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RCRA Assessment Report: Total Organic Halogen Assessment at the 1324-N/NA Site

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
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Westinghouse
Hanford Company Richland, Washington

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7. Abstract

Total organic halogen (TOX) has been elevated in 2 groundwater monitoring wells downgradient of the 1324-N/NA site. This document presents the results of the first phase of a RCRA assessment program to investigate the elevated TOX. The TOX is due, at least in part, to chloroform. The source of the chloroform is not believed to be the 1324-N/NA site, and may be chlorinated water from a nearby paint shop. The assessment program will continue according to recommendations in this document.

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TERMS

EOX	extractable organic halogens
EP	Extraction Procedure
MSDS	material safety data sheets
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
TOC	total organic carbon
TOX	total organic halogens

RCRA ASSESSMENT REPORT: TOTAL ORGANIC HALOGEN AT THE 1324-N/NA SITE

1.0 INTRODUCTION

1.1 GROUNDWATER MONITORING AT THE 1324-N/NA SITE

The 1324-N Surface Impoundment and 1324-NA Percolation Pond are *Resource Conservation and Recovery Act of 1976* (RCRA) treatment and disposal units in the 100-N Area of the Hanford Site (Figures 1 and 2). Groundwater has been monitored for these two units in a combined program since December 1987. The original monitoring network comprised five wells. Upgradient well 699-81-58 was southeast of the 100-N Area, beyond the influence of a groundwater mound created by effluent disposal to the 1324-N/NA unit. The downgradient wells, N-58[1], N-59, N-60, and N-61, were located immediately adjacent to the unit. All but one of these downgradient wells (N-59) went dry after effluent discharge to the facilities ceased in 1990 and the mound dissipated. A new upgradient well (N-71) was installed closer to the unit, and new downgradient wells (N-72, N-73, and N-77) were installed adjacent to the unit in 1991 and 1992 (see Figure 2).

Effluent to the 1324-N/NA site contained high concentrations of sulfate and sodium. These constituents, along with other metals and anions, caused specific conductance to be elevated in downgradient wells. The source of these constituents was effluent discharged to the 1324-NA Percolation Pond. In May 1989, the site entered assessment monitoring (Gilmore 1989). Results of the initial assessment program indicated that the constituents causing the elevated specific conductance are not dangerous waste constituents (Hartman 1992a).

The assessment program was revised in 1993 to investigate the cause of elevated total organic halogen (TOX) in some of the downgradient wells (Hartman 1993a). This document presents the results of the first phase of the revised assessment program.

The 1324-N/NA site is within the 100-NR-1 source operable unit and the 100-NR-2 groundwater operable unit. These are RCRA past-practice units under the regulatory authority of the Washington State Department of Ecology.

1.2 REVISED ASSESSMENT PROGRAM

The first phase of a monitoring program to assess elevated TOX is described in Hartman (1993a). The program consists of quarterly sampling for the constituents listed in Table 1. Quality control samples (duplicates, full trip blank, field transfer blank) were also collected and analyzed. Water levels were measured monthly in the 1324-N/NA wells and in most of the other wells in the 100-N Area.

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[1]Well numbers in the 100-N Area are abbreviated in this document by deleting the "199-" prefix. e.g., 199-N-59 is written N-59.

1.3 HYDROGEOLOGY

The hydrogeology of the 100-N Area is described in Hartman and Lindsey (1993). The 1324-N/NA monitoring network monitors the uppermost aquifer, an unconsolidated sand and gravel unit approximately 23 m (75 ft) deep and 6.7 m (22 ft) thick directly beneath the 1324-N/NA site.

Figure 3 is a water table map constructed from the average of monthly measurements from October 1993 through September 1994. Based on the water table, groundwater flow is interpreted to be toward the northwest beneath the 1324-N/NA Site. Flow rate, estimated from the movement of a sulfate plume, is 0.5 m/d (2 ft/d) (Hartman 1994a).

The upgradient well (N-71) and three downgradient wells (N-59, N-72, and N-73) monitor the top of the aquifer. One well (N-77) monitors the base of the aquifer. Well locations are shown in Figure 2. Figure 4 is a schematic cross section of the aquifer and monitoring system. As-built drawings of the wells are presented in Appendix A.

2.0 INTERPRETATION OF ASSESSMENT DATA

Data collected during the period of assessment monitoring (August 1993 through December 1994) were presented in quarterly reports (Hartman 1994b, c, d, e, f, 1995). A subset of these data (organic constituents) is presented in Appendix B.

2.1 ORGANIC CONSTITUENTS

2.1.1 Organic Constituents Present in Groundwater

Chloroform was the only organic constituent detected in 1324-N/NA groundwater samples consistently and in significant concentrations. Volatile organic analyses by gas chromatography did not identify any other organic constituents (see Appendix B).

Figures 5 and 6 illustrate TOX and chloroform concentrations in 1324-N/NA wells. TOX data for 1992 and most of 1994 are considered suspect because of an unsatisfactory audit of the analytical laboratory (DOE 1994a). The suspect data include the highest TOX values observed. An alternative laboratory was used for TOX analyses beginning with the November 1993 sampling. Wells N-72 and N-77 exhibit the highest concentrations of TOX (up to 76 ppb for unflagged data) and chloroform (up to 94 ppb).

TOX was slightly elevated in the 1324-N/NA monitoring wells that are now dry (N-58, N-60, and N-61) and in well N-59 (Figure 7). All of these wells were "downgradient" when 1324-N/NA was active because the percolation pond created a groundwater mound. Well N-61 showed the highest concentrations of TOX, with a replicate average up to 37 ppb. Chloroform was measured in well N-61 from 5 to 15 ppb.

If chloroform were the only halogenated organic compound present, and assuming perfect recovery, TOX values would be approximately 89 percent of the concentration of chloroform. For example, 70 ppb chloroform would give a TOX

value of 62 ppb. This relationship is not as clear at low concentrations because of analytical scatter. At wells N-72 and N-77, which had the highest levels of chloroform and TOX, TOX concentrations were usually greater than or equal to chloroform concentrations (Table 2). This indicates that another halogenated organic compound may be present in the groundwater. However, as mentioned earlier, no other volatile organic constituents were detected in significant quantities by gas chromatography. Samples from wells N-71, N-72, and N-73 were analyzed for semivolatile compounds, phenols, pesticides, and herbicides in 1992, with no significant detections.

2.1.2 Possible Sources of Organic Contaminants

Possible sources of elevated TOX and chloroform in wells N-72 and N-77 include the following:

- Chlorinated water discharged to the percolation pond
- Water from a nearby paint shop that is contaminated with chlorinated hydrocarbons from paints and thinners
- Water from the paint shop that is chlorinated to control algal growth.

The third of these possibilities is the most likely for the following reasons.

2.1.2.1 1324-NA Percolation Pond. Records indicate that no organic waste was disposed of in the 1324-N Surface Impoundment, the 1324-NA Percolation Pond, or the settling ponds that formerly occupied the site. However, chloroform can be produced when water is chlorinated, as chlorine reacts with organic material. Sittig (1985) notes that in a survey of 80 American cities, every water system contained chloroform in concentrations ranging from <0.3 ppb to 311 ppb. Waste water from the 163-N demineralizer, which was discharged to the percolation pond, was analyzed in 1988 and contained from 7 to 21 ppb chloroform and 32 to 104 ppb TOX (WHC 1989). Additional constituents may have contributed to the TOX, but they were not identified.

The highest TOX concentrations in 1324-N/NA groundwater were measured in 1992-93. Although these data are flagged as suspect, they show a general trend that appears consistent with chloroform data and subsequent TOX data. In late 1993 and 1994, TOX has decreased. These changing patterns do not coincide with changes in the use of the percolation pond. If the pond were the source, we would expect to see the highest levels of TOX during its use (i.e., before 1990). The downgradient wells in use at that time (N-58 through N-61) showed relatively moderate levels of TOX and chloroform levels from less than detection to 15 ppb.

2.1.2.2 1143-N Paint Shop. No organic waste has been disposed of in the backwash lake, which is upgradient of the 1324-N/NA site. The only other potential waste sites nearby are septic tanks from office buildings and a paint shop (DOE 1994b). Figures 1 and 2 show the location of these facilities.

The 1143-N paint shop, built in 1985, is not on a sewer line. A sink, a fire system relief valve, and an eye wash station drain into a French drain

adjacent to the building. The sink is used for washing hands, brushes, etc. when latex paints are used. Wastes from oil-based paints are stored in barrels and are disposed of elsewhere as dangerous waste.

The shop is equipped with a spray booth that employs a water "curtain" to filter paint fumes. The booth has not been used in approximately 2 years. The water [approximately 2,700 L (715 gal)] was changed three times a year when the booth was in use. The waste water was stored in barrels while samples were analyzed for dangerous constituents. The water was always certified non-regulated based on analysis results, and was then disposed of down the French drain. Analyses included those for metals, anions, Extraction Procedure (EP) toxicity, and pH. Analyses for total organic carbon (TOC), TOX, and other organic constituents were not performed.

