanol plus acetate, neither of which is tabulated here, were determined as the difference between DOC and the remaining organic compounds during the August test.

MARCH 1977 PUMPING TEST

Three pumping tests were conducted in the vicinity of the injection well, including a 48-h test using well 1 during June 1973, a 66-h test using well 1 during July 1976, and a 48-h test using the injection well during March 1977. Additional tests were conducted using the injection well during development in April 1978. The analyses described hereafter are preliminary; the measured water-level data are not listed. However, they may be obtained from E. P. Weeks upon request.

Results of the two tests for well 1 are not included. For the first test, the pumping rate was only 1.7 L/s, and drawdowns in nearby observation wells were so small that they were difficult to analyze. During the July 1976 test, the well was pumped at a rate of 4.0 L/s, the maximum rate that could be sustained without drawing the water level in the well below the pump bowls. Data collected during the tests from nearby observation wells gave information similar to that listed for the March 1977 (table 6) and March 1978 (table 9) tests. Water-level data from well 1 indicate that the well was poorly developed and hydraulic-head losses across the gravel pack and screen were very large. After data from the July 1976 test were analyzed, it was decided to construct a new injection well. Anticipated yield of the new well, based on the July 1976 test data, was 12 to 16 L/s.

A 48-h test was conducted using the new injection well during March 1977, to confirm the anticipated production rate and to stress the aquifer sufficiently to obtain large drawdowns, hence, obtaining more reliable test data than had been possible by pumping well 1. Unfortunately, the well failed to produce at the anticipated rate. Initial production was only 4.1 L/s, which could not be sustained, and had to be reduced to 4.0 L/s during the last few hours of the test.

During the test, water levels were measured in the various piezometers, in the fully penetrating observation wells located 2, 5, and 30 m from the

injection well (figs. 2 and 4), in the partly penetrating observation wells located 10 and 15 m from the production well, and in observation wells A3, A6, A8, A9, A10, and A14 (fig. 2). Piezometers 1 and 4 in the 2-m nest were plugged, and repeated attempts to develop them were unsuccessful. Piezometer 4 at 5 m was above the water table, and piezometer 1 at 30 m was so near the water table that the water table declined below the piezometer early during the test. Reliable water-level data were obtained from the remaining piezometers and observation wells, although the water levels were significantly affected by barometric effects. Measured drawdowns were corrected for those effects using the method described by Weeks (1979), based on barometric records obtained at the site and a value for the pneumatic diffusivity of the unsaturated zone of 2,400 m^2/d.

Results of analysis of the corrected water levels by use of the Cooper and Jacob (1946) modification of the Theis (1935) nonequilibrium equation to determine values for transmissivity and the storage coefficient of the aquifer are listed for selected observation wells in table 6. Transmissivity values determined from the various wells are reasonably consistent, and indicate that the transmissivity of the aquifer at the injection-well site is about 220 m^2/d. Values for the storage coefficient, on the other hand, vary by two orders of magnitude. At least part of the variation arises from the fact that water enters the production well only in certain zones, creating an effect similar to that of partial penetration. These effects cause wide variations in the computed storage coefficient, as described by Weeks (1969). However, even data from the fully penetrating observation wells show considerable scatter in computed storage coefficient, and the value is extremely small for a water-table aquifer. Consequently, the storage coefficient values are not reliable for predicting drawdown or hydraulic-head buildup during long-term pumping or injection. Because the injection well had a sustainable production rate of almost exactly the same magnitude as that for well 1, and because of the care exercised in drilling and developing the injection well, it was hypothesized that the relatively small yield was due to dewatering of a thin and very permeable zone near the water table, rather than to inadequate well development.

MARCH 1978 INJECTION TEST

The injection test conducted on March 1-2, 1978 was primarily designed to test the efficiency of the point samplers and pumps, and to provide experience with the operation of the treatment plant for use with subsequent lake-water injection tests. It was suspected that the inorganic tracers used during this test might be somewhat non-conservative; however, their function was simply to tag the water for evaluation of flow past the detection points. By reserving the most conservative tracers for subsequent tests, it was possible to reduce interference between experiments and avoid increasing the background concentration. The tracers used, time periods of tracer injection, and initial concentrations in the injected water are listed in table 7. The iodide tracer was added to the injection water continuously

Table 6.--*Transmissivity and storage values computed for the Ogallala aquifer based on data from the March 1977 pumping test*

[Computations are based on a discharge rate of 4.10 L/s]

Well number	Distance from production well (m)	Transmissivity (m^2/d)	Storage (dimensionless)
I-1	2	240	2×10^{-3}
I-2-3	2	220	2×10^{-4}
I-2-2	2	220	8×10^{-4}
I-4	5	230	8×10^{-4}
I-6-1	5	250	4×10^{-3}
I-6-2	5	220	9×10^{-4}
I-6-3	5	200	1×10^{-4}
A-8	10	240	3×10^{-3}
I-8-4	30	410	6×10^{-4}
I-8-3	30	410	6×10^{-4}
I-8-2	30	190	2×10^{-2}

Table 7.--*Tracer information for March 1978 injection test*

Tracer	Length of injection (min)	Start time (CST)	Date	Initial concentration
Iodide------	continuous	1200	3/1/78	1.1 mg/L
Ethanol-----	54	1200	3/1/78	50 mg C/L
$CBrClF_2$-----	80	1200	3/1/78	.7 µg/L
Ethanol-----	54	2130	3/1/78	45 mg C/L
Benzoate----	54	2130	3/1/78	5 mg C/L
Freon-12----	60	2130	3/1/78	2.5 µg/L

at a constant rate throughout the test. Consequently, its concentration increased each time the injection rate, described below, was reduced. The input concentration of 1.1 mg/L listed in table 7 is for an injection rate of 10 L/s. Concentrations for other injection rates, as listed in table 8, may be computed by the formula:

$$CI = 1.1 \text{ mg/L} \times (10 \text{ L/s} \div Qt)$$

where

CI = injection concentration, in milligrams per liter; and
Qt = injection rate at time t, in liters per second.

Other tracers were added during periods when the injection rate was constant, and are as listed in table 7.

For the test, ground water was pumped from well 3 into the horseshoe settling basin, where it was picked up by the 38-kW lift pump. Diatomaceous earth was added at a rate of about 10 mg/L as a filter aid, and the water routed through one of the diatomaceous-earth filters. Tracers were added downstream from the filter, and their concentration in the injection stream was adjusted by monitoring the injection water as it ran to waste. The test was started by quick-connecting the injection line to the injection pipe in the well.

The injection pipe consisted of 51-mm diameter plastic pipe extending to a depth of 43.6 m in the well. The pipe was equipped with a spring-loaded foot valve to maintain sufficient back pressure to prevent the pressure in the injection pipe at land surface from decreasing to less than that in the atmosphere. Such an arrangement prevents air from entering the injection stream at joints or valves, becoming entrained, and clogging the aquifer near the well bore.

The planned rate of injection for the March test was 10 L/s, based on analyses of data from the March 1977 pumping test; however, the maximum long-term pumping rate for well 3 was only 3.8 L/s. Consequently, water was pumped at that rate from well 3 into the horseshoe-shaped settling basin for 7 days prior to the start of the test to provide a supply reservoir. However, leakage from the settling basin about equalled the 3.8 L/s inflow rate when about 1,200 m^3 of water was in storage and this was the maximum volume that could be stored. The stored water plus the well 3 pumpage was adequate for about 24 h of injection at the planned rate.

During the first hour of the test, an attempt was made to maintain the injection rate constant at 10 L/s by manually adjusting a gate valve on the injection line. However, because of the damped response of the in-line flowmeter recorder and a rapid rise of water level in the injection well (which caused a back pressure that affected the injection rate), the flow rate varied somewhat during the first hour. Moreover, the water level in the injection well had risen about 26 m during that hour, and it became obvious

Table 8.--*Injection rates and cumulative volumes for the March 1-2, 1978, injection test*

Date and time interval	Flow rate (L/s)	Time increment (min)	Cumulative time (min)	Recharge volume		Comment
				Incremental (L)	Cumulative (L)	
3/1/78:						
1200-1210	9.2	10	10	5,500	5,500	
1210-1214	10.0	4	14	2,400	7,900	
1214-1300	9.5	46	60	26,200	34,100	
1300-0020	7.5	680	740	306,300	340,400	
3/2/78:						
0020-0240	7.6	140	880	64,100	404,500	
0240-0355	7.4	75	955	33,200	437,700	
0355-0727	6.5	212	1,167	82,600	520,300	
0727-0800	3.5	33	1,200	6,900	527,200	Water level in settling basin below pump intake
0800-1000	5.7	120	1,320	40,900	568,100	

that water would flow from the well in about another hour at that injection rate. Consequently, the injection rate was decreased to 7.5 L/s. This rate was approximately maintained until 0355 on March 2, when it again had to be decreased to prevent the well from overflowing. The rate inadvertently decreased to about 3.5 L/s for about 30 min on March 2, when the facility was unattended, and the water level in the basin declined below the pump intake. At the time the pump intake was adjusted, the flow rate was again decreased (to 5.7 L/s) to prevent the well from overflowing. By 1000, the water level in the injection well was at land surface, and the test was stopped. Flow rates and cumulative volumes of injected water are listed in table 8.

The approximate 33-m rise of the water level in the injection well, compared to a maximum water-level rise of about 2 m in the observation well and piezometers located 2 m from the injection well, indicated that the injection well became severely plugged during the test. Moreover, it appeared likely that initial development attempts had been inadequate. Causes of the plugging are described in the section on the May test.

Hydraulic Data

Flowmeter Logs

In addition to the injection rate into the well, deep-well flowmeter logs were made periodically to determine the zones within the aquifer that were being recharged. The results of these logs are shown in figure 12.

Water-level Data and Analysis

Water levels were closely monitored using steel tapes during the March 1-2 injection test in piezometers 2 and 3 at 2 m, and in piezometers 1 through 4 at both 5 and 30 m. Water levels in the observation wells at 5 and 30 m could not be measured, because the steel tapes would not pass by the sampling pumps. However, water level in the 2-m observation well rose to above the top of the pump in that well after about 30 min of injection, and water levels were obtained after that time.

Results of analyses of the water-level buildup data using the Cooper and Jacob (1946) modification of the Theis (1935) non-equilibrium equation are listed in table 9. For these analyses, data collected from 100 to 1,000 min after the start of injection were analyzed. These data were selected because the injection rate was relatively stable, and the decrease in the rate after 60 min of injection had become small. In general, the results are quite similar to those obtained from the March 1977 pumping test. However, computed values for the storage coefficient varied over an even greater range. This probably results both from the quasi-partial penetration effects described above, and from the effects of clogging during injection.

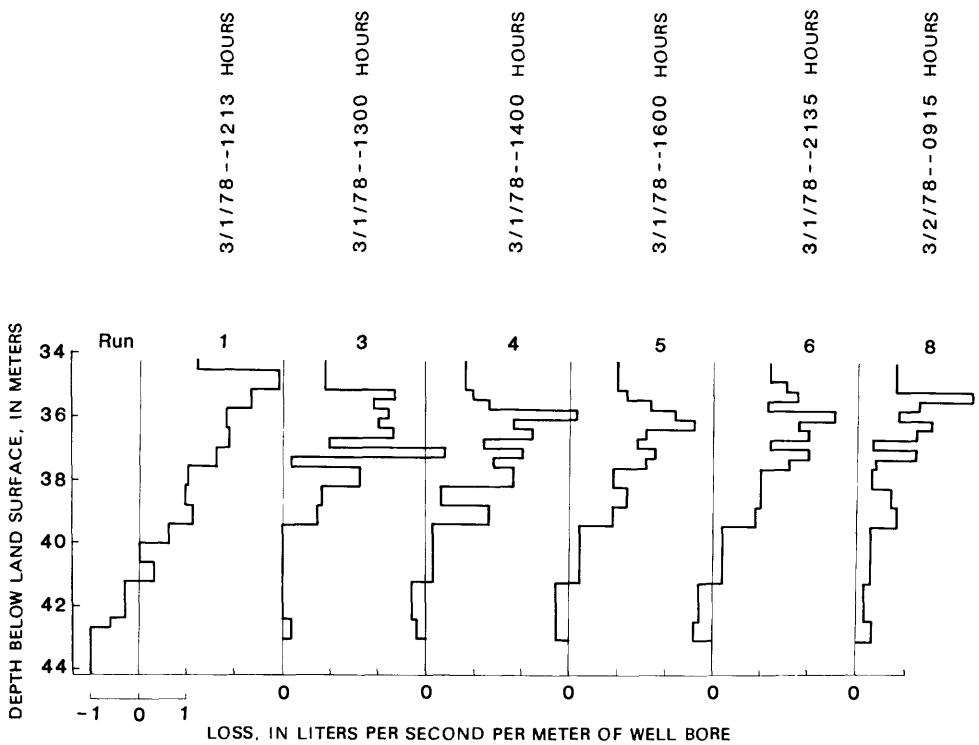

Figure 12.--Flowmeter logs from the injection well obtained during the March 1978 test.

Table 9.--*Transmissivity and storage values computed for the Ogallala aquifer, based on data from the March 1978 injection test*

[Computations are based on data obtained from 100 to 1,000 min, using an injection rate of 7.57 L/s]

Well number	Distance from production well (m)	Transmissivity (m^2/d)	Storage Coefficient (dimensionless)
I-1	2	300	2×10^{-5}
I-2-3	2	210	1×10^{-3}
I-2-2	2	210	4×10^{-4}
I-6-4	5	260	3×10^{-2}
I-6-3	5	240	7×10^{-3}
I-6-2	5	230	8×10^{-4}
A-10	15	280	4×10^{-3}
I-8-4	30	230	1×10^{-2}
I-8-3	30	240	8×10^{-3}
I-8-2	30	290	3×10^{-2}
I-8-1	30	290	3×10^{-2}

Availability of flowmeter and water-level data from various piezometers make feasible the use of computer simulation to identify, at least grossly, the vertical hydraulic-conductivity distribution in the aquifer. However, the results of these simulations are beyond the scope of this report.

Sampling Schedule and Tracer Data

The injection test began at 1200 on March 1, 1978; sampling of ground water and monitoring of water levels began at that time. Water samples were collected from the 2-m wells at approximately 5-min intervals for the first hour, 10-min intervals for the next 1½ h, then increased to 30 min, 1 h, and longer intervals for the remainder of the test. Sampling of the 5-m wells began with 10-min sampling intervals and increased in a similar schedule to that for the 2-m wells. The 10-, 15-, and 30-m wells were sampled less frequently, because of the long time required for the tracer to reach those wells.

Two separate tracer experiments were conducted during the injection test. The first experiment began with the start of injection at 1200 on March 1. Iodide, ethanol, and $CBrClF_2$ were added to the injection water according to the schedule shown in table 7. At 2130 on March 1, the second experiment began with ethanol, benzoate, and Freon-12 used as tracers.

In the following tables, data from the observation wells will be denoted by referring to the well distance from the injection well. For example, the well at 2 m has the heading "2-Meter well." Data from the point samplers are titled with a heading that denotes both the radial distance and the color of the point-sampler tubing, which in turn indicates the depth from which the sample was obtained, for example, "2-Meter red point sampler." A key for the depths of point samplers is provided in table 2, and the spatial arrangement also is shown in figures 4 and 5.

The breakthrough of ethanol during the first experiment was measured as DOC. The DOC was equivalent to ethanol, because ethanol was the only organic tracer added. The breakthrough of ethanol during the second experiment as DOC was determined by subtracting benzoate as DOC from total DOC. The background concentration of DOC in the Ogallala aquifer water is normally 1.0 mg/L. This background was subtracted from the total DOC for the first experiment. In the second experiment, the background was slightly increased due to the presence of ethanol still in the system from the first experiment. No attempt was made to correct the ethanol measurements in the second experiment for this interference. Analyses of water samples taken from the sampling locations during the first tracer experiment are given in tables 10 to 21, and from the second tracer experiment in tables 22 to 29.

Table 10.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	0.02	0	*
Do.	1205	5	.02	0	*
Do.	1208	8	.02	0	*
Do.	1210	10	----	0	*
Do.	1211	11	.02	0	*
Do.	1213	13	.06	0	40.0
Do.	1215	15	.36	25	125
Do.	1219	19	.51	*	221
Do.	1220	20	----	25	*
Do.	1222	22	.38	*	177
Do.	1227	27	.33	*	125
Do.	1230	30	----	16	*
Do.	1232	32	.33	*	113
Do.	1235	35	----	14	*
Do.	1237	37	.32	*	*
Do.	1243	43	.37	*	121
Do.	1248	48	----	10	*
Do.	1250	50	.43	*	178
Do.	1300	60	----	14	178
Do.	1310	70	.51	17	190
Do.	1320	80	.56	15	*

Table 10.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1322	82	.60	*	217
Do.	1334	94	.73	*	210
Do.	1340	100	----	10	*
Do.	1349	109	0.80	*	174
Do.	1400	120	.88	8	190
Do.	1420	140	.94	*	174
Do.	1430	150	.95	6	182
Do.	1445	165	.97	*	*
Do.	1500	180	.98	6	*
Do.	1515	195	1.04	*	178
Do.	1530	210	1.08	5	*
Do.	1550	230	1.10	*	153
Do.	1630	270	----	2	*
Do.	1730	330	1.20	*	158
Do.	1830	390	1.18	*	*
Do.	1930	450	1.20	*	*
Do.	2135	575	1.26	1	53.0
3-2-78	0815	1,215	1.30	[1]/	*

[1]/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 11.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m black located 41.6 m below land surface and 2 m radially from the injection well. An asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter black point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	0.07	0	*
Do.	1205	5	.07	0	*
Do.	1211	11	.07	0	*
Do.	1300	60	.06	0	*
Do.	1400	120	.06	0	*
Do.	1500	180	.06	0	*
Do.	2000	480	.11	0	*
Do.	2305	665	.17	0	*
3-2-78	0030	750	.26	0	*
Do.	0100	780	.28	0	*
Do.	0130	810	.31	0	*
Do.	0230	870	.34	0	*
Do.	0400	960	.39	0	*
Do.	0800	1,200	.52	0	*
Do.	1150	1,430	.56	0	*

Table 12.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	0.08	0	*
Do.	1205	5	.06	0	*
Do.	1206	6	----	1	*
Do.	1208	8	.07	*	*
Do.	1211	11	.07	*	*
Do.	1215	15	.07	2	*
Do.	1220	20	.09	*	*
Do.	1224	24	.11	*	*
Do.	1225	25	----	5.5	*
Do.	1227	27	.13	*	*
Do.	1230	30	----	10	*
Do.	1232	32	.17	*	*
Do.	1235	35	----	15	*
Do.	1237	37	.20	*	*
Do.	1240	40	.22	21	*
Do.	1243	43	.26	*	*
Do.	1248	48	----	31	*
Do.	1250	50	.32	*	*
Do.	1255	55	.36	33	*
Do.	1300	60	.40	36	*
Do.	1310	70	.43	37	*
Do.	1315	75	----	33	*
Do.	1320	80	.46	*	*

Table 12.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1330	90	0.59	26	*
Do.	1340	100	.63	20	*
Do.	1349	109	.66	*	*
Do.	1350	110	----	17	*
Do.	1400	120	.74	16	*
Do.	1415	135	.80	12	*
Do.	1430	150	.86	11	*
Do.	1445	165	.90	10.5	*
Do.	1500	180	.97	9	*
Do.	1530	210	----	6	*
Do.	1600	240	----	4.5	*
Do.	1700	300	----	1.5	*

Table 13.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	0.21	0	*
Do.	1205	5	.17	0	*
Do.	1206	6	----	1	*
Do.	1208	8	.15	*	*
Do.	1211	11	.13	*	*
Do.	1215	15	----	1	*
Do.	1220	20	.08	*	*
Do.	1224	24	.09	*	*
Do.	1225	25	----	3	*
Do.	1227	27	.14	*	*
Do.	1230	30	----	3	*
Do.	1232	32	.25	*	*
Do.	1235	35	----	4	*
Do.	1237	37	.40	*	*
Do.	1240	40	----	*	*
Do.	1243	43	.52	*	*
Do.	1248	48	----	10	*
Do.	1250	50	.74	*	*
Do.	1255	55	----	*	*
Do.	1258	58	.79	*	*
Do.	1300	60	.85	15	*
Do.	1310	70	.87	17	*
Do.	1315	75	----	18	*

Table 13.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1320	80	0.88	*	*
Do.	1330	90	.91	22	*
Do.	1340	100	.98	22	*
Do.	1349	109	1.02	*	*
Do.	1350	110	----	22	*
Do.	1400	120	.97	22	*
Do.	1415	135	1.00	15	*
Do.	1430	150	1.04	15	*
Do.	1445	165	1.06	15	*
Do.	1500	180	1.14	15	*
Do.	1530	210	----	8	*
Do.	1600	240	1.15	6	*
Do.	1700	300	1.25	2	*
Do.	1900	420	----	2	*
3-2-78	0005	725	1.38	[1]/	*
Do.	0130	810	1.38	[1]/	*
Do.	0230	870	1.38	[1]/	*
Do.	0400	960	----	[1]/	*
Do.	0600	1,080	1.38	[1]/	*
Do.	0800	1,200	1.50	[1]/	*
Do.	1150	1,430	1.70	[1]/	*

[1]/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 14.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m green located 2 m radially from the injection well and 32.6 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter green point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	0.17	0	*
Do.	1204	4	.19	0	*
Do.	1208	8	.21	0	*
Do.	1212	12	.23	0	*
Do.	1216	16	.27	0	*
Do.	1220	20	.31	0	*
Do.	1224	24	.32	0	*
Do.	1228	28	.34	0	*
Do.	1232	32	.34	*	*
Do.	1236	36	.34	*	*
Do.	1240	40	.32	*	*
Do.	1244	44	.32	*	*
Do.	1245	45	----	4	*
Do.	1248	48	.36	*	*
Do.	1255	55	.37	*	*
Do.	1300	60	.38	4.5	*
Do.	1310	70	.39	4	*
Do.	1320	80	.41	*	*
Do.	1330	90	.42	*	*
Do.	1340	100	.48	4	*
Do.	1350	110	.53	4.5	*
Do.	1400	120	.55	4.5	*
Do.	1415	135	.60	5	*
Do.	1430	150	.64	9	*

Table 14.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter green point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1445	165	0.68	9	*
Do.	1530	210	.82	*	*
Do.	1600	240	.93	10	*
Do.	1700	300	1.08	*	*
Do.	1800	360	1.20	3	*
Do.	1900	420	1.26	3	*
3-2-78	0005	725	1.43	[1]/	*
Do.	1150	1,430	1.46	[1]/	*

[1]/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 15.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1200	0	<0.01	*	*
Do.	1213	13	<.01	*	*
Do.	1220	20	<.01	*	*
Do.	1227	27	<.01	*	2.3
Do.	1237	37	<.01	*	*
Do.	1240	40	.01	*	6.9
Do.	1243	43	.02	*	3.9
Do.	1250	50	.02	*	10.3
Do.	1300	60	.03	0	13.7
Do.	1310	70	.05	0	18.4
Do.	1320	80	.06	0	20.7
Do.	1330	90	.09	0	30.4
Do.	1349	109	.16	*	*
Do.	1350	110	----	6	37.0
Do.	1400	120	.19	6	39.5
Do.	1415	135	.22	7.5	46.1
Do.	1430	150	.27	8	54.0
Do.	1445	165	.30	6	53.0
Do.	1500	180	.30	*	*
Do.	1515	195	.38	*	107
Do.	1530	210	.39	*	113
Do.	1555	235	----	8	*

Table 15.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

5-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1620	260	.51	0	149
Do.	1730	330	.59	0	135
Do.	1830	390	0.66	6	*
Do.	1930	450	.70	*	*
Do.	2010	490	.72	*	*
Do.	2135	575	.71	*	*
Do.	2205	605	----	[1]/	80.2
Do.	2315	675	----	[1]/	94.3
Do.	2415	735	----	[1]/	70.1
3-2-78	0130	810	----	[1]/	35.0
Do.	0230	870	----	[1]/	41.0
Do.	0400	960	----	[1]/	48.0
Do.	0600	1,080	.80	[1]/	*
Do.	0630	1,110	----	[1]/	43.0
Do.	0800	1,200	.80	[1]/	38.9
Do.	0945	1,305	.81	[1]/	*
Do.	1100	1,380	.67	[1]/	27.9

[1]/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 16.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m black located 5 m radially from the injection well and 41.8 m below land surface. An asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter black point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1211	0	0.13	0	*
Do.	1220	9	.13	0	*
Do.	1230	19	.14	0	*
Do.	1310	59	.15	0	*
Do.	1410	119	.17	0	*
Do.	1550	219	.27	0	*
Do.	1630	259	.32	0	*
Do.	1710	299	.35	0	*
Do.	1800	349	.40	0	*
Do.	1900	409	.45	0	*
Do.	1930	439	.46	0	*
Do.	2000	469	.53	0	*
Do.	2030	499	.59	0	*
Do.	2245	634	.72	[1]/	*
3-2-78	0005	714	1.01	[1]/	*
Do.	1100	1,369	1.01	[1]/	*
Do.	1150	1,419	1.01	[1]/	*

[1]/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 17.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1211	0	0.05	0	*
Do.	1230	19	.04	0	*
Do.	1240	29	.04	0	*
Do.	1258	47	.08	0	*
Do.	1305	54	.10	0	*
Do.	1317	66	----	4	*
Do.	1320	69	.18	*	*
Do.	1322	71	.29	*	*
Do.	1325	74	----	6	*
Do.	1330	79	----	8	*
Do.	1334	83	.38	*	*
Do.	1349	98	.41	*	*
Do.	1400	109	----	12	*
Do.	1410	119	.41	*	*
Do.	1430	139	.42	12	*
Do.	1440	149	----	12	*
Do.	1450	159	----	12	*
Do.	1500	169	----	12	*
Do.	1510	179	.51	11	*
Do.	1520	189	----	11	*
Do.	1530	199	.51	11	*
Do.	1540	209	----	10	*
Do.	1550	219	.51	11	*

Table 17.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1610	239	----	10	*
Do.	1650	279	.54	*	*
Do.	1730	319	----	6	*
Do.	1800	349	0.49	*	*
Do.	1830	379	----	5	*
Do.	1930	439	.49	*	*
Do.	2030	499	.53	*	*
Do.	2245	634	.75	1/	*
3-2-78	0005	714	.90	1/	*
Do.	1150	1,419	.86	1/	*

1/ Interference due to the reuse of this tracer in the second test conducted at 2130 on March 1, 1978 (see subsequent tables).

Table 18.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m green located 5 m radially from the injection well and 33.9 m below land surface. An asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter green point sampler					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1211	0	0.02	*	*
Do.	1230	19	.02	*	*
Do.	1240	29	.04	*	*
Do.	1250	39	.04	*	*
Do.	1255	44	.05	*	*
Do.	1258	47	.07	*	*
Do.	1300	49	.10	*	*
Do.	1310	59	.12	*	*
Do.	1320	69	.15	*	*
Do.	1330	79	.29	*	*
Do.	1349	98	.29	*	*
Do.	1410	119	.39	*	*
Do.	1430	139	.42	*	*
Do.	1500	169	.55	*	*
Do.	1530	199	.68	*	*
Do.	1600	229	.73	*	*
Do.	1650	279	.71	*	*
Do.	1730	319	.79	*	*
Do.	1830	379	.92	*	*
Do.	1930	439	.82	*	*
Do.	2030	499	.84	*	*
Do.	2245	634	.84	*	*
3-2-78	0005	714	.84	*	*

Table 19.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 10 m from the injection well and are screened only for a 1.2-m section, 41.5 m below land surface. An asterisk (*) indicates the sample was not analyzed and is no longer available.]

10-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1205	0	0.13	*	0
Do.	1230	25	.12	*	*
Do.	1245	40	.12	*	*
Do.	1300	55	.11	*	*
Do.	1440	155	<.1	*	*
Do.	1530	205	<.1	*	*
Do.	1625	260	<.1	*	*
Do.	1645	280	<.1	*	*
Do.	1730	325	<.1	*	*
Do.	1830	385	<.1	*	*
Do.	1930	445	<.1	*	*
Do.	2010	485	<.1	*	*
Do.	2130	565	<.1	*	0
Do.	2230	625	<.1	*	0
3-2-78	0130	805	<.1	*	0
Do.	0645	1,120	<.1	*	10.7
Do.	0820	1,215	<.1	*	0
Do.	0958	1,313	<.1	*	0
Do.	1010	1,325	<.1	*	0

Table 20.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 15 m from the injection well, which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

15-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1215	0	<0.01	*	0
Do.	1230	15	<.01	*	*
Do.	1300	45	<.01	*	*
Do.	1330	75	<.01	*	*
Do.	1345	90	*	*	0
Do.	1400	105	<.01	*	*
Do.	1445	150	<.01	*	*
Do.	1630	255	<.01	*	*
Do.	1730	315	<.01	*	*
Do.	1830	375	<.01	*	*
Do.	1930	435	<.01	*	*
Do.	2010	475	<.01	*	*
Do.	2135	560	<.01	*	*
Do.	2230	625	*	*	0
3-2-78	0335	920	.13	*	*
Do.	0600	1,065	.20	*	*
Do.	0640	1,105	*	*	0
Do.	0820	1,205	.22	*	10.8
Do.	1145	1,425	----	*	1.9
Do.	1235	1,475	----	*	2.8

Table 21.--*Data obtained from the first tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 30 m from the injection well, which is screened for the saturated thickness of the aquifer. An asterisk (*) indicates the sample was not analyzed and is no longer available.]

30-Meter well					
Date	Clock time	Elapsed time (min)	Iodide (mg/L)	Ethanol (mg C/L)	$CBrClF_2$ (ng/L)
3-1-78	1230	0	<0.1	*	*
Do.	1330	60	<.1	*	*
Do.	1400	90	<.1	*	*
Do.	1530	180	<.1	*	*
Do.	1630	240	<.1	*	*
Do.	1730	300	<.1	*	*
Do.	1830	360	<.1	*	*
Do.	1930	420	<.1	*	*
Do.	2015	465	<.1	*	*
Do.	2135	545	<.1	*	*
Do.	2230	600	<.1	*	*
Do.	2245	615	<.1	*	*
Do.	2330	660	<.1	*	*
3-2-78	0130	780	<.1	*	*
Do.	0330	900	<.1	*	*
Do.	0620	1,070	<.1	*	*
Do.	0820	1,190	<.1	*	*
Do.	0955	1,285	<.1	*	*

Table 22.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full-saturated thickness of the aquifer. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2145	15	1	0.00	6.59
Do.	2150	20	2	.00	*
Do.	2155	25	6	.23	*
Do.	2200	30	6	.57	45.5
Do.	2205	35	7	1.00	*
Do.	2210	40	11	1.27	*
Do.	2215	45	11	1.47	*
Do.	2220	50	11	1.63	*
Do.	2225	55	16	1.90	*
Do.	2230	60	15	2.10	110
Do.	2235	65	17	2.40	*
Do.	2240	70	17	2.57	*
Do.	2245	75	21	*	123
Do.	2250	80	19	2.47	*
Do.	2255	85	16	2.20	*
Do.	2300	90	16	1.87	117
Do.	2305	95	*	1.73	*
Do.	2310	100	11	*	*
Do.	2315	105	*	1.33	77
Do.	2320	110	8	*	*
Do.	2325	115	*	1.07	97.3
Do.	2330	120	8	*	*

Table 22.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter well					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2400	150	6	.40	73.1
3-2-78	0015	165	5.6	0.40	*
Do.	0030	180	5.7	.30	*
Do.	0100	210	*	.17	37.0
Do.	0130	240	5.4	.10	*
Do.	0200	270	*	0	*
Do.	0300	330	*	0	20.9
Do.	0400	390	*	0	*
Do.	0630	540	*	0	*

Table 23.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m black located 41.6 m below land surface and 2 m radially from the injection well. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter black point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2135	5	0	0	*
3-2-78	0030	180	0	0	*
Do.	0230	300	0	.07	*
Do.	0400	390	0	.10	*
Do.	0600	510	0	.13	*

Table 24.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2130	0	2	*	*
Do.	2140	10	2	0	*
Do.	2145	15	2	0	*
Do.	2150	20	2	.05	*
Do.	2155	25	2	.2	*
Do.	2200	30	3	.3	*
Do.	2205	35	4	.55	*
Do.	2210	40	5	.65	*
Do.	2215	45	*	*	*
Do.	2220	50	8	.95	*
Do.	2225	55	12	1.15	*
Do.	2230	60	16	1.4	*
Do.	2235	65	17	1.65	*
Do.	2240	70	22	1.8	*
Do.	2245	75	24	1.85	*
Do.	2250	80	26	1.6	*
Do.	2255	85	*	1.55	*
Do.	2300	90	28	1.8	*
Do.	2310	100	25	1.35	*
Do.	2320	110	20	1.6	*
Do.	2330	120	12	1.55	*
Do.	2345	135	7	1.1	*
Do.	2400	150	2	.95	*

Table 24.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-2-78	0015	165	1	.7	*
Do.	0030	180	1	0.6	*
Do.	0100	210	0	.3	*
Do.	0130	240	0	.3	*
Do.	0230	300	0	.5	*
Do.	0400	390	0	.25	*
Do.	0600	510	0	0	*
Do.	0800	630	0	0	*

Table 25.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injection well. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2130	0	3	*	*
Do.	2135	5	*	0	*
Do.	2140	10	*	0	*
Do.	2145	15	*	0	*
Do.	2150	20	*	0	*
Do.	2155	25	*	0	*
Do.	2200	30	5	.03	*
Do.	2205	35	6	.06	3.30
Do.	2210	40	7	.16	2.20
Do.	2215	45	8	.5	2.51
Do.	2220	50	10	.96	5.96
Do.	2225	55	10	1.61	2.04
Do.	2230	60	12	2.12	6.90
Do.	2235	65	12	2.6	6.43
Do.	2240	70	13	3.1	*
Do.	2245	75	13	3.47	*
Do.	2250	80	13	3.66	*
Do.	2255	85	*	3.9	*
Do.	2300	90	11	4.1	3.45
Do.	2310	100	11	3.34	11.1
Do.	2320	110	11	2.51	*
Do.	2330	120	12	1.41	27.0
Do.	2345	135	13	.68	12.9

Table 25.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-2-78	2400	150	12	.25	4.86
Do.	0015	165	9	0.13	*
Do.	0030	180	9	.06	*
Do.	0100	210	9	.06	*
Do.	0130	240	9	.06	4.39
Do.	0230	300	6	0	*
Do.	0400	390	5	0	*
Do.	0600	510	2	0	*
Do.	0800	630	1	0	*

Table 26.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m green located 2 m radially from the injection well and 32.6 m below land surface. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter green point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2130	0	*	*	*
Do.	2135	5	4.0	0.00	*
Do.	2140	10	4.0	.00	*
Do.	2220	50	4.0	.10	*
Do.	2225	55	4.0	.17	*
Do.	2230	60	4.0	.30	*
Do.	2235	65	*	.47	*
Do.	2240	70	*	.53	*
Do.	2245	75	7	.60	*
Do.	2250	80	7	.70	*
Do.	2255	85	*	.80	*
Do.	2300	90	7	.97	*
Do.	2310	100	9	.97	*
Do.	2320	110	9	1.17	*
Do.	2330	120	10	1.27	*
Do.	2335	125	*	*	*
Do.	2345	135	9	1.20	*
Do.	2400	150	9	1.20	*
3-2-78	0015	165	10	1.17	*
Do.	0030	180	10	1.13	*
Do.	0100	210	10	1.13	*
Do.	0130	240	11	1.03	*
Do.	0230	300	7	.83	*
Do.	0400	390	6	.57	*
Do.	0600	510	2	.27	*
Do.	0800	630	2	.13	*

Table 27.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for full-saturated thickness of the aquifer. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2145	15	4	0	*
Do.	2205	35	4	0	5.81
Do.	2235	65	5	0	*
Do.	2245	75	4	.15	*
Do.	2255	85	*	.23	*
Do.	2300	90	*	*	*
Do.	2315	105	*	.46	5.81
Do.	2320	110	*	*	*
Do.	2325	115	*	.54	*
Do.	2340	130	3	.77	*
Do.	2400	150	*	.85	*
3-2-78	0010	160	*	*	*
Do.	0015	165	*	1.0	7.85
Do.	0020	170	*	*	*
Do.	0030	180	4	1.0	*
Do.	0100	210	3	.92	*
Do.	0130	240	4	.77	11.9
Do.	0230	300	5	.62	23.9
Do.	0300	330	4	.54	*
Do.	0400	390	1	.31	29.9
Do.	0600	510	*	*	*
DO.	0630	540	*	.15	29.9
Do.	0815	645	*	*	25.9
Do.	1100	810	*	*	11.9

Table 28.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler 5-m black located 5 m radially from the injection well and 41.8 m below land surface. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter black point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2140	10	*	0	*
Do.	2210	40	*	0	*
Do.	2230	60	4	*	*
Do.	2240	70	*	0	*
Do.	2330	120	4	*	*
Do.	2345	135	*	.01	*
Do.	2400	150	5	*	*
3-2-78	0030	180	4.5	.13	*
Do.	0100	210	*	.30	*
Do.	0130	240	6	.33	*
Do.	0200	270	7	.33	*
Do.	0230	300	5.5	.33	*
Do.	0400	390	5	.37	*
Do.	0600	510	6	.33	*
Do.	0800	630	*	.27	*
Do.	0945	735	*	.20	*

Table 29.--*Data obtained from the second tracer experiment on March 1, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler					
Date	Clock time	Elapsed time (min)	Ethanol (mg C/L)	Benzoate (mg C/L)	CCl_2F_2 (ng/L)
3-1-78	2140	0	1	0	0
Do.	2200	20	*	*	*
Do.	2210	30	4	0	*
Do.	2220	40	4	0	*
Do.	2230	50	3	.07	3.77
Do.	2240	60	4	*	*
Do.	2250	70	4	.13	16.2
Do.	2300	80	4	.20	16.2
Do.	2310	90	*	.23	21.7
Do.	2320	100	4	.30	28.9
Do.	2330	110	6	.33	*
Do.	2345	125	5	.43	*
Do.	2400	140	5	.53	*
3-2-78	0015	155	6	.80	*
Do.	0030	170	6	.87	25.9
Do.	0100	200	*	.80	*
Do.	0130	230	7	.63	17.9
Do.	0200	260	8	.53	34.5
Do.	0230	290	7	.40	*
Do.	0400	380	5	.33	*
Do.	0600	500	5	.33	*
Do.	0800	620	4	.30	*
Do.	0945	725	1	0	*

APRIL 1978 WELL-REDEVELOPMENT TEST

Because of the positive indications of well-bore plugging during the March injection test, the injection well was redeveloped during April 1978. A step-drawdown test was performed prior to development, which indicated that the maximum yield of the well was 4.7 L/s with 9.15 m of drawdown. The well was then acidized with 110 kg of sulfamic acid and bailed. Following bailing, an inflatable packer was set in the injection well at a depth of 39.6 m, and the well was swabbed through a 102-mm diameter swab pipe extending below the packer. The packer prevented water from being swabbed from well-bore storage, and allowed the aquifer to be stressed during the swabbing operation.