Sludge and other immiscible portions of the spray booth waste were analyzed for selected metals, polychlorinated biphenyls, EP-toxicity, ignitability, and extractable organic halogens (EOX). One EOX result from 1990 was 731 μg/g (ppb). Although the sludge was not disposed of in the French drain, the presence of organic halides in the sludge indicates that they also were present in the water.

Some of the paints, paint removers, and thinners used in the shop contained chlorinated hydrocarbons, according to material safety data sheets (MSDS) on file in the shop. Because the MSDSs often are not specific (listing "chlorinated hydrocarbon" rather than a specific chemical, for example), whether any of these could degrade to chloroform in groundwater is unclear. It would seem likely that some of the original chemical would also be present, rather than just the degradation product. As noted, no other organic constituents were identified in 1324-N/NA groundwater.

Water from the paint spray booth was treated with sodium hypochlorite to curb algae growth. A painter employed in the shop described the water as being "scummy" with a swampy odor. With abundant organic material, significant quantities of chloroform could have been produced, accounting for the elevated EOX in at least one sludge sample, and the elevated TOX in groundwater.

TOX and chloroform concentrations in wells N-72 and N-77 have decreased in the last 1 to 2 years. This coincides with the cessation of use of the paint spray booth and disposal of spray booth water down the French drain.

2.2 INORGANIC CONSTITUENTS

Groundwater from 1324-N/NA wells contains relatively high concentrations of sulfate and sodium (Figures 8 and 9). These constituents contribute to elevated specific conductance. The highest levels of these contaminants were observed before 1990, when the percolation pond was in operation. Concentrations have been higher in well N-59 than in the other downgradient wells until recently. In 1993, sulfate, sodium, and specific conductance increased sharply in well N-73. In late 1994, an increasing trend appeared to be beginning in wells N-72 and N-77 also.

The precise patterns of groundwater flow beneath the 1324-N/NA site cannot be determined, but it is clear that groundwater is not well mixed.

When the 1324-NA Percolation Pond was in use, it contaminated the aquifer with sulfate, sodium, and other inorganic constituents in all directions. This contaminant plume is now moving downgradient (toward the river), but the shape of the plume and relative concentrations of contaminants are irregular and not well defined. There appear to be "pockets" or "lenses" of relatively more- and less-contaminated water from the pond effluent remaining in the aquifer and moving with time under natural processes of flow and dispersion.

Another possible reason for increases in inorganic constituents is the presence of a new source. Potentially active waste sources near and upgradient of 1324-N/NA include septic tanks, the paint shop, and the "backwash lake," as discussed earlier. However, none of these sources would be expected to cause chemical changes like those noted recently in 1324-N/NA groundwater, based on effluent chemistry and patterns of use.

The cause of the spatial variations in groundwater chemistry is unclear. Wells N-59, N-72, and N-73 are all completed at the top of the aquifer. The geology, as noted in logs and grain-size distribution curves, is similar (Table 3). Data on aquifer properties are limited, but these data do indicate that the aquifer is slightly less transmissive at well N-73 than at N-72 or N-77.

2.3 GROUNDWATER FLOW

Water levels were measured monthly in most of the 100-N Area monitoring wells during the period of assessment. The water table indicates that water flows toward the northwest beneath the 1324-N/NA site (see Figure 3). The shape and position of the high-conductivity plume map indicates flow toward the north and northwest (Figure 10).

Local anomalies in flow direction may exist beneath the 1324-N/NA site. The water level in well N-72 have been consistently about 0.3 m (1 ft) higher than in well N-73 (Figure 11). Recently, however, this difference has decreased. Slight differences in geology and hydraulic properties were noted during drilling, as summarized in Table 3.

The rate of groundwater flow beneath the 1324-N/NA site in 1994 was estimated based on a form of the Darcy equation (Hartman 1995). The estimate ranged from 0.14 to 2.6 m/d (0.5 to 9 ft/d), representing the maximum rate at which 1324-N/NA contaminants could move. The rate of contaminant transport was estimated based on movement of the sulfate plume between 1990 and 1993, yielding an estimate of 0.46 m/d (1.5 ft/d) (Hartman 1994a). Because the gradient has not changed significantly since this estimate was made, current transport rates are probably similar. Enough information is not available to estimate the rate of chloroform migration.

2.4 QUALITY CONTROL

The 1324-N/NA assessment data are subject to the same quality assurance/quality control program as other RCRA groundwater data at the Hanford Site (WHC 1993). In addition, the assessment plan proposed some special quality control (QC) samples (see data in Appendix B).

An audit of the analytical laboratory identified problems with the TOX analyses (DOE 1994a). A new laboratory subsequently was used for TOX analyses and the earlier data are flagged as suspect. For the 1324-N/NA assessment, data collected in August 1993 are suspect and were not relied on in interpretations in this document. TOX data collected after that date are considered representative. As illustrated in Figure 5, the suspect TOX data represent the highest observed values of TOX. Chloroform concentrations were also higher during that time (see Figure 6), so the suspect TOX values may be accurate.

Field duplicate samples were collected from well N-72 in February and November 1994 and analyzed by the same laboratory. Results are flagged if the difference between duplicates is more than 25 percent.

A full trip blank accompanied 1324-N/NA samples in February 1994 and was analyzed for volatile organic constituents. This blank helps check for contamination in sample bottles and sample preparation. No organic contaminants were detected.

A field transfer blank was collected in February 1994. Clean water was transferred to a prepared bottle in the field and analyzed for volatile organic constituents. This blank helps check for contaminants introduced from the air at the sampling site. No organic contaminants were detected.

Cation-anion charge balances were performed on all data from the 1324-N/NA assessment. Results were all within ±5percent, which indicates the analyses were acceptable.

The assessment plan (Hartman 1993a) specified that field duplicates, full trip blanks, and field transfer blanks would be collected for four quarters. Not all of these samples were collected as planned. Duplicate samples were collected twice, and trip and transfer blanks were each collected once. In addition, two matrix spike samples were proposed in the assessment plan, but were not collected. The lack of the extra duplicate and blank samples is not detrimental to the program. A matrix spike, however, would be useful to determine if all the chloroform is being recovered, given the unique chemistry of groundwater at the site. Water from well N-72 will be spiked with chloroform in the laboratory and analyzed for volatile organics and TOX in Phase II of the assessment program.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Groundwater beneath the 1324-N/NA site is poorly mixed. Groundwater chemistry downgradient of the site is not consistent between wells. These inconsistencies may be caused by differences in hydrogeologic properties of the sediments.

Elevated TOX in wells N-72 and N-77 is caused, in part, by chloroform. Other constituents contributing to the TOX have not been identified. The source of the chloroform may never be proven, but one likely source is chlorinated water from a paint spray booth disposed of to a French drain in a nearby paint shop. This spray booth is no longer used, so water cannot be tested to confirm or refute this hypothesis.

Further investigation is recommended to attempt to identify additional organic halides in 1324-N/NA groundwater and to conduct QC sampling to check for chloroform recovery in groundwater samples from well N-72.

A modified assessment program is described in Appendix C. The modified program differs from Hartman (1993a) in its constituent lists and QC sampling. The modified program will begin in June 1995.

Groundwater and contaminants from the 1324-N/NA site have been estimated to move at approximately 0.5 m/d (2 ft/d).

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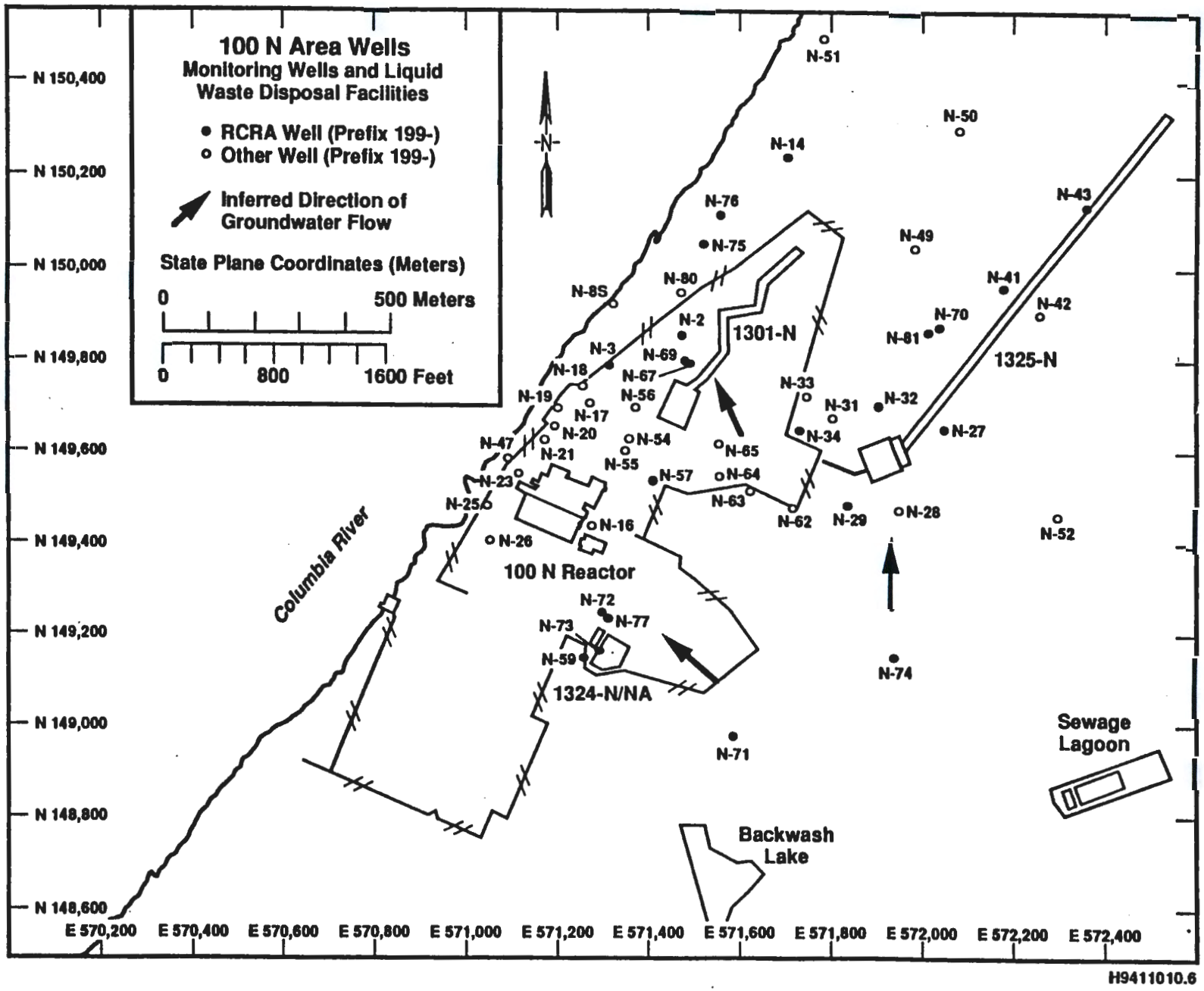


Figure 1. Locations of the 1324-N/NA Site and Groundwater Monitoring Wells.

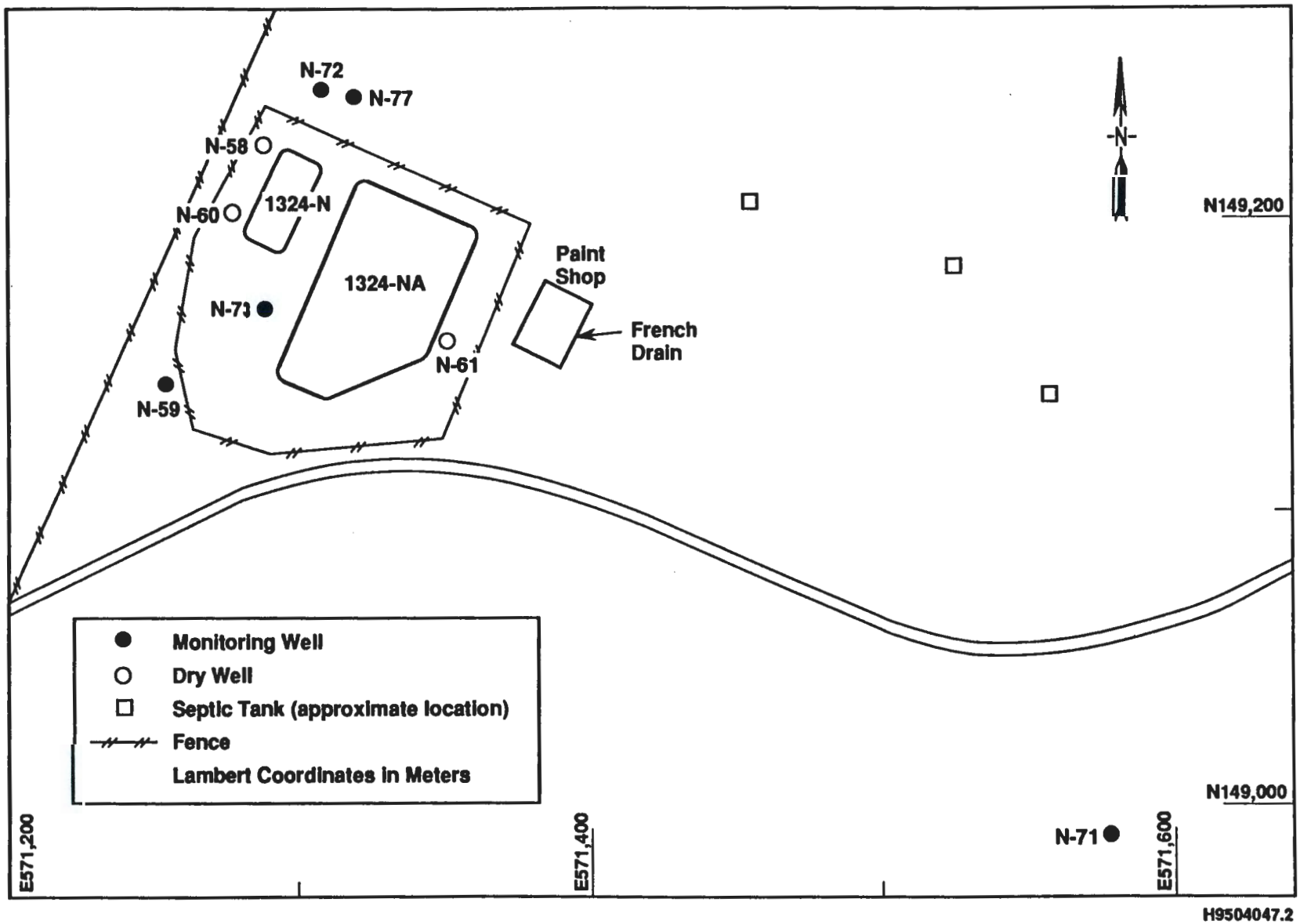


Figure 2. Locations of 1324-N/NA Monitoring Wells and Potential Waste Sources.