Following the acid treatment, bailing, and swabbing operations, the well was pumped again to determine its maximum sustainable yield. The well was pumped at a rate of 13.9 L/s with a drawdown of 8.5 m after about 4 h of pumping; this was the capacity of the pump. These data indicate a more than three-fold improvement in the injection-well yield.

MAY 1978 INJECTION TEST

The main experimental objective of the Artificial-Recharge Research project for the Stanton site was to monitor and model the quality of injected playa-lake water. However, achievement of this goal had been continually thwarted by the weather. Runoff accumulations in the playa lake were minimal during the spring, summer, and fall of 1977, when the tests were initially scheduled, and the lake was dry during most of that time. The lowest inlet for the lake-lift pump, which had become blocked by silt, was cleaned out during the spring of 1978. Enough runoff collected in the lake from a rainstorm on May 22, 1978 to allow a 3-d injection test at an intended injection rate of 10 L/s. A test of this duration and rate was considered the minimum that would meet the project objectives. Although it had not been possible to maintain that large an injection rate during the March test, it was believed that the development work completed during April that resulted in a production rate of 13.7 L/s was sufficient to allow the 10-L/s injection rate.

For the test, which started on May 24, 1979, water was picked up by the lake-lift pump, and a flocculating agent (Nalco 607) was added at a rate of about 10 mg/L at the pump. Water was routed through the horseshoe settling basin and was picked up by the lift pump in the building, with diatomaceous earth added as a filter aid. Water was routed through one of the diatomaceous-earth filters, and various tracers were added downstream from the filter.

The injection sequence was similar to that for the March test, with tracer concentrations being adjusted to the desired amounts while the injection stream was run to waste. Injection of the tracer-bearing water was then started using the quick-connect procedure.

Injection was started at a rate of slightly less than 10 L/s at 1400 on May 24. The well plugged even more rapidly than it had during the March test, and the injection rate had to be continually decreased. Injection was temporarily halted at 2220 on May 24 because of uncertainties resulting from the clogging, and was resumed at 1101 on May 25. After about 6 hours of injection at a continually decreasing rate, the test was stopped. Flow rates and cumulative volumes of injected water after selected times are listed in table 30.

Post-test experiments indicated that the filter tanks and recharge line were not adequately purged of air before injection started. Because the plant had originally been designed to recharge much larger quantities of water than could actually be injected, output from the plant had to be severely restricted by valves. Air apparently became entrained in the injection stream, both from the air reservoir remaining in the tanks and line, and from a Venturi effect immediately downstream from one or more of the nearly-closed valves. Injection of the aerated water resulted in the severe plugging observed during the test.

Hydraulic Data

Hydraulic data for the May test include, in addition to the injection rates, periodic vertical flow-meter logs made in the injection well (fig. 13). These logs show the zones that were taking water at selected intervals during the test.

Water levels were closely monitored in the various piezometers and in selected observation wells during the May test. However, water-level data are not readily interpretable by standard methods because of the extreme variability in the injection rate during the test; these data are not included.

Chemical and Tracer Data

Despite the problems involving clogging during injection, data collected during the test provide valuable comparisons between the dissolved organic material naturally present in the playa water as a natural tracer and the added tracers. The playa-lake water and the ground water had significantly different compositions (table 31); consequently, the alkalinity, specific conductance, and major-cation chemistry were monitored as well. The cation-exchange process was only beginning to have a detectable effect on water composition at the termination of the test; those data are not presented. Specific-conductance and alkalinity data are presented in figures 14 to 17.

Tracers chosen for this test and their concentrations are shown in table 32. A new analytical method for bromide was used; this proved unsatisfactory, so only boron, fluorocarbon, and natural-organics data are presented.

Table 30.--*Injection rates and amounts; Stanton injection test, May 24-25, 1978*

Flow into recharge well						
Date and time interval	Average flow rate (L/s)	Time increment (min)	Cumulative time (min)	Recharge volume		Comment
				Increment (L)	Cumulative (L)	
5/24/78:						
1401-1450	9.8	49	49	28,800	28,800	
1450-1625	9.2	95	144	52,200	81,000	Range 8.5-9.8 L/s.
1625-1650	Flow to waste	25	169	------	-------	Filter change.
1650-1800	7.7	70	239	32,300	113,300	
1800-1920	7.2	80	319	34,400	147,700	Range 6.6-7.7 L/s.
1920-1950	Flow stopped	30	349	------	-------	Line broke.
1950-2145	6.4	115	464	44,400	192,100	Range 5.7-7.9 L/s.
2145-2220	4.5	35	499	9,500	201,600	
2220-1101	----	761	1,260	------	-------	
5/25/78:						Restart.
1101-1358	4.7	177	1,437	50,200	251,800	Well ran over at 1358.
1358-1623	3.9	145	1,582	34,000	285,800	Well ran over at 1623.
1623-1703	3.5	40	1,622	8,300	295,100	Recharge stopped.

Table 30.--*Injection rates and amounts; Stanton injection test, May 24-25, 1978*--Continued

Flow to waste			
Date	Time	Rate (L/s)	Volume (L)
5/24/78	1340-1401	10.1	12,700
Do.	1625-1650	10.7	16,100
5/25/78	0932-0940	7.9	3,800
Do.	0940-1101	6.3	30,700
		Total	63,300

Volume check	
Total flow from recorder chart:	357,400 L
Total flow from line meter reading:	352,900 L[1/]

[1/] Chart discrepancy of 1.26 percent from line meter reading.

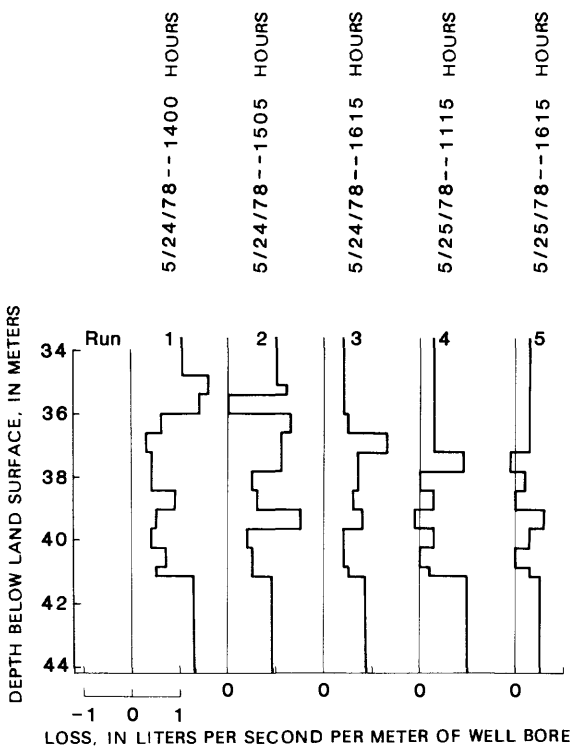

Figure 13.--Flowmeter logs from the injection well obtained during the May 1978 test.

Table 31.--*Analyses of the playa-lake water and ground water prior to the May 24-25, 1978, injection test*

Constituent	Playa lake (mg/L)	Ground water (mg/L)
Calcium (Ca)	27	37
Magnesium (Mg)	2.5	23
Sodium (Na)	7.7	8.4
Potassium (K)	6.0	20
Chloride (Cl)	12	19
Sulfate (SO_4)	14	28
On-site alkalinity (HCO_3)	31	116
Laboratory alkalinity ($CaCO_3$)	60	170
Lithium (Li)	<.005	.06
Nitrate (N)	.31	.6
Silica (SiO_2)	5.9	44
Strontium (Sr)	.210	1.4
Boron (B)	.23	.110
Iron (Fe)	.04	<.005
Fluoride (F)	.3	1.9
Bromide (Br)	.5	.1
Manganese (Mn)	.02	.47
pH on-site (units)	7.84	7.95
Specific conductance (µmhos/cm)	203	462
Dissolved solids	115	288

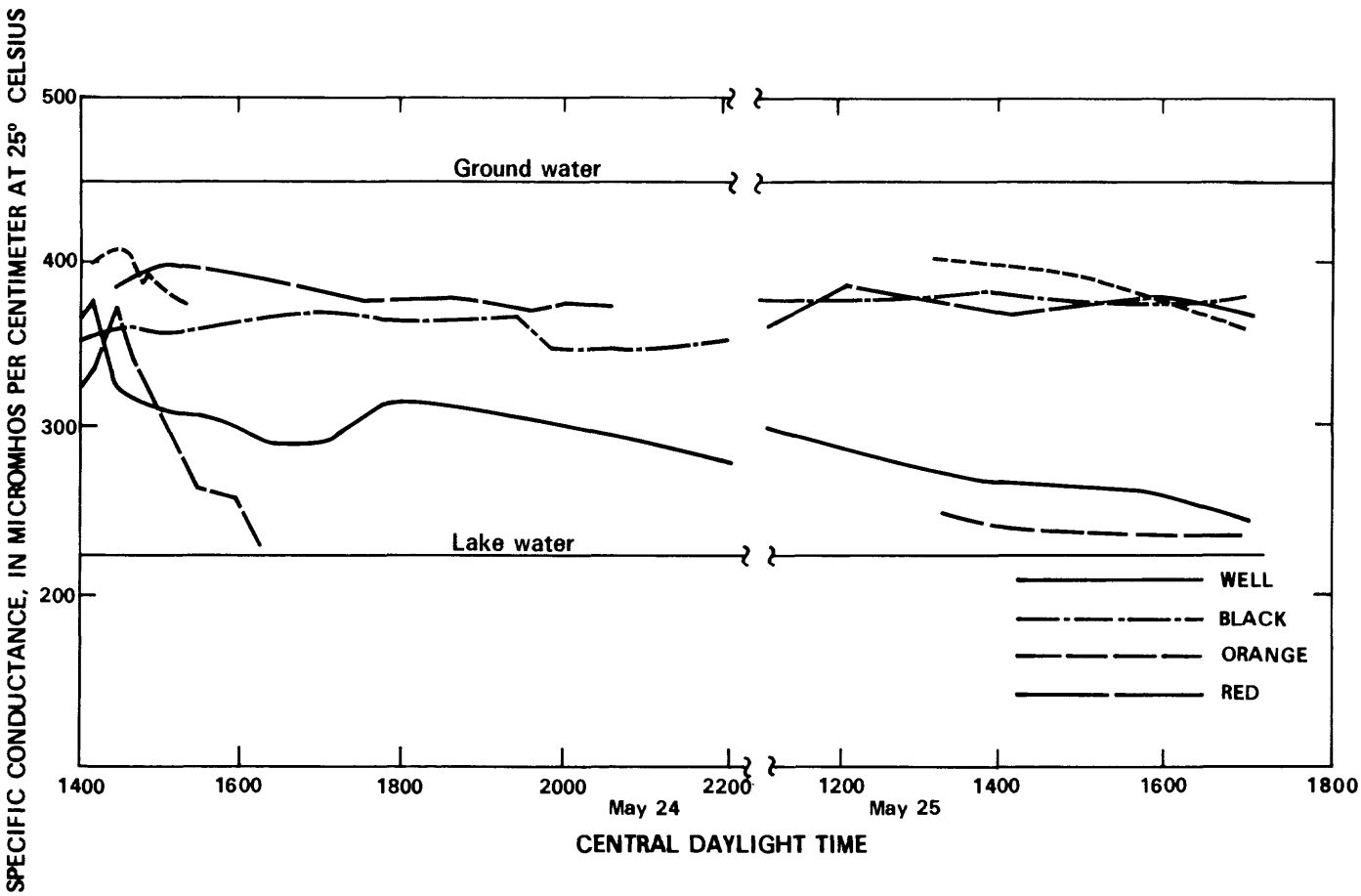

Figure 14.--Change in specific conductance measured in samples from the 2-meter well and point samplers collected May 24-25, 1978.

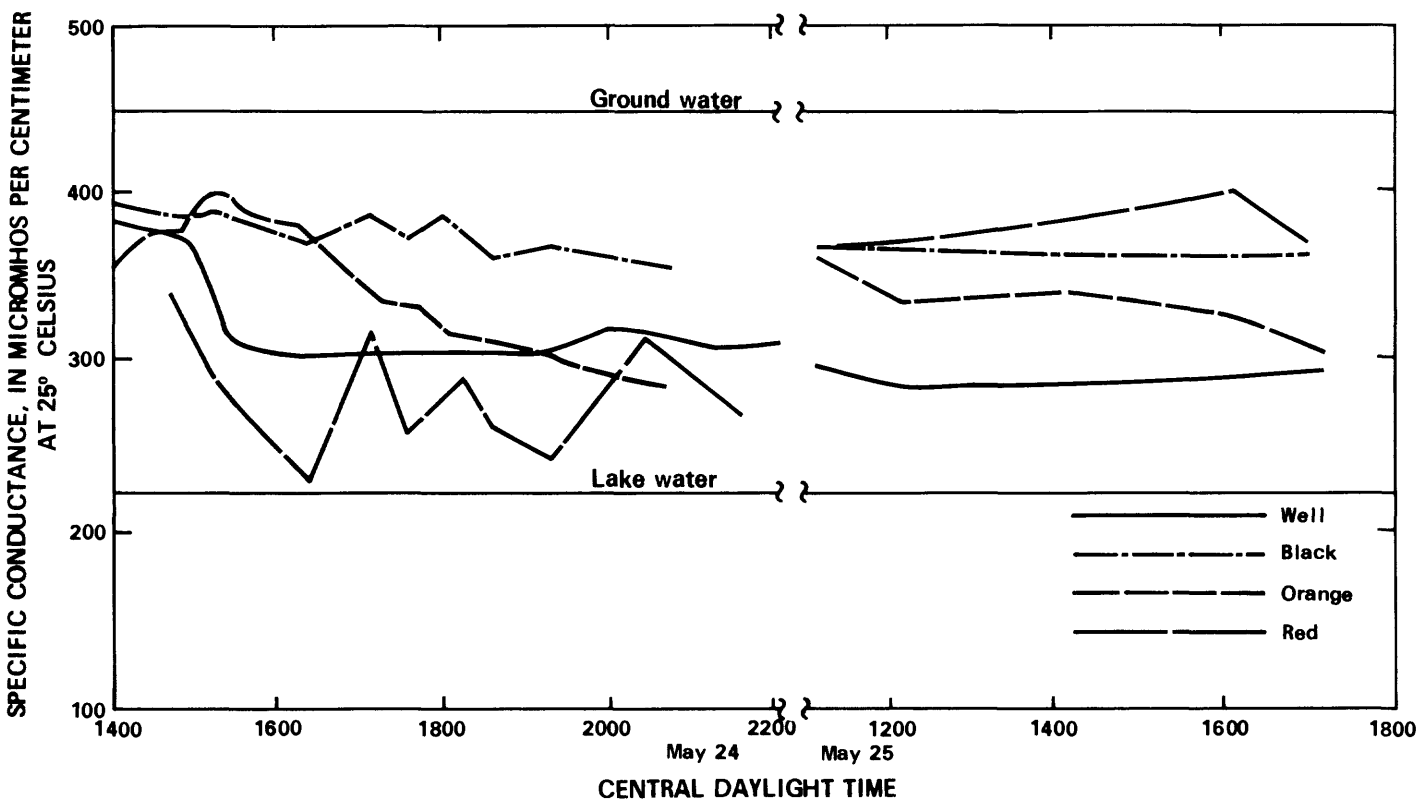

Figure 15.--Change in specific conductance measured in samples from the 5-meter well and point samplers collected May 24-25, 1978.

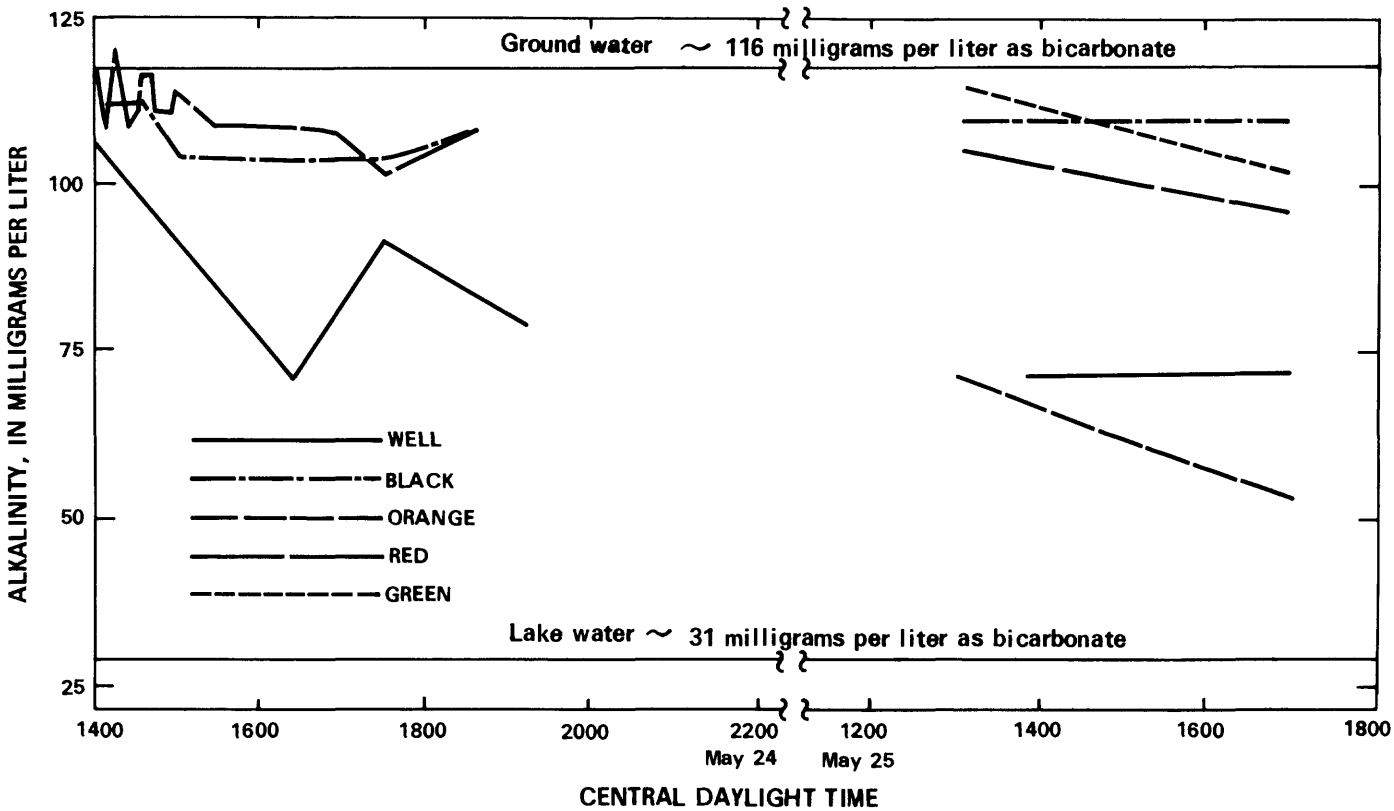

Figure 16.--Change in alkalinity measured in samples from the 2-meter well and point samplers collected May 24-25, 1978.

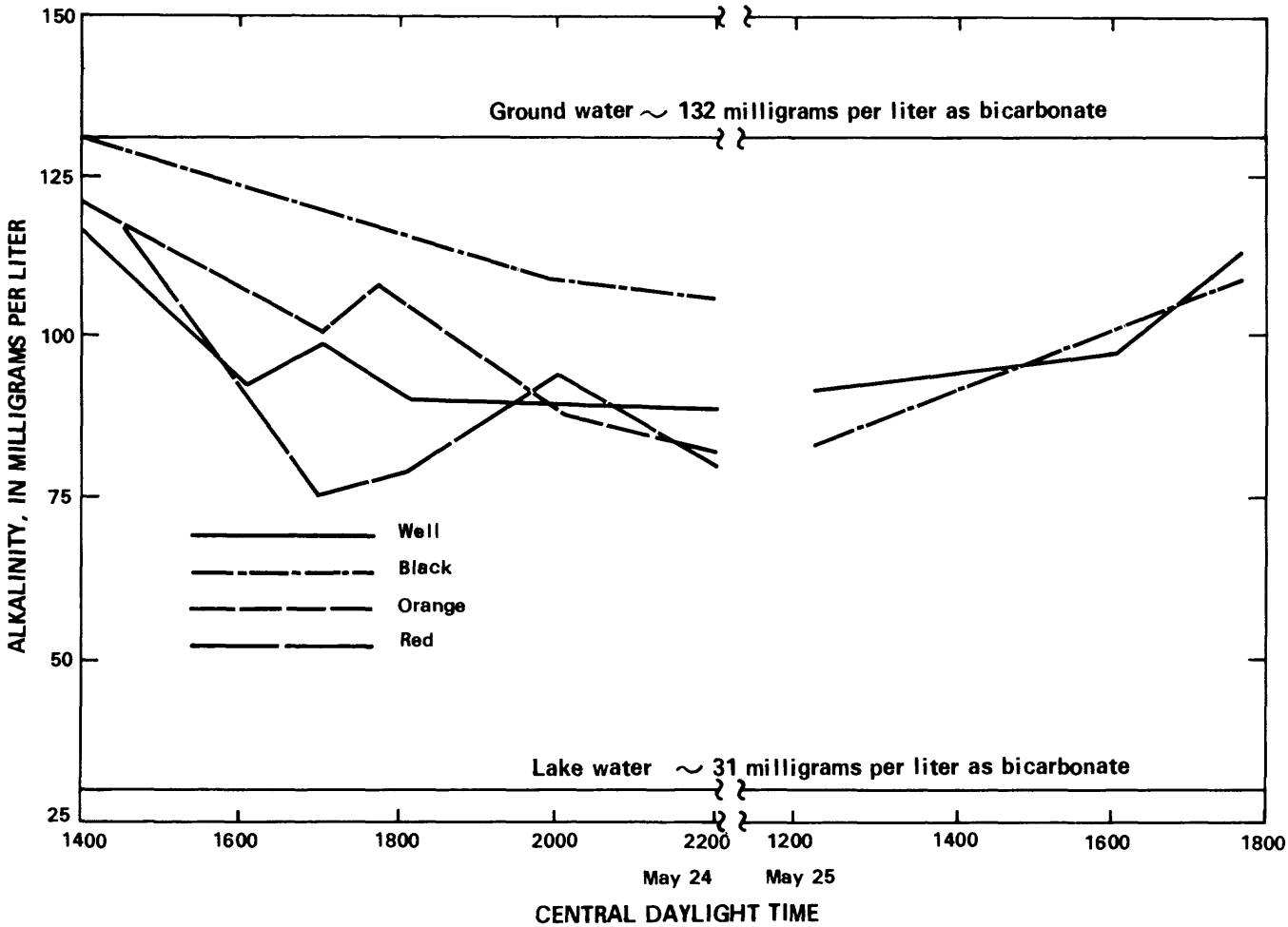

Figure 17.--Change in alkalinity measured in samples from the 5-meter well and point samplers collected May 24-25, 1978.

Table 32.--*Tracer information for May injection*

Tracer	Length of injection	Start time	Date	Initial concentration
Boron----------	Continuous	1400	5/24/78	982 µg/L
Bromide----------	do.	1400	do.	1.20 mg/L
Natural playa-dissolved organics--	do.	1400	do.	8.4 mg C/L
CCl_2F_2----------	do.	1400	do.	30 µg/L
$CBrClF_2$----------	do.	1400	do.	22 µg/L
CBr_2F_2----------	do.	1400	do.	28 µg/L

Sampling Schedule and Tracer Data

The injection test began at 1400 on May 24, 1978; sampling of ground water and monitoring of water levels began at that time. Virtually the same sampling frequency used during the March test was used during this experiment. These samples were analyzed to determine the tracer concentrations at selected times, as listed in tables 33 through 43. Data shown in these tables are labeled with the same location designations used for the data obtained during the March test (tables 22 through 29). The fluorocarbon data are presented as the unitless ratio C/Co, because problems with the injection pump caused an irregular delivery of the tracer into the injection stream. Data are presented as the ratio to input concentration in order to compensate for this difficulty.

AUGUST 1978 INJECTION TEST

The August injection test was run using ground water to provide a final evaluation of various ground-water tracers. Prior to the test, the injection well had again been acidized and swabbed, as it had been during April. A subsequent pump test indicated that the well had a sustainable yield of 13.2 L/s, somewhat less than the 13.7 L/s yield measured during April, but substantially greater than its yield of 7.6 L/s measured after the May injection test, but before redevelopment.

Water for the test was obtained from wells 2 and 3 (fig. 1), and was routed through the treatment plant by bypassing the diatomaceous-earth filters. Wells 2 and 3 were pumped at rates of about 1.26 and 3.79 L/s, respectively, for a combined rate of 5.05 L/s. Ground-water injection was started at 1754 on August 5, 1979, about 3 d before any chemical tracers were added, to stabilize the flow pattern and minimize the effect on tracer transit time resulting from ground-water storage near the injection well. These initial conditions for the start of tracer injection differ from those for the March and May tests, when water and tracer injection were started simultaneously. These differences need to be considered when results of the different tests are compared.

Hydraulic Data

Submersible pumps equipped with 7.5 and 3.75-kW electric motors were used to pump wells 3 and 2, respectively. Because these motors were much smaller than the 38-kW motor used to pick up water from the horseshoe-settling basin, valves in the system were much less constricted, minimizing the chance for air to be entrained by a Venturi effect. Consequently, plugging was minimal; water level in the injection well was relatively stable; and the injection rate could be held constant at 5.05 L/s within the accuracy of the flow meters throughout the test. Cumulative volumes of injected water at the start of each tracer injection are listed in table 44.

Table 33.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1401	1	80	---	7.0	1.4	1.2
Do.	1403	3	-----	4	*	*	*
Do.	1405	5	-----	2	*	*	*
Do.	1406	6	-----	.8	6.5	1.4	1.0
Do.	1410	10	-----	1.1	8.0	1.4	*
Do.	1417	17	-----	.6	400	17	15
Do.	1422	22	-----	3	130	450	680
Do.	1426	26	-----	3.3	170	800	760
Do.	1431	31	-----	3.3	84	250	560
Do.	1435	35	-----	3.2	84	120	340
Do.	1441	41	-----	3.2	150	280	740
Do.	1445	45	-----	---	170	230	840
Do.	1451	51	-----	3.0	170	450	860
Do.	1501	61	540	3.2	*	*	*
Do.	1507	67	-----	3.2	*	*	*
Do.	1515	75	-----	3.4	*	*	*
Do.	1521	81	-----	3.5	*	*	*
Do.	1536	96	-----	3.6	*	*	*
Do.	1543	103	-----	3.8	*	*	*
Do.	1551	111	-----	3.8	*	*	*
Do.	1556	116	-----	4.1	*	*	*
Do.	1600	120	-----	4.2	*	*	*
Do.	1603	123	660	4.1	*	*	*
Do.	1611	131	-----	3.7	*	*	*

Table 33.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

2-Meter well							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1620	140	-----	3.9	1,820	2,200	1,900
Do.	1642	162	-----	3.7	*	*	*
Do.	1645	165	-----	3.2	*	*	*
Do.	1700	180	650	4	*	*	*
Do.	1714	194	-----	4.2	4,500	4,800	2,500
Do.	1726	206	-----	3.6	*	*	*
Do.	1743	223	-----	3.6	*	*	*
Do.	1803	243	630	3.6	*	*	*
Do.	1815	255	-----	3.8	*	*	*
Do.	1830	270	-----	3.8	*	*	*
Do.	1852	292	670	3.5	3,200	3,800	1,200
Do.	1938	338	-----	4.0	*	*	*
Do.	2001	361	720	3.6	*	*	*
Do.	2030	390	-----	3.8	*	*	*
Do.	2205	485	1,012	3.9	1,050	4,700	1,400
Do.	1105	1,265	850	3.3	4,600	4,400	1,500
Do.	1200	1,320	-----	3.8	*	*	*
Do.	1345	1,425	880	4.1	*	*	*
Do.	1400	1,440	-----	4.2	*	*	*
Do.	1556	1,556	920	4.0	*	*	*
Do.	1700	1,620	1,000	4.0	*	*	*

Table 34.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 2-m black located 41.6 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter black point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1405	5	---	0.6	*	*	*
Do.	1415	15	---	.5	*	*	*
Do.	1420	20	---	.7	*	*	*
Do.	1425	25	---	.6	*	*	*
Do.	1430	30	---	.5	*	*	*
Do.	1435	35	---	.5	*	*	*
Do.	1440	40	---	.5	*	*	*
Do.	1445	45	---	.6	*	*	*
Do.	1450	50	---	.6	*	*	*
Do.	1455	55	80	.6	*	*	*
Do.	1500	60	---	.6	*	*	*
Do.	1505	65	---	.8	*	*	*
Do.	1510	70	---	.7	*	*	*
Do.	1515	75	---	.6	*	*	*
Do.	1520	80	78	---	*	*	*
Do.	1530	90	---	.6	*	*	*
Do.	1540	100	---	.7	*	*	*
Do.	1550	110	---	.7	*	*	*
Do.	1600	120	---	.8	*	*	*
Do.	1610	130	---	.8	*	*	*
Do.	1620	140	---	.8	*	*	*
Do.	1655	175	80	.7	*	*	*
Do.	1700	180	---	.9	*	*	*
Do.	1710	190	---	.6	*	*	*
Do.	1720	200	---	1.2	*	*	*

Table 34.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

2-Meter black point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1730	210	---	0.6	*	*	*
Do.	1740	220	---	.6	*	*	*
Do.	1800	240	---	.7	*	*	*
Do.	1815	255	80	---	*	*	*
Do.	1830	270	---	.8	*	*	*
Do.	1845	285	90	.6	*	*	*
Do.	1900	300	---	1.1	*	*	*
Do.	1920	320	---	.7	*	*	*
Do.	1940	340	---	.9	*	*	*
Do.	2000	360	---	.6	*	*	*
Do.	2030	390	---	.6	*	*	*
Do.	2100	420	80	.8	*	*	*
Do.	2200	480	80	.8	*	*	*
5-25-78	1100	1,260	90	1.5	*	*	*
Do.	1200	1,320	---	1.1	*	*	*
Do.	1300	1,380	100	---	*	*	*
Do.	1400	1,440	---	1.6	*	*	*
Do.	1407	1,447	93	---	*	*	*
Do.	1600	1,560	274(?)	2.0	*	*	*
Do.	1700	1,620	120	---	*	*	*

Table 35.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1415	15	---	0.5	*	*	*
Do.	1420	20	---	.5	*	*	*
Do.	1425	25	74	---	*	*	*
Do.	1430	30	---	.5	*	*	*
Do.	1500	60	---	.6	*	*	*
Do.	1510	70	85	---	*	*	*
Do.	1515	75	---	.7	*	*	*
Do.	1520	80	---	.8	*	*	*
Do.	1525	85	---	.6	*	*	*
Do.	1530	90	---	.7	*	*	*
Do.	1540	100	---	.6	*	*	*
Do.	1550	110	---	.7	*	*	*
Do.	1600	120	---	1.0	*	*	*
Do.	1610	130	122	1.6	*	*	*
Do.	1620	140	---	1.4	*	*	*
Do.	1655	175	---	1.6	*	*	*
Do.	1700	180	---	1.6	*	*	*
Do.	1710	190	176	1.5	*	*	*
Do.	1720	200	---	1.5	*	*	*
Do.	1730	210	---	1.3	*	*	*
Do.	1740	220	---	1.3	*	*	*
Do.	1800	240	---	1.3	*	*	*
Do.	1815	255	174	---	*	*	*
Do.	1830	270	---	1.9	*	*	*
Do.	1845	285	---	1.9	*	*	*

Table 35.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

2-Meter red point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1900	300	---	1.5	*	*	*
Do.	1920	320	172	---	*	*	*
Do.	1930	330	---	1.3	*	*	*
Do.	1940	340	---	1.6	*	*	*
Do.	2000	360	---	1.4	*	*	*
Do.	2030	390	176	1.4	*	*	*
Do.	2040	400	---	3.6	*	*	*
Do.	2100	420	185	1.6	*	*	*
Do.	2200	480	---	2.0	*	*	*
5-25-78	1100	1,260	222	1.6	*	*	*
Do.	1200	1,320	---	3.5	*	*	*
Do.	1300	1,380	228	2.9	*	*	*
Do.	1400	1,440	237	3.4	*	*	*
Do.	1600	1,560	---	2.0	*	*	*
Do.	1700	1,620	289	2.0	*	*	*