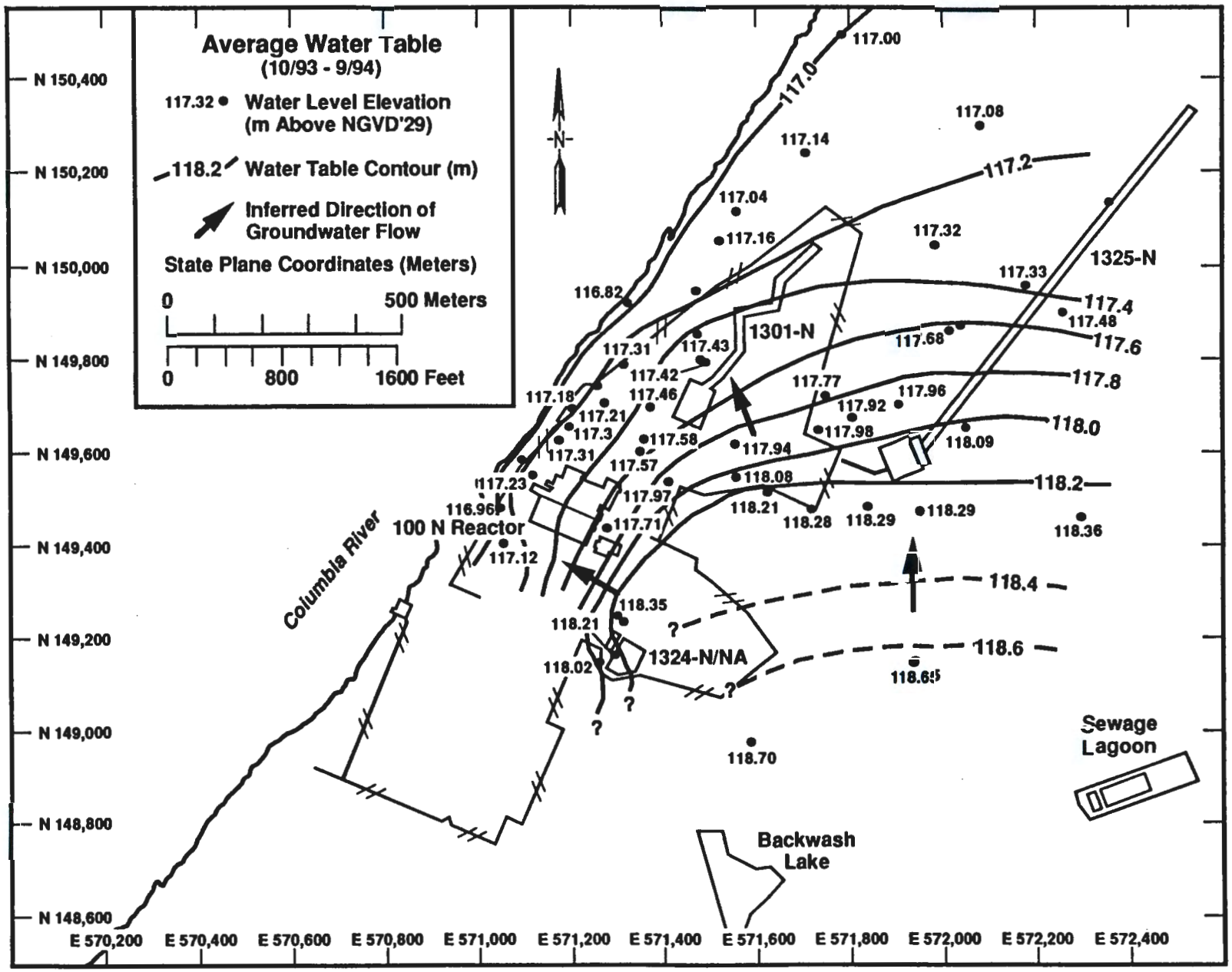


Figure 3. Average Water Table in the 100-N Area, October 1993 through September 1994.

Figure 4. Schematic Cross Section of Uppermost Aquifer Beneath 1324-N/NA.

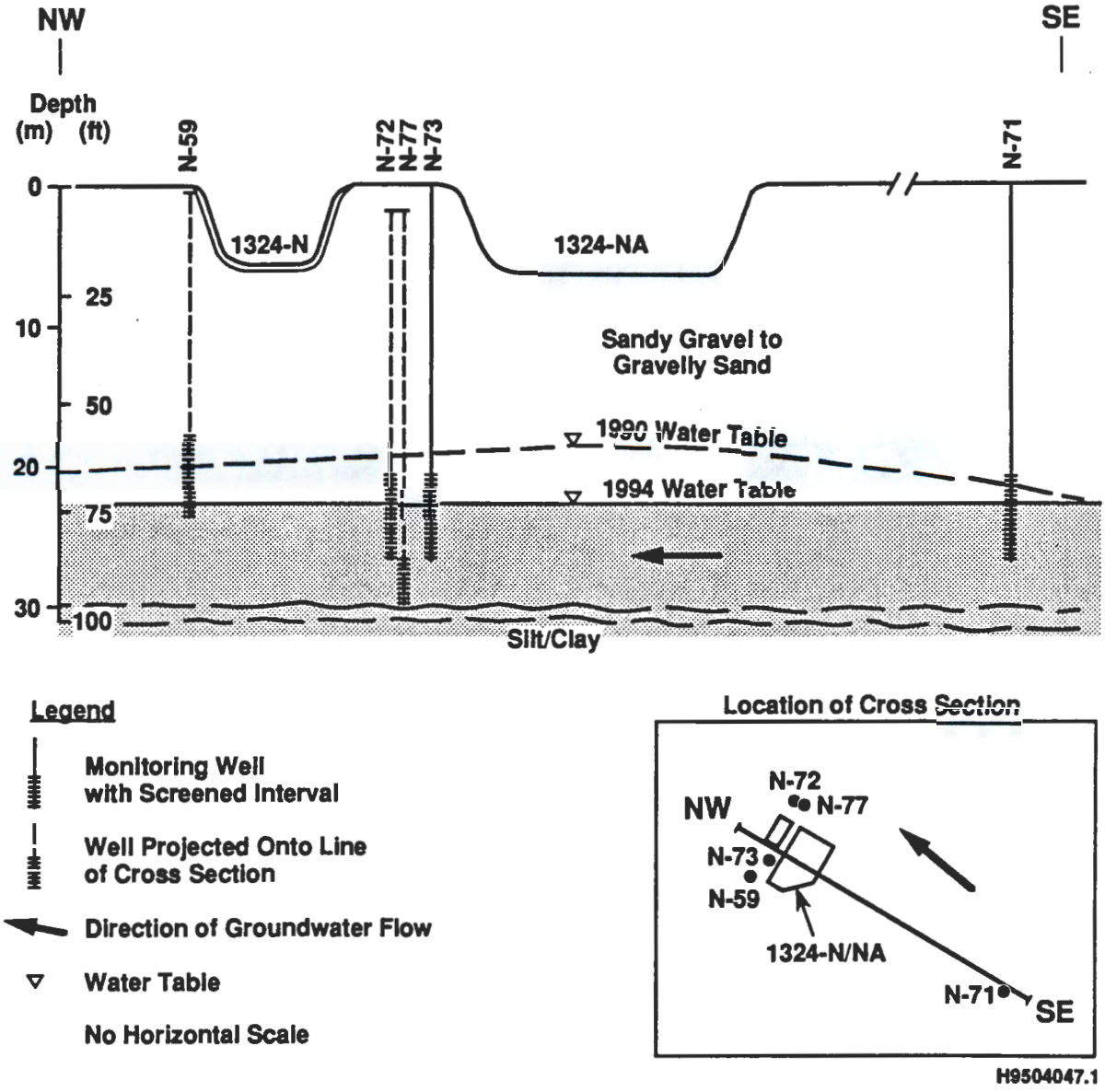


Figure 5. TOX vs Time in 1324-N/NA Wells.

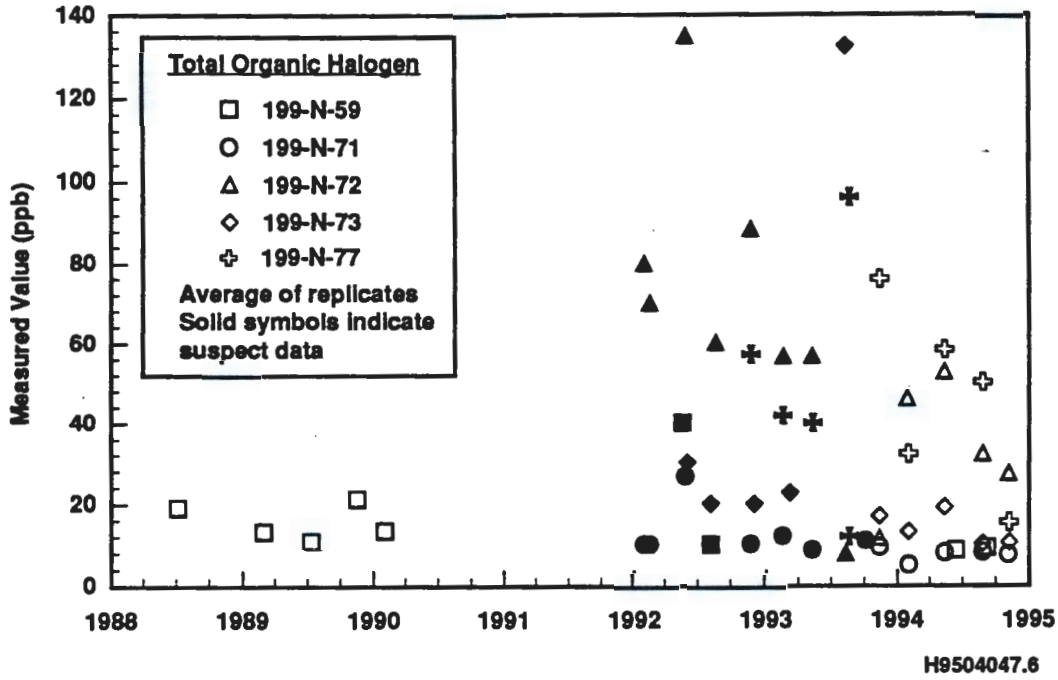


Figure 6. Chloroform vs Time in 1324-N/NA Wells.

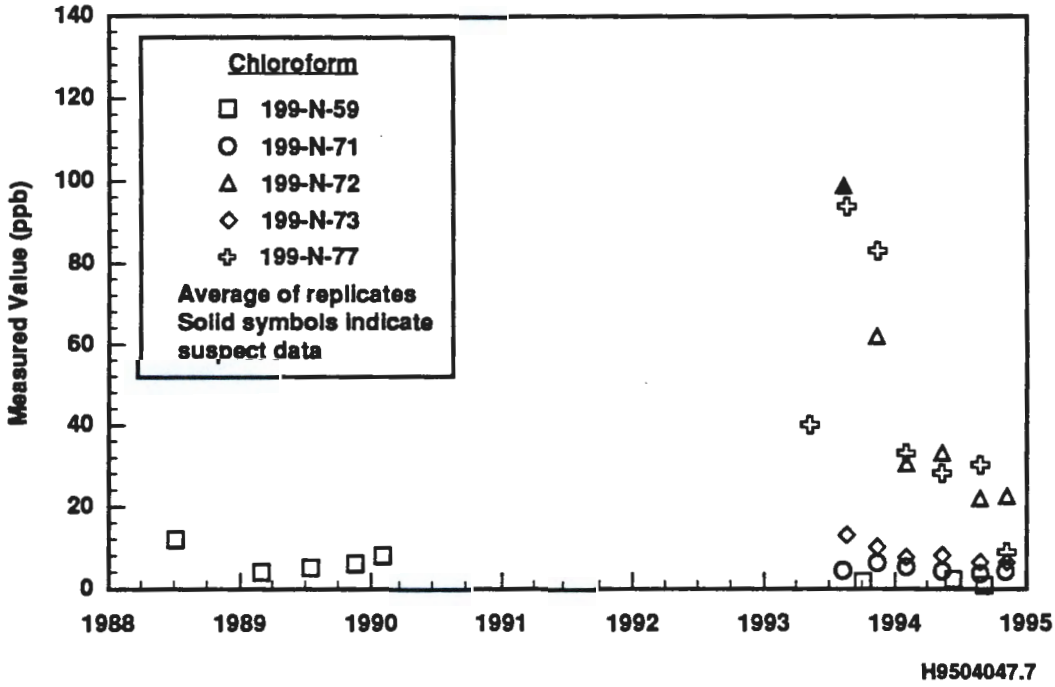


Figure 7. TOX vs Time in Former 1324-N/NA Monitoring Network.

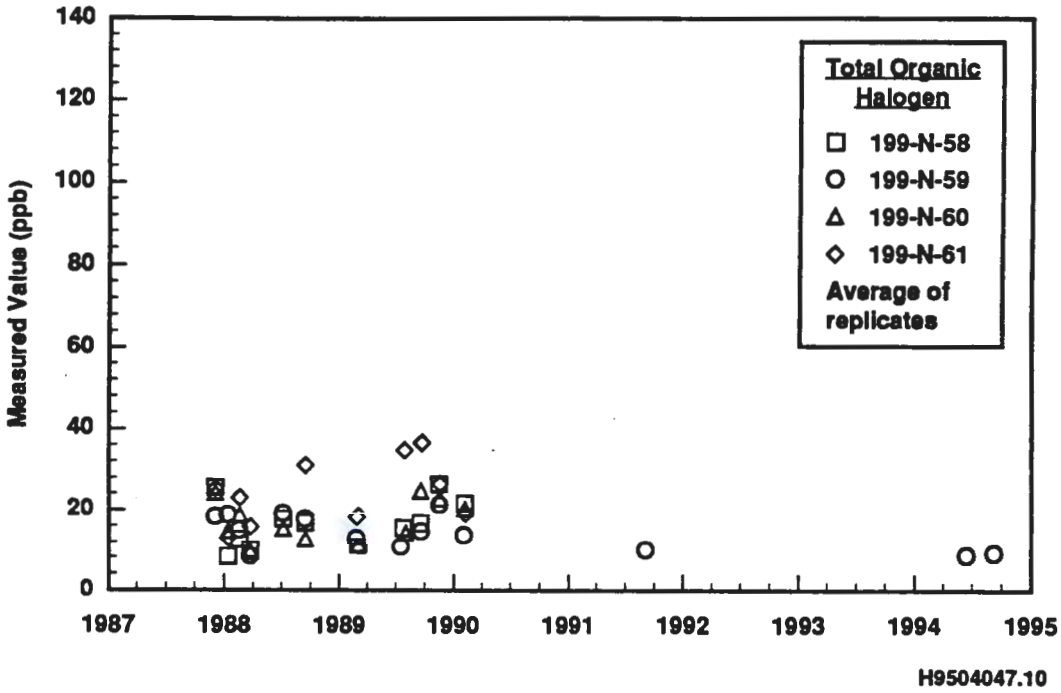


Figure 8. Sulfate vs Time in 1324-N/NA Wells.

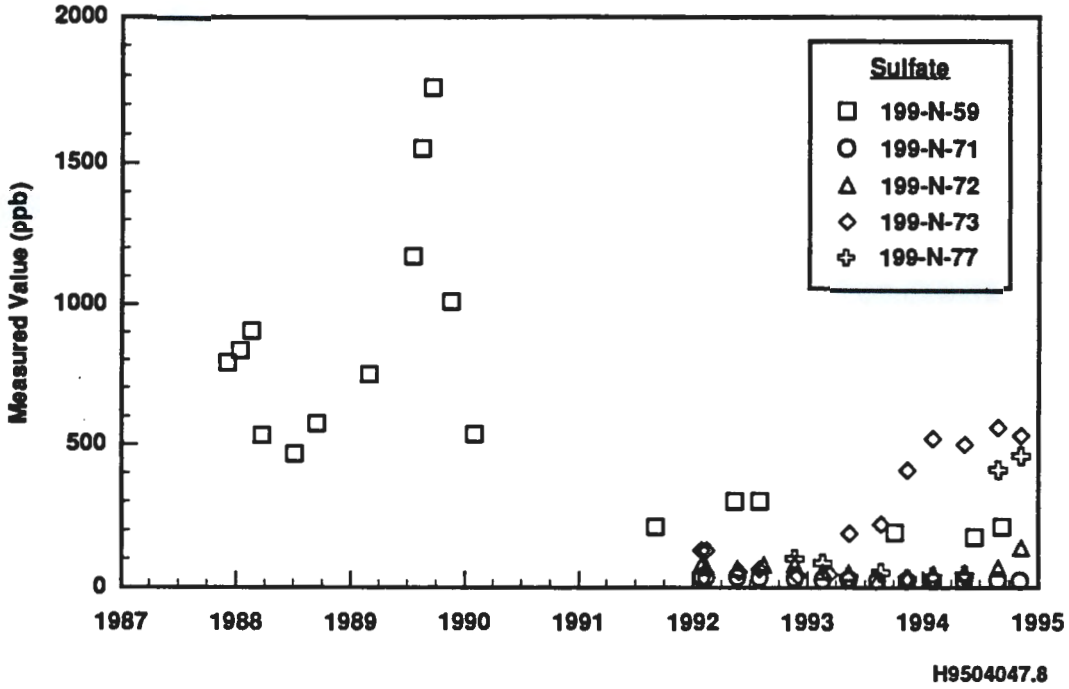
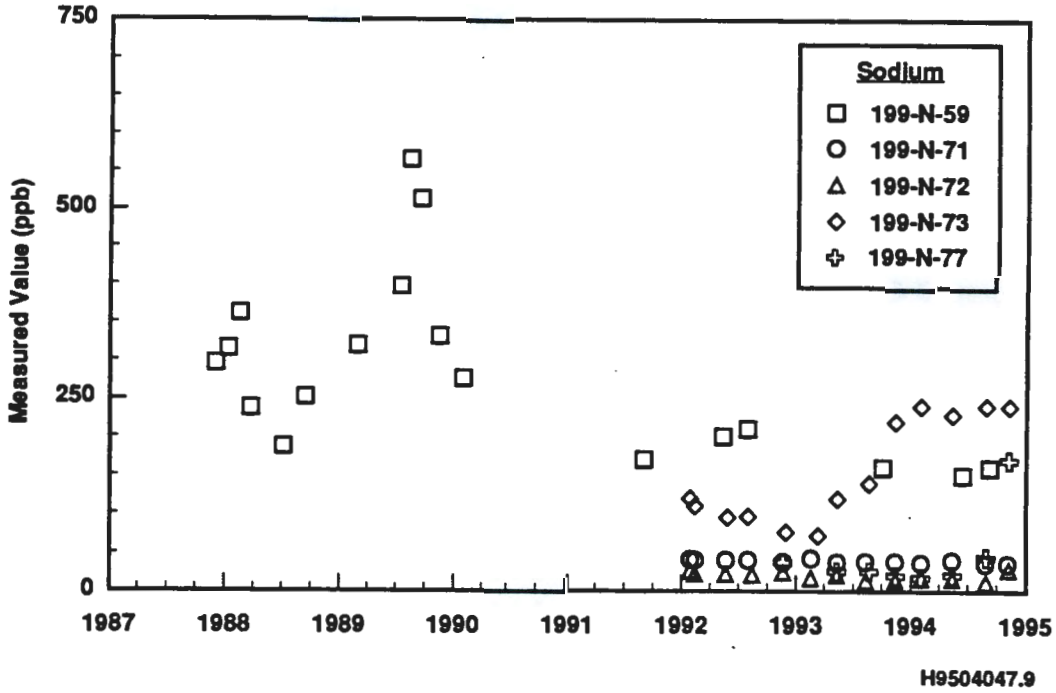


Figure 9. Sodium vs Time in 1324-N/NA Wells.