Table 36.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injected well. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter orange point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1410	10	133	1.6	*	*	*
Do.	1415	15	---	1.4	*	*	*
Do.	1435	35	---	1.2	*	*	*
Do.	1445	45	---	1.7	*	*	*
Do.	1455	55	---	2.2	*	*	*
Do.	1500	60	---	3.5	*	*	*
Do.	1505	65	478	---	*	*	*
Do.	1510	70	---	7	*	*	*
Do.	1520	80	---	3.7	*	*	*
Do.	1530	90	---	3.7	*	*	*
Do.	1550	110	---	4.2	*	*	*
Do.	1600	120	---	4.2	*	*	*
Do.	1610	130	732	---	*	*	*
Do.	1620	140	---	5.3	*	*	*
Do.	1655	175	---	4.3	*	*	*
Do.	1700	180	---	4.6	*	*	*
Do.	1710	190	---	3.5	*	*	*
Do.	1720	200	---	3.6	*	*	*
Do.	1730	210	---	3.6	*	*	*
Do.	1740	220	---	3.6	*	*	*
Do.	1750	230	---	3.8	*	*	*
Do.	1800	240	---	4.7	*	*	*
Do.	1815	255	---	4.8	*	*	*
Do.	1830	270	---	4.4	*	*	*
Do.	1845	285	---	4.2	*	*	*

Table 36.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

2-Meter orange point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1900	300	---	4.8	*	*	*
Do.	1920	320	---	4.4	*	*	*
Do.	1940	340	---	4.7	*	*	*
Do.	2000	360	---	4.4	*	*	*
Do.	2030	390	---	4.2	*	*	*
Do.	2100	420	---	4.2	*	*	*
Do.	2200	480	---	4.3	*	*	*
5-25-78	1100	1,260	---	3.6	*	*	*
Do.	1300	1,380	---	4	*	*	*
Do.	1400	1,440	---	4	*	*	*
Do.	1401	1,441	946	---	*	*	*
Do.	(1409-1415)	1,449-1,455	---	(4)	*	*	*
Do.	1600	1,560	974	4.2	*	*	*
Do.	1700	1,620	1,061	4.3	*	*	*

Table 37.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 2-m green located 2 m radially from the injection well and 32.6 m below land surface. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter green point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1410	10	185	---	*	*	*
Do.	1415	15	154	1.2	*	*	*
Do.	1425	25	---	1.2	*	*	*
Do.	1435	35	---	.8	*	*	*
Do.	1445	45	---	.8	*	*	*
Do.	1455	55	---	.8	*	*	*
Do.	1500	60	---	.8	*	*	*
Do.	1510	70	---	1.0	*	*	*
Do.	1515	75	165	---	*	*	*
Do.	1520	80	---	.9	*	*	*
Do.	1530	90	---	.9	*	*	*
Do.	1540	100	---	.9	*	*	*
Do.	1550	110	---	1.0	*	*	*
Do.	1600	120	---	1.9	*	*	*
Do.	1610	130	170	---	*	*	*
Do.	1620	140	---	.9	*	*	*
Do.	1655	175	---	.9	*	*	*
Do.	1700	180	---	1.3	*	*	*
Do.	1710	190	---	1.3	*	*	*
Do.	1720	200	---	.9	*	*	*
Do.	1740	220	---	1.2	*	*	*
Do.	1800	240	---	1.6	*	*	*
Do.	1815	255	---	1.1	*	*	*
Do.	1830	270	---	2.3	*	*	*

Table 37.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

2-Meter green point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1845	285	---	0.8	*	*	*
Do.	1900	300	---	1.1	*	*	*
Do.	1920	320	---	1.2	*	*	*
Do.	1940	340	---	2.0	*	*	*
Do.	2000	360	---	1.1	*	*	*
Do.	2030	390	---	1.6	*	*	*
Do.	2100	420	---	.9	*	*	*
Do.	2200	480	---	1.5	*	*	*
Do.	1200	1,320	---	1.5	*	*	*
Do.	1300	1,380	250	1.1	*	*	*
Do.	1400	1,440	---	1.3	*	*	*
Do.	1407	1,447	287	1.2	*	*	*
Do.	1600	1,560	339	1.6	*	*	*
Do.	1700	1,620	354	1.4	*	*	*
Do.	1730	1,650	348	---	*	*	*

Table 38.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1401	1	90	1	6.4	1.5	0
Do.	1410	10	---	.6	6.4	1.4	0
Do.	1422	22	---	.7	*	*	*
Do.	1430	30	---	---	6.4	1.5	0
Do.	1440	40	---	.9	7.4	1.8	0
Do.	1445	45	---	---	16	190	7.9
Do.	1451	51	---	---	110	880	31
Do.	1501	61	---	1.2	210	1,400	280
Do.	1506	66	---	3.2	*	*	*
Do.	1511	71	---	1.5	*	*	*
Do.	1516	76	250	1.7	*	*	*
Do.	1522	81	---	1.8	*	*	*
Do.	1532	92	---	2.35	860	2,000	570
Do.	1542	102	---	3.1	*	*	*
Do.	1552	112	---	3.6	*	*	*
Do.	1601	121	---	2.8	1,100	2,700	660
Do.	1611	131	---	3	*	*	*
Do.	1620	140	---	4	*	*	*
Do.	1640	160	---	2	280	1,500	580
Do.	1700	180	360	2	*	*	*
Do.	1712	192	---	2.1	*	*	*
Do.	1715	195	---	---	140	400	780
Do.	1726	206	---	2.6	*	*	*

Table 38.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

5-Meter well							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1741	221	---	2.2	2,800	3,100	940
Do.	1803	243	---	2.4	*	*	*
Do.	1815	255	---	3	*	*	*
Do.	1830	270	---	3.1	*	*	*
Do.	1850	290	---	2.3	*	*	*
Do.	1856	296	540	2.6	2,100	3,200	820
Do.	1936	336	---	1.7	*	*	*
Do.	2000	360	---	2.3	1,500	2,800	840
Do.	2020	380	---	3.1	*	*	*
Do.	2040	400	---	3	*	*	*
Do.	2104	424	630	2.6	*	*	*
Do.	2135	455	---	2.4	*	*	*
Do.	2205	485	---	2.6	*	*	*
5-25-78	1105	1,265	670	2.6	5,000	4,400	1,300
Do.	1200	1,320	---	3.3	*	*	*
Do.	1400	1,440	650	3.4	*	*	*
Do.	1600	1,560	---	3.2	*	*	*
Do.	1700	1,620	710	3.1	*	*	*

Table 39.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 5-m black located 5 m radially from the injection well and 41.8 m below land surface. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter black point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1400	0	113	---	*	*	*
Do.	1430	30	---	1.1	*	*	*
Do.	1500	60	---	1.0	*	*	*
Do.	1505	65	---	1.0	*	*	*
Do.	1510	70	---	1.0	*	*	*
Do.	1515	75	---	1.1	*	*	*
Do.	1525	85	---	.8	*	*	*
Do.	1535	95	---	1.0	*	*	*
Do.	1540	100	---	1.0	*	*	*
Do.	1545	105	---	1.1	*	*	*
Do.	1555	115	122	1.0	*	*	*
Do.	1600	120	---	1.8	*	*	*
Do.	1605	125	---	1.0	*	*	*
Do.	1610	130	---	1.6	*	*	*
Do.	1615	135	---	1.0	*	*	*
Do.	1620	140	---	1.0	*	*	*
Do.	1655	175	---	.8	*	*	*
Do.	1700	180	---	1.0	*	*	*
Do.	1705	185	---	.8	*	*	*
Do.	1710	190	---	1.0	*	*	*
Do.	1715	195	---	1.1	*	*	*
Do.	1720	200	---	1.1	*	*	*
Do.	1725	205	---	2.4	*	*	*
Do.	1730	210	---	1.1	*	*	*
Do.	1735	215	---	1.3	*	*	*

Table 39.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

5-Meter black point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1740	220	---	2.3	*	*	*
Do.	1750	230	---	1.3	*	*	*
Do.	1755	235	122	1.5	*	*	*
Do.	1800	240	---	1.5	*	*	*
Do.	1810	250	---	1.7	*	*	*
Do.	1820	260	---	1.5	*	*	*
Do.	1830	270	---	2.0	*	*	*
Do.	1840	280	---	2.0	*	*	*
Do.	1850	290	---	2.0	*	*	*
Do.	1900	300	---	1.9	*	*	*
Do.	1915	315	---	1.8	*	*	*
Do.	1930	330	---	1.9	*	*	*
Do.	1945	345	---	1.6	*	*	*
Do.	2000	360	---	1.6	*	*	*
Do.	2020	380	118	1.6	*	*	*
Do.	2040	400	---	1.7	*	*	*
Do.	2200	480	200	---	*	*	*
5-25-78	1100	1,260	116	---	*	*	*
Do.	1200	1,320	116	---	*	*	*
Do.	1400	1,440	116	1.9	*	*	*
Do.	1700	1,620	116	---	*	*	*

Table 40.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from an observation well designated 5-m red and screened only for 0.7 m at 40.0 m below land surface. This sampler is located at a distance of 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; the asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter red point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1430	30	---	0.8	*	*	*
Do.	1440	40	277	2.0	*	*	*
Do.	1450	50	---	3.5	*	*	*
Do.	1500	60	---	2.8	*	*	*
Do.	1505	65	476	3.0	*	*	*
Do.	1510	70	---	3.4	*	*	*
Do.	1515	75	---	3.4	*	*	*
Do.	1520	80	---	3.9	*	*	*
Do.	1525	85	---	3.9	*	*	*
Do.	1530	90	---	3.9	*	*	*
Do.	1540	100	---	4.8	*	*	*
Do.	1545	105	---	4.5	*	*	*
Do.	1550	110	---	4.0	*	*	*
Do.	1555	115	---	4.8	*	*	*
Do.	1600	120	---	4.7	*	*	*
Do.	1605	125	---	4.4	*	*	*
Do.	1610	130	---	4.5	*	*	*
Do.	1620	140	---	4.5	*	*	*
Do.	1655	175	---	4.5	*	*	*
Do.	1700	180	---	3.8	*	*	*
Do.	1705	185	449	2.6	*	*	*
Do.	1710	190	---	2.8	*	*	*
Do.	1715	195	---	3.1	*	*	*
Do.	1720	200	---	3.9	*	*	*

Table 40.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

5-Meter red point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1725	205	---	3.5	*	*	*
Do.	1730	210	---	4.4	*	*	*
Do.	1735	215	---	4.1	*	*	*
Do.	1740	220	---	4.1	*	*	*
Do.	1750	230	---	4.7	*	*	*
Do.	1755	235	---	3.5	*	*	*
Do.	1820	260	---	3.4	*	*	*
Do.	1850	290	---	4.4	*	*	*
Do.	1915	315	856	4.3	*	*	*
Do.	2020	380	---	3.0	*	*	*
Do.	2040	400	491	---	*	*	*
Do.	2130	450	558	---	*	*	*
Do.	2200	480	---	3.5	*	*	*
5-25-78	1115	1,275	602	---	*	*	*
Do.	1200	1,320	637	---	*	*	*
Do.	1400	1,440	754	---	*	*	*
Do.	1600	1,560	664	---	*	*	*
Do.	1700	1,620	891	---	*	*	*

Table 41.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1400	0	---	0.6	*	*	*
Do.	1410	10	100	---	*	*	*
Do.	1420	20	---	.6	*	*	*
Do.	1440	40	---	.7	*	*	*
Do.	1505	65	90	.6	*	*	*
Do.	1530	90	---	.8	*	*	*
Do.	1545	105	---	.9	*	*	*
Do.	1600	120	---	1.5	*	*	*
Do.	1605	125	120	---	*	*	*
Do.	1615	135	---	2.6	*	*	*
Do.	1655	175	---	2.3	*	*	*
Do.	1705	185	120	---	*	*	*
Do.	1710	190	---	2.9	*	*	*
Do.	1735	215	---	2.6	*	*	*
Do.	1750	230	---	2.8	*	*	*
Do.	1755	235	150	---	*	*	*
Do.	1800	240	---	2.6	*	*	*
Do.	1820	260	---	2.7	*	*	*
Do.	1840	280	---	2.6	*	*	*
Do.	1850	290	160	---	*	*	*
Do.	1900	300	---	2.9	*	*	*
Do.	1930	330	---	3.1	*	*	*
Do.	2020	380	170	3.2	*	*	*
Do.	2200	480	---	3	*	*	*

Table 41.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*--Continued

5-Meter orange point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-25-78	1100	1,260	120	---	*	*	*
Do.	1400	1,440	140	---	*	*	*
Do.	1600	1,560	140	---	*	*	*
Do.	1700	1,620	150	---	*	*	*

Table 42.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the observation well 10 m from the injection well and are from the zone screened only from 41.5 to 42.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

10-Meter point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1411	11	80	---	6.4	1.4	0
Do.	1445	45	---	0.6	*	*	*
Do.	1540	90	---	---	6.4	0	0
Do.	1645	165	80	.6	6.4	1.4	0
Do.	1745	225	---	.6	14	3.6	1
Do.	1859	229	80	---	32	100	8
Do.	2001	361	---	1.1	66	84	17
Do.	2031	391	100	1.2	88	220	43
Do.	2135	455	---	1.3	*	*	*
Do.	2205	485	130	---	*	*	*
5-25-78	1135	1,296	150	---	*	*	*
Do.	1250	1,370	---	---	170	1,200	320
Do.	1400	1,440	170	---	*	*	*
Do.	1600	1,560	180	---	*	*	*
Do.	1710	1,630	270	---	*	*	*

Table 43.--*Data obtained from water samples collected during the May 24-25, 1978, injection test using playa-lake water*

[Samples are from the observation well 15 m from the injection well, which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

15-Meter point sampler							
Date	Clock time	Elapsed time (min)	Boron (µg/L)	Natural organics (mg C/L)	C/Co X 10^5		
					F-12	BCF	DBM
5-24-78	1400	0	---	0.4	6.4	1.4	0
Do.	1514	74	80	.6	*	*	*
Do.	1540	100	---	.6	*	*	*
Do.	1600	120	---	---	280	1.3	380
Do.	1645	165	80	.6	*	*	*
Do.	1700	180	---	---	12	3.2	1.3
Do.	1740	220	---	.7	*	*	*
Do.	1744	224	70	---	*	*	*
Do.	1858	298	---	.9	*	*	*
Do.	2003	363	80	.7	*	*	*
Do.	2102	422	---	.6	*	*	*
Do.	2205	485	70	---	*	*	*
5-25-78	1105	1,265	70	---	*	*	*
Do.	1200	1,320	---	.7	6.4	1.4	0
Do.	1400	1,440	73	---	*	*	*
Do.	1600	1,560	371	---	*	*	*
Do.	1700	1,620	70	---	*	*	*

Table 44.--*Cumulative volume of water injected after selected times during the August 1978 injection test*

[Injection rate held constant at 5.05 L/s throughout the test]

Date	Time	Cumulative volume of injected water (L)	Remarks
8-05-78	1754	0	Injection started.
8-08-78	1200	1,201,000	Start of first tracer experiment.
8-10-78	1300	2,093,000	Start of second tracer experiment.
8-12-78	1710	3,038,900	Start of third tracer experiment.
8-14-78	1200	3,817,100	Start of fourth tracer experiment.
8-15-78	1000	4,216,800	Start of fifth tracer experiment.
8-15-78	1935	4,390,900	End of injection.

Vertical well-bore flow-meter data were collected approximately twice daily during tracer injection to determine the zones being recharged. Results of these measurements are shown in figure 18.

Water levels also were measured twice daily in the various piezometers and in selected observation wells. These data are too few to analyze for hydraulic properties of the aquifer. Data for such analyses had been collected during the March 1977 pumping test and the March 1978 injection test. August water-level data are not presented here.

Sampling Schedule and Tracer Data

Data presented in the following sections represent analyses of samples collected during the tests conducted August 8-15, 1978. The tables are arranged chronologically and labeled according to the sampling location, as in the previous sections.

During the first experiment, which began at 1200 on August 8, both bromide (Br) as sodium bromide and boron (B) as boric acid were added to the injection water. Bromide and boron were added simultaneously for two reasons: (1) For a comparison between the two tracers; and (2) known conservative tracers were needed to redefine the flow field, because the well had been redeveloped shortly after the May test to remove entrained air and particulates.

During the second and third experiments, bromide and boron data are provided for comparison with organic tracers used during the experiments. In the fourth experiment, a comparison is made between the following eight tracers: fluoride (F), chloride (Cl), bromide (Br), iodide (I), yeast, Freon-11, Freon-12, and $CBrCl_2F$. A fifth experiment was conducted using only the three fluorocarbons Freon-12, Freon-11, and $CBrCl_2F$. This experiment was performed because the concentrations of these three compounds in experiment 4 were too small. (Because hydrologic conditions and injection times for experiments 4 and 5 were identical, the data are presented together in tables 75 through 82 in terms of elapsed time.) Data in table 45 summarize information about the tracers used in each of the five experiments. Chemical composition of ground water used as injection water remained virtually constant throughout the test; a typical analysis is given in table 46.

Concentrations of the inorganic tracers were determined in the laboratory; consequently, many more analyses could be performed than with the halocarbons and several of the nonvolatile organic compounds. Because of greater frequency of inorganic tracer data and because these tracers were used in all four experiments during the August test, these data are given separately in tables 47 to 60.

For the second and third experiments during the August test, several compounds were added to the water, each with a different initial-input concentration. To compare the concentration of tracer (C) that is observed

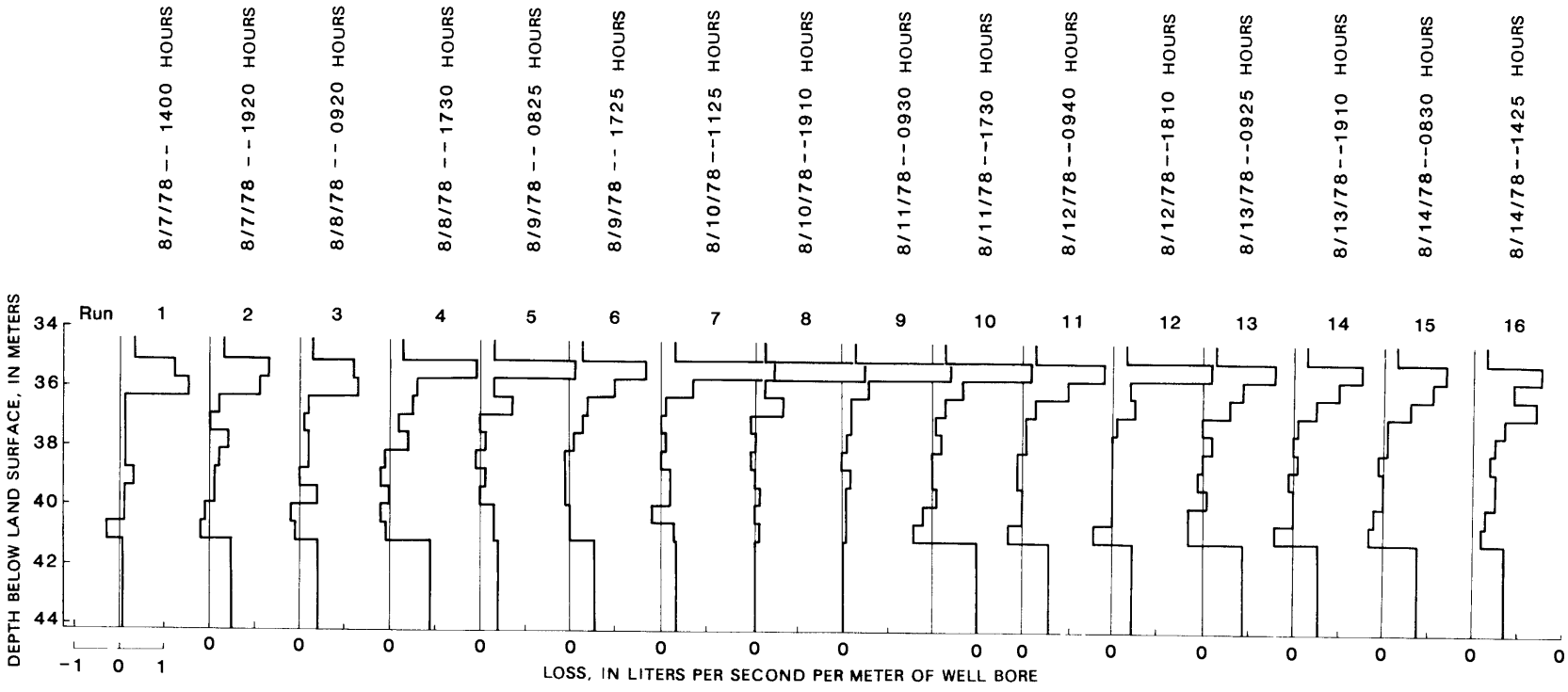

Figure 18.--Flowmeter logs from the injection well obtained during the August 7-15, 1978 test.

Table 45.--*Tracer information for the August 1978 test*

Tracer	Injection duration	Start time	Date	Initial concentration (mg/L)
First experiment:				
Boron----------	6 h	1200	8- 8-78	3.61
Bromide----------	6 h	1200	do.	36.0
Copper----------	6 h	1200	do.	2.0
Deuterium----------	6 h	1200	do.	trace
$CBrClF_2$----------	4.5 h	1200	do.	3.9
Second experiment:				
Bromide----------	5 h	1300	8-10-78	20
Ethanol----------	4 h	1300	do.	24
Acetate----------	3 h	1300	do.	10
Phenolphthalein------	4 h	1300	do.	2
Benzoate----------	3 h	1300	do.	10.4
Freon-12----------	9 h	1300	do.	8.6
Third experiment:				
Boron----------	6 h	1710	8-12-78	3.93
Ethanol----------	8 h	1710	do.	11.6
Aniline----------	8 h	1710	do.	9.4
Ethylamine----------	8 h	1710	do.	25
CBr_2F_2----------	14 h	1710	do.	1.9
Fourth experiment:				
Fluoride----------	2 min	1200	8-14-78	96
Chloride----------	2 min	1200	do.	1,300
Bromide----------	2 min	1200	do.	150
Iodide----------	2 min	1200	do.	60
Yeast----------	2 min	1200	do.	1.44×10^5 [1]
Fifth experiment:[2]				
Freon-11----------	2 min	1000	8-15-78	51
Freon-12----------	2 min	1000	do.	470
$CBrClF_2$----------	2 min	1000	do.	62

[1] Colonies of yeast per milliliter of injection water.

[2] Data for the fifth experiment are presented with data for the fourth experiment.

Table 46.--*Analysis of the ground water used during the August 1978 tracer test*

[Analyses by U.S. Geological Survey Central Laboratory]

Constituent	mg/L
Calcium (Ca)	36
Magnesium (Mg)	20
Sodium (Na)	26
Potassium (K)	8.5
Chloride (Cl)	17
Sulfate (SO_4)	26
Alkalinity ($CaCO_3$)	170
Lithium (Li)	.03
Nitrate (N)	1.5
Silica (SiO_2)	43
Strontium (Sr)	1.6
Boron (B)	.1
Iron (Fe)	.01
Copper (Cu)	.01
Fluoride (F)	3.0
Iodide (I)	.09
Hardness (noncarbonate)	4
Total hardness	170
SAR (dimensionless)	.9
pH (units)	7.57
Alkalinity (on-site as HCO_3^-)	110
Specific conductance (μmhos/cm)	456

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	242	----	*
Do.	1210	0	10	---	----	*
Do.	1220	0	20	---	----	*
Do.	1230	0	30	231	----	0
Do.	1240	0	40	---	----	*
Do.	1250	0	50	---	----	.01
Do.	1300	0	60	270	----	.01
Do.	1310	0	70	---	----	*
Do.	1320	0	80	---	----	*
Do.	1330	0	90	379	1.60	.03
Do.	1340	0	100	---	----	*
Do.	1350	0	110	---	----	*
Do.	1400	0	120	509	3.20	.11
Do.	1410	0	130	---	----	*
Do.	1420	0	140	---	----	*
Do.	1430	0	150	678	4.80	.10
Do.	1440	0	160	---	----	*
Do.	1450	0	170	---	----	*
Do.	1500	0	180	818	7.40	.40
Do.	1510	0	190	---	----	*
Do.	1520	0	200	---	----	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1530	0	210	967	9.40	0.60
Do.	1540	0	220	-----	-----	.68
Do.	1550	0	230	-----	-----	*
Do.	1600	0	240	1,135	10.70	.09
Do.	1630	0	270	1,297	13.30	.54
Do.	1700	0	300	1,448	14.60	.55
Do.	1730	0	330	1,481	14.80	*
Do.	1800	0	360	1,575	16.00	.09
Do.	1815	0	375	-----	-----	*
Do.	1830	0	390	1,635	16.90	*
Do.	1845	0	405	-----	-----	*
Do.	1900	0	420	-----	-----	.06
Do.	1915	0	435	1,704	16.90	*
Do.	1930	0	450	-----	-----	*
Do.	1945	0	465	1,575	15.70	*
Do.	2000	0	480	-----	-----	*
Do.	2020	0	500	-----	-----	*
Do.	2030	0	510	1,503	13.50	*
Do.	2045	0	525	-----	-----	*
Do.	2100	0	540	1,282	11.80	.04
Do.	2120	0	560	-----	-----	*
Do.	2140	0	580	1,165	9.80	*
Do.	2200	0	600	1,130	9.30	.42
Do.	2230	0	630	1,004	8.20	*
Do.	2300	0	660	958	6.70	.03
Do.	2400	0	720	850	6.10	.14

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	0200	0	840	704	4.20	0.13
Do.	0400	0	960	603	3.30	.08
Do.	0600	0	1,080	497	2.70	*
Do.	0815	0	1,215	444	2.30	*
Do.	1000	0	1,320	---	1.90	.02
Do.	1200	1	0	379	1.90	*
Do.	1415	1	135	---	1.90	*
Do.	1600	1	240	340	1.80	*
Do.	1800	1	360	---	1.70	*
Do.	2130	1	570	288	1.50	*
8-10-78	0605	1	1,085	---	1.16	*
Do.	0610	1	1,090	278	----	*
Do.	0800	1	1,200	---	1.20	*
Do.	1000	1	1,320	248	1.15	*
Do.	1158	1	1,438	244	1.10	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1300	2	60	244	.6	*
Do.	1310	2	70	---	----	*
Do.	1320	2	80	---	----	*
Do.	1330	2	90	---	.6	*
Do.	1340	2	100	---	----	*
Do.	1350	2	110	---	----	*
Do.	1400	2	120	237	.8	*
Do.	1410	2	130	---	----	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1420	2	140	---	---	*
Do.	1430	2	150	---	1.3	*
Do.	1445	2	165	---	---	*
Do.	1500	2	180	---	2.5	*
Do.	1515	2	195	---	---	*
Do.	1530	2	210	---	3.8	*
Do.	1545	2	225	---	4.8	*
Do.	1600	2	240	231	---	*
Do.	1630	2	270	---	4.8	*
Do.	1700	2	300	---	5.2	*
Do.	1730	2	330	---	5.0	*
Do.	1800	2	360	---	4.6	*
Do.	1900	2	420	---	4.2	*
Do.	2000	2	480	220	4.8	*
Do.	2010	2	490	---	---	*
Do.	2100	2	540	---	4.4	*
Do.	2210	2	610	---	2.8	*
Do.	2215	2	615	---	---	*
Do.	2310	2	670	---	2.6	*
Do.	2320	2	680	---	---	*
Do.	2400	2	720	211	2.1	*
8-11-78	0030	2	750	---	---	*
Do.	0100	2	780	---	---	*
Do.	0205	2	845	---	1.5	*
Do.	0225	2	865	---	---	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-11-78	1300	Second tracer experiment started--Continued				
8-11-78	0300	2	900	---	---	*
Do.	0305	2	905	---	---	*
Do.	0315	2	915	---	---	*
Do.	0405	2	965	---	1.3	*
Do.	0600	2	1,080	198	1.8	*
Do.	0800	2	1,200	---	1.8	*
Do.	1010	2	1,330	---	1.5	*
Do.	1020	2	1,340	---	---	*
Do.	1200	3	0	181	1.4	*
Do.	1213	3	13	---	---	*
Do.	1400	3	60	---	1.3	*
Do.	1408	3	68	---	---	*
Do.	1555	3	235	---	---	*
Do.	1805	3	365	179	1.2	*
Do.	2100	3	540	---	1.1	*
Do.	2400	3	720	181	1.0	*
8-12-78	0600	3	1,080	---	.9	*
Do.	1043	3	1,363	163	.9	*
Do.	1650	4	290	---	---	*
Do.	1700	4	300	152	.9	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1713	4	313	---	.9	*
Do.	1800	4	360	402	---	*
Do.	1815	4	375	416	---	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-12-78	1830	4	390	396	---	*
Do.	1845	4	405	396	---	*
Do.	1900	4	420	515	---	*
Do.	1915	4	435	475	---	*
Do.	1930	4	450	574	---	*
Do.	1945	4	465	851	---	*
Do.	2000	4	480	1,030	0.9	*
Do.	2030	4	510	-----	---	*
Do.	2100	4	540	-----	---	*
Do.	2130	4	570	1,235	---	*
Do.	2200	4	600	-----	---	*
Do.	2230	4	630	1,268	---	*
Do.	2300	4	660	1,475	.9	*
Do.	2330	4	690	1,525	---	*
Do.	2400	4	720	1,628	---	*
8-13-78	0100	4	780	1,485	---	*
Do.	0130	4	810	-----	---	*
Do.	0200	4	840	-----	---	*
Do.	0230	4	870	1,210	---	*
Do.	0300	4	900	-----	---	*
Do.	0330	4	930	-----	---	*
Do.	0400	4	960	994	---	*
Do.	0500	4	1,020	-----	---	*
Do.	0600	4	1,080	793	.9	*
Do.	0700	4	1,140	-----	---	*
Do.	0800	4	1,200	651	---	*
Do.	0900	4	1,260	-----	---	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-13-78	0900	4	1,260	---	---	*
Do.	1000	4	1,320	573	---	*
Do.	1200	5	0	---	0.9	*
Do.	1400	5	120	453	---	*
Do.	1600	5	240	398	---	*
Do.	2000	5	480	347	---	*
Do.	2300	5	540	296	.9	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	230	.8	*
Do.	1215	6	15	---	---	*
Do.	1230	6	30	230	1.8	*
Do.	1245	6	45	---	---	*
Do.	1300	6	60	210	4.5	*
Do.	1315	6	75	---	---	*
Do.	1330	6	90	---	---	*
Do.	1345	6	105	240	8.0	*
Do.	1400	6	120	240	10.0	*
Do.	1430	6	150	220	12.0	*
Do.	1500	6	180	230	4.5	*
Do.	1530	6	210	---	---	*
Do.	1600	6	240	230	3.8	*
Do.	1630	6	270	---	---	*
Do.	1700	6	300	240	3.4	*
Do.	1730	6	330	---	---	*

Table 47.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1800	6	360	220	----	*
Do.	1900	6	420	---	----	*
Do.	2000	6	480	---	----	*
Do.	2100	6	540	---	----	*
Do.	2200	6	600	---	----	*
Do.	2300	6	660	---	----	*
Do.	2400	6	720	210	0.86	*
8-15-78	0200	6	840	---	.70	*
Do.	0400	6	960	---	----	*
Do.	0600	6	1,080	---	----	*
Do.	0800	6	1,200	---	----	*
Do.	1000	6	1,320	190	.43	*
Do.	1200	7	0	---	----	*
Do.	1400	7	120	---	----	*
Do.	1800	7	360	190	----	*

Table 48.--*Data obtained from the tracer experiments conducted during August. 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m black located 41.6 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	222	1.8	*
Do.	1210	0	10	---	---	*
Do.	1220	0	20	---	---	*
Do.	1230	0	30	---	---	*
Do.	1240	0	40	---	---	*
Do.	1250	0	50	---	---	*
Do.	1300	0	60	191	.9	*
Do.	1310	0	70	---	---	*
Do.	1320	0	80	---	---	*
Do.	1330	0	90	---	---	*
Do.	1340	0	100	---	---	*
Do.	1350	0	110	---	---	*
Do.	1400	0	120	---	---	*
Do.	1407	0	127	187	.9	*
Do.	1410	0	130	---	---	*
Do.	1420	0	140	---	---	*
Do.	1430	0	150	---	---	*
Do.	1440	0	160	---	---	*
Do.	1450	0	170	---	---	*
Do.	1500	0	180	196	2.2	*
Do.	1510	0	190	---	---	*

Table 48.--*Data obtained from the tracer experiment conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1520	0	200	---	---	*
Do.	1530	0	210	---	---	*
Do.	1540	0	220	---	---	*
Do.	1550	0	230	---	---	*
Do.	1600	0	240	187	0.9	*
Do.	1630	0	270	---	---	*
Do.	1700	0	300	187	.8	*
Do.	1730	0	330	---	---	*
Do.	1800	0	360	189	1.0	*
Do.	1815	0	375	---	---	*
Do.	1830	0	390	---	---	*
Do.	1845	0	405	---	---	*
Do.	1900	0	420	183	.9	*
Do.	1915	0	435	---	---	*
Do.	1930	0	450	---	---	*
Do.	1945	0	465	---	---	*
Do.	2000	0	480	187	.9	*
Do.	2020	0	500	---	---	*
Do.	2030	0	510	---	---	*
Do.	2045	0	525	---	---	*
Do.	2100	0	540	191	---	*
Do.	2120	0	560	---	---	*
Do.	2140	0	580	---	---	*
Do.	2200	0	600	178	.8	*
Do.	2230	0	630	---	---	*

Table 48.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	2300	0	660	---	---	*
Do.	2400	0	720	177	1.0	*
8-9-78	0200	0	840	181	---	*
Do.	0400	0	960	179	.9	*
Do.	0600	0	1,080	189	1.1	*
Do.	0815	0	1,215	250	1.4	*
Do.	1000	0	1,320	235	1.6	*
Do.	1200	1	0	245	2.2	*
Do.	1415	1	1,350	243	2.8	*
Do.	1600	1	240	264	3.5	*
Do.	1800	1	360	273	3.9	*
8-10-78	0605	1	1,085	343	6.2	*
Do.	0800	1	1,200	372	6.4	*
8-10-78	1300	Second tracer experiment initiated				
8-10-78	1300	2	60	---	---	*
Do.	1310	2	70	405	5.5	*
Do.	1400	2	120	412	5.5	*
Do.	1600	2	240	---	4.1	*
Do.	1650	2	290	398	---	*
Do.	2000	2	480	392	4.2	*
Do.	2400	2	720	376	3.8	*
8-11-78	0600	2	1,080	365	4.4	*
Do.	1200	3	0	359	4.2	*
Do.	1800	3	360	346	4.2	*
Do.	2100	3	540	321	3.8	*