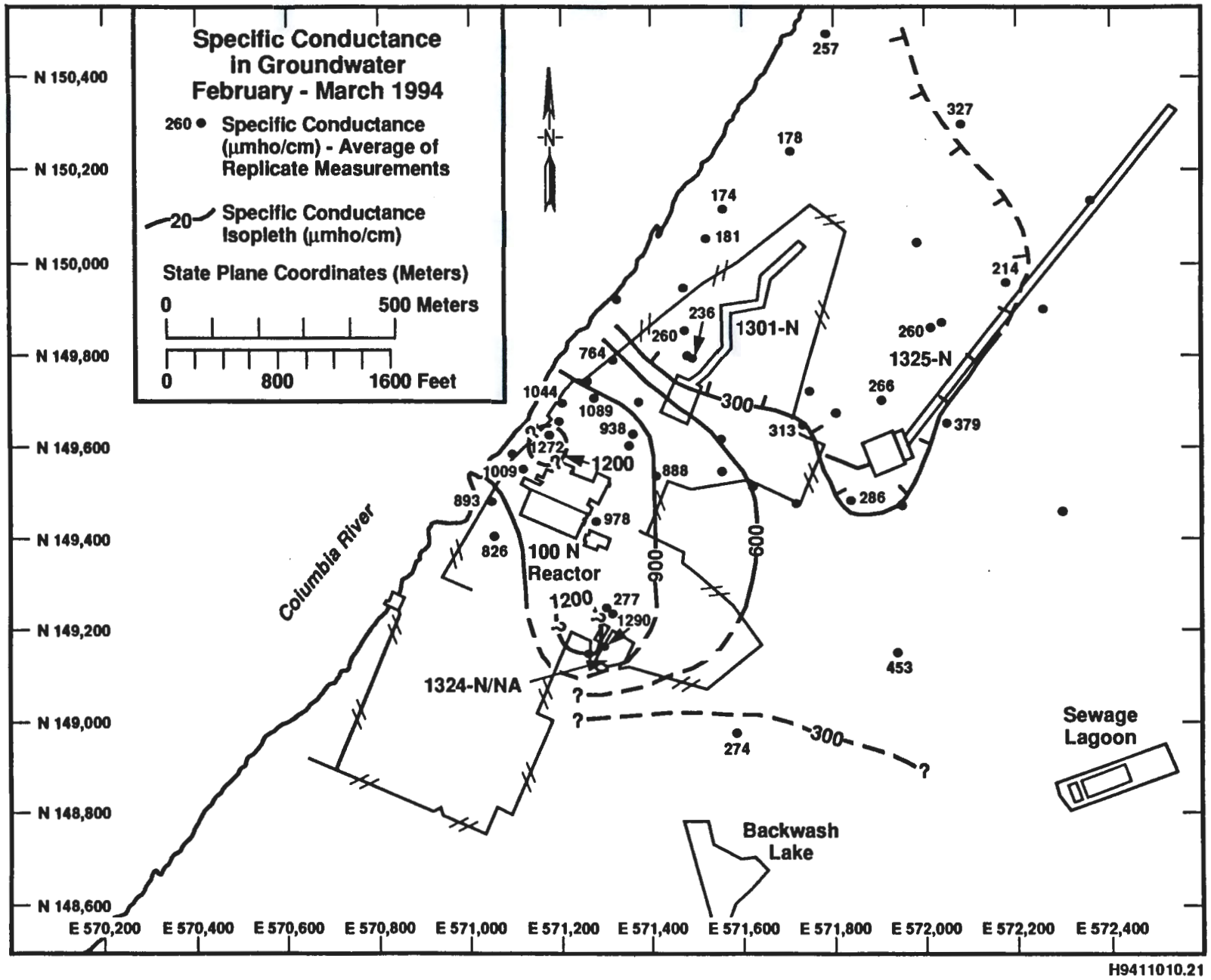


Figure 10. Conductivity in the Uppermost Aquifer, February/March 1994.

9513381.0642

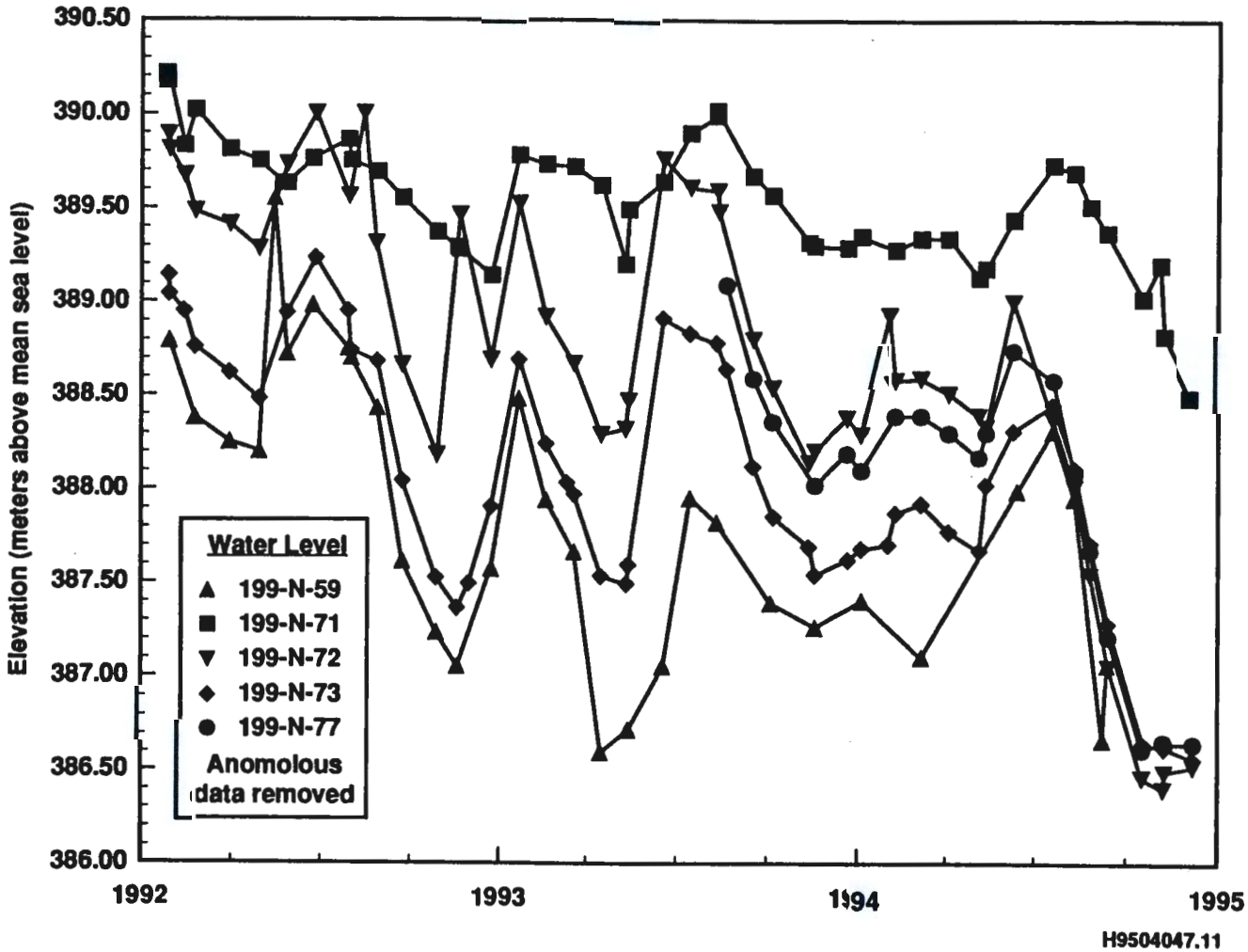


Figure 11. Water Levels in 1324-N/NA Wells.

Table 1. Constituent List for 1324-N/NA Assessment, Phase I (Hartman 1993a).

pH (field and lab)
specific conductance (field and lab)
total organic carbon
total organic halogen (low detection limit)
turbidity
temperature (field)
Metals by the inductively coupled plasma method (filtered, unfiltered*)
Metals by atomic absorption* (filtered, unfiltered)
Anions by ion chromatography
Volatile organics by gas chromatography

*Unfiltered metals and all atomic absorption metals were dropped from list after calendar year 1994, as documented in Engineering Change Notice 602624, 15 February, 1995.

Table 2. TOX and Chloroform Data* (3 sheets).