Table 48.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-12-78	0600	3	1,080	301	4.2	*
Do.	1035	3	1,355	288	4.4	*
Do.	1200	4	0	---	----	*
Do.	1650	4	290	284	4.9	*
Do.	1700	4	300	---	----	*
8-12-78	1710	Third tracer experiment started				
8-12-78	2000	4	480	262	3.7	*
Do.	2400	4	720	253	4.1	*
8-13-78	0100	4	780	264	4.5	*
Do.	0500	4	1,020	257	4.0	*
Do.	0900	4	1,260	279	4.6	*
Do.	1200	5	0	264	3.7	*
Do.	1400	5	120	279	4.4	*
Do.	1800	5	360	293	3.1	*
Do.	2300	5	660	324	4.7	*
8-14-78	0600	5	1,080	348	4.6	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	350	1.2	*
Do.	1215	6	15	---	----	*
Do.	1230	6	30	---	----	*
Do.	1245	6	45	---	----	*
Do.	1300	6	60	360	.76	*
Do.	1315	6	75	---	----	*

Table 48.--*Data obtained from the tracer experiments conducted during August 8-15, 1978 at the Stanton, Tex. site*--Continued

2-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1330	6	90	---	----	*
Do.	1345	6	105	---	----	*
Do.	1400	6	120	---	----	*
Do.	1430	6	150	---	----	*
Do.	1500	6	180	---	----	*
Do.	1530	6	210	---	----	*
Do.	1600	6	240	---	----	*
Do.	1630	6	270	---	----	*
Do.	1700	6	300	---	----	*
Do.	1730	6	330	---	----	*
Do.	1800	6	360	370	1.1	*
Do.	1900	6	420	---	----	*
Do.	2000	6	480	---	----	*
Do.	2100	6	540	---	----	*
Do.	2200	6	600	380	.6	*
Do.	2300	6	660	---	----	*
Do.	2400	6	720	---	----	*
8-15-78	0200	6	840	370	1.0	*
Do.	0400	6	960	---	----	*
Do.	0600	6	1,080	380	1.4	*
Do.	0800	6	1,200	---	----	*
Do.	1000	6	1,320	370	.78	*
Do.	1200	7	0	---	----	*
Do.	1400	7	120	---	----	*
Do.	1800	7	360	380	----	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	101	----	*
Do.	1210	0	10	---	1.0	*
Do.	1220	0	20	---	----	0
Do.	1230	0	30	107	----	0
Do.	1240	0	40	---	----	0
Do.	1250	0	50	---	----	0
Do.	1300	0	60	101	----	0
Do.	1310	0	70	---	.8	*
Do.	1320	0	80	---	----	*
Do.	1330	0	90	113	----	.01
Do.	1340	0	100	---	1.8	*
Do.	1350	0	110	---	----	*
Do.	1400	0	120	169	----	*
Do.	1410	0	130	---	2.0	.01
Do.	1420	0	140	---	----	*
Do.	1430	0	150	227	2.30	.02
Do.	1440	0	160	---	----	*
Do.	1450	0	170	---	----	*
Do.	1500	0	180	333	3.70	.04
Do.	1510	0	190	---	----	*
Do.	1520	0	200	487	5.4	*
Do.	1530	0	210	---	----	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1540	0	220	-----	----	0.09
Do.	1550	0	230	-----	----	*
Do.	1600	0	240	586	8.3	*
Do.	1630	0	270	800	11.0	.01
Do.	1700	0	300	895	12.3	.48
Do.	1730	0	330	1,077	15.0	*
Do.	1800	0	360	1,229	16.6	.30
Do.	1815	0	375	-----	----	*
Do.	1830	0	390	1,432	19.0	.74
Do.	1845	0	405	-----	----	*
Do.	1900	0	420	1,535	19.3	.74
Do.	1915	0	435	-----	----	*
Do.	1930	0	450	1,625	19.9	.73
Do.	1945	0	465	-----	----	*
Do.	2000	0	480	1,731	20.3	.40
Do.	2020	0	500	-----	----	*
Do.	2030	0	510	1,748	20.4	.63
Do.	2045	0	525	-----	----	*
Do.	2100	0	540	1,726	19.7	.45
Do.	2120	0	560	-----	----	*
Do.	2140	0	580	-----	----	*
Do.	2200	0	600	1,667	18.8	.28
Do.	2230	0	630	-----	----	*
Do.	2300	0	660	1,562	17.5	*
Do.	2400	0	720	1,476	15.5	.22
8-9-78	0200	0	840	1,280	11.8	.06

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	0400	0	960	968	8.9	0.13
Do.	0600	0	1,080	747	6.4	*
Do.	0815	0	1,115	613	5.4	*
Do.	1000	0	1,320	---	3.8	*
Do.	1200	1	0	440	3.6	*
Do.	1415	1	135	---	1.7	*
Do.	1600	1	240	308	2.0	*
Do.	1800	1	360	---	1.7	*
Do.	2130	1	570	251	1.8	.12
8-10-78	0605	1	1,085	---	1.2	*
Do.	0800	1	1,200	---	1.2	*
Do.	1000	1	1,320	179	---	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1320	2	80	159	---	*
Do.	1330	2	90	---	3.0	*
Do.	1340	2	100	---	---	*
Do.	1350	2	110	---	---	*
Do.	1400	2	120	165	---	*
Do.	1410	2	130	---	3.1	*
Do.	1420	2	140	---	---	*
Do.	1430	2	150	---	2.6	*
Do.	1445	2	165	---	---	*
Do.	1500	2	180	---	3.6	*
Do.	1515	2	195	---	---	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1530	2	210	---	3.1	*
Do.	1545	2	225	---	----	*
Do.	1600	2	240	157	----	*
Do.	1630	2	270	---	----	*
Do.	1700	2	300	---	4.4	*
Do.	1730	2	330	---	6.2	*
Do.	1800	2	360	148	----	*
Do.	1900	2	420	---	9.5	*
Do.	2000	2	480	---	----	*
Do.	2100	2	540	---	14.2	*
Do.	2200	2	600	---	14.0	*
Do.	2300	2	660	---	12.2	*
Do.	2400	2	720	134	----	*
8-11-78	0100	2	780	---	----	*
Do.	0204	2	844	---	9.4	*
Do.	0300	2	900	---	9.0	*
Do.	0600	2	1,080	132	----	*
Do.	0800	2	1,200	---	5.6	*
Do.	1005	2	1,325	---	6.1	*
Do.	1200	3	0	120	----	*
Do.	1400	3	120	---	5.8	*
Do.	1800	3	360	120	----	*
Do.	2100	3	540	---	4.8	*
8-12-78	0200	3	840	---	----	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-12-78	1035	3	1,355	118	---	*
Do.	1650	4	290	---	1.7	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1730	4	330	120	---	*
Do.	1800	4	360	118	---	*
Do.	1815	4	375	---	1.6	*
Do.	1830	4	390	120	---	*
Do.	1845	4	405	---	1.6	*
Do.	1900	4	420	118	---	*
Do.	1915	4	435	---	1.4	*
Do.	1930	4	450	---	1.1	*
Do.	1945	4	465	---	1.7	*
Do.	2000	4	480	167	---	*
Do.	2030	4	510	---	1.2	*
Do.	2100	4	540	242	---	*
Do.	2130	4	570	---	1.5	*
Do.	2200	4	600	291	---	*
Do.	2230	4	630	---	1.1	*
Do.	2300	4	660	510	---	*
Do.	2400	4	720	710	1.5	*
8-13-78	0030	4	750	870	---	*
Do.	0100	4	780	---	1.2	*
Do.	0130	4	810	1200	1.2	*
Do.	0200	4	840	---	1.4	*
Do.	0230	4	870	---	1.5	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-13-78	0300	4	900	---	1.5	*
Do.	0330	4	930	---	1.5	*
Do.	0400	4	960	1570	---	*
Do.	0500	4	1,020	1525	---	*
Do.	0600	4	1,080	---	1.6	*
Do.	0700	4	1,140	1390	1.8	*
Do.	0800	4	1,200	1195	1.8	*
Do.	0900	4	1,260	---	1.8	*
Do.	1000	4	1,320	1020	---	*
Do.	1200	5	0	920	2.1	*
Do.	1400	5	120	960	2.3	*
Do.	1600	5	240	800	2.1	*
Do.	1800	5	360	510	1.8	*
Do.	2010	5	490	---	1.8	*
Do.	2300	5	660	---	1.9	*
8-14-78	0300	5	900	472	---	*
Do.	0600	5	1,080	329	---	*
8-12-78	1200	Fourth tracer experiment started				
8-12-78	1200	6	0	290	.1	*
Do.	1215	6	15	---	---	*
Do.	1230	6	30	250	.0	*
Do.	1245	6	45	---	---	*
Do.	1300	6	60	230	.2	*
Do.	1315	6	75	---	---	*
Do.	1330	6	90	230	.8	*
Do.	1345	6	105	---	---	*

Table 49.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1200	Fourth tracer experiment started--Continued				
8-12-78	1400	6	120	230	1.3	*
Do.	1430	6	150	---	---	*
Do.	1500	6	180	230	2.3	*
Do.	1530	6	210	---	---	*
Do.	1600	6	240	210	3.5	*
Do.	1630	6	270	---	---	*
Do.	1700	6	300	230	5.0	*
Do.	1730	6	330	---	---	*
Do.	1800	6	360	---	---	*
Do.	1900	6	420	---	---	*
Do.	2000	6	480	---	---	*
8-14-78	2100	6	540	---	---	*
Do.	2200	6	600	190	4.4	*
Do.	2300	6	660	---	---	*
Do.	2400	6	720	180	2.5	*
8-15-78	0200	6	840	180	2.8	*
Do.	0400	6	960	---	---	*
Do.	0600	6	1,080	180	1.8	*
Do.	0800	6	1,200	---	---	*
Do.	1000	6	1,320	---	---	*
Do.	1200	7	0	160	---	*
Do.	1400	7	120	150	---	*
Do.	1800	7	360	---	---	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates this sample was not analyzed and is no longer available.]

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	-----	----	*
Do.	1215	0	15	173	0.8	*
Do.	1220	0	20	-----	----	*
Do.	1230	0	30	162	.8	*
Do.	1240	0	40	-----	----	*
Do.	1250	0	50	-----	----	*
Do.	1300	0	60	579	3.5	*
Do.	1310	0	70	-----	----	*
Do.	1320	0	80	-----	----	*
Do.	1330	0	90	1,064	9.0	*
Do.	1340	0	100	-----	----	*
Do.	1350	0	110	-----	----	*
Do.	1355	0	115	-----	----	*
Do.	1407	0	127	1,640	12.5	*
Do.	1420	0	140	-----	----	*
Do.	1430	0	150	1,767	16.2	*
Do.	1440	0	160	-----	----	*
Do.	1450	0	170	-----	----	*
Do.	1500	0	180	1,973	18.2	*
Do.	1510	0	190	-----	----	*

Table 50.--*Data obtained from the tracer experiment conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1520	0	200	-----	----	*
Do.	1530	0	210	-----	----	*
Do.	1540	0	220	2,186	19.0	*
Do.	1550	0	230	-----	----	*
Do.	1600	0	240	-----	----	*
Do.	1630	0	270	2,310	21.6	*
Do.	1700	0	300	2,446	21.8	*
Do.	1730	0	330	2,684	21.7	*
Do.	1800	0	360	2,518	24.0	*
Do.	1815	0	375	-----	----	*
Do.	1830	0	390	2,596	23.1	*
Do.	1845	0	405	-----	----	*
Do.	1900	0	420	2,248	21.0	*
Do.	1915	0	435	-----	----	*
Do.	1930	0	450	1,878	16.0	*
Do.	1945	0	465	-----	----	*
Do.	2000	0	480	1,481	11.8	*
Do.	2020	0	500	-----	----	*
Do.	2030	0	510	1,278	9.5	*
Do.	2045	0	525	-----	----	*
Do.	2100	0	540	1,084	8.5	*
Do.	2120	0	560	-----	----	*
Do.	2140	0	580	-----	----	*
Do.	2200	0	600	886	5.3	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	2230	0	630	---	---	*
Do.	2300	0	660	711	4.3	*
Do.	2400	0	720	626	3.9	*
8-9-78	0200	0	840	526	3.4	*
Do.	0400	0	960	512	3.2	*
Do.	0600	0	1,080	497	2.9	*
Do.	0815	0	1,215	352	2.3	*
Do.	1000	0	1,320	225	1.8	*
Do.	1200	1	0	---	2.3	*
Do.	1415	1	135	194	1.5	*
Do.	1600	1	240	---	1.4	*
Do.	1800	1	480	---	1.4	*
Do.	2130	1	570	159	1.4	*
8-10-78	0605	1	1,085	---	---	*
Do.	0800	1	1,200	---	---	*
Do.	1000	1	1,320	---	---	*
Do.	1255	2	55	192	1.2	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1310	2	70	---	2.5	*
Do.	1320	2	80	---	---	*
Do.	1330	2	90	---	2.6	*
Do.	1340	2	100	---	---	*
Do.	1350	2	110	---	---	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1400	2	120	---	5.4	*
Do.	1410	2	130	---	----	*
Do.	1420	2	140	---	----	*
Do.	1430	2	150	---	12.0	*
Do.	1445	2	165	---	----	*
Do.	1500	2	180	---	14.2	*
Do.	1515	2	195	---	----	*
Do.	1530	2	210	---	9.1	*
Do.	1545	2	225	---	----	*
Do.	1600	2	240	161	13.8	*
Do.	1630	2	270	---	13.8	*
Do.	1700	2	300	---	18.4	*
Do.	1730	2	330	---	20.2	*
Do.	1800	2	360	---	19.0	*
Do.	1900	2	420	161	14.8	*
Do.	2000	2	480	---	12.8	*
Do.	2100	2	540	---	8.0	*
Do.	2200	2	600	---	----	*
Do.	2300	2	660	148	4.9	*
Do.	2400	2	720	---	----	*
8-11-78	0100	2	780	---	5.1	*
Do.	0300	2	900	---	----	*
Do.	0400	2	960	---	----	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-11-78	0600	2	1,080	140	2.7	*
Do.	0800	2	1,200	-----	---	*
Do.	1200	3	0	144	2.7	*
Do.	1410	3	130	-----	---	*
Do.	1600	3	240	-----	---	*
Do.	1800	3	360	-----	---	*
Do.	2100	3	540	146	2.0	*
8-12-78	0600	3	1,080	-----	---	*
Do.	1215	4	15	-----	---	*
Do.	1230	4	30	157	---	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1800	4	360	-----	---	*
Do.	1815	4	375	-----	---	*
Do.	1830	4	390	807	1.3	*
Do.	1845	4	405	-----	---	*
Do.	1900	4	420	1,220	---	*
Do.	1915	4	435	-----	2.4	*
Do.	1930	4	450	1,435	---	*
Do.	2030	4	510	1,670	2.3	*
Do.	2100	4	540	1,930	---	*
Do.	2130	4	570	-----	1.6	*
Do.	2200	4	600	2,055	---	*
Do.	2230	4	630	-----	---	*
Do.	2300	4	660	2,165	1.7	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-12-78	2330	4	690	-----	---	*
Do.	2400	4	720	-----	---	*
8-13-78	0030	4	750	2,005	---	*
Do.	0100	4	780	-----	1.3	*
Do.	0130	4	810	-----	---	*
Do.	0200	4	840	1,309	2.0	*
Do.	0230	4	870	-----	---	*
Do.	0300	4	900	-----	---	*
Do.	0330	4	930	-----	3.3	*
Do.	0400	4	960	-----	---	*
Do.	0500	4	1,020	741	---	*
Do.	0600	4	1,080	-----	---	*
Do.	0700	4	1,140	-----	---	*
Do.	0800	4	1,200	-----	1.5	*
Do.	0900	4	1,260	-----	---	*
Do.	1000	4	1,320	566	2.0	*
Do.	1200	5	0	-----	---	*
Do.	1400	5	120	861	---	*
Do.	1800	5	360	-----	---	*
Do.	1945	5	465	-----	---	*
Do.	2010	5	490	402	2.1	*
Do.	2300	5	660	-----	---	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	380	0.4	*
Do.	1215	6	15	---	----	*
Do.	1230	6	30	310	4.5	*
Do.	1245	6	45	---	----	*
Do.	1300	6	60	330	11.0	*
Do.	1315	6	75	---	----	*
Do.	1330	6	90	270	11.0	*
Do.	1345	6	105	---	----	*
Do.	1400	6	120	290	8.5	*
Do.	1430	6	150	260	----	*
Do.	1500	6	180	260	5.7	*
Do.	1530	6	210	---	----	*
Do.	1600	6	240	240	3.3	*
Do.	1630	6	270	---	----	*
Do.	1700	6	300	---	----	*
Do.	1730	6	330	260	----	*
Do.	1800	6	360	---	----	*
Do.	1900	6	420	---	----	*
Do.	2000	6	480	---	----	*
Do.	2100	6	540	---	----	*
Do.	2200	6	600	---	----	*
Do.	2300	6	660	---	----	*
Do.	2400	6	720	220	1.5	*

Table 50.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-15-78	0200	6	840	---	---	*
Do.	0400	6	960	---	---	*
Do.	0600	6	1,080	---	---	*
Do.	0800	6	1,200	---	---	*
Do.	1000	6	1,320	220	1.5	*
Do.	1200	7	0	---	---	*
Do.	1400	7	120	---	---	*
Do.	1800	7	360	160	1.5	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	105	----	*
Do.	1210	0	10	-----	----	*
Do.	1220	0	20	-----	0.3	0.01
Do.	1230	0	30	101	----	*
Do.	1240	0	40	-----	.4	*
Do.	1250	0	50	-----	----	.02
Do.	1300	0	60	386	3.0	*
Do.	1310	0	70	-----	----	*
Do.	1320	0	80	-----	----	*
Do.	1330	0	90	650	4.8	.34
Do.	1340	0	100	-----	----	*
Do.	1350	0	110	-----	----	*
Do.	1400	0	120	964	8.0	.40
Do.	1410	0	130	-----	----	*
Do.	1420	0	140	-----	----	*
Do.	1430	0	150	1,271	11.3	.98
Do.	1440	0	160	-----	----	*
Do.	1450	0	170	-----	----	*
Do.	1500	0	180	1,325	11.9	1.20
Do.	1510	0	190	-----	----	*
Do.	1520	0	200	-----	----	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1530	0	210	1,352	----	1.22
Do.	1540	0	220	-----	----	1.85
Do.	1550	0	230	-----	----	*
Do.	1600	0	240	1,866	17.5	*
Do.	1630	0	270	1,721	15.7	1.64
Do.	1700	0	300	3,160	28.7	.86
Do.	1730	0	330	1,853	17.0	*
Do.	1800	0	360	1,630	14.5	*
Do.	1815	0	375	-----	----	*
Do.	1830	0	390	1,819	17.5	.05
Do.	1845	0	405	-----	----	*
Do.	1900	0	420	-----	----	*
Do.	1915	0	435	1,962	19.4	*
Do.	1930	0	450	-----	----	.04
Do.	1945	0	465	1,716	15.7	*
Do.	2000	0	480	-----	----	.04
Do.	2020	0	500	-----	----	*
Do.	2030	0	510	1,320	12.5	*
Do.	2045	0	525	-----	----	*
Do.	2100	0	540	1,156	9.4	*
Do.	2120	0	560	-----	----	*
Do.	2140	0	580	973	6.7	*
Do.	2200	0	600	916	6.4	.04
Do.	2230	0	630	826	6.5	*
Do.	2300	0	660	561	4.2	*
Do.	2400	0	720	670	5.1	.19

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	0200	0	840	502	3.5	0.13
Do.	0400	0	960	444	2.9	.06
Do.	0600	0	1,080	382	2.3	*
Do.	0815	0	1,215	350	1.9	*
Do.	1000	0	1,320	---	1.6	*
Do.	1200	1	0	299	1.5	*
Do.	1415	1	15	---	1.3	*
Do.	1600	1	240	263	1.2	*
Do.	1800	1	360	---	1.1	.01
8-10-78	0605	1	1,085	---	---	*
Do.	0815	1	1,215	269	---	*
Do.	1000	1	1,320	---	1.0	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1310	2	70	222	---	*
Do.	1320	2	80	---	---	*
Do.	1330	2	90	---	1.1	*
Do.	1340	2	100	---	---	*
Do.	1350	2	110	---	---	*
Do.	1401	2	121	224	1.2	*
Do.	1410	2	130	---	---	*
Do.	1420	2	140	---	1.6	*
Do.	1430	2	150	---	3.2	*
Do.	1445	2	165	---	---	*
Do.	1500	2	180	---	3.3	*
Do.	1515	2	195	---	6.2	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1530	2	210	---	5.3	*
Do.	1545	2	225	---	----	*
Do.	1600	2	240	228	10.5	*
Do.	1630	2	270	---	8.3	*
Do.	1700	2	300	---	----	*
Do.	1800	2	360	---	11.3	*
Do.	1900	2	420	---	10.5	*
Do.	2000	2	480	216	----	*
Do.	2010	2	490	---	----	*
Do.	2100	2	540	---	6.2	*
Do.	2210	2	610	---	5.4	*
Do.	2215	2	615	---	----	*
Do.	2310	2	670	---	4.3	*
Do.	2320	2	680	---	----	*
Do.	2400	2	720	216	3.4	*
8-11-78	0030	2	750	---	----	*
Do.	0100	2	780	---	----	*
Do.	0205	2	845	---	----	*
Do.	0225	2	865	---	----	*
Do.	0305	2	905	---	----	*
Do.	0315	2	915	---	----	*
Do.	0405	2	965	---	2.7	*
Do.	0415	2	975	---	----	*
Do.	0600	2	1,080	222	----	*
Do.	0800	2	1,200	---	2.6	*
Do.	1010	2	1,330	---	----	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-11-78	1020	2	1,340	---	---	*
Do.	1200	3	0	210	2.0	*
Do.	1210	3	10	---	---	*
Do.	1400	3	120	---	---	*
Do.	1408	3	128	---	---	*
Do.	1555	3	235	---	---	*
Do.	1805	3	365	206	2.2	*
Do.	2100	3	540	---	---	*
Do.	2400	3	720	---	2.0	*
8-12-78	0600	3	1,080	192	---	*
Do.	1043	3	1,363	220	2.0	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1710	4	310	192	---	*
Do.	1730	4	330	190	---	*
Do.	1800	4	360	216	1.9	*
Do.	1815	4	375	---	---	*
Do.	1830	4	390	384	---	*
Do.	1845	4	405	520	---	*
Do.	1900	4	420	---	---	*
Do.	1915	4	435	---	---	*
Do.	1930	4	450	---	---	*
Do.	1945	4	465	880	---	*
Do.	2000	4	480	---	---	*
Do.	2030	4	510	---	---	*
Do.	2100	4	540	---	2.1	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-12-78	2130	4	570	1,402	---	*
Do.	2200	4	600	-----	---	*
Do.	2230	4	630	1,526	---	*
Do.	2300	4	660	-----	---	*
Do.	2330	4	690	-----	---	*
Do.	2400	4	720	1,699	2.3	*
8-13-78	0030	4	750	1,718	---	*
Do.	0100	4	780	-----	---	*
Do.	0130	4	810	-----	---	*
Do.	0200	4	840	-----	---	*
Do.	0230	4	870	1,171	---	*
Do.	0300	4	900	-----	1.2	*
Do.	0330	4	930	-----	---	*
Do.	0400	4	960	896	---	*
Do.	0500	4	1,020	-----	---	*
Do.	0600	4	1,080	687	1.9	*
Do.	0700	4	1,140	-----	---	*
Do.	0800	4	1,200	565	---	*
Do.	0900	4	1,260	-----	---	*
Do.	1000	4	1,320	496	---	*
Do.	1200	5	0	421	1.9	*
Do.	1400	5	120	387	---	*
Do.	1600	5	240	353	---	*
Do.	2000	5	480	315	1.7	*
8-14-78	0600	5	1,080	276	---	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	260	---	*
Do.	1215	6	15	---	---	*
Do.	1230	6	30	220	0.3	*
Do.	1245	6	45	---	---	*
Do.	1300	6	60	220	2.1	*
Do.	1315	6	75	---	---	*
Do.	1330	6	90	250	3.3	*
Do.	1345	6	105	---	---	*
Do.	1400	6	120	260	8.0	*
Do.	1430	6	150	280	3.5	*
Do.	1500	6	180	300	3.2	*
Do.	1530	6	210	270	3.3	*
Do.	1600	6	240	260	3.0	*
Do.	1630	6	270	---	---	*
Do.	1700	6	300	270	1.8	*
Do.	1730	6	330	---	---	*
Do.	1800	6	360	---	---	*
Do.	1900	6	420	---	---	*
Do.	2000	6	480	---	---	*
Do.	2100	6	540	---	---	*
Do.	2200	6	600	250	1.0	*
Do.	2300	6	660	---	---	*
Do.	2400	6	720	---	---	*
8-15-78	0200	6	840	---	---	*
Do.	0400	6	960	240	1.0	*

Table 51.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-15-78	0600	6	1,080	---	---	*
Do.	0800	6	1,200	---	---	*
Do.	1000	6	1,320	230	1.0	*
Do.	1200	7	0	---	---	*
Do.	1400	7	120	---	---	*
Do.	1800	7	360	220	3.4	*

Table 52.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m black located 5 m radially from the injection well and 41.8 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	178	---	*
Do.	1210	0	10	---	---	*
Do.	1220	0	20	---	3.0	*
Do.	1230	0	30	---	---	*
Do.	1240	0	40	---	---	*
Do.	1250	0	50	---	---	*
Do.	1300	0	60	178	---	*
Do.	1310	0	70	---	5.2	*
Do.	1320	0	80	---	---	*
Do.	1330	0	90	---	---	*
Do.	1340	0	100	---	---	*
Do.	1350	0	110	---	---	*
Do.	1400	0	120	158	---	*
Do.	1410	0	130	---	5.4	*
Do.	1420	0	140	---	---	*
Do.	1430	0	150	---	---	*
Do.	1440	0	160	---	---	*
Do.	1450	0	170	---	---	*
Do.	1500	0	180	159	---	*
Do.	1510	0	190	---	---	*
Do.	1520	0	200	---	9.1	*
Do.	1530	0	210	---	---	*

Table 52.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiments started--Continued				
8-8-78	1540	0	220	---	---	*
Do.	1550	0	230	---	---	*
Do.	1600	0	240	248	---	*
Do.	1630	0	290	---	5.4	*
Do.	1700	0	300	---	---	*
Do.	1730	0	330	---	5.8	*
Do.	1800	0	360	148	---	*
Do.	1815	0	375	---	---	*
Do.	1830	0	390	---	6.7	*
Do.	1845	0	405	---	---	*
Do.	1900	0	420	---	---	*
Do.	1915	0	435	---	---	*
Do.	1930	0	450	---	5.1	*
Do.	1945	0	465	---	---	*
Do.	2000	0	480	152	---	*
Do.	2020	0	500	---	---	*
Do.	2030	0	510	---	---	*
Do.	2045	0	525	---	---	*
Do.	2100	0	540	---	9.2	*
Do.	2120	0	560	---	---	*
Do.	2140	0	580	---	---	*
Do.	2200	0	600	138	---	*
Do.	2230	0	630	---	---	*
Do.	2300	0	660	---	5.6	*
Do.	2400	0	720	144	---	*
8-9-78	0200	0	840	154	---	*

Table 52.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	0400	0	960	---	7.0	*
Do.	0600	0	1,080	140	----	*
Do.	0815	0	1,215	194	----	*
Do.	1000	0	1,320	---	9.9	*
Do.	1200	1	0	210	11.5	*
Do.	1400	1	120	---	11.9	*
Do.	1415	1	135	---	----	*
Do.	1600	1	240	196	13.1	*
Do.	1800	1	360	---	16.2	*
Do.	2130	1	570	276	15.5	*
Do.	2400	1	720	---	14.3	*
8-10-78	0600	1	1,080	350	13.1	*
Do.	0605	1	1,085	---	----	*
Do.	0800	1	1,200	---	----	*
8-10-78	1310	Second tracer experiment started				
8-10-78	1310	2	70	286	12.6	*
Do.	1400	2	120	200	7.7	*
Do.	1600	2	240	184	8.9	*
Do.	2000	2	480	208	3.7	*
Do.	2400	2	720	206	5.4	*
8-11-78	0600	2	1,080	155	6.9	*
Do.	1200	3	0	206	6.1	*
Do.	1800	3	360	214	6.1	*
Do.	2100	3	540	223	6.1	*
8-12-78	0600	3	1,080	212	5.8	*

Table 52.--*Data obtained from the tracer experiment conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started				
8-12-78	1730	4	330	212	4.4	*
Do.	1900	4	420	178	5.2	*
Do.	2200	4	600	167	7.2	*
Do.	2400	4	720	159	5.2	*
8-13-78	0600	4	1,080	---	---	*
Do.	1200	5	0	176	4.1	*
Do.	1800	5	360	208	6.6	*
Do.	2300	5	660	191	8.9	*
8-14-78	0300	5	900	202	9.6	*
Do.	0600	5	1,080	230	6.1	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	180	.4	*
Do.	1215	6	15	---	---	*
Do.	1230	6	30	270	1.5	*
Do.	1245	6	45	---	---	*
Do.	1300	6	60	220	1.2	*
Do.	1315	6	75	---	---	*
Do.	1330	6	90	230	1.7	*
Do.	1345	6	105	---	---	*
Do.	1400	6	120	210	.9	*
Do.	1430	6	150	---	---	*
Do.	1500	6	180	220	.7	*
Do.	1530	6	210	---	---	*
Do.	1600	6	240	220	1.0	*
Do.	1630	6	270	---	---	*

Table 52.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1700	6	300	---	---	*
Do.	1730	6	330	---	---	*
Do.	1800	6	360	200	1.0	*
Do.	1900	6	420	---	---	*
Do.	2000	6	480	---	---	*
Do.	2100	6	540	---	---	*
Do.	2200	6	600	---	---	*
Do.	2300	6	660	---	---	*
Do.	2400	6	720	220	1.2	*
8-15-78	0200	6	840	---	---	*
Do.	0400	6	960	240	1.5	*
Do.	0600	6	1,080	---	---	*
Do.	0800	6	1,200	---	---	*
Do.	1000	6	1,320	290	1.2	*
Do.	1200	7	0	---	---	*
Do.	1400	7	120	---	---	*
Do.	1800	7	360	240	.7	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from an observation well designated 5-m red and screened only for 0.7 m at 40.0 m below land surface. This sampler is located at a distance of 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	-----	----	*
Do.	1210	0	10	-----	----	*
Do.	1220	0	20	95	0.6	*
Do.	1230	0	30	-----	3.6	0.01
Do.	1240	0	40	1,044	10.9	*
Do.	1250	0	50	-----	13.5	.11
Do.	1300	0	60	1,609	17.0	*
Do.	1310	0	70	-----	18.3	*
Do.	1320	0	80	1,889	19.6	.41
Do.	1330	0	90	-----	20.7	*
Do.	1340	0	100	2,021	22.1	*
Do.	1350	0	110	-----	23.0	*
Do.	1400	0	120	2,234	23.3	*
Do.	1410	0	130	-----	24.0	*
Do.	1420	0	140	2,383	24.7	*
Do.	1430	0	150	-----	25.0	2.6
Do.	1440	0	160	2,549	26.5	*
Do.	1450	0	170	-----	28.5	*
Do.	1500	0	180	2,697	29.0	1.5

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1510	0	190	-----	29.0	*
Do.	1520	0	200	2,760	30.0	*
Do.	1530	0	210	-----	31.0	0.92
Do.	1540	0	220	2,739	----	1.0
Do.	1550	0	230	-----	31.5	*
Do.	1600	0	240	2,866	----	*
Do.	1630	0	270	2,908	33.0	.59
Do.	1700	0	300	-----	----	1.8
Do.	1730	0	330	3,121	34.0	*
Do.	1800	0	360	3,181	35.0	*
Do.	1815	0	375	-----	34.5	*
Do.	1830	0	390	2,846	29.6	*
Do.	1845	0	405	-----	----	*
Do.	1900	0	420	-----	16.9	*
Do.	1915	0	435	1,460	15.1	*
Do.	1930	0	450	1,340	14.0	*
Do.	1945	0	465	-----	----	*
Do.	2000	0	480	1,100	11.5	*
Do.	2020	0	500	-----	10.3	*
Do.	2030	0	510	980	9.6	*
Do.	2045	0	525	-----	9.6	*
Do.	2100	0	540	840	----	*
Do.	2120	0	560	-----	7.8	*
Do.	2140	0	580	700	7.1	*
Do.	2200	0	600	-----	----	.38
Do.	2230	0	630	520	5.5	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	2300	0	660	---	6.8	*
Do.	2400	0	720	472	3.7	0.37
8-9-78	0200	0	840	324	2.4	.37
Do.	0400	0	960	258	1.8	.02
Do.	0600	0	1,080	206	1.4	*
Do.	0815	0	1,215	170	1.0	*
Do.	1000	0	1,320	---	1.1	*
Do.	1200	1	0	162	----	*
Do.	1415	1	215	---	.7	*
Do.	1600	1	320	---	----	*
Do.	1800	1	440	---	.6	.01
Do.	2130	1	650	125	----	.01
8-10-78	0615	1	1,175	---	.4	*
Do.	0810	1	1,295	---	.4	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1300	2	60	110	----	*
Do.	1320	2	80	---	.7	*
Do.	1330	2	90	---	2.2	*
Do.	1340	2	100	---	8.1	*
Do.	1350	2	110	---	12.5	*
Do.	1400	2	120	110	----	*
Do.	1410	2	130	---	10.9	*
Do.	1420	2	140	---	12.6	*
Do.	1430	2	150	---	13.2	*
Do.	1445	2	165	---	----	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1500	2	180	---	----	*
Do.	1515	2	195	---	12.8	*
Do.	1530	2	210	---	12.7	*
Do.	1545	2	225	---	12.7	*
Do.	1600	2	240	108	14.8	*
Do.	1630	2	270	---	----	*
Do.	1700	2	300	---	----	*
Do.	1730	2	330	---	----	*
Do.	1805	2	365	---	4.4	*
Do.	1900	2	420	---	3.2	*
Do.	2000	2	480	102	----	*
Do.	2115	2	555	---	1.7	*
Do.	2210	2	610	---	1.4	*
Do.	2310	2	670	108	----	*
8-11-78	0005	2	725	---	1.3	*
Do.	0100	2	780	---	----	*
Do.	0215	2	855	---	----	*
Do.	0310	2	910	---	----	*
Do.	0410	2	970	---	----	*
Do.	0600	2	1,080	102	.8	*
Do.	0800	2	1,200	---	----	*
Do.	1025	2	1,345	---	----	*
Do.	1206	3	6	102	.5	*
Do.	1406	3	126	---	----	*
Do.	1610	3	250	---	----	*
Do.	1735	3	335	---	----	*
Do.	1810	3	370	102	----	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiments started--Continued				
8-11-78	2100	3	540	-----	---	*
Do.	2130	3	570	-----	---	*
Do.	2400	3	720	98	0.4	*
8-12-78	1048	3	1,368	109	.5	*
Do.	1700	4	300	-----	.5	*
8-12-78	1710	Third tracer experiments started				
8-12-78	1735	4	335	>1,544	---	*
Do.	1802	4	362	>2,128	---	*
Do.	1817	4	377	-----	---	*
Do.	1845	4	405	-----	---	*
Do.	1904	4	424	>2,600	---	*
Do.	1915	4	435	-----	---	*
Do.	1930	4	450	>2,702	---	*
Do.	1945	4	465	-----	.6	*
Do.	2000	4	480	2,968	---	*
Do.	2030	4	510	3,086	---	*
Do.	2100	4	540	3,142	---	*
Do.	2200	4	600	3,130	---	*
Do.	2230	4	630	-----	---	*
Do.	2300	4	660	3,352	---	*
Do.	2330	4	690	-----	.7	*
Do.	2400	4	720	2,568	---	*
8-13-78	0030	4	750	-----	---	*
Do.	0100	4	780	1,144	---	*
Do.	0130	4	810	-----	---	*
Do.	0200	4	840	894	---	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-13-78	0230	4	870	---	----	*
Do.	0300	4	900	681	----	*
Do.	0330	4	930	---	----	*
Do.	0400	4	960	558	----	*
Do.	0500	4	1,020	---	0.7	*
Do.	0600	4	1,020	385	----	*
Do.	0700	4	1,140	---	----	*
Do.	0800	4	1,200	291	----	*
Do.	0900	4	1,260	---	----	*
Do.	1000	4	1,340	---	----	*
Do.	1200	4	0	218	0.5	*
Do.	1400	4	120	---	----	*
Do.	1810	4	370	---	----	*
Do.	2012	4	492	161	----	*
Do.	2300	4	660	149	.4	*
8-14-78	0610	4	1,090	---	.4	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	5	0	260	1.7	*
Do.	1215	6	15	140	7.5	*
Do.	1230	6	30	140	70.1	*
Do.	1245	6	45	130	27.4	*
Do.	1300	6	60	120	10.0	*
Do.	1315	6	75	130	11.0	*
Do.	1330	6	90	110	10.0	*
Do.	1345	6	105	120	7.0	*
Do.	1400	6	120	120	5.5	*

Table 53.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter red point well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1430	6	150	110	4.6	*
Do.	1500	6	180	110	4.0	*
Do.	1530	6	210	---	----	*
Do.	1600	6	240	---	----	*
Do.	1630	6	270	---	----	*
Do.	1700	6	300	---	----	*
Do.	1730	6	330	---	----	*
Do.	1800	6	360	110	1.5	*
Do.	1900	6	420	---	----	*
Do.	2000	6	480	---	----	*
Do.	2100	6	540	---	----	*
Do.	2200	6	600	110	0.6	*
Do.	2300	6	660	---	----	*
Do.	2400	6	720	---	----	*
8-15-78	0200	7	840	---	----	*
Do.	0400	7	960	100	2.5	*
Do.	0600	7	1,080	---	----	*
Do.	0800	7	1,200	---	----	*
Do.	1000	7	1,320	130	----	*
Do.	1200	7	0	---	----	*
Do.	1400	7	120	---	----	*
Do.	1800	7	480	120	.9	*

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1200	0	0	130	0.3	*
Do.	1210	0	10	---	----	*
Do.	1220	0	20	---	----	*
Do.	1230	0	30	---	----	*
Do.	1240	0	40	---	----	*
Do.	1250	0	50	---	----	*
Do.	1300	0	60	99	.5	*
Do.	1310	0	70	---	----	*
Do.	1320	0	80	---	----	*
Do.	1330	0	90	107	1.1	0.01
Do.	1400	0	120	119	3.5	.03
Do.	1410	0	130	---	----	*
Do.	1420	0	140	---	----	*
Do.	1430	0	150	142	7.2	.08
Do.	1440	0	160	---	----	*
Do.	1450	0	170	---	----	*
Do.	1500	0	180	166	12.1	.22
Do.	1510	0	190	---	----	*
Do.	1520	0	200	---	----	*
Do.	1530	0	210	---	----	*
Do.	1540	0	220	324	12.8	.27

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-8-78	1550	0	230	-----	----	*
Do.	1600	0	240	-----	----	*
Do.	1630	0	270	305	17.0	0.65
Do.	1700	0	300	372	18.3	.86
Do.	1730	0	330	431	19.5	.55
Do.	1800	0	360	521	21.2	.56
Do.	1815	0	375	-----	----	*
Do.	1830	0	390	672	25.7	.28
Do.	1845	0	405	-----	----	*
Do.	1900	0	420	922	28.3	.72
Do.	1915	0	435	-----	----	*
Do.	1930	0	450	1,044	27.4	.58
Do.	1945	0	465	-----	----	*
Do.	2000	0	480	1,188	24.5	.70
Do.	2020	0	500	-----	----	*
Do.	2030	0	510	-----	----	.21
Do.	2045	0	525	-----	----	*
Do.	2100	0	540	1,416	18.0	.17
Do.	2120	0	560	-----	----	*
Do.	2140	0	580	-----	----	*
Do.	2200	0	600	1,483	13.9	.10
Do.	2230	0	630	-----	----	*
Do.	2300	0	660	1,366	12.4	*
Do.	2400	0	720	1,314	9.9	*
8-9-78	0200	0	840	1,220	7.6	.08
Do.	0400	0	960	1,146	4.9	.09

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	0600	0	1,080	1,027	3.3	*
Do.	0815	0	1,215	891	2.7	0.04
Do.	1000	0	1,320	-----	2.7	.02
Do.	1200	1	0	750	1.8	*
Do.	1415	1	135	-----	1.7	*
Do.	1600	1	240	-----	1.8	*
Do.	1800	1	360	-----	1.7	*
Do.	2130	1	570	443	1.7	.04
8-10-78	0605	1	1,085	370	---	*
Do.	0800	1	1,200	-----	---	*
Do.	1255	2	55	251	---	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1300	2	60	-----	.8	*
Do.	1310	2	70	-----	---	*
Do.	1320	2	80	-----	---	*
Do.	1330	2	90	-----	1.0	*
Do.	1350	2	110	190	---	*
Do.	1400	2	120	-----	.9	*
Do.	1410	2	130	-----	---	*
Do.	1420	2	140	-----	---	*
Do.	1430	2	150	-----	1.0	*
Do.	1445	2	165	188	---	*
Do.	1500	2	180	----	2.8	*
Do.	1515	2	195	-----	---	*
Do.	1530	2	210	-----	8.9	*

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	1545	2	225	179	-----	*
Do.	1600	2	240	---	8.6	*
Do.	1630	2	270	---	9.6	*
Do.	1700	2	300	162	11.5	*
Do.	1730	2	330	---	13.2	*
Do.	1800	2	360	158	12.5	*
Do.	1900	2	420	---	20.5	*
Do.	2000	2	480	154	15.7	*
Do.	2100	2	540	---	13.7	*
Do.	2300	2	660	152	8.0	*
8-11-78	0100	2	780	150	4.6	*
Do.	0204	2	844	---	3.1	*
Do.	0300	2	900	145	2.8	*
Do.	0400	2	960	---	2.1	*
Do.	0600	2	1,080	140	1.5	*
Do.	0800	2	1,200	140	-----	*
Do.	1005	2	1,325	140	1.6	*
Do.	1200	3	0	138	1.0	*
Do.	1400	3	120	131	-----	*
Do.	1600	3	240	133	-----	*
Do.	1800	3	360	131	1.15	*
8-12-78	0030	3	750	---	.7	*
Do.	0600	3	1,080	125	.7	*
Do.	1035	3	1,355	117	-----	*
Do.	1650	4	290	---	.6	*

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiments started				
8-12-78	1710	4	310	-----	---	*
Do.	1730	4	330	108	---	*
Do.	1800	4	360	-----	---	*
Do.	1815	4	375	-----	0.6	*
Do.	1830	4	390	121	---	*
Do.	1845	4	405	-----	---	*
Do.	1900	4	420	-----	---	*
Do.	1915	4	435	-----	---	*
Do.	1930	4	450	171	---	*
Do.	1945	4	465	-----	---	*
Do.	2000	4	480	234	.5	*
Do.	2100	4	540	-----	---	*
Do.	2130	4	570	313	---	*
Do.	2200	4	600	-----	---	*
Do.	2230	4	630	-----	---	*
Do.	2300	4	660	-----	---	*
Do.	2330	4	690	-----	---	*
Do.	2400	4	720	555	.8	*
8-13-78	0100	4	780	786	---	*
Do.	0130	4	810	-----	---	*
Do.	0200	4	840	-----	---	*
Do.	0230	4	870	1,054	---	*
Do.	0300	4	900	-----	---	*
Do.	0330	4	930	-----	---	*
Do.	0400	4	960	-----	---	*

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-13-78	0500	4	1,020	1,235	---	*
Do.	0600	4	1,080	-----	0.8	*
Do.	0700	4	1,140	1,380	---	*
Do.	0800	4	1,200	-----	---	*
Do.	0900	4	1,260	1,302	---	*
Do.	1000	4	1,320	-----	---	*
Do.	1200	5	0	1,145	.7	*
Do.	1400	5	120	1,207	---	*
Do.	1600	5	240	1,145	---	*
Do.	1800	5	360	841	.7	*
Do.	2000	5	480	740	---	*
Do.	2300	5	540	628	.6	*
8-14-78	0300	5	900	643	---	*
Do.	0600	5	1,080	468	---	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1200	6	0	520	.1	*
Do.	1215	6	15	-----	---	*
Do.	1230	6	30	320	.2	*
Do.	1245	6	45	-----	---	*
Do.	1300	6	60	330	.2	*
Do.	1315	6	75	-----	---	*
Do.	1330	6	90	330	2.5	*
Do.	1345	6	105	-----	---	*
Do.	1400	6	120	300	5.5	*
Do.	1430	6	150	300	6.5	*

Table 54.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

5-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1500	6	180	280	7.0	*
Do.	1530	6	210	290	7.0	*
Do.	1600	6	240	310	8.6	*
Do.	1630	6	270	---	---	*
Do.	1700	6	300	---	---	*
Do.	1730	6	330	---	---	*
Do.	1800	6	360	260	7.0	*
Do.	1900	6	420	---	---	*
Do.	2000	6	480	---	---	*
Do.	2100	6	540	---	---	*
Do.	2200	6	600	---	---	*
Do.	2300	6	660	210	3.8	*
Do.	2400	6	720	---	---	*
8-15-78	0200	6	840	---	---	*
Do.	0400	6	960	---	---	*
Do.	0600	6	1,080	200	1.1	*
Do.	0800	6	1,200	---	---	*
Do.	1000	6	1,320	---	---	*
Do.	1200	7	0	190	.6	*
Do.	1400	7	120	---	---	*
Do.	1800	7	480	160	.4	*

Table 55.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 10 m from the injection well and are screened only for a 1.2-m section, 41.5 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

10-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1505	0	185	94	0.3	*
Do.	1600	0	240	96	.3	*
Do.	1904	0	424	105	.3	*
Do.	2002	0	482	---	.8	*
Do.	2106	0	546	196	2.0	*
Do.	2200	0	600	247	2.8	*
Do.	2300	0	660	---	3.8	*
Do.	2400	0	720	397	5.0	*
8-9-78	0200	0	840	---	9.5	*
Do.	0400	0	960	629	10.1	*
Do.	0822	0	1,202	---	9.4	*
Do.	1000	0	1,320	621	8.5	*
Do.	1200	1	0	---	7.4	*
Do.	1415	1	135	553	6.6	*
Do.	1602	1	242	---	----	*
Do.	1800	1	480	498	5.8	*
Do.	2130	1	570	---	4.9	*
Do.	2400	1	720	430	4.6	*
8-10-78	0610	1	1,090	386	3.8	*
Do.	0815	1	1,215	344	----	*

Table 55.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

10-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started				
8-10-78	1305	2	65	312	2.9	*
8-11-78	0600	2	1,080	149	1.2	*
Do.	0800	2	1,200	149	1.2	*
Do.	2400	3	720	154	1.4	*
8-12-78	0600	3	1,080	154	1.5	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1735	4	335	---	1.6	*
Do.	1910	4	430	162	----	*
Do.	2100	4	540	162	1.6	*
Do.	2300	4	660	160	1.2	*
8-13-78	0100	4	780	168	1.5	*
Do.	0300	4	900	174	1.5	*
Do.	0500	4	1,020	215	----	*
Do.	0600	4	1,060	---	1.5	*
Do.	0708	4	1,148	314	1.7	*
Do.	0800	4	1,208	---	1.8	*
Do.	0908	4	1,268	398	----	*
Do.	1007	4	1,327	---	1.6	*
Do.	1100	4	1,380	475	1.9	*
Do.	1200	5	0	---	2.35	*
Do.	1300	5	60	549	----	*
Do.	1408	5	128	---	----	*
Do.	1500	5	180	605	2.5	*
Do.	1600	5	240	---	----	*
Do.	1800	5	360	600	2.7	*

Table 55.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

10-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1700	Third tracer experiment started--Continued				
8-13-78	2012	5	612	598	2.7	*
Do.	2300	5	660	579	2.9	*
8-14-78	0300	5	900	544	2.6	*
Do.	0612	5	1,092	496	2.3	*
Do.	1000	5	1,320	333	2.0	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1240	6	40	470	---	*
Do.	1300	6	60	422	2.6	*
Do.	1400	6	120	367	---	*
Do.	1600	6	240	365	---	*
Do.	1800	6	360	370	---	*
Do.	2010	6	610	341	---	*
Do.	2400	6	720	330	3.7	*
8-15-78	0200	6	840	309	---	*
Do.	0400	6	960	300	4.2	*
Do.	0945	6	1,065	290	4.5	*
Do.	1007	6	1,327	278	---	*
Do.	1225	7	25	270	2.6	*
Do.	1400	7	120	---	---	*
Do.	1800	7	360	270	1.5	*

Table 56.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 15 m from the injection well, which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

15-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started				
8-8-78	1204	0	4	64	0.48	*
Do.	1300	0	60	---	.43	*
Do.	1400	0	120	91	.39	*
Do.	1500	0	180	---	.37	*
Do.	1600	0	240	76	.35	*
Do.	1800	0	360	74	.38	*
Do.	1815	0	375	---	----	*
Do.	1830	0	390	---	----	*
Do.	1900	0	420	70	.40	*
Do.	2006	0	486	64	.41	*
Do.	2106	0	546	---	.51	*
Do.	2200	0	600	---	.50	*
Do.	2300	0	600	78	.58	*
Do.	2400	0	720	---	.62	*
8-9-78	0200	0	840	---	1.10	*
Do.	0400	0	960	---	1.25	*
Do.	0820	0	1,220	---	2.30	*
Do.	1028	120-124 [1]	0	1,348	227	2.8	*
Do.	1152	124-128 [1]	0	1,432	227	2.4	*

[1] These numbers indicate depth (in feet) at which packers were used to isolate an interval in the well.

Table 56.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

15-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	First tracer experiment started--Continued				
8-9-78	1232	1	32	175	----	*
Do.	1348	1	108	126	----	*
Do.	1420	116-120[1]	1	140	116	1.8	*
Do.	1505	120-124[1]	1	185	251	3.2	*
Do.	1521	124-128[1]	1	201	---	3.0	*
Do.	1540	128-132[1]	1	220	---	1.6	*
Do.	1800	128-132[1]	1	480	180	2.3	*
Do.	2400		1	720	---	2.7	*
8-10-78	0613		1	1,093	---	2.65	*
Do.	0815		1	1,215	---	2.65	*
Do.	1025	120-124[1]	1	1,345	217	2.3	*
Do.	1055	124-128[1]	1	1,375	---	2.9	*
Do.	1113	128-132[1]	1	1,393	238	2.4	*
8-10-78	1300	Second tracer experiment started				
8-10-78	1300	2	60	---	2.5	*
Do.	1400	2	120	---	----	*
Do.	1500	2	180	---	----	*
Do.	1615	2	255	281	----	*
Do.	1700	2	300	---	2.3	*
Do.	1805	2	265	---	----	*
Do.	1900	2	420	---	----	*

[1] These numbers indicate depth (in feet) at which packers were used to isolate an interval in the well.

Table 56.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

15-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-10-78	1300	Second tracer experiment started--Continued				
8-10-78	2000	2	480	267	----	*
Do.	2115	2	555	---	----	*
Do.	2210	2	610	---	2.05	*
8-11-78	0004	2	724	172	----	*
Do.	0100	2	780	---	2.1	*
Do.	0215	2	855	---	----	*
Do.	0410	2	970	238	----	*
Do.	0600	2	1,080	---	----	*
Do.	0800	2	1,200	247	----	*
Do.	1025	2	1,345	---	----	*
Do.	1120	2	1,400	---	----	*
Do.	1406	3	126	---	----	*
Do.	1614	3	254	202	2.45	*
Do.	1815	3	375	---	----	*
Do.	2100	3	540	206	----	*
Do.	2400	3	720	196	----	*
8-12-78	0600	3	1,080	180	----	*
Do.	1049	3	1,369	172	2.6	*
Do.	1450	4	170	---	2.3	*
8-12-78	1710	Third tracer experiment started				
8-12-78	1715	4	315	218	----	*
Do.	1910	4	430	---	2.4	*
Do.	2300	4	660	176	----	*
8-13-78	0100	4	780	166	2.3	*
Do.	0300	4	900	166	2.5	*

Table 56.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

15-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-12-78	1710	Third tracer experiment started--Continued				
8-13-78	0500	4	1,020	189	2.5	*
Do.	0600	4	1,080	---	2.1	*
Do.	0700	4	1,140	236	2.0	*
Do.	0800	4	1,200	---	2.1	*
Do.	0900	4	1,260	274	2.1	*
Do.	1000	4	1,320	---	2.1	*
Do.	1100	4	1,380	293	2.0	*
Do.	1200	5	0	---	2.4	*
Do.	1300	5	60	306	2.2	*
Do.	1400	5	120	---	---	*
Do.	1500	5	180	320	2.3	*
Do.	1600	5	240	---	2.3	*
Do.	1800	5	360	316	2.3	*
Do.	2008	5	488	332	2.3	*
Do.	2100	5	540	---	2.0	*
Do.	2300	5	660	338	2.3	*
8-14-78	0300	5	900	331	2.3	*
Do.	0610	5	1,090	338	2.3	*
Do.	1002	5	1,322	---	2.3	*
8-14-78	1200	Fourth tracer experiment started				
8-14-78	1250	6	50	330	2.4	*
Do.	1300	6	60	339	---	*
Do.	1400	6	120	330	1.3	*
Do.	1600	6	240	---	---	*

Table 56.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

15-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-14-78	1200	Fourth tracer experiment started--Continued				
8-14-78	1800	6	360	320	3.7	*
Do.	2013	6	493	---	---	*
Do.	2400	6	720	310	1.3	*
8-15-78	0200	6	840	---	---	*
Do.	0400	6	960	300	1.0	*
Do.	1007	6	1,327	280	2.5	*
Do.	1225	7	25	---	---	*
Do.	1400	7	120	270	3.0	*
Do.	1800	7	360	270	2.2	*

Table 57.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the observation well 30 m from the injection well, which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

30-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-9-78	1400	1	120	127	---	*
Do.	1800	1	360	124	---	*
Do.	2130	1	570	127	---	*
8-10-78	1300	2	60	138	---	*
Do.	1500	2	180	136	---	*
Do.	1900	2	420	136	---	*
Do.	2210	2	610	136	---	*
Do.	2400	2	720	136	---	*
8-11-78	0220	2	860	133	---	*
Do.	0410	2	990	131	---	*
Do.	1015	2	1,335	142	---	*
Do.	1202	3	2	144	---	*
Do.	1400	3	128	144	---	*
Do.	1555	3	235	142	---	*
Do.	1805	3	365	147	---	*
Do.	2115	3	555	145	---	*
8-12-78	0300	3	900	162	---	*
Do.	0600	3	1,080	92	---	*
Do.	1045	3	1,365	158	---	*
Do.	1700	4	300	160	---	*
Do.	1902	4	422	160	---	*
Do.	2100	4	540	160	---	*
Do.	2300	4	660	156	---	*

Table 57.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*--Continued

30-Meter well						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-13-78	0100	4	780	160	---	*
Do.	0500	4	1,020	162	---	*
Do.	0700	4	1,140	173	---	*
Do.	1000	4	1,320	164	---	*
Do.	1200	5	0	167	---	*
Do.	1400	5	120	176	---	*
Do.	1600	5	240	162	---	*
Do.	1800	5	360	167	---	*
Do.	2001	5	601	166	---	*
Do.	2300	5	660	176	---	*
8-14-78	0300	5	900	173	---	*
Do.	0605	5	1,085	176	---	*
Do.	1300	6	60	184	---	*

Table 58.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 30-m black, located 42.4 m below land surface and 30 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

30-Meter black point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1800	---	360	130	---	*
Do.	2200	---	600	130	---	*
8-9-78	0613	---	1,093	130	---	*
Do.	1200	1	0	140	---	*
8-11-78	1200	3	0	150	---	*
Do.	1800	3	360	140	---	*
8-12-78	1600	4	240	150	---	*
8-13-78	1600	5	240	150	---	*
8-14-78	0600	5	1,080	170	---	*

Table 59.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 30-m red, located 37.4 m below land surface and 30 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

30-Meter red point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	1200	---	0	180	---	*
8-9-78	0200	---	840	220	---	*
8-10-78	1500	2	180	180	---	*
Do.	1900	2	420	180	---	*
8-11-78	1005	2	1,325	180	---	*
Do.	2130	3	540	150	---	*
8-12-78	1040	3	1,360	170	---	*
Do.	2000	4	480	220	---	*
8-13-78	0300	4	900	240	---	*
Do.	1200	5	0	190	---	*
8-14-78	0600	5	1,080	200	---	*

Table 60.--*Data obtained from the tracer experiments conducted during August 8-15, 1978, at the Stanton, Tex. site*

[Samples are from the point sampler designated 30-m orange, located 35.7 m below land surface and 30 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

30-Meter orange point sampler						
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron (µg/L)	Bromide (mg/L)	$CBrClF_2$ (mg/L)
8-8-78	2000	---	240	200	---	*
8-9-78	0200	---	840	240	---	*
8-10-78	1300	2	60	180	---	*
Do.	2200	2	600	180	---	*
8-11-78	1005	2	1,325	190	---	*
Do.	1800	3	360	180	---	*
8-12-78	1650	4	290	180	---	*
Do.	2400	4	720	170	---	*
8-13-78	1600	5	240	240	---	*
8-14-78	0600	5	1,090	300	---	*

at any sampling point to the initial input concentration (Co), the data are presented as a unitless ratio, C/Co (tables 61 through 74). Data normalized in this form facilitate a comparison between the tracers.

The fourth experiment of the August test involved the addition of fluoride, chloride, bromide, iodide, yeast, and three fluorocarbons as a 2-min pulse beginning at 1200 on August 14 using a bypass chamber containing 355 L of the tracer solution. The concentrations of the three fluorocarbons (F-12, F-11, and $CBrClF_2$) were too small to detect in the water samples for the fourth experiment, so these compounds were added in an identical manner beginning at 1000 on August 15 for the fifth experiment. The combined results of the fourth and fifth experiments are presented in tables 75 through 82 as unitless concentrations (C/Co). Background concentrations have not been subtracted from the measured concentrations. However, background concentrations of inorganic compounds in the ground water are listed in table 46. Residual concentrations of bromide and $CBrCl_2F$ remaining from previous tracer experiments are listed in tables 47 through 60.

Because the breakthrough of the tracer at the sampling points tended to trend uniformly with time, only samples necessary to describe the trend were analyzed. Many samples are available for future analysis if necessary, and these samples are designated with a (-) in the tables. Selected data from tables 47 to 82 are presented in figures 19 to 38, as the variation of the tracer concentration with time is more readily seen from graphic data than from tabular data.

DECEMBER 1978 TRACER TEST

Two-well tracer tests are conducted by pumping water from one well and injecting it into a nearby well, with tracer being added after the flow field has stabilized. A two-well tracer test was conducted at the Stanton site by injecting water from well 1 into the injection well to provide a comparison with results obtained during the single-well injection tests conducted during March, May, and August to see whether the two types of tests give similar results.

For the test, injection was started 1330 on December 7, 1978 at a rate of 3.8 L/s. Tracer injection was started 0900 on December 12, and was halted at 2100 the same day. Injection of ground water continued at the 3.8-L/s rate until 0900 on December 14, when the well began to flow. The rate was decreased to 3.0 L/s until 0900 December 15, when injection was halted. Injection rates and cumulative volumes of injected water are listed in table 83. Flow-meter logs were not obtained for this test. Water levels were measured daily, but are not listed.

Well 1 is equipped with a 22.5-kW electric motor, and it was necessary to greatly constrict a valve in the injection line to maintain sufficient back pressure, so the pump did not break suction. The water apparently

Table 61.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1310	10	-----	0	0	*
Do.	1320	20	-----	0	0	*
Do.	1330	30	0.032	0	0	0
Do.	1340	40	-----	0	0	*
Do.	1350	50	-----	0	0	*
Do.	1400	60	.038	0	.0091	0
Do.	1410	70	-----	0	.018	*
Do.	1420	80	-----	*	.027	0
Do.	1430	90	.067	.07	.055	*
Do.	1445	105	-----	.11	.082	0
Do.	1500	120	.125	.16	*	.01
Do.	1515	135	-----	*	.140	.02
Do.	1530	150	.190	.18	*	*
Do.	1545	165	.244	.20	.210	.04
Do.	1600	180	-----	.22	*	.05
Do.	1620	200	-----	*	*	*
Do.	1630	210	.244	.27	.240	.04
Do.	1700	240	.260	.32	.350	.10
Do.	1730	270	.250	*	.300	.10
Do.	1800	300	.230	.34	.250	.10
Do.	1900	360	-----	.37	.160	.13
Do.	2000	420	.210	.34	.100	.19

Table 61.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter well						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	2100	480	-----	0.25	*	0.19
Do.	2200	540	-----	.20	*	.61
Do.	2300	600	-----	.20	*	.17
Do.	2400	660	-----	.20	0.023	.16
8-11-78	0100	720	-----	.18	*	.15
Do.	0200	780	-----	*	0	*
Do.	0300	840	-----	*	*	*
Do.	0400	900	-----	*	*	*
Do.	0600	1,020	-----	.12	*	*
Do.	0700	1,080	-----	*	*	*
Do.	0800	1,140	-----	.07	*	*

Table 62.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1310	10	-----	0	0	*
Do.	1320	20	-----	0	0	*
Do.	1330	30	0.150	0	0	0
Do.	1340	40	-----	0	0	*
Do.	1350	50	-----	0	0	*
Do.	1400	60	-----	0	0	0
Do.	1410	70	.16	0	0	*
Do.	1420	80	-----	0	0	0
Do.	1430	90	.13	0	0	0
Do.	1445	105	-----	0	0	*
Do.	1500	120	.18	0	0	0
Do.	1515	135	.16	0	0	0
Do.	1530	150	-----	0	0	*
Do.	1545	165	-----	0	0	.04
Do.	1600	180	-----	0	0	0
Do.	1620	200	-----	0	0	*
Do.	1630	210	-----	0	0	0
Do.	1700	240	.22	0	0	.05
Do.	1730	270	.31	0	.036	.23
Do.	1800	300	-----	0	*	0
Do.	1900	360	.48	0	.150	.85

Table 62.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter red point sampler						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	2000	420	-----	0	*	*
Do.	2100	480	0.71	0	.250	0.39
Do.	2200	540	.70	0	.270	0
Do.	2300	600	.61	0	*	*
Do.	2400	660	-----	0	.120	1.80
8-11-78	0100	720	-----	0	*	1.40
Do.	0200	780	.47	0	.055	.70
Do.	0300	840	.45	0	.13	1.80
Do.	0400	900	-----	0	*	*
Do.	0600	1,020	-----	0	*	.45
Do.	0700	1,080	-----	0	.009	*
Do.	0800	1,140	.28	0	0	.90

Table 63.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates this sample was not analyzed and is no longer available.]

2-Meter orange point sampler						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1310	10	0.13	0	0	*
Do.	1320	20	----	0	0	*
Do.	1330	30	.13	0	0	*
Do.	1340	40	----	0	0	*
Do.	1350	50	----	0	0	*
Do.	1400	60	.27	0	0	*
Do.	1410	70	----	.1	.045	*
Do.	1420	80	----	.13	.110	*
Do.	1430	90	.60	.16	.160	*
Do.	1445	105	----	.2	.170	*
Do.	1500	120	.71	.21	.160	*
Do.	1515	135	----	.25	.270	*
Do.	1530	150	.46	.25	.450	*
Do.	1545	165	----	.3	.400	*
Do.	1600	180	.69	.32	.350	*
Do.	1620	200	----	*	*	*
Do.	1630	210	.69	.32	*	*
Do.	1700	240	.92	.34	.250	*
Do.	1730	270	1.0	*	.410	*
Do.	1800	300	.95	.32	.170	*

Table 63.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter orange point sampler						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1900	360	0.74	0.19	*	*
Do.	2000	420	.64	.16	.091	*
Do.	2100	480	.40	.14	0	*
Do.	2200	540	----	.11	0	*
Do.	2300	600	.25	.09	0	*
Do.	2400	660	----	.09	0	*
8-11-78	0100	720	.26	.11	0	*
Do.	0200	780	----	.09	0	*
Do.	0300	840	----	0	0	*
Do.	0400	900	----	0	0	*
Do.	0600	1,020	.14	0	0	*
Do.	0700	1,080	----	0	0	*
Do.	0800	1,140	----	0	0	*
Do.	1200	1,380	.14	0	0	*

Table 64.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1400	60	0.06	0	0	*
Do.	1410	70	----	0	.0045	*
Do.	1430	90	.16	.07	.045	*
Do.	1445	105	----	.11	*	0.01
Do.	1500	120	.17	.16	.12	.04
Do.	1515	135	.31	*	*	.07
Do.	1530	150	.27	.2	.19	*
Do.	1545	165	----	.25	*	.12
Do.	1600	180	.53	.25	.25	.19
Do.	1630	210	.42	.32	.31	.15
Do.	1700	240	----	.39	.35	.39
Do.	1800	300	.57	.45	.29	.78
Do.	1900	360	.53	.39	.18	.71
Do.	2000	420	----	.25	.064	.76
Do.	2100	480	.31	.25	.036	.73
Do.	2200	540	.27	.13	0	.20
Do.	2300	600	.22	.13	0	.47
Do.	2400	660	.17	.16	0	.47
8-11-78	0100	720	----	.16	0	.45
Do.	0300	840	.15	0	0	*

Table 64.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*--Continued

5-Meter well						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-11-78	0600	1,020	----	0	0	*
Do.	0800	1,140	0.13	0	0	*
Do.	1000	1,260	----	0	0	0.10
Do.	2400	2,100	----	0	0	.04

Table 65.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler						
Date	Clock time	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1400	60	0.05	0	0	0
Do.	1410	70	----	0	0	*
Do.	1430	90	.05	0	.0091	0
Do.	1445	105	----	0	.018	*
Do.	1500	120	.14	.07	*	0
Do.	1515	135	----	.07	.064	0
Do.	1530	150	.45	.07	.140	*
Do.	1545	165	----	.08	*	*
Do.	1600	180	.43	.12	.26	.63
Do.	1630	210	.48	.13	*	.85
Do.	1700	240	.58	.12	.39	1.30
Do.	1800	300	.63	.17	.43	2.10
Do.	1900	360	1.0	*	.48	3.50
Do.	2000	420	.79	.25	.45	1.90
Do.	2100	480	.69	.22	.32	*
Do.	2200	540	----	*	*	2.30
Do.	2300	600	.40	.13	.11	*
Do.	2400	660	----	*	*	*
8-11-78	0100	720	.23	.10	.05	*
Do.	0300	840	.14	*	.009	*
Do.	0600	1,020	.08	.07	0	*
Do.	0800	1,140	----	0	0	*

Table 66.--*A comparison between all tracers used during the second tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1300, August 10, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well located 15 m from the injection well, which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

15-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Bromide	Phenol-phthalein	Benzo-ate	Freon-12
8-10-78	1615	0	195	----	0	0	*
Do.	1700	0	240	0.12	0	0	*
Do.	1800	0	300	----	0	0	*
Do.	1900	0	360	----	0	0	*
Do.	2000	0	420	----	0	0	*
Do.	2200	0	540	.10	0	0	*
Do.	2400	0	660	----	0	.0045	*
8-11-78	0100	0	720	.10	0	*	*
Do.	0200	0	780	----	0	.0073	*
Do.	0215	0	795	----	0	*	*
Do.	0300	0	840	----	0	.014	*
Do.	0315	0	855	----	0	*	*
Do.	0400	0	900	----	0	.014	*
Do.	0410	0	910	----	0	*	*
Do.	0600	0	1,020	----	0	.017	*
Do.	0800	0	1,140	----	0	.017	*
Do.	1030	0	1,290	----	0	*	*
Do.	1100	0	1,320	----	0	.0091	*
Do.	1130	0	1,350	----	0	*	*
Do.	1400	1	60	----	0	.0045	*
Do.	1600	1	180	.10	0	.001	*
Do.	1615	1	195	----	0	0	*
Do.	1815	1	315	----	0	0	*
Do.	2100	1	480	----	0	0	*

Table 67.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well located 2 m from the injection well. The 2-m well is screened for the full saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1710	0	0	----	*	*	*
Do.	1730	0	20	----	*	*	*
Do.	1800	0	50	0.10	0.005	0	0.01
Do.	1830	0	80	.10	.06	*	.05
Do.	1900	0	110	.13	*	.022	.02
Do.	1930	0	140	.15	.27	*	.10
Do.	2000	0	170	.26	.21	*	.05
Do.	2030	0	200	----	.28	*	.22
Do.	2100	0	230	----	*	*	.25
Do.	2130	0	260	.31	.35	.022	.21
Do.	2200	0	290	----	.35	*	.30
Do.	2230	0	320	.32	.38	*	.29
Do.	2300	0	350	.38	.40	*	.25
Do.	2330	0	380	.39	.43	*	.33
Do.	2400	0	410	.41	.45	*	.35
8-13-78	0030	0	440	----	*	*	.31
Do.	0100	0	470	.38	.46	.064	.37
Do.	0130	0	500	----	.46	*	*
Do.	0200	0	530	----	.46	*	.43
Do.	0230	0	560	.31	.43	.064	.46
Do.	0300	0	590	----	.39	*	.35

Table 67.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0330	0	620	----	0.35	*	*
Do.	0400	0	650	0.25	.32	0.064	*
Do.	0500	0	710	----	.25	.042	0.41
Do.	0600	0	770	.20	.21	*	.43
Do.	0700	0	830	----	.18	.042	.44
Do.	0800	0	890	.17	.14	*	.41
Do.	0900	0	950	----	.12	*	.42
Do.	1000	0	1,010	.15	.10	.042	.41
Do.	1200	0	1,130	----	.09	*	*
Do.	1400	0	1,250	.12	.06	*	*
Do.	1600	0	1,370	.10	.04	*	*
Do.	1800	1	50	----	*	*	*
Do.	2000	1	170	.12	.03	.042	*
Do.	2300	1	350	.08	.02	*	*

Table 68.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 2-m red located 2 m radially from the injection well and 38.7 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

2-Meter red point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1700	0	0	-----	0	*	*
Do.	1730	0	20	0.03	0	*	*
Do.	1800	0	50	.03	0	*	*
Do.	1830	0	80	.03	0	*	*
Do.	1900	0	110	.03	0	*	*
Do.	1930	0	140	-----	.005	*	*
Do.	2000	0	170	.04	.027	*	*
Do.	2030	0	200	-----	*	*	0.01
Do.	2100	0	230	.06	.043	*	*
Do.	2130	0	260	-----	.043	*	.01
Do.	2200	0	290	.07	*	*	.01
Do.	2230	0	320	-----	.085	0	.03
Do.	2300	0	350	.13	*	*	.05
Do.	2330	0	380	-----	.17	*	.02
Do.	2400	0	410	.18	.19	*	.02
8-13-78	0030	0	440	.22	.27	*	.04
Do.	0100	0	470	-----	.32	0	.01
Do.	0130	0	500	.31	.37	*	.01
Do.	0200	0	530	-----	.41	*	.15
Do.	0230	0	560	-----	.44	*	.04
Do.	0300	0	590	-----	.47	*	.09

Table 68.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter red point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0330	0	620	-----	0.51	*	0.19
Do.	0400	0	650	.40	.52	*	.17
Do.	0500	0	710	.39	.54	0.092	.19
Do.	0600	0	770	-----	.52	.019	.04
Do.	0700	0	830	.35	.50	.021	.06
Do.	0800	0	890	.30	.41	*	.25
Do.	0900	0	950	-----	.36	.015	.01
Do.	1000	0	1,010	.26	*	*	.01
Do.	1200	0	1,130	.23	.29	*	.12
Do.	1400	0	1,250	.25	.27	*	*
Do.	1600	0	1,370	.20	.15	.019	*
Do.	1800	1	50	.13	.10	*	.35
Do.	2000	1	170	-----	.07	*	*
Do.	2300	1	350	-----	.06	*	*
8-14-78	0300	1	590	.12	.05	*	*
Do.	0400	1	650	-----	*	*	*
Do.	0600	1	770	.084	.04	*	*

Table 69.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 2-m orange located 34.8 m below land surface and 2 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates this sample was not analyzed and is no longer available.]