Well	Date	TOX	Av. TOX	Chloroform	Av. TOX /Chloroform
199-N-59	06-Jul-88	9.9 U	19.08	12	1.59
		14.6 U			
		18.2 U			
		33.6 U			
	01-Mar-89	13	13.33	4 U	3.33
		13			
		14			
	17-Jul-89	9 U	11.00	5	2.20
		10			
		14			
	16-Nov-89	19	21.25	6	3.54
		19			
		23			
		24			
	02-Feb-90	13	13.50	8	1.69
		14			
	13-Jun-94	7.3	8.55	2.3	3.72
		9.8		2	4.28
	07-Sep-94	9.2	9.20	0.76	12.11

Table 2. TOX and Chloroform Data* (3 sheets).

Well	Date	TOX	Av. TOX	Chloroform	Av. TOX /Chloroform
199-N-71	12-Nov-93	5 U	9.38	6.2	1.51
		7.3			
		11			
		14.2			
	01-Feb-94	5	5.08	5.3	0.96
		5 U			
		5 U			
		5.3			
	12-May-94	8.1	8.10	4.2	1.93
	26-Aug-94	7.6	8.23	3.5	2.35
		8			
		8.4			
		8.9			
	04-Nov-94	6.2	7.50	4.1	1.83
		6.9		4.1	
		8.4			
		8.5			
199-N-72	12-Nov-93	11.7	11.70	62 D	0.19
	03-Feb-94	41.2	46.70	32	1.46
		52.2		29	1.61
	12-May-94	52.8	52.80	33	1.60
	26-Aug-94	32.2	32.20	22	1.46
	07-Nov-94	28.2 Q	27.40	22	1.25
		26.6 Q		23	1.19
199-N-73	12-Nov-93	17	17.00	10	1.70
	01-Feb-94	13.2	13.20	7.6	1.74
	12-May-94	19.2	19.20	8.1	2.37
	26-Aug-94	10.2	10.20	6.3	1.62
	07-Nov-94	10.5 Q	10.50	6.3	1.67

Table 2. TOX and Chloroform Data* (3 sheets).

Well	Date	TOX	Av. TOX	Chloroform	Av. TOX /Chloroform
199-N-77	12-Nov-93	76	76.00	83 D	0.92
	01-Feb-94	32.1	32.10	33	0.97
	12-May-94	58.2	58.20	28	2.08
	26-Aug-94	50.1	50.10	30	1.67
	07-Nov-94	15.4 Q	15.40	8.8	1.75

*For dates well was sampled for chloroform and TOX. Suspect data excluded. Units are ppb.
Q = sample associated with blank contamination.
U = not detected OR detected below laboratory's contractual limit.
D = sample diluted.

Table 3. Geologic and Hydrologic Properties of the Unconfined Aquifer.

	Well N-59	Well N-72	Well N-73	Well N-77
monitored zone [ft (m) msl][a]	384.0 - 387.5 (117.04 - 118.11)	373.3 - 388.4 (113.78 - 118.38)	373.6 - 387.8 (113.87 - 118.20)	361.2 - 371.4 (110.09 - 113.20)
Geology of monitored zone[b]	85% sand, 10% silt. Moderately sorted, moderately consolidated.	85% gravel, 15% sand. Poorly sorted.	65% gravel, 35% sand. Moderately sorted. 10% gravel, 90% sand. Well sorted.	60% gravel, 40% sand.
Specific capacity[c] [gal/min/ft (l/min/m)]	not determined	6 (75)	1-2 (12-25)	4 (50)
Hydraulic conductivity (slug tests)[d]	not determined	21 ft/d (6.4 m/d)	9.5 ft/d (2.9 m/d)	57 ft/d (17.4 m/d)
Average water level [ft (m) msl][e]	387.49 (118.11)	388.35 (118.37)	387.92 (118.24)	388.22 (118.33)

[a]From average water level to bottom of screen.
[b]References: N-59 -- geologist's log on file. Wells N-72 and N-73: geologist's log in Hartman (1992b); Well N-77: geologist's log in Hartman (1993b).
[c] Average discharge during well development divided by maximum drawdown. Drawdown had not necessarily stabilized.
[d] References: N-72 and N-73: Hartman (1992b); N-77: Hartman (1993b).
[e]average of data collected during period of assessment (8/93-12/94), excluding data of questionable quality.

APPENDIX A

AS-BUILT DIAGRAMS OF 1324-N/NA MONITORING WELLS

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APPENDIX B

SELECTED ANALYTICAL DATA

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APPENDIX B

SELECTED ANALYTICAL DATA

This appendix contains a selection of groundwater chemistry data collected during Phase I of the assessment of total organic halogen at the 1324-N/NA Site. Table B-1 includes organic constituents, analyzed by gas chromatography, for samples collected between August 1993 and December 1994. Table B-1 includes results of duplicate samples. Tables B-2 and B-3 contain other quality control data. These data have been reported in quarterly RCRA groundwater monitoring reports.

The following data flags are assigned to groundwater data and should be used in conjunction with the data tables provided:

"Qualifier"--assigned by laboratory

B	Laboratory blank associated with analyte is contaminated
D	Analyzed sample is diluted
L	Concentration is below the contract required quantitation limit but above the method detection limit
U--"Undetected"	Analyte concentration is below method detection limit; for radionuclides, reported value less than or equal to total error
X, XY	Miscellaneous laboratory comment

"Flag"--assigned by WHC

H	Laboratory holding time exceeded
Q	Result associated with suspect QC data (duplicates differ by >25% or a blank submitted to the lab was contaminated)
F	Suspect data currently under review (often a data review is requested when a reported value is out of line with historical data)
G	Reviewed data that are considered valid
R	Reviewed data that have been rejected
Y	Reviewed data that continue to be suspect

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-59	10/04/93	B090L3	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	1.70			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	6/13/94	B0C0H1	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	2.30			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
		B0C0H2	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	2.00			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-59	9/07/94	B0C985	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	.76			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
199-N-71	8/10/93	B090L8	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	4.30			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	L		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	11/12/93	B09LC3	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	6.20			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	BL		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-71	2/01/94	B09TT9	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UX		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	5.30			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	UX		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	5/12/94	B0BWN1	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	4.20			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	8/26/94	B0C9C2	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	3.50			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-71	11/04/94	B0D714	1,1,1-Trichloroethane	.04	U		ppb
			1,1,2-Trichloroethane	.08	UH		ppb
			1,1-Dichloroethane	.06	U		ppb
			1,2-Dichloroethane	.03	U		ppb
			1,4-Dichlorobenzene	.06	U		ppb
			Benzene	.01	U		ppb
			Carbon tetrachloride	.08	U		ppb
			Chloroform	4.10			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.09	U		ppb
			Tetrachloroethene	.22	U		ppb
			Toluene	.02	U		ppb
			Trichloroethene	.11	U		ppb
			Vinyl chloride	.13	U		ppb
			Xylenes (total)	.04	U		ppb
			cis-1,2-Dichloroethylene	.11	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
199-N-72	8/11/93	B090M3	1,1,1-Trichloroethane	.07	UY		ppb
			1,1,2-Trichloroethane	.04	UHY		ppb
			1,1-Dichloroethane	.34	UY		ppb
			1,2-Dichloroethane	.14	UY		ppb
			1,4-Dichlorobenzene	.11	UY		ppb
			Benzene	.11	UY		ppb
			Carbon tetrachloride	.12	UY		ppb
			Chloroform	99.00	Y		ppb
			Ethylbenzene	.05	UY		ppb
			Methylene chloride	1.10	LBY		ppb
			Tetrachloroethene	.05	UY		ppb
			Toluene	.06	UY		ppb
			Trichloroethene	.32	LY		ppb
			Vinyl chloride	.27	UY		ppb
			Xylenes (total)	.20	UY		ppb
			cis-1,2-Dichloroethylene	.13	UY		ppb
			trans-1,2-Dichloroethylene	.15	UY		ppb
	11/12/93	B09LC8	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	62.00	D		ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	2/03/94	B09FH3	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UY		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	32.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-72	2/03/94	B09FH3	Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	UXY		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
		B09TV4	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UY		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	29.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	UXY		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	5/12/94	B0BWN6	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	33.00			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	8/26/94	B0C9C7	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	22.00			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-72	11/07/94	B0D719	1,1,1-Trichloroethane	.04	U		ppb
			1,1,2-Trichloroethane	.08	UH		ppb
			1,1-Dichloroethane	.06	U		ppb
			1,2-Dichloroethane	.03	U		ppb
			1,4-Dichlorobenzene	.06	U		ppb
			Benzene	.01	U		ppb
			Carbon tetrachloride	.08	U		ppb
			Chloroform	23.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.09	U		ppb
			Tetrachloroethene	.22	U		ppb
			Toluene	.02	U		ppb
			Trichloroethene	.11	U		ppb
			Vinyl chloride	.13	U		ppb
			Xylenes (total)	.04	U		ppb
			cis-1,2-Dichloroethylene	.11	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
		B0D720	1,1,1-Trichloroethane	.04	U		ppb
			1,1,2-Trichloroethane	.08	UH		ppb
			1,1-Dichloroethane	.06	U		ppb
			1,2-Dichloroethane	.03	U		ppb
			1,4-Dichlorobenzene	.06	U		ppb
			Benzene	.01	U		ppb
			Carbon tetrachloride	.08	U		ppb
			Chloroform	22.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.09	U		ppb
			Tetrachloroethene	.22	U		ppb
			Toluene	.02	U		ppb
			Trichloroethene	.11	U		ppb
			Vinyl chloride	.13	U		ppb
			Xylenes (total)	.04	U		ppb
			cis-1,2-Dichloroethylene	.11	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
199-N-73	8/20/93	B090M8	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	13.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	11/12/93	B09LD0	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	10.00			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-73	11/12/93	B09LD0	Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	2/01/94	B09TW1	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UX		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.49	L		ppb
			Chloroform	7.60			ppb
			Ethylbenzene	.09	BL		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	UX		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	5/12/94	B0BWN8	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	8.10			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	8/26/94	B0C9C9	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	6.30			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	11/07/94	B0D723	1,1,1-Trichloroethane	.04	U		ppb
			1,1,2-Trichloroethane	.08	UH		ppb
			1,1-Dichloroethane	.06	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-73	11/07/94	B0D723	1,2-Dichloroethane	.03	U		ppb
			1,4-Dichlorobenzene	.06	U		ppb
			Benzene	.01	U		ppb
			Carbon tetrachloride	.08	U		ppb
			Chloroform	6.30			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.09	U		ppb
			Tetrachloroethene	.22	U		ppb
			Toluene	.02	U		ppb
			Trichloroethene	.11	U		ppb
			Vinyl chloride	.13	U		ppb
			Xylenes (total)	.04	U		ppb
			cis-1,2-Dichloroethylene	.11	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
199-N-77	8/20/93	B090N3	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	94.00	D		ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.10	LB		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	11/12/93	B09LD2	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	83.00	D		ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.05	U		ppb
			Toluene	.06	U		ppb
			Trichloroethene	.07	U		ppb
			Vinyl chloride	.27	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	2/01/94	B09TW3	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UX		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.11	U		ppb
			Carbon tetrachloride	.12	U		ppb
			Chloroform	33.00			ppb
			Ethylbenzene	.05	BL		ppb
			Methylene chloride	.06	U		ppb
			Tetrachloroethene	.06	L		ppb
			Toluene	.07	L		ppb
			Trichloroethene	.07	U		ppb