2-Meter orange point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1710	0	0	----	*	*	*
Do.	1730	0	20	----	0.01	*	*
Do.	1800	0	50	----	.043	0	*
Do.	1830	0	80	0.21	.15	*	*
Do.	1900	0	110	.31	.27	.042	*
Do.	1930	0	140	.37	*	*	*
Do.	2000	0	170	----	*	*	*
Do.	2030	0	200	.42	.45	.064	*
Do.	2100	0	230	.49	.52	*	*
Do.	2130	0	260	----	.55	*	*
Do.	2200	0	290	.52	.56	*	*
Do.	2230	0	320	----	*	*	*
Do.	2300	0	350	.55	.56	*	*
Do.	2330	0	380	----	.58	.127	*
Do.	2400	0	410	----	.58	*	*
8-13-78	0030	0	440	.51	*	*	*
Do.	0100	0	470	----	.59	.170	*
Do.	0130	0	500	----	.59	*	*
Do.	0200	0	530	.33	.56	*	*
Do.	0230	0	560	----	.49	*	*

Table 69.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

2-Meter orange point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0300	0	590	----	0.43	0.192	*
Do.	0330	0	620	----	.35	*	*
Do.	0400	0	650	----	.30	*	*
Do.	0500	0	710	0.19	.24	.127	*
Do.	0600	0	770	----	.24	*	*
Do.	0700	0	830	----	.18	.106	*
Do.	0800	0	890	----	.16	*	*
Do.	0900	0	950	----	.17	*	*
Do.	1000	0	1,010	.14	.13	.085	*
Do.	1200	0	1,130	----	.12	*	*
Do.	1400	0	1,250	.22	.15	*	*
Do.	1600	0	1,370	----	.13	*	*
Do.	1800	1	50	----	.10	.064	*
Do.	2000	1	170	.10	.07	*	*
Do.	2300	1	350	----	.06	.042	*
8-14-78	0300	1	590	----	.06	*	*
Do.	0400	1	650	----	*	*	*
Do.	0600	1	770	----	.03	*	*

Table 70.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well located 5 m from the injection well. The 5-m well is screened for the full-saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1710	0	0	0.05	0	*	*
Do.	1730	0	20	.05	*	*	1.0
Do.	1800	0	50	.05	0	0.006	*
Do.	1830	0	80	.10	.03	*	*
Do.	1845	0	95	.13	*	*	*
Do.	1900	0	110	----	.11	*	.04
Do.	1930	0	140	----	.18	.021	.14
Do.	1945	0	155	.22	*	*	*
Do.	2000	0	170	----	.24	*	.18
Do.	2030	0	200	----	.28	*	*
Do.	2100	0	230	----	.33	*	.37
Do.	2130	0	260	.36	.36	.042	*
Do.	2200	0	290	----	.38	*	*
Do.	2230	0	320	.39	.39	*	.49
Do.	2300	0	350	----	.40	*	.46
Do.	2330	0	380	----	.41	*	.47
Do.	2400	0	410	.43	.43	.064	.47
8-13-78	0030	0	440	.44	.44	*	.52
Do.	0100	0	470	----	.45	*	.53
Do.	0130	0	500	----	.46	*	.42
Do.	0200	0	530	----	.47	.085	.61

Table 70.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

5-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0230	0	560	0.30	0.44	*	0.58
Do.	0300	0	590	----	.38	*	.53
Do.	0330	0	620	----	.33	0.085	*
Do.	0400	0	650	.23	.29	*	.58
Do.	0500	0	710	----	.22	.064	.42
Do.	0600	0	770	.17	.17	.064	.38
Do.	0700	0	830	----	.13	*	.41
Do.	0800	0	890	.14	.11	*	.46
Do.	0900	0	950	----	.10	*	.51
Do.	1000	0	1,010	.13	.08	.064	.47
Do.	1200	0	1,130	.11	.05	*	.43
Do.	1400	0	1,250	.10	.04	*	.44
Do.	1600	0	1,370	.09	.03	.042	.40
Do.	1800	1	50	----	*	*	*
Do.	2000	1	170	.08	.02	*	*
Do.	2300	1	350	----	*	*	*
8-14-78	0300	1	590	----	*	*	*
Do.	0400	1	650	----	*	*	*
Do.	0600	1	770	.07	.005	.006	*

Table 71.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from an observation well designated 5-m red and screened only for 0.7 m at 40.0 m below land surface. This sampler is located at a distance of 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter red point well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1710	0	0	----	*	*	*
Do.	1730	0	20	0.39	0.17	0.042	0.05
Do.	1800	0	50	.54	.52	*	.17
Do.	1817	0	67	----	*	*	.17
Do.	1830	0	80	----	.63	.36	*
Do.	1845	0	95	----	*	*	*
Do.	1900	0	110	.66	.69	*	.19
Do.	1930	0	140	.69	.69	*	.25
Do.	2000	0	170	.75	.73	*	.14
Do.	2030	0	200	.79	.78	*	*
Do.	2100	0	230	.80	.79	.57	.39
Do.	2130	0	260	----	*	*	*
Do.	2200	0	290	.80	.70	*	.39
Do.	2230	0	320	----	.71	*	.40
Do.	2300	0	350	.85	.69	*	.25
Do.	2330	0	380	----	.69	*	.27
Do.	2400	0	410	.65	.69	*	.31
8-13-78	0030	0	440	----	.70	*	*
Do.	0100	0	470	.29	*	.55	.24
Do.	0130	0	500	----	.72	*	.25
Do.	0200	0	530	.23	.63	*	.28

Table 71.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

5-Meter red point well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0230	0	560	----	0.34	0.25	0.26
Do.	0300	0	590	0.17	.26	*	.30
Do.	0330	0	620	----	*	*	.37
Do.	0400	0	650	.14	.20	*	.21
Do.	0500	0	710	----	.14	*	.21
Do.	0600	0	770	.10	.10	.106	.17
Do.	0700	0	830	----	.06	*	.07
Do.	0800	0	890	.07	.04	*	.21
Do.	0900	0	950	----	*	*	.16
Do.	1000	0	1,010	----	.02	*	.13
Do.	1200	0	1,130	.06	.01	*	*
Do.	1400	0	1,250	----	.01	*	*
Do.	1600	0	1,370	----	*	*	*
Do.	1800	1	50	----	*	*	*
Do.	2000	1	170	.04	*	*	*
Do.	2300	1	350	.04	*	*	*

Table 72.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the point sampler designated 5-m orange located 37.5 m below land surface and 5 m radially from the injection well. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

5-Meter orange point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-12-78	1710	0	0	----	0	*	*
Do.	1730	0	20	0.03	0	*	*
Do.	1800	0	50	----	0	*	*
Do.	1830	0	80	.03	0	*	*
Do.	1900	0	110	----	.01	*	*
Do.	1930	0	140	.04	.02	*	*
Do.	2000	0	170	.06	.14	0	0.04
Do.	2030	0	200	----	.21	*	*
Do.	2100	0	230	----	.19	*	.15
Do.	2130	0	260	.08	.31	*	.58
Do.	2200	0	290	----	.34	*	*
Do.	2230	0	320	----	*	*	.22
Do.	2300	0	350	----	.47	0	.72
Do.	2330	0	380	----	.52	*	.23
Do.	2400	0	410	.14	.58	.042	.23
8-13-78	0030	0	440	----	.63	*	.19
Do.	0100	0	470	.20	.68	*	.35
Do.	0130	0	500	----	.68	*	.37
Do.	0200	0	530	----	.68	*	.32
Do.	0230	0	560	.27	.68	*	.35

Table 72.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*--Continued

5-Meter orange point sampler							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0300	0	590	----	0.68	*	0.31
Do.	0330	0	620	----	.68	*	*
Do.	0400	0	650	----	.68	0.127	.16
Do.	0500	0	710	0.31	.61	*	.29
Do.	0600	0	770	----	.52	0	.17
Do.	0700	0	830	.35	.38	*	.09
Do.	0800	0	890	----	.28	*	.31
Do.	0900	0	950	.33	.20	0	.37
Do.	1000	0	1,010	----	.16	*	.35
Do.	1200	0	1,130	.29	.12	*	.33
Do.	1400	0	1,250	.31	.13	*	*
Do.	1600	0	1,370	.29	.12	0	*
Do.	1800	1	50	.21	.06	*	*
Do.	2000	1	170	.19	.04	*	*
Do.	2300	1	350	.16	.03	*	*
8-14-78	0300	1	590	.16	.03	*	*
Do.	0400	1	650	----	*	*	*
Do.	0600	1	770	.12	*	*	*

Table 73.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well 10 m from the injection well and are screened only for a 1.2-m section, 41.5 m below land surface. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

10-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0100	0	470	0.04	0	*	*
Do.	0300	0	590	.04	.05	*	*
Do.	0500	0	710	.05	*	*	*
Do.	0600	0	770	----	.04	*	*
Do.	0700	0	830	.08	.07	*	*
Do.	0800	0	890	----	.08	*	*
Do.	0900	0	950	.10	.10	*	*
Do.	1000	0	1,010	----	.12	*	*
Do.	1100	0	1,070	.12	.13	*	*
Do.	1200	0	1,130	----	.14	*	*
Do.	1300	0	1,190	.14	.15	*	*
Do.	1400	0	1,250	----	.15	*	*
Do.	1500	0	1,310	.15	.15	*	*
Do.	1600	0	1,370	----	.15	*	*
Do.	1800	1	50	.15	.14	*	*
Do.	2000	1	170	.15	*	*	*
Do.	2300	1	350	.15	.12	*	*
8-14-78	0300	1	590	.14	.10	*	*
Do.	0600	1	770	.13	.06	*	*
Do.	1100	1	1,070	----	*	*	*
Do.	1300	1	1,190	.11	.04	*	*

Table 74.--*A comparison between all tracers used during the third tracer experiment written in terms of the unitless concentration ratio C/Co. The tracers were added simultaneously at 1710, August 12, 1978, and the initial concentrations are given in table 45*

[Samples are from the observation well 15 m from the injection well which is screened for the saturated thickness of the aquifer. The dash (-) indicates sample is available but was not analyzed; an asterisk (*) indicates the sample was not analyzed and is no longer available.]

15-Meter well							
Date	Clock time	Elapsed time (d)	Elapsed time (min)	Boron	Aniline	Ethyl-amine	CBr_2F_2
8-13-78	0100	0	470	0.04	*	*	*
Do.	0300	0	590	.04	*	*	*
Do.	0500	0	710	.05	0.005	*	*
Do.	0600	0	770	----	.02	*	*
Do.	0700	0	830	.06	.02	*	*
Do.	0800	0	890	----	.03	*	*
Do.	0900	0	950	.07	.04	*	*
Do.	1000	0	1,010	----	*	*	*
Do.	1100	0	1,070	.07	.04	*	*
Do.	1200	0	1,130	----	.04	*	*
Do.	1300	0	1,190	.08	.04	*	*
Do.	1400	0	1,250	----	.05	*	*
Do.	1500	0	1,310	.08	.05	*	*
Do.	1600	0	1,370	----	.05	*	*
Do.	1800	1	50	.08	*	*	*
Do.	2000	1	170	.08	.05	*	*
Do.	2300	1	350	.09	.05	*	*
8-14-78	0300	1	590	.08	.05	*	*
Do.	0600	1	770	.09	.05	*	*
Do.	1100	1	1,070	----	*	*	*
Do.	1300	1	1,190	.09	.03	*	*

Table 75.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

2-Meter well										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.005	0.013	0.045	0.001	0	---	---	---
Do.	1215	15	-----	-----	-----	-----	3	---	---	---
Do.	1217	17	-----	-----	-----	-----	----	510	---	---
Do.	1228	28	-----	-----	-----	-----	----	690	45	173
Do.	1230	30	.012	.013	.048	.005	495	---	---	---
Do.	1245	45	-----	-----	-----	-----	1,420	540	50	180
Do.	1255	55	-----	-----	-----	-----	----	556	48	176
Do.	1300	60	.030	-----	.049	.010	800	---	---	---
Do.	1310	70	-----	-----	-----	-----	----	452	41	146
Do.	1315	75	-----	-----	-----	-----	530	---	---	---
Do.	1330	90	-----	-----	-----	-----	----	772	55	234
Do.	1345	105	.053	.015	.048	.009	100	---	---	---
Do.	1350	110	-----	-----	-----	-----	----	577	49	181
Do.	1400	120	.067	.016	.049	.010	120	---	---	---

Table 75.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*--Continued

2-Meter well										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1416	136	-----	-----	-----	-----	---	880	61	230
Do.	1430	150	0.080	0.017	0.049	0.012	140	---	---	---
Do.	1450	170	-----	-----	-----	-----	---	560	54	183
Do.	1500	180	.030	.017	.051	.012	10	---	---	---
Do.	1525	205	-----	-----	-----	-----	6	643	61	204
Do.	1530	210	.025	.016	.047	.012	---	---	---	---
Do.	1610	250	-----	-----	-----	-----	17	567	46	186
Do.	1645	285	-----	-----	-----	-----	16	504	55	182
Do.	1700	300	.022	.016	.048	.010	4	---	---	---
Do.	1734	334	-----	-----	-----	-----	3	524	63	203
Do.	1830	390	-----	-----	-----	-----	---	565	75	237
Do.	1925	445	-----	-----	-----	-----	---	459	65	179
Do.	2000	480	-----	-----	-----	-----	---	525	67	232
Do.	2400	720	.005	.014	.045	.008	1	---	---	---
8-15-78	1000	1,320	.003	.013	.047	.003	7	---	---	---

Table 76.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

2-Meter black point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.008	0.013	0.021	0.005	0	*	*	*
Do.	1400	120	.005	.013	.021	.005	0	*	*	*
Do.	1800	360	.007	.012	.021	.005	0	*	*	*
Do.	2200	600	.004	.013	.022	.005	0	*	*	*
8-15-78	0200	840	.006	.013	.021	.008	0	*	*	*
Do.	0600	1,080	.009	.013	.022	.009	0	*	*	*
Do.	1000	1,320	.005	.012	.022	.007	0	*	*	*
Do.	1800	1,800	.032	.015	.023	.010	0	*	*	*

Table 77.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

2-Meter red point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.001	0.012	0.042	0.002	0	0	0	0
Do.	1207	7	-----	-----	-----	-----	---	1.3	24	100
Do.	1215	15	-----	-----	-----	-----	---	0	22	60
Do.	1230	30	.001	.012	.041	.002	0	-----	---	---
Do.	1300	60	.001	.012	.038	.003	0	-----	---	---
Do.	1305	65	-----	-----	-----	-----	---	4	24	73
Do.	1324	84	-----	-----	-----	-----	---	1.3	26	65
Do.	1330	90	.005	.012	-----	.003	0	-----	---	---
Do.	1343	103	-----	-----	-----	-----	---	61	24	58
Do.	1400	120	.008	.013	.041	.003	1	-----	---	---
Do.	1410	130	-----	-----	-----	-----	---	396	34	94
Do.	1445	165	-----	-----	-----	-----	---	650	41	124
Do.	1500	180	.015	.015	.040	.015	1	-----	---	---
Do.	1507	187	-----	-----	-----	-----	---	713	37	113

Table 77.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*--Continued

2-Meter red point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1530	210	-----	-----	-----	-----	5	---	---	---
Do.	1548	228	-----	-----	-----	-----	---	339	43	113
Do.	1600	240	0.023	0.020	0.040	0.016	17	---	---	---
Do.	1630	270	-----	-----	-----	-----	2	54	39	56
Do.	1700	300	.033	.018	.041	.020	1	---	---	---
Do.	1710	310	-----	-----	-----	-----	---	383	38	100
Do.	1730	330	-----	-----	-----	-----	3	---	---	---
Do.	1745	330	-----	-----	-----	-----	---	853	44	144
Do.	1805	365	-----	-----	-----	-----	0	786	52	145
Do.	1850	410	-----	-----	-----	-----	0	566	50	126
Do.	1922	442	-----	-----	-----	-----	---	452	50	109
Do.	2000	480	-----	-----	-----	-----	70	---	---	---
Do.	2100	540	-----	-----	-----	-----	10	---	---	---
Do.	2200	600	.029	.016	.044	.015	---	---	---	---
Do.	2400	720	.017	.015	.044	.017	---	---	---	---
8-15-78	0200	840	.019	.015	.044	.012	---	---	---	---
Do.	0600	1,080	.012	.014	.044	.010	---	---	---	---
Do.	1230	1,470	.001	.013	.040	.005	---	---	---	---

Table 78.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

2-Meter orange point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.003	0.013	0.033	0.002	0	*	*	*
Do.	1215	15	-----	-----	-----	-----	1,280	*	*	*
Do.	1230	30	.030	.019	.042	.011	1,100	*	*	*
Do.	1300	60	.073	.026	.051	.025	390	*	*	*
Do.	1315	75	-----	-----	-----	-----	243	*	*	*
Do.	1330	90	.073	.028	.052	.017	128	*	*	*
Do.	1345	105	-----	-----	-----	-----	87	*	*	*
Do.	1400	120	.057	.023	.048	.015	110	*	*	*
Do.	1430	150	-----	-----	-----	-----	65	*	*	*
Do.	1500	180	.038	.018	.048	.012	2	*	*	*
Do.	1530	210	-----	-----	-----	-----	41	*	*	*
Do.	1600	240	.022	.016	.045	.009	-----	*	*	*
Do.	1700	300	-----	-----	-----	-----	22	*	*	*
Do.	1730	330	-----	-----	-----	-----	1	*	*	*
Do.	2400	720	.010	.016	.042	.003	6	*	*	*
8-15-78	1000	1,320	.010	.013	.044	.005	----	*	*	*
Do.	1800	1,800	.010	.013	.040	.003	----	*	*	*

Table 79.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

5-Meter well										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	-----	0.014	0.051	0.001	0	-----	---	---
Do.	1211	11	-----	-----	-----	-----	2	63	27	194
Do.	1215	15	-----	-----	-----	-----	2	-----	---	---
Do.	1220	20	-----	-----	-----	-----	2	44	24	167
Do.	1230	30	.002	.014	.049	.001	61	58	28	191
Do.	1245	45	-----	-----	-----	-----	19,100	-----	---	---
Do.	1247	47	-----	-----	-----	-----	------	1,221	59	290
Do.	1255	55	-----	-----	-----	-----	------	2,108	83	377
Do.	1300	60	.014	.016	.053	.011	19,200	-----	---	---
Do.	1312	72	-----	-----	-----	-----	------	3,612	120	475
Do.	1330	90	.022	.016	.053	.008	TNTC	-----	---	---
Do.	1332	92	-----	-----	-----	-----	------	6,199	181	662
Do.	1345	105	-----	-----	-----	-----	TNTC	-----	---	---
Do.	1352	112	-----	-----	-----	-----	------	6,397	181	655
Do.	1400	120	.053	.019	.053	.057	------	-----	---	---

Table 79.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*--Continued

5-Meter well										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1417	137	-----	-----	-----	-----	------	4,424	144	534
Do.	1430	150	0.023	0.017	0.054	0.028	1,000	-----	---	---
Do.	1450	170	-----	-----	-----	-----	------	3,412	120	434
Do.	1500	180	.021	.017	.054	.027	TNTC	-----	---	---
Do.	1522	202	-----	-----	-----	-----	------	3,478	119	438
Do.	1530	210	.022	.017	-----	.033	86	-----	---	---
Do.	1600	240	.020	.017	.054	.010	70	-----	---	---
Do.	1610	250	-----	-----	-----	-----	------	3,000	102	410
Do.	1645	285	-----	-----	-----	-----	40	2,175	85	330
Do.	1700	300	.012	.015	.053	.010	15	-----	---	---
Do.	1734	334	-----	-----	-----	-----	------	1,950	88	378
Do.	1800	360	-----	-----	-----	-----	8	-----	---	---
Do.	1831	391	-----	-----	-----	-----	------	1,250	80	333
Do.	1925	445	-----	-----	-----	-----	------	938	75	300
Do.	2000	480	-----	-----	-----	-----	35	895	62	295
Do.	2200	600	.007	.015	.052	.005	10	-----	---	---
8-15-78	0400	960	.007	.014	-----	.003	------	-----	---	---
Do.	0800	1,200	-----	-----	-----	-----	6	-----	---	---
Do.	1000	1,320	.007	.013	.052	.002	----	-----	---	---
Do.	1800	1,800	.023	.015	.044	.004	----	-----	---	---

Table 80.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

5-Meter red point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.011	0.014	0.051	0.001	320	-----	---	---
Do.	1207	7	-----	-----	-----	-----	------	0	17	26
Do.	1215	15	.050	.032	.067	.017	TNTC	-----	---	---
Do.	1220	20	-----	-----	-----	-----	------	5,844	153	574
Do.	1230	30	.467	.115	.146	.333	49,560	4,638	135	479
Do.	1245	45	.183	.046	.093	.053	11,000	-----	---	---
Do.	1247	47	-----	-----	-----	-----	------	1,870	65	211
Do.	1255	55	-----	-----	-----	-----	------	2,770	82	287
Do.	1300	60	.067	.028	.072	.033	3,200	-----	---	---
Do.	1312	72	-----	-----	-----	-----	------	1,350	57	163
Do.	1330	90	.067	.022	.061	.023	700	1,660	55	173
Do.	1345	105	.047	.021	.058	.018	500	-----	---	---
Do.	1352	112	-----	-----	-----	-----	------	840	40	112
Do.	1400	120	.037	.021	.058	.017	700	-----	---	---
Do.	1430	150	.031	.022	.053	.016	500	-----	---	---

Table 80.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*--Continued

5-Meter red point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1450	170	-----	-----	-----	-----	----	680	39	102
Do.	1500	180	0.027	0.018	0.055	0.013	TNTC	-----	---	---
Do.	1525	205	-----	-----	-----	-----	----	400	39	86
Do.	1530	210	-----	-----	-----	-----	500	-----	---	---
Do.	1605	245	-----	-----	-----	-----	----	350	77	71
Do.	1625	265	-----	-----	-----	-----	90	1,040	34	130
Do.	1645	285	-----	-----	-----	-----	----	330	34	72
Do.	1700	300	-----	-----	-----	-----	100	-----	---	---
Do.	1734	334	-----	-----	-----	-----	----	230	43	68
Do.	1800	360	.010	.015	.045	.008	----	-----	---	---
Do.	1830	390	-----	-----	-----	-----	----	150	43	70
Do.	1900	420	-----	-----	-----	-----	100	-----	---	---
Do.	1925	445	-----	-----	-----	-----	----	240	55	94
Do.	2000	480	-----	-----	-----	-----	100	120	37	62
Do.	2200	600	.004	.016	.048	.005	70	-----	---	---
Do.	2400	720	-----	-----	-----	-----	50	-----	---	---
Do.	0200	840	-----	-----	-----	-----	400	-----	---	---
8-15-78	1000	1,320	.000	.012	.047	.002	----	-----	---	---
Do.	1800	1,800	.001	.012	.041	.005	----	-----	---	---

Table 81.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

5-Meter orange point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1200	0	0.001	0.014	0.044	0.003	1	0	22	56
Do.	1230	30	.001	.012	.044	.001	5	-----	---	---
Do.	1245	45	-----	-----	-----	-----	5	-----	---	---
Do.	1300	60	.001	.013	.045	.002	2	-----	---	---
Do.	1305	65	-----	-----	-----	-----	--	10	21	50
Do.	1315	75	-----	-----	-----	-----	4	-----	---	---
Do.	1324	84	-----	-----	-----	-----	--	30	24	56
Do.	1330	90	.017	.014	.045	.006	1	-----	---	---
Do.	1345	105	-----	-----	-----	-----	1	110	25	61
Do.	1400	120	.037	.019	.044	.020	--	-----	---	---
Do.	1407	127	-----	-----	-----	-----	--	720	43	121
Do.	1430	150	.043	.022	.044	.027	39	-----	---	---
Do.	1440	160	-----	-----	-----	-----	--	880	43	130
Do.	1500	180	.047	.023	.044	.038	--	-----	---	---
Do.	1510	190	-----	-----	-----	-----	--	1,490	59	194
Do.	1530	210	.047	.023	.044	.042	2	-----	---	---

Table 81.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*--Continued

5-Meter orange point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1547	227	-----	-----	-----	-----	--	1,380	56	191
Do.	1600	240	0.057	0.025	0.045	0.03	4	-----	---	---
Do.	1645	285	-----	-----	-----	-----	--	1,685	69	220
Do.	1745	345	-----	-----	-----	-----	--	2,590	73	300
Do.	1800	360	.047	.022	.049	.017	3	-----	---	---
Do.	1805	365	-----	-----	-----	-----	3	680	55	155
Do.	1850	410	-----	-----	-----	-----	3	950	55	186
Do.	1920	440	-----	-----	-----	-----	--	1,000	74	270
Do.	2300	480	-----	-----	-----	-----	8	590	75	108
Do.	2300	660	.025	.017	.051	.013	--	-----	---	---
Do.	2400	720	-----	-----	-----	-----	5	-----	---	---
8-15-78	0600	1,080	.007	.014	.049	.005	--	-----	---	---
Do.	1200	1,440	.004	.014	.040	.006	--	-----	---	---
Do.	1800	1,800	.003	.012	.044	.005	--	-----	---	---

Table 82.--*A comparison between all tracers used during the fourth tracer experiment (began 1200, August 14, 1978) and the fifth tracer experiment (began 1000, August 15, 1978)*

[Inorganic tracers expressed in terms of the unitless concentration ratio C/Co; yeast and fluorocarbons expressed in concentration units (because of difficulty in defining initial concentrations). Tracers were added virtually instantaneously as a pulse lasting less than 2 min.]

5-Meter black point sampler										
Date	Clock time	Elapsed time (min)	C/Co				Colonies/mL	µg/L		
			Br	Cl	F	I	Yeast	F-12	F-11	$CBrClF_2$
8-14-78	1210	10	0.003	0.018	0.023	0.008	0	*	*	*
Do.	1215	---	-----	-----	-----	-----	0	*	*	*
Do.	1230	30	.009	.015	.022	.007	165	*	*	*
Do.	1245	---	-----	-----	-----	-----	1	*	*	*
Do.	1300	60	.008	.016	.023	.009	14	*	*	*
Do.	1330	90	.011	.017	.023	.011	0	*	*	*
Do.	1400	120	.006	.016	.022	.007	---	*	*	*
Do.	1430	---	-----	-----	-----	-----	1	*	*	*
Do.	1500	150	.004	.015	.023	.007	0	*	*	*
Do.	1530	---	-----	-----	-----	-----	1	*	*	*
Do.	1600	240	.006	.015	.023	.009	8	*	*	*
Do.	1630	270	-----	-----	-----	-----	0	*	*	*
Do.	1800	360	.006	.015	.024	.009	---	*	*	*
Do.	2400	720	.008	.015	.024	.009	---	*	*	*
8-15-78	0400	960	.009	.015	.024	.008	---	*	*	*
Do.	1000	1,320	.008	.015	.023	.007	---	*	*	*
Do.	1800	1,800	.005	.015	.028	.028	---	*	*	*

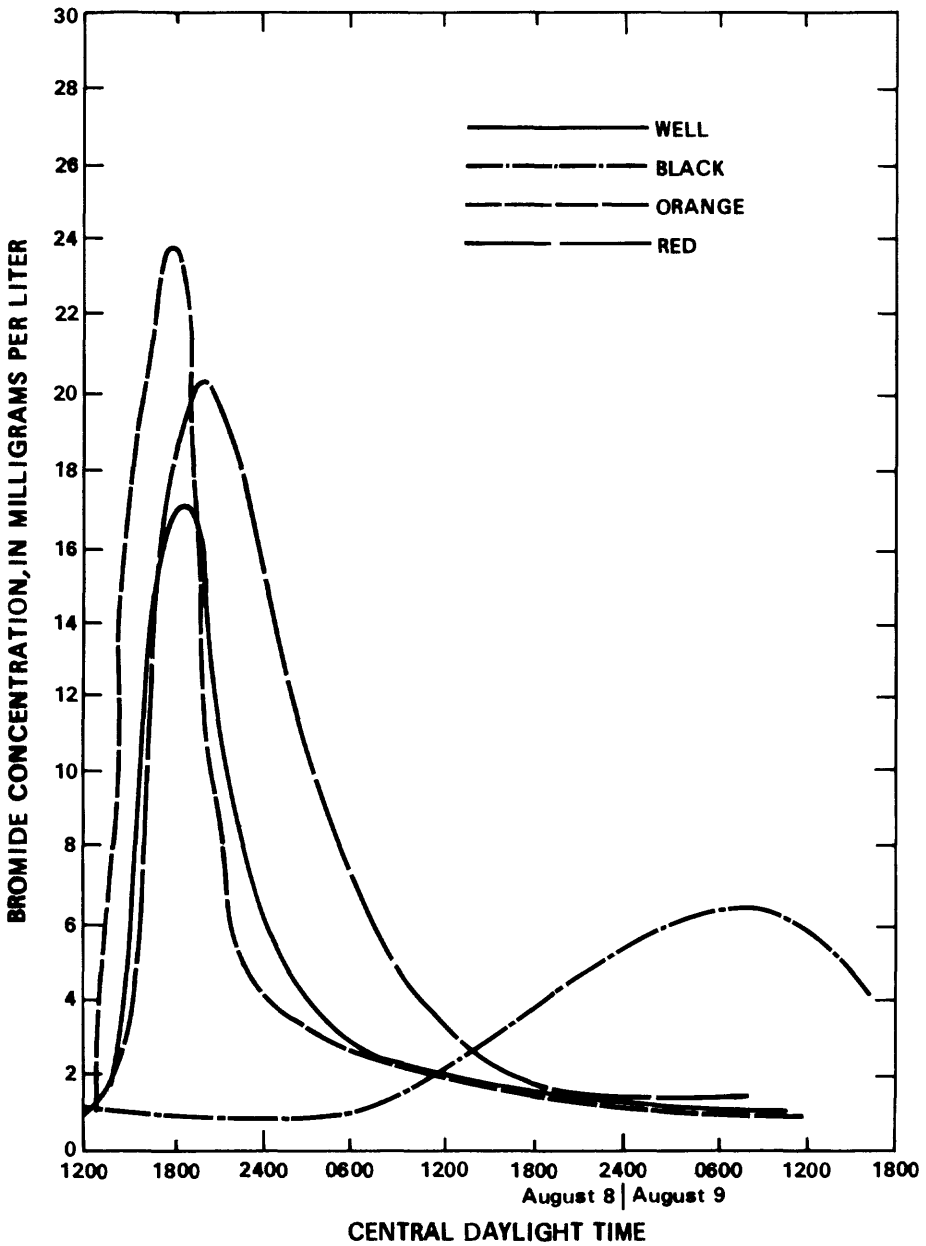

Figure 19.--Bromide data obtained from the 2-meter well and point samplers during the first experiment of the August 1978 test. (Data are from tables 47-50.)

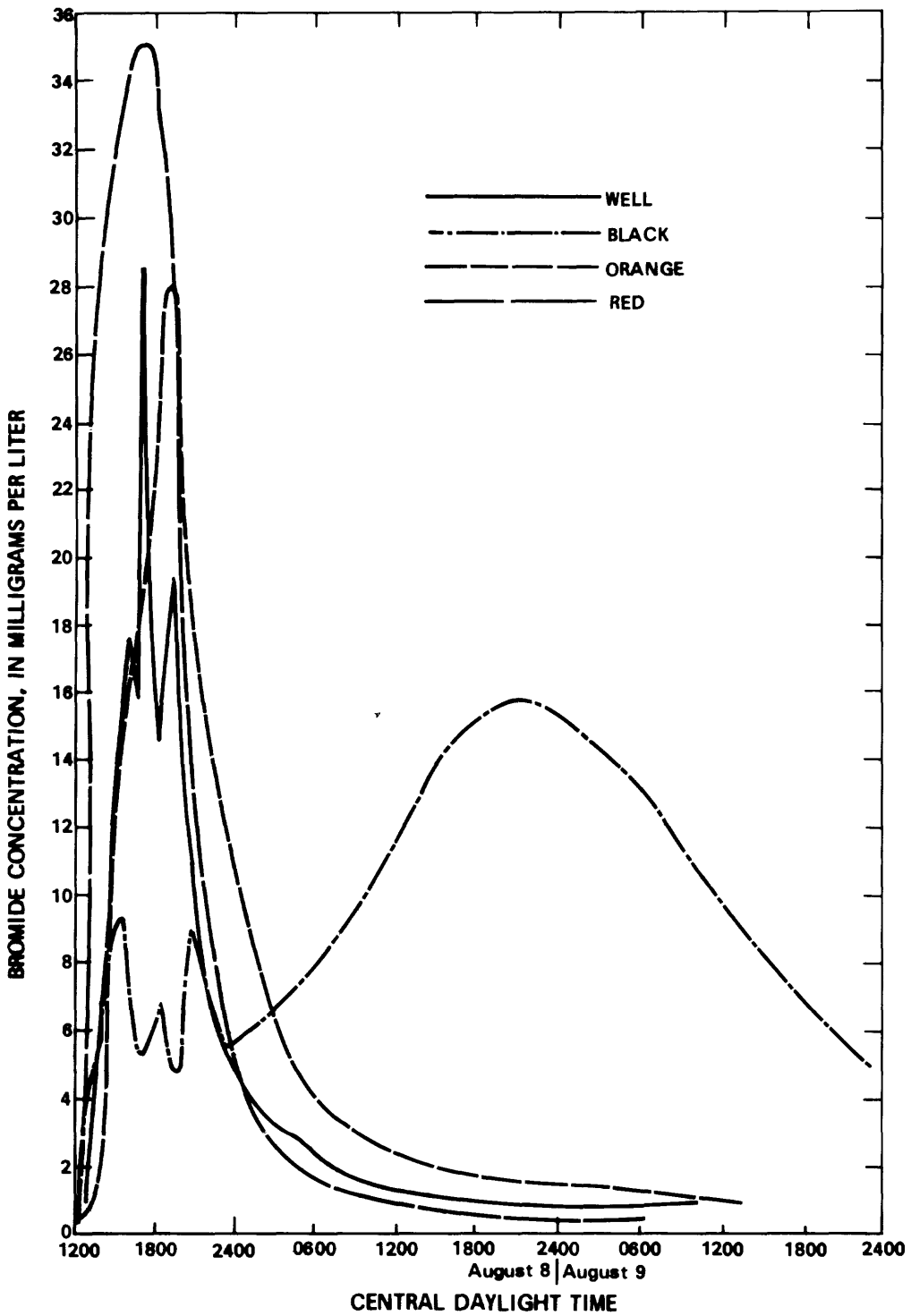

Figure 20.--Bromide data obtained from the 5-meter well and point samplers during the first experiment of the August 1978 test. (Data are from tables 51-54.)

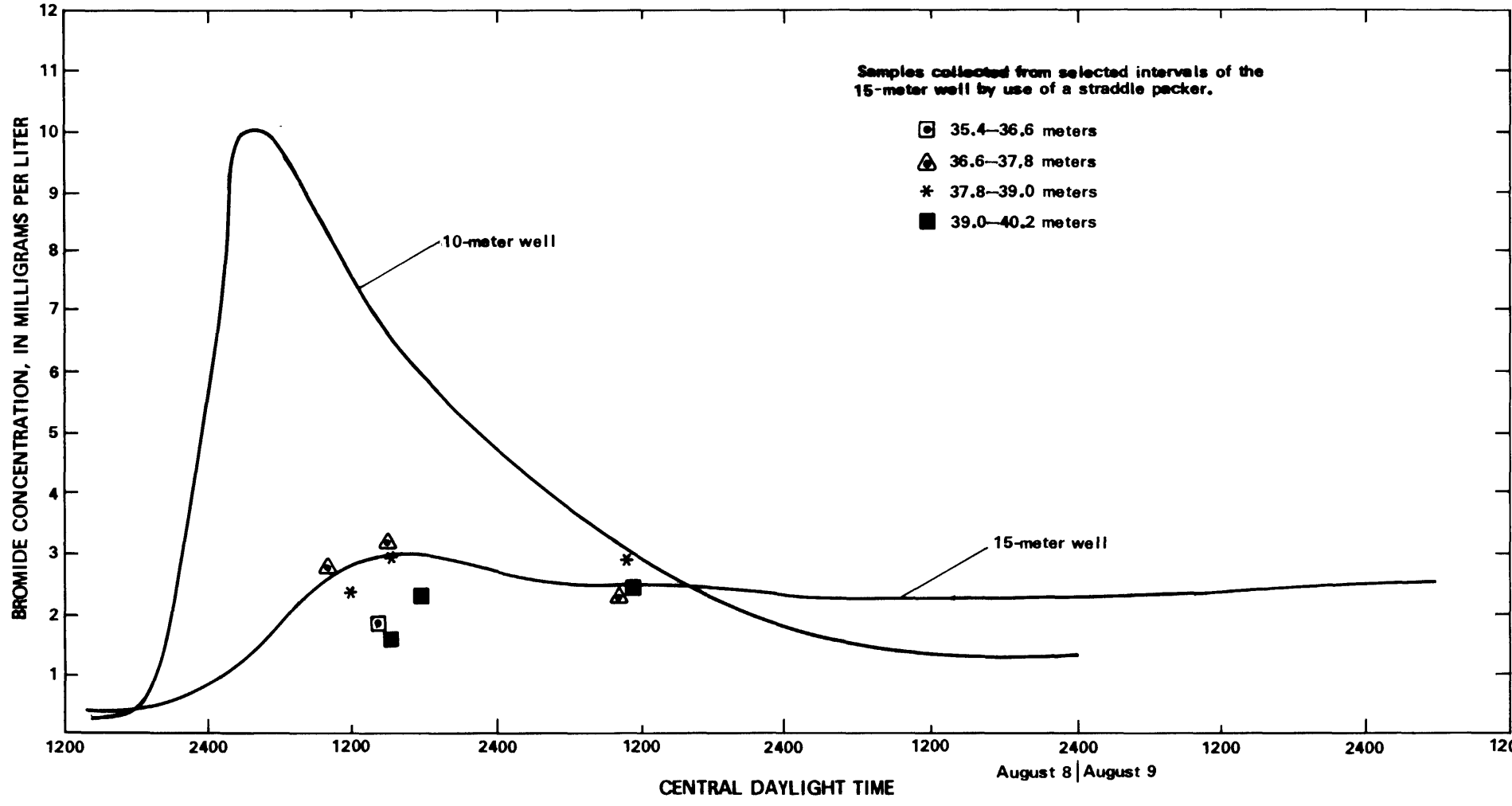

Figure 21.--Bromide data obtained from the 10- and 15-meter wells during the first experiment of the August 1978 test.
(Data are from tables 55-56.)

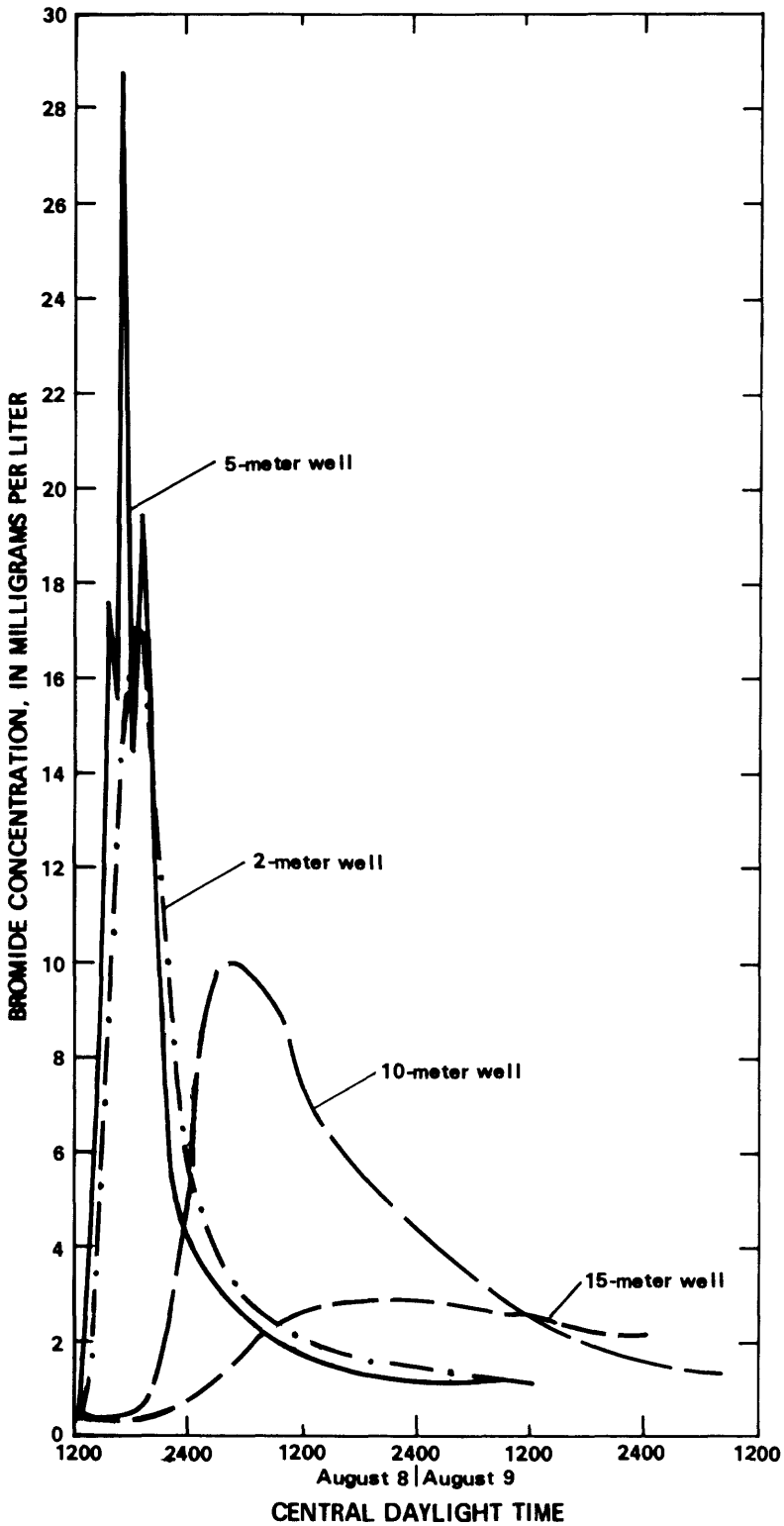

Figure 22.--Bromide data obtained from the 2-, 5-, 10-, and 15-meter wells during the first experiment of the August 1978 test. (Data are from tables 47-56.)

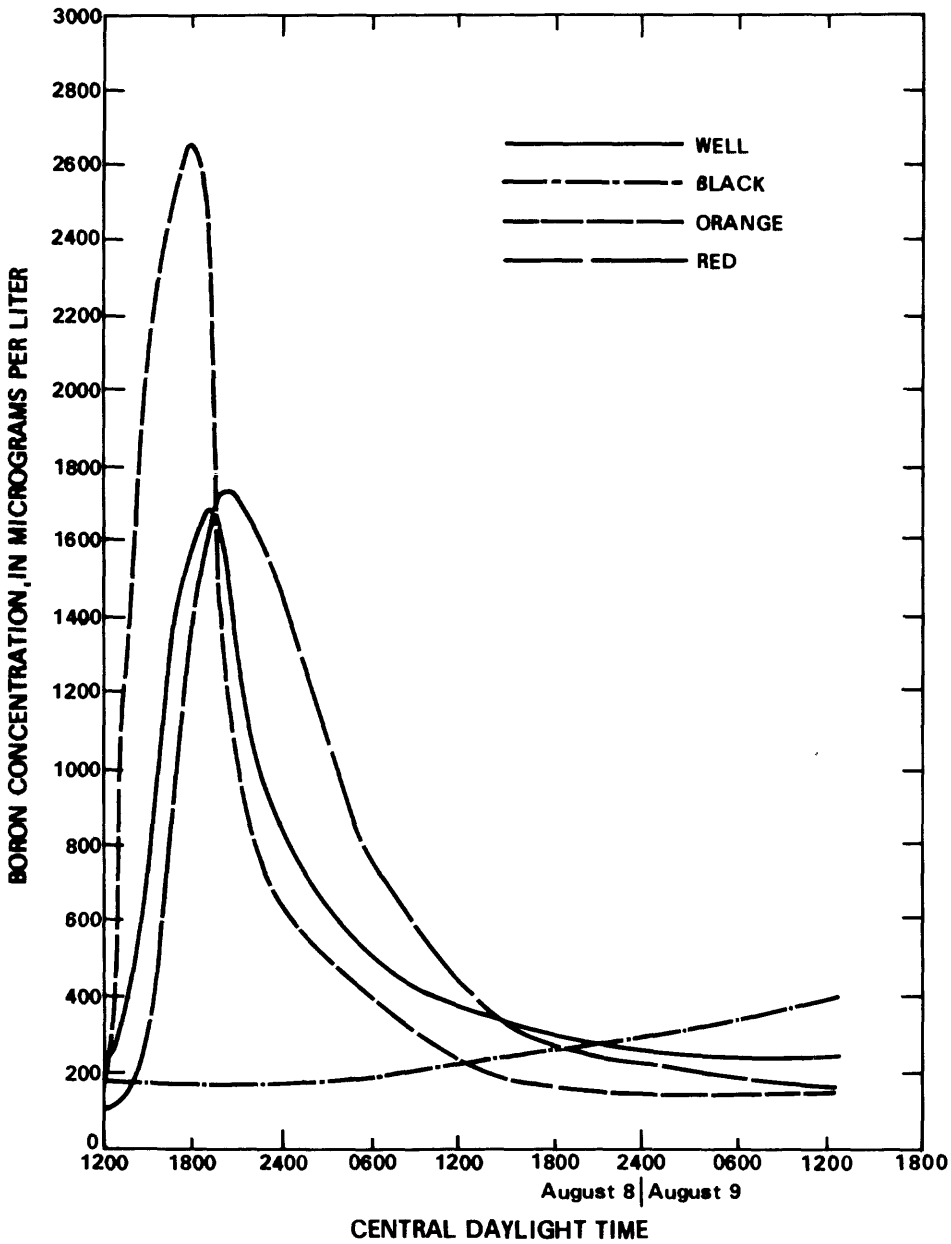

Figure 23.--Boron data obtained from the 2-meter well and point samplers during the first experiment of the August 1978 test. (Data are from tables 47-50.)

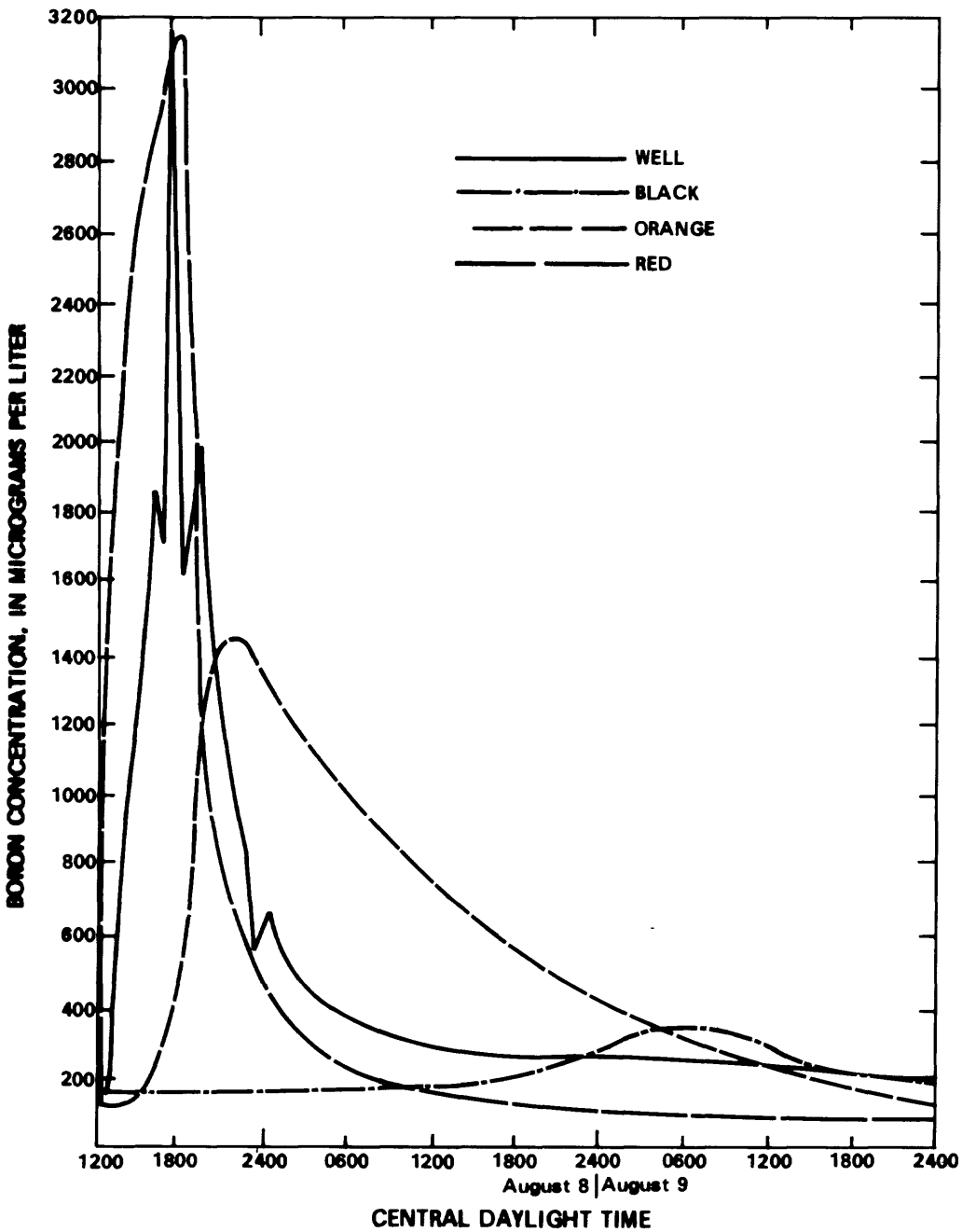

Figure 24.--Boron data obtained from the 5-meter well and point samplers during the first experiment of the August 1978 test. (Data are from tables 51-54.)

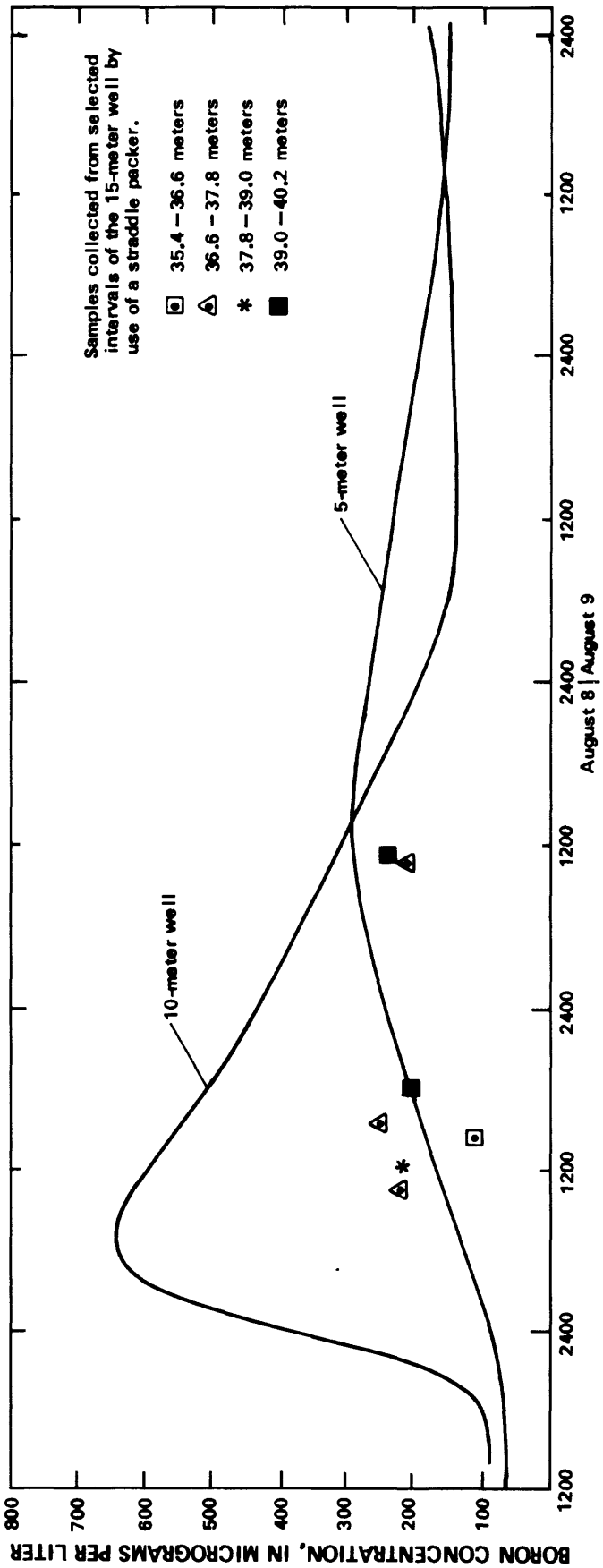

Figure 25.--Boron data obtained from the 10- and 15-meter wells during the first experiment of the August 1978 test. (Data are from tables 55-56.)

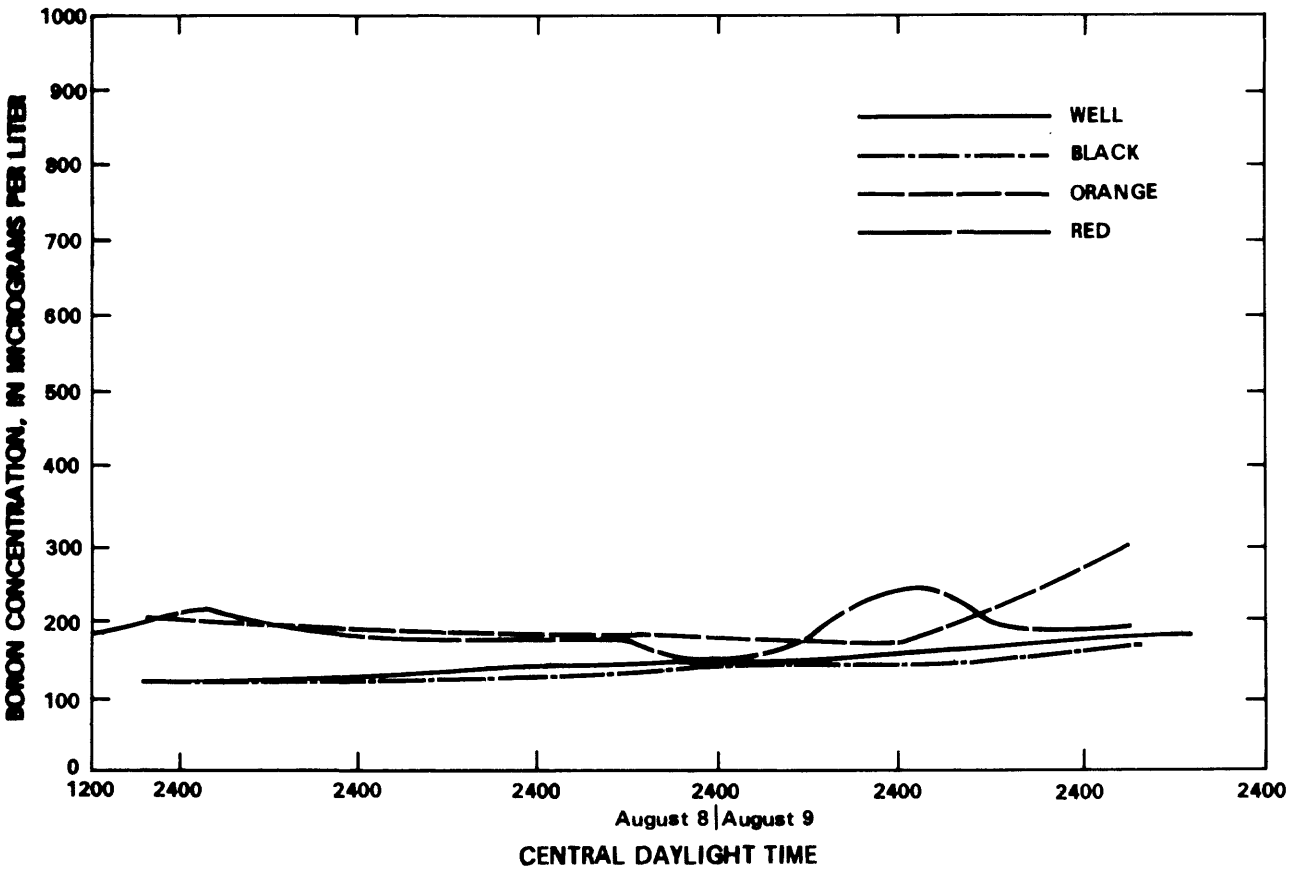

Figure 26.--Boron data obtained from the 30-meter well and point samplers during the first experiment of the August 1978 test. (Data are from tables 57-60.)

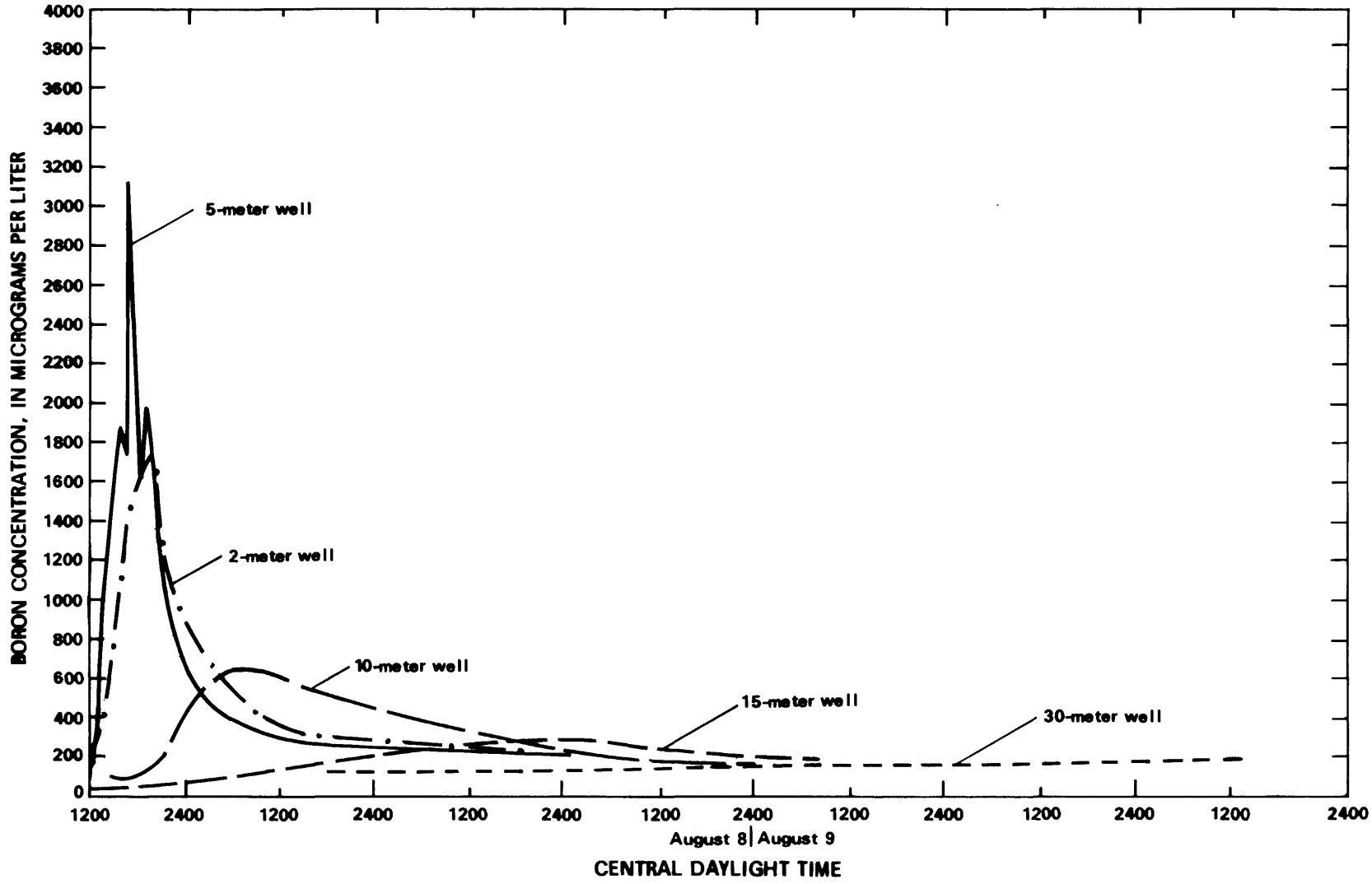

Figure 27.--Boron data obtained from the 2-, 5-, 10-, 15-, and 30-meter wells during the first experiment of the August 1978 test. (Data are from tables 47-60.)

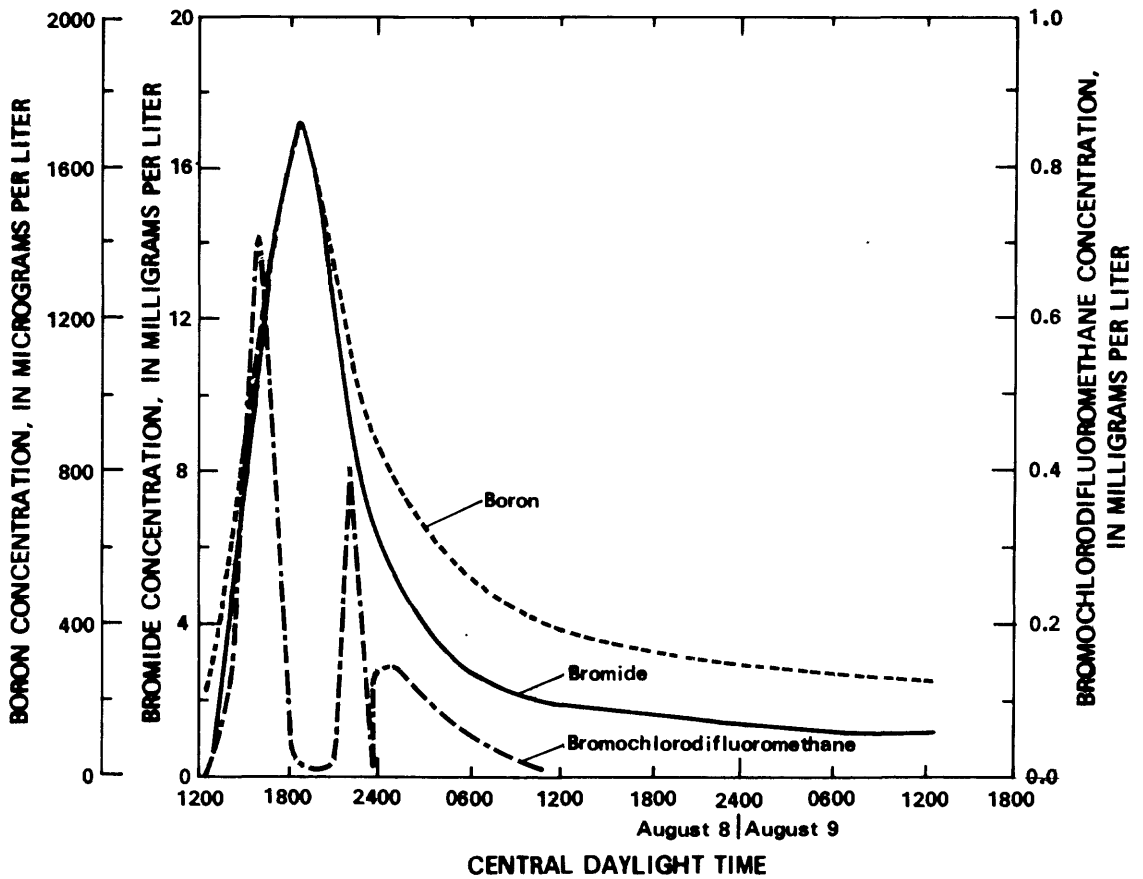

Figure 28.--Comparison of boron, bromide, and bromochlorodifluoromethane data obtained from the 2-meter well during the first experiment of the August 1978 test. (Data are from table 47.)

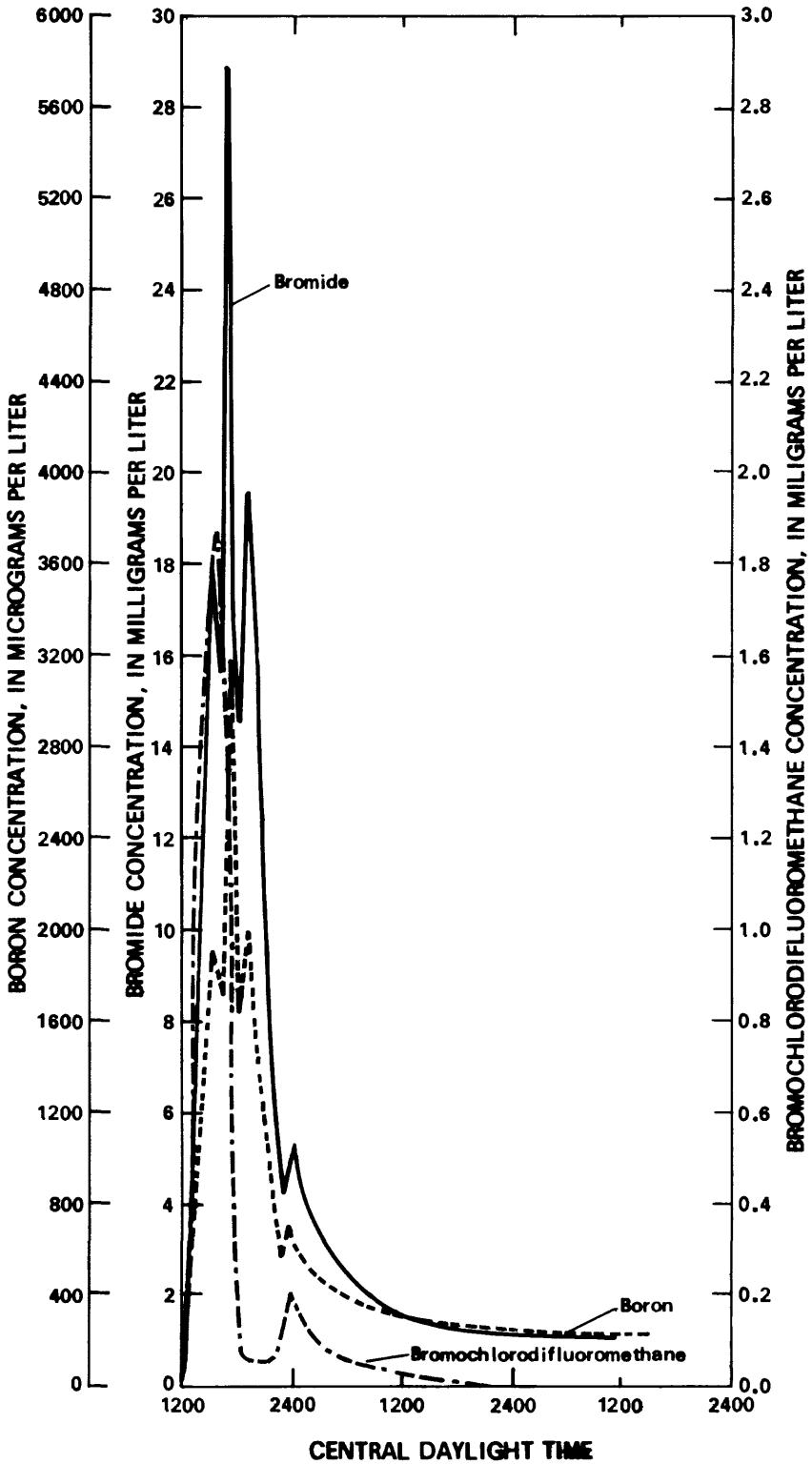

Figure 29.--Comparison of boron, bromide, and bromochlorodifluoromethane data obtained from the 5-meter well during the first experiment of the August 1978 test. (Data are from table 51.)

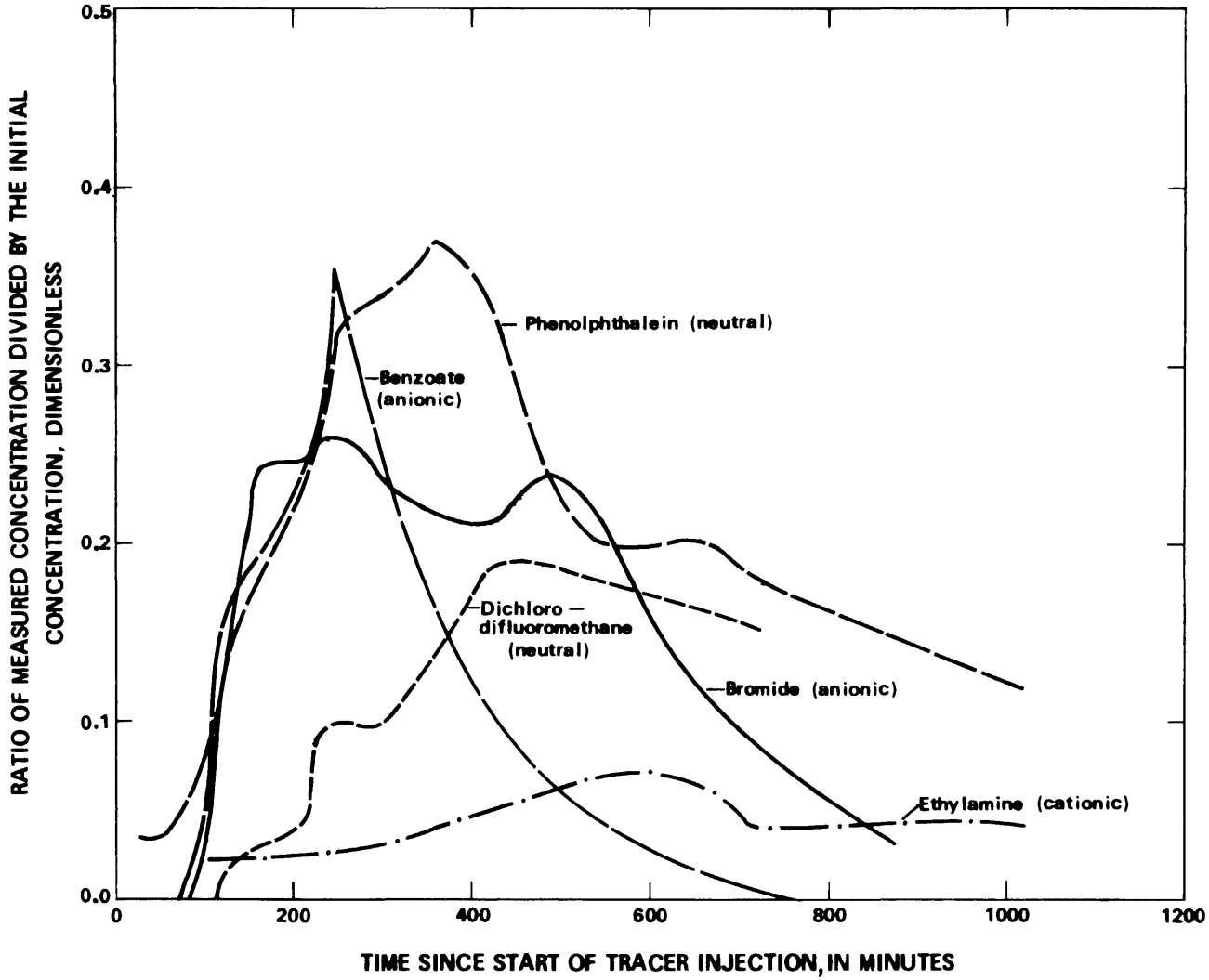

Figure 30.--Comparison of tracer data obtained from the 2-meter well during the second experiment of the August 1978 test. Curves show the relative migration rates of three types of solutes: Anionic, neutral, and cationic. Bromide, benzoate, phenolphthalein, and dichlorodifluoromethane were injected simultaneously on August 10, and ethylamine was injected under the same conditions on August 12. Concentrations of each tracer have been divided by the input concentration, Co.
(Data are from tables 47, 61, and 67.)

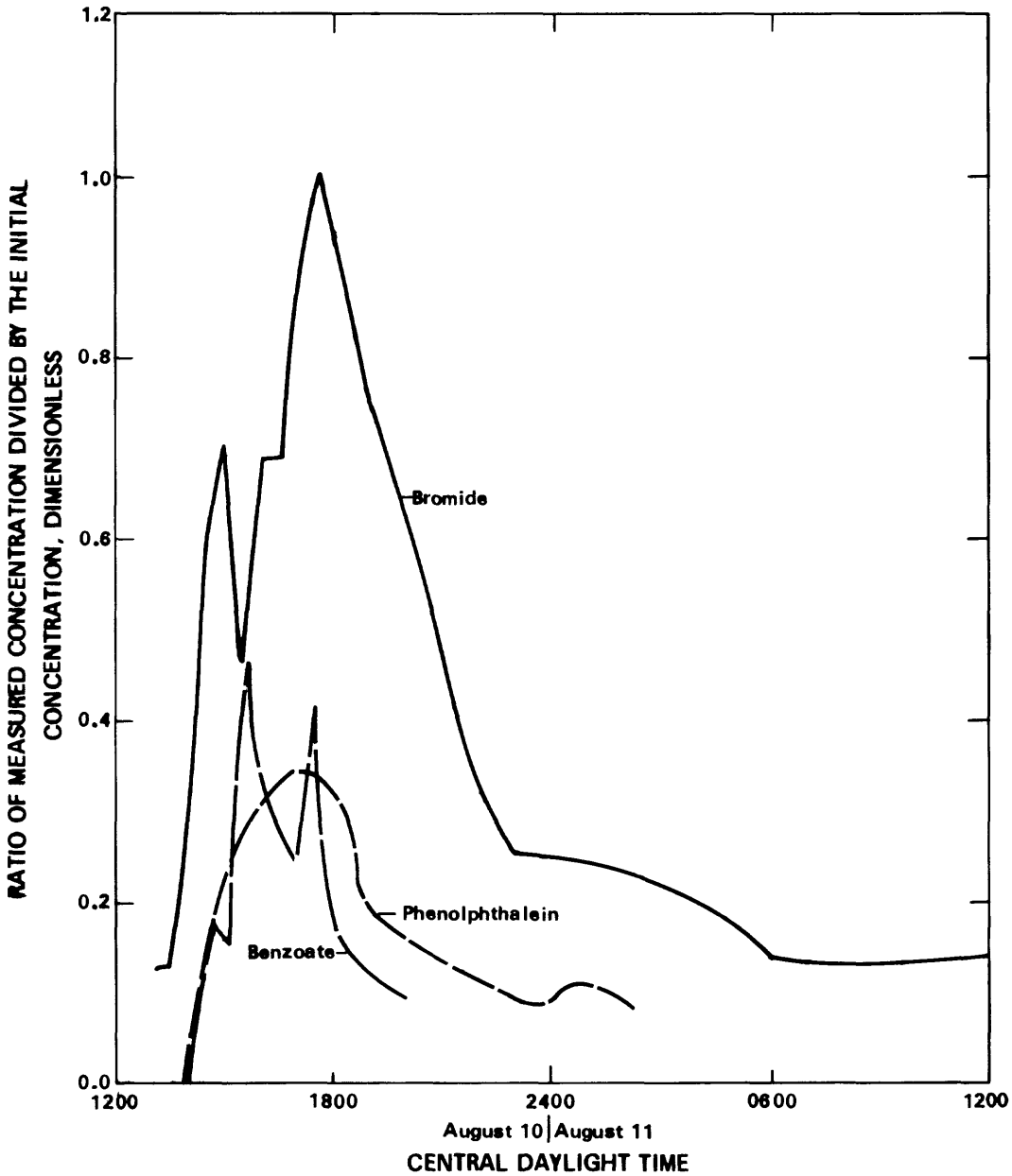

Figure 31.--Comparison of bromide, benzoate, and phenolphthalein data obtained from the 2-meter orange point sampler during the second experiment of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co. (Data are from table 63.)

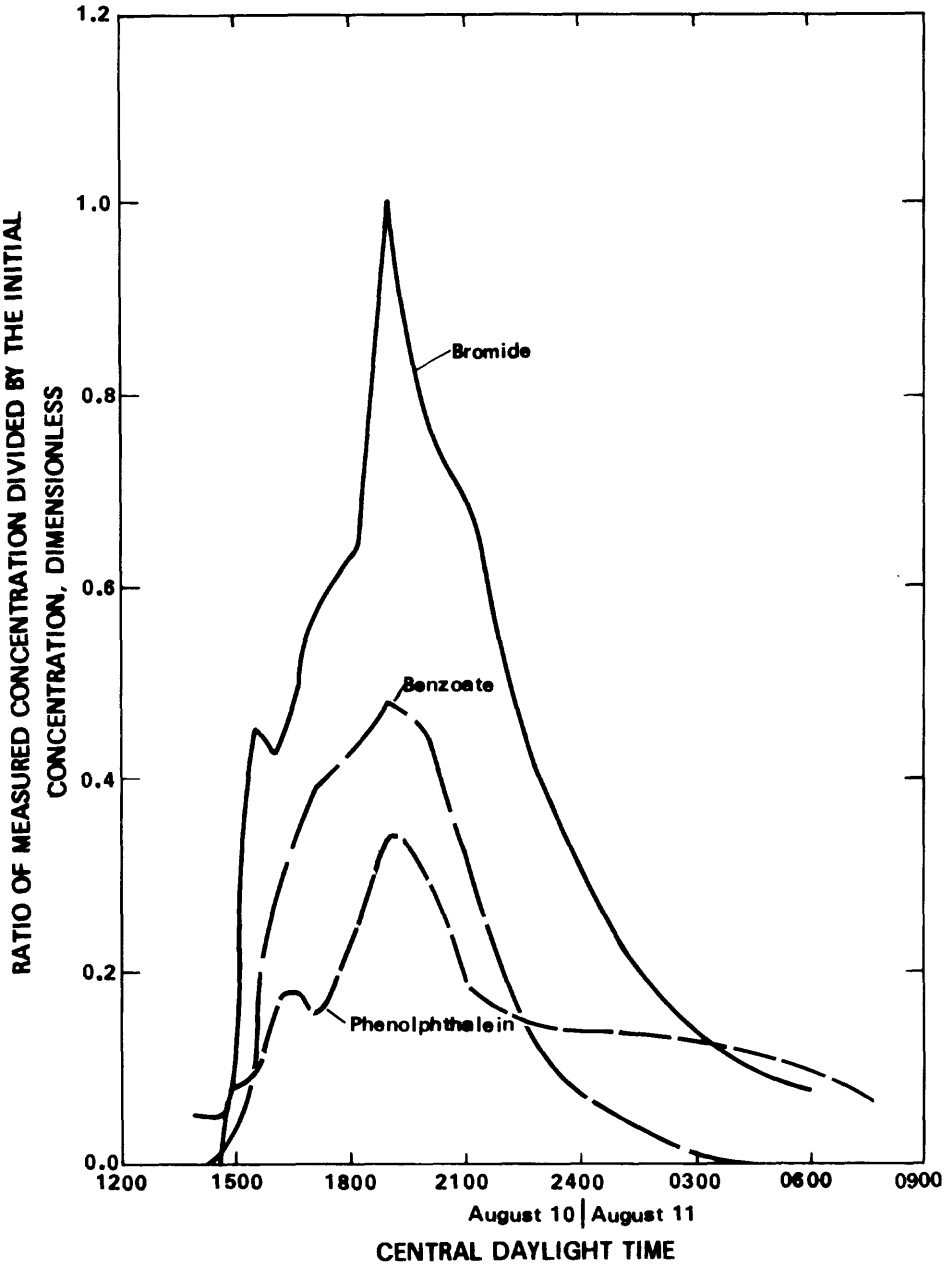

Figure 32.--Comparison of tracer data from the 5-meter orange point sampler during the second experiment of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co. (Data are from table 65.)

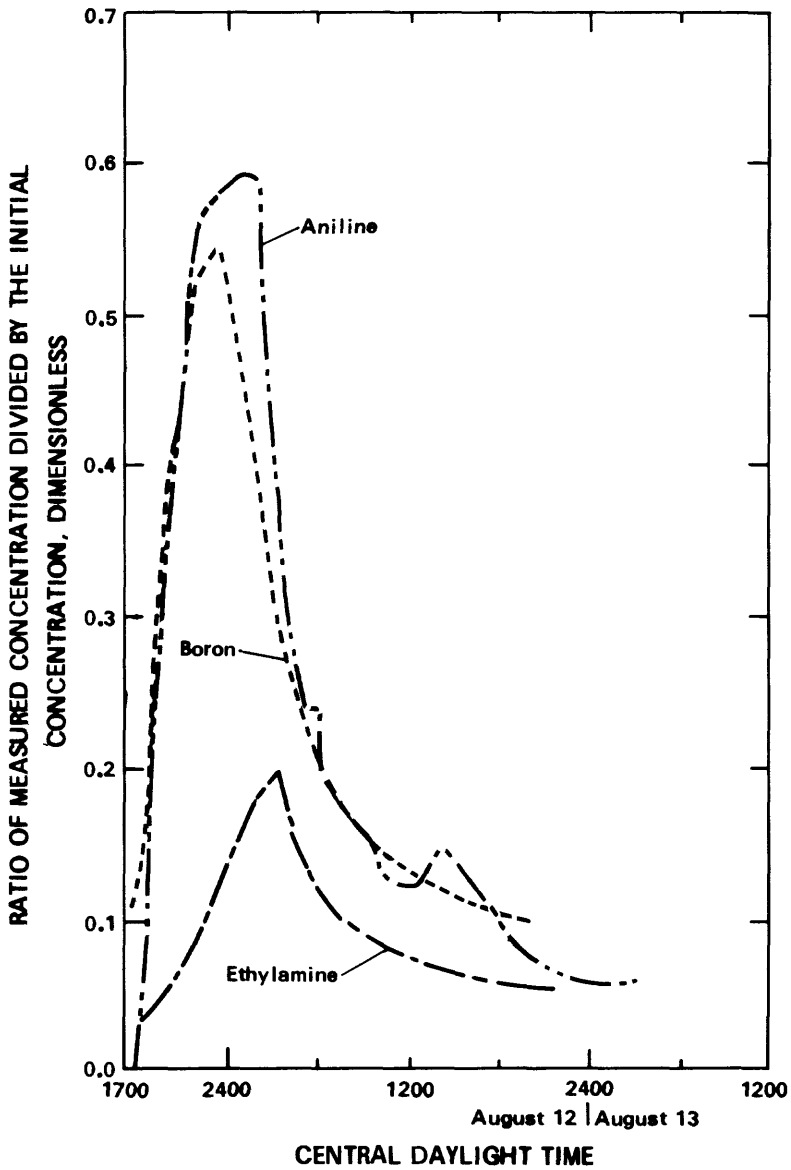

Figure 33.--Comparison of tracer data from the 2-meter orange point sampler during the third experiment of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co. (Data are from table 69.)

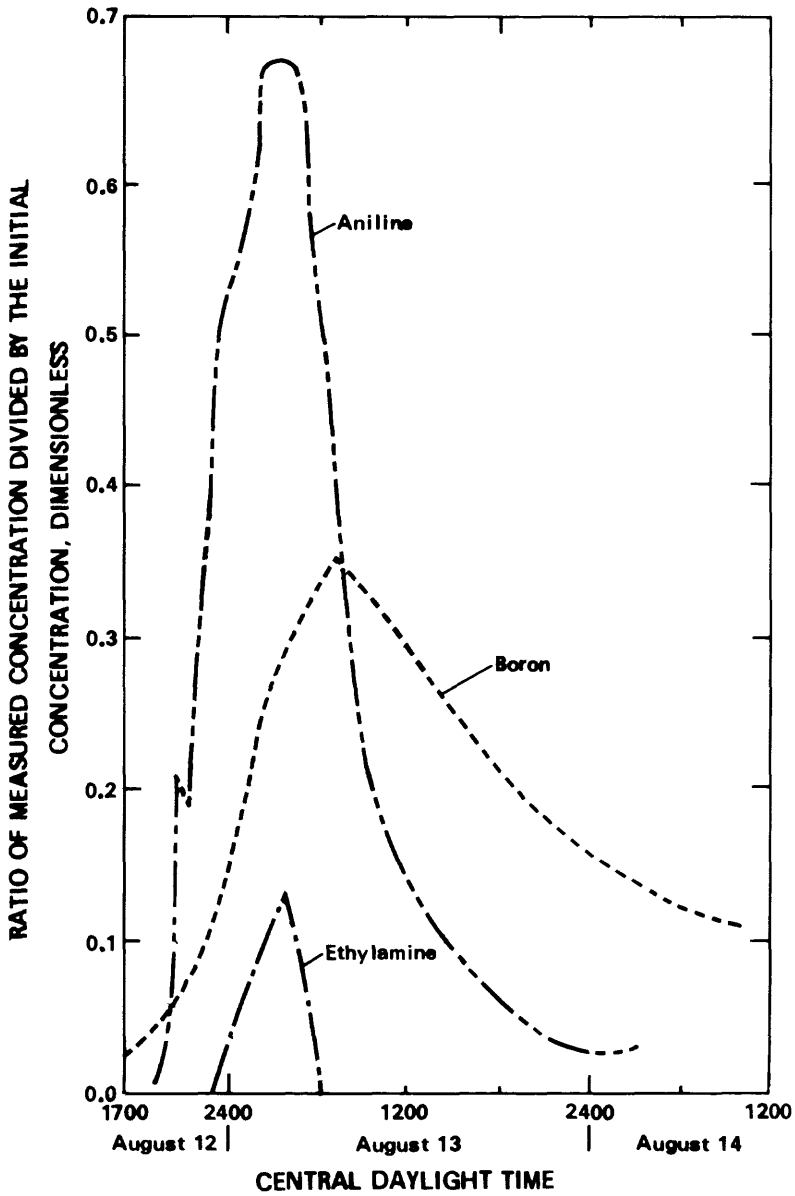

Figure 34.--Comparison of tracer data from the 5-meter orange point sampler during the third experiment of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co. (Data are from table 72.)

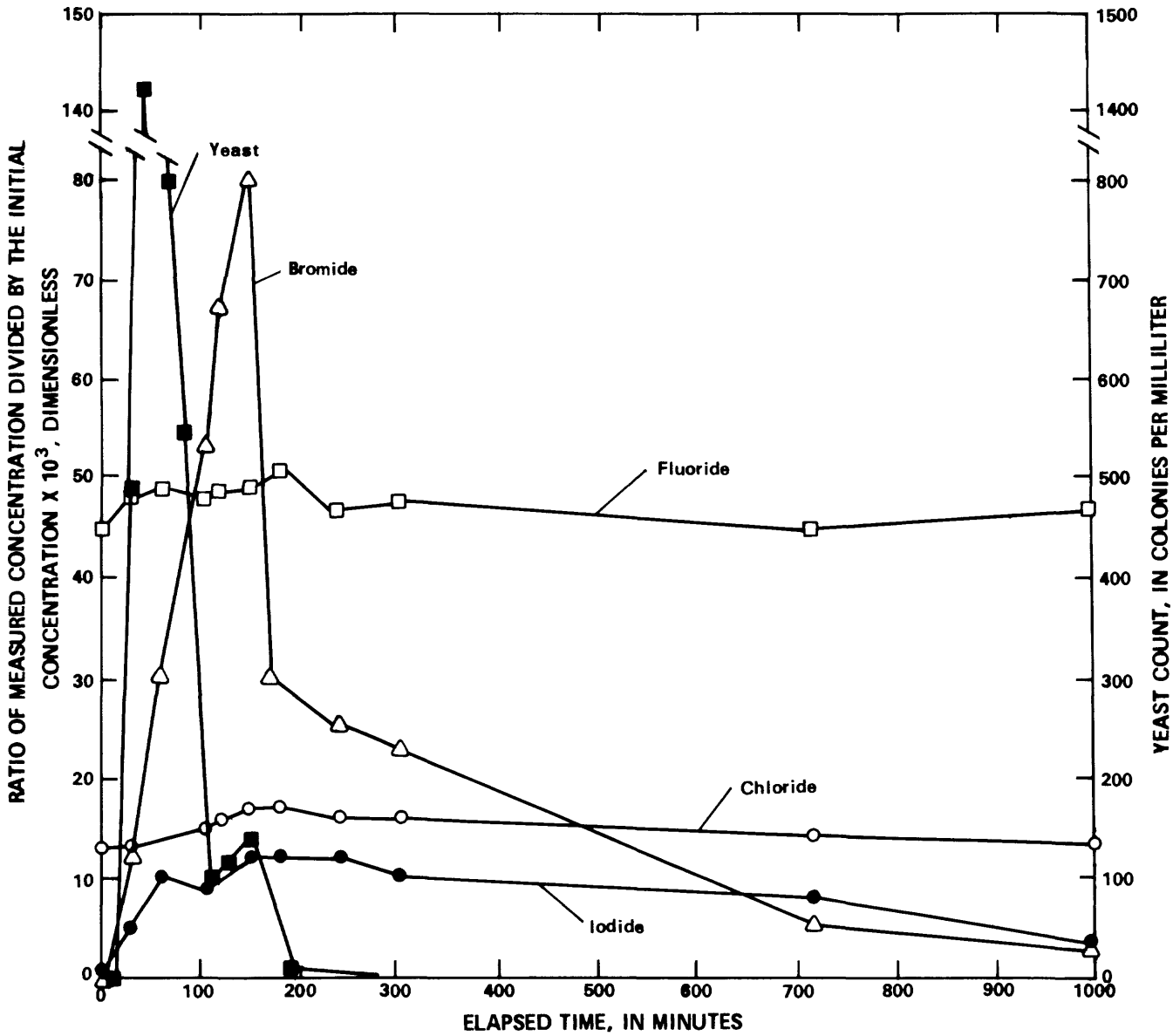

Figure 35.--Comparison of halide tracer data with yeast from the 2-meter well during the fourth experiment (pulse injection) of the August 1978 test. Concentrations of each halide tracer have been divided by the input concentration, Co. (Data are from table 75.)

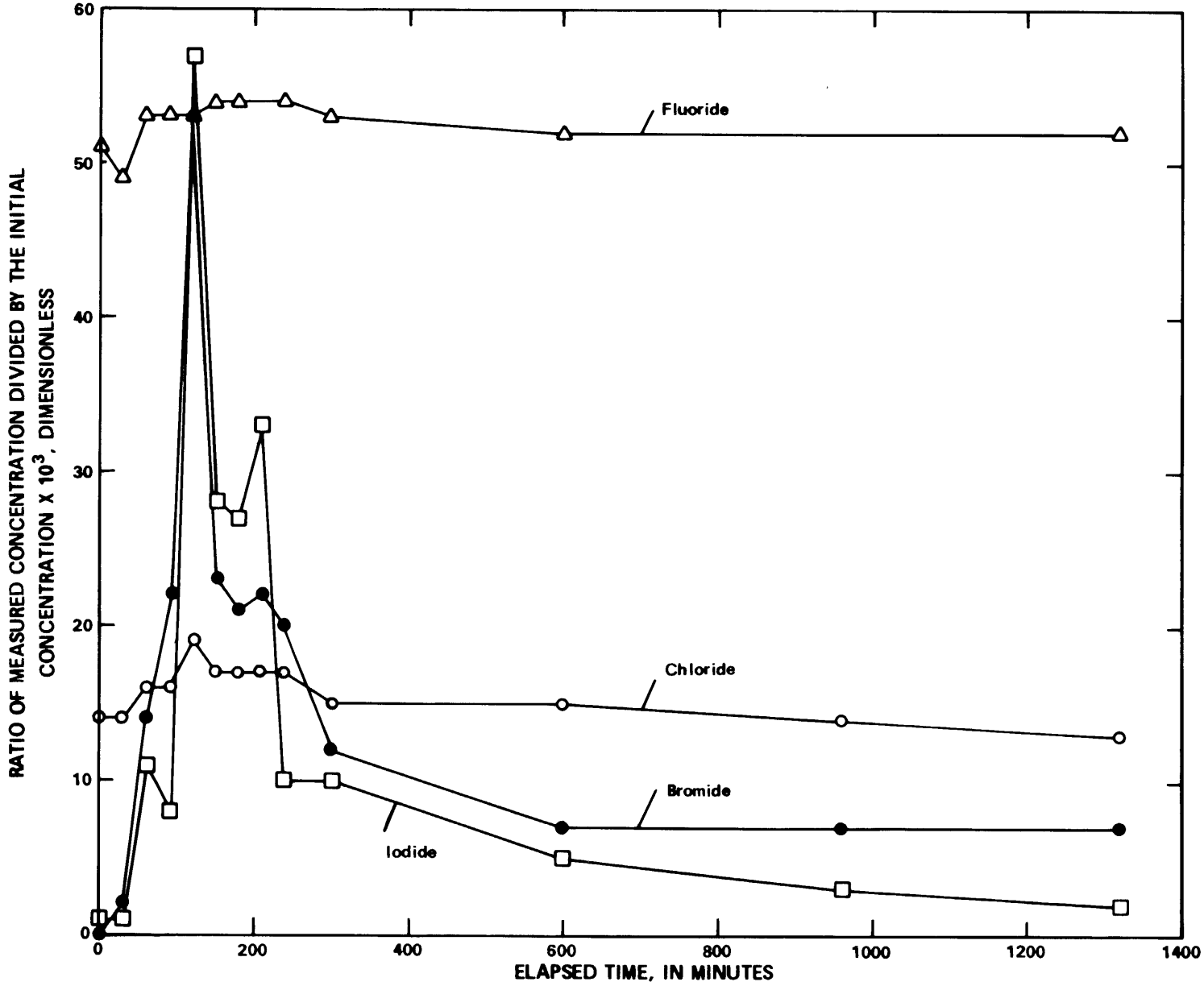

Figure 36.--Comparison of halide tracer data obtained from the 5-meter well during the fourth experiment (pulse injection) of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co. (Data are from table 79.)

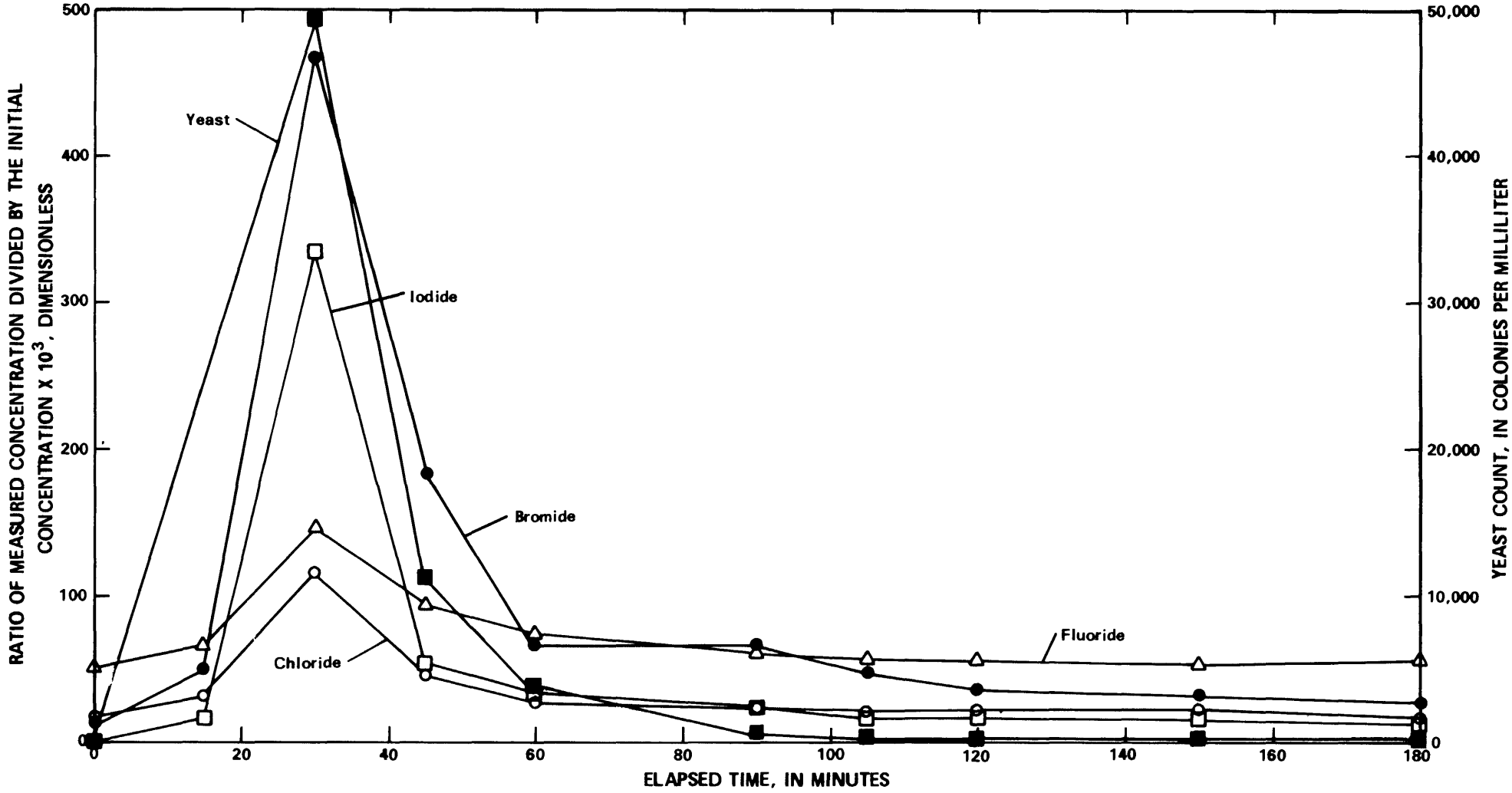

Figure 37.--Comparison of halide and yeast tracer data from the 5-meter red piezometer during the fourth experiment (pulse injection) of the August 1978 test. Concentrations of each halide tracer have been divided by the input concentration, Co. (Data are from table 80.)

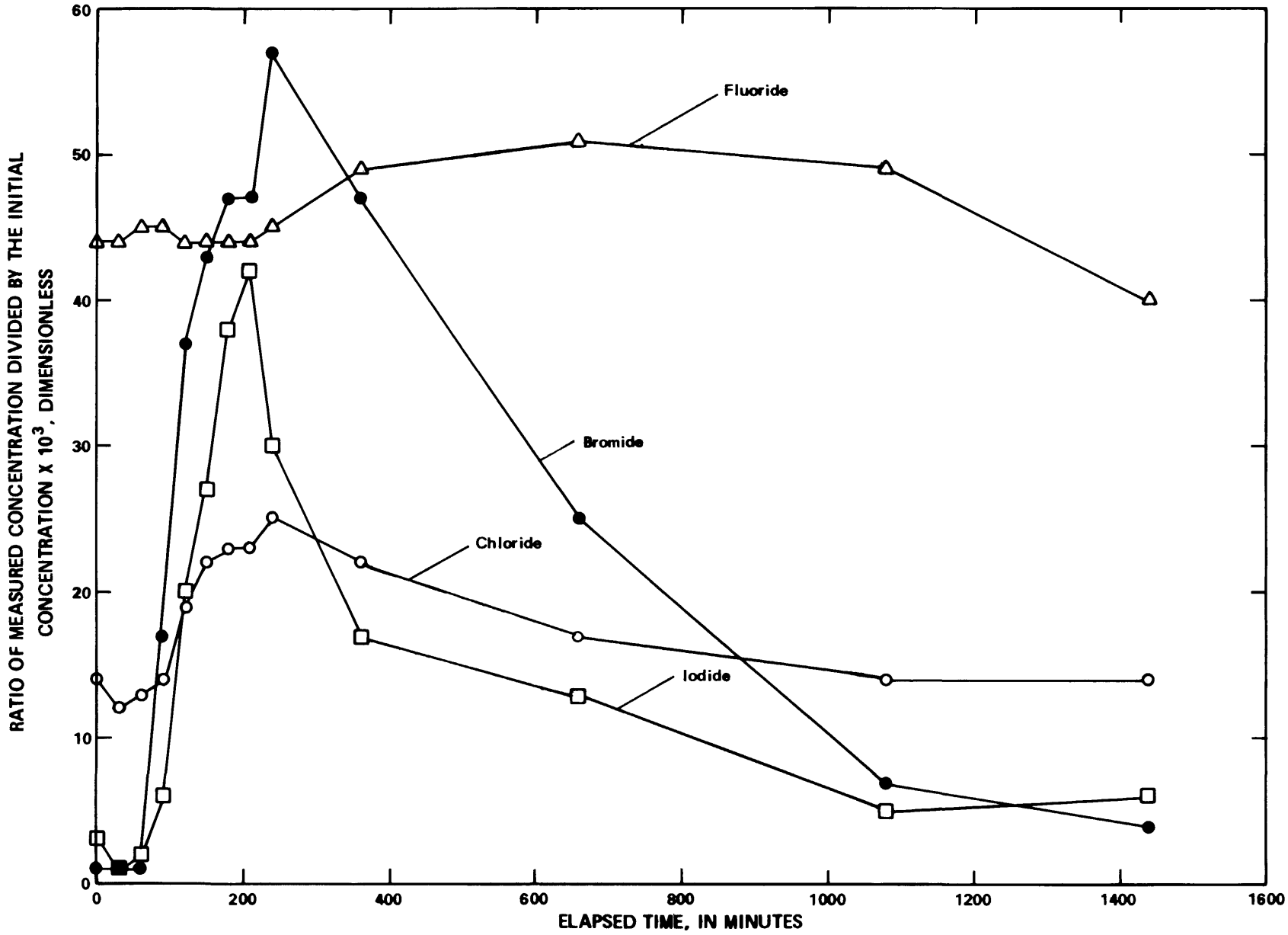

Figure 38.--Comparison of halide tracer data obtained from the 5-meter orange point sampler during the fourth experiment (pulse injection) of the August 1978 test. Concentrations of each tracer have been divided by the input concentration, Co.
(Data are from table 81.)

Table 83.--*Injection rates and cumulative volumes for the December 1978 two-well tracer test*

Date	Time	Flow rate (L/s)	Time increment (min)	Cumulative time from start of tracer injection (min)	Incremental recharge volume (L)	Cumulative recharge volume (L)	Remarks
12-07-78	1330	4.1	0	-6,930	0	0	Pump on.
12-11-78	1115	3.5	5,625	-1,305	1,277,400	1,277,400	Flow adjusted.
12-12-78	0900	3.8	1,305	0	301,100	1,578,500	Tracer started.
12-13-79	0830	3.76	1,410	1,410	324,500	1,903,000	
12-14-79	0900	3.68	1,470	2,880	324,800	2,227,800	Flow decreased.
12-15-79	0900	3.05	1,440	4,320	257,000	2,484,800	Test ended.

picked up entrained air downstream from the valve, which then plugged the near-well-bore materials in the injection well. An attempt was made to alleviate this problem by switching back-pressure control from one valve to another, to little or no avail.

Two tracers were used for the test, sodium benzoate and boric acid, added at concentrations of 10.0 mg/L dissolved carbon and 20 mg/L as boron, respectively. Samples were collected hourly from the injection line upstream from the point at which tracer was introduced, using an automatic sampler. The samples were collected in bottles packed in ice to retard biodegradation of the benzoate, and were re-packed in ice prior to shipment to the laboratory. Measured concentrations of benzoate as dissolved carbon in the injection stream, and in the water pumped from well 1, are listed in table 84. Unfortunately, the samples were inadvertently discarded before the boric-acid analyses could be made.

All samples collected after 1600 on December 13, 1978, showed no dissolved carbon. These samples were sent to the laboratory in a second shipment that was delayed in transit. The ice in which they were packed melted, and the samples became warm. Hence, any benzoate present may have biodegraded.

Table 84.--*Chemical data from the two-well tracer test conducted during December 1978 at the Stanton, Tex. site*

[* Indicates sample not analyzed]

Date	Time	Time since start of injection (min)	Benzoate as C (mg/L)	
			Injection sample	Withdrawal sample
12-12-78	1000	60	9.8	0
Do.	1100	120	*	0
Do.	1200	180	*	0
Do.	1300	240	*	0
Do.	1400	300	9.9	0
Do.	1500	360	*	.09
Do.	1600	420	10.0	.13
Do.	1700	480	10.0	.17
Do.	1800	540	8.8	.34
Do.	1900	600	8.7	.51
Do.	2000	660	10.0	.8
Do.	2100	720	10.2	*
Do.	2155	775	----	1.0
Do.	2250	830	----	1.0
Do.	2345	885	----	1.20
12-13-78	0040	940	----	1.11
Do.	0135	995	----	1.36
Do.	0230	1,050	----	1.28
Do.	0325	1,105	----	.77
Do.	0420	1,160	----	1.2
Do.	0610	1,270	----	.77
Do.	0700	1,320	----	.85
Do.	0800	1,380	----	.00
Do.	0900	1,440	----	.17

Table 84.--*Chemical data from the two-well tracer test conducted during December 1978 at the Stanton, Tex. site*--Continued

Date	Time	Time since start of injection (min)	Benzoate as C (mg/L)	
			Injection sample	Withdrawal sample
12-13-78	1000	1,500	----	0.43
Do.	1100	1,560	----	.34
Do.	1200	1,620	----	.26
Do.	1300	1,680	----	.17
Do.	1600	1,860	----	.09

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