Table B-1. 1324-N/NA Volatile Organic Analyses.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-N-77	2/01/94	B09TW3	Vinyl chloride	.27	UX		ppb
			Xylenes (total)	.23	L		ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			trans-1,2-Dichloroethylene	.15	U		ppb
	5/12/94	B0BWP0	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	28.00			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	8/26/94	B0C9D1	1,1,1-Trichloroethane	.22	U		ppb
			1,1,2-Trichloroethane	.06	UH		ppb
			1,1-Dichloroethane	.08	U		ppb
			1,2-Dichloroethane	.06	U		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Benzene	.24	U		ppb
			Carbon tetrachloride	.32	U		ppb
			Chloroform	30.00			ppb
			Ethylbenzene	.04	U		ppb
			Methylene chloride	.08	U		ppb
			Tetrachloroethene	.08	U		ppb
			Toluene	.08	U		ppb
			Trichloroethene	.04	U		ppb
			Vinyl chloride	.15	U		ppb
			Xylenes (total)	.20	U		ppb
			cis-1,2-Dichloroethylene	.05	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb
	11/07/94	B0D725	1,1,1-Trichloroethane	.04	U		ppb
			1,1,2-Trichloroethane	.08	UH		ppb
			1,1-Dichloroethane	.06	U		ppb
			1,2-Dichloroethane	.03	U		ppb
			1,4-Dichlorobenzene	.06	U		ppb
			Benzene	.01	U		ppb
			Carbon tetrachloride	.08	U		ppb
			Chloroform	8.80			ppb
			Ethylbenzene	.05	U		ppb
			Methylene chloride	.09	U		ppb
			Tetrachloroethene	.22	U		ppb
			Toluene	.02	U		ppb
			Trichloroethene	.11	U		ppb
			Vinyl chloride	.13	U		ppb
			Xylenes (total)	.04	U		ppb
			cis-1,2-Dichloroethylene	.11	U		ppb
			trans-1,2-Dichloroethylene	.07	U		ppb

Table B-2. 1324-N/NA Full Trip Blank.

Well	Date	Sample Number	Constituent Name	Result	fiers	Error	Units
FTR185	2/03/94	B09FH4	1,1,1-Trichloroethane	.07	U		ppb
			1,1,2-Trichloroethane	.04	UH		ppb
			1,1-Dichloroethane	.34	U		ppb
			1,2-Dichloroethane	.14	UY		ppb
			1,4-Dichlorobenzene	.11	U		ppb
			Alkalinity	2.00	LB		ppm
			Aluminum	32.50	U		ppb
			Antimony	69.40	U		ppb
			Arsenic	1.38	U		ppb
			Barium	.43	BL	.01	ppb
			Benzene	.11	U		ppb
			Beryllium	.81	U		ppb
			Bromide	52.80	U		ppb
			Cadmium	4.70	U		ppb
			Calcium	56.00	L	10.10	ppb
			Carbon tetrachloride	.12	U		ppb
			Chloride	82.50	U		ppb
			Chloroform	.04	U		ppb
			Chromium	5.42	U		ppb
			Cobalt	4.05	U		ppb
			Copper	2.65	U		ppb
			Ethylbenzene	.05	U		ppb
			Fluoride	13.90	U		ppb
			Iron	19.00	LQ	3.42	ppb
			Lead	.60	L	.13	ppb
			Magnesium	26.00	U		ppb
			Manganese	1.35	U		ppb
			Methylene chloride	.06	U		ppb
			Nickel	17.90	U		ppb
			Nitrate	44.40	U		ppb
			Nitrite	38.30	U		ppb
			Phosphate	147.00	U		ppb
			Potassium	370.00	BL	55.50	ppb
			Silver	2.87	U		ppb
			Sodium	170.00	BLQ	51.00	ppb
			Specific conductance	10.00	U		umhos
			Sulfate	49.90	U		ppb
			Tetrachloroethene	.05	U		ppb
			Tin	51.10	U		ppb
			Toluene	.06	U		ppb
			Total Carbon	500.00	LBQ		ppb
			Total Dissolved Solids	10.00	U		ppm
			Total Organic Carbon	200.00	U		ppb
			Total Organic Halogen	5.00	U		ppb
			Trichloroethene	.07	U		ppb
			Turbidity	.18	Q		NTU
			Vanadium	3.84	U		ppb
			Vinyl chloride	.27	UXY		ppb
	2/03/94	B09FH4	Xylenes (total)	.20	U		ppb
			Zinc	8.60	BL	.26	ppb
			cis-1,2-Dichloroethylene	.13	U		ppb
			pH	5.60			
			trans-1,2-Dichloroethylene	.15	U		ppb
		B09FH5	Aluminum, filtered	32.50	U		ppb
			Antimony, filtered	69.40	U		ppb
			Arsenic, filtered	1.38	U		ppb
			Barium, filtered	.99	BL	.03	ppb
			Beryllium, filtered	.81	U		ppb
			Cadmium, filtered	4.70	U		ppb
			Calcium, filtered	56.00	L	10.10	ppb
			Chromium, filtered	5.42	U		ppb
			Cobalt, filtered	4.05	U		ppb
			Copper, filtered	2.65	U		ppb
			Iron, filtered	19.00	LQ	3.42	ppb
			Lead, filtered	.88	L	.19	ppb

Table B-2. 1324-N/NA Full Trip Blank.

Well	Date	Sample Number	Constituent Name	Result	fiers	Error	Units
FTR185	2/03/95	B09FH5	Magnesium, filtered	26.00	U		ppb
			Manganese, filtered	1.35	U		ppb
			Nickel, filtered	17.90	U		ppb
			Potassium, filtered	350.00	BL	52.50	ppb
			Silver, filtered	3.80	L	.46	ppb
			Sodium, filtered	330.00	BQ	99.00	ppb
			Tin, filtered	51.10	U		ppb
			Vanadium, filtered	3.84	U		ppb
			Zinc, filtered	6.60	BL	.20	ppb

Table B-3. 1324-N/NA Field Transfer Blank.

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
FER205	2/03/94	B09F72	1,1,1-Trichloroethane	.64	U		ppb
			1,1,2-Trichloroethane	.25	U		ppb
			1,1-Dichloroethane	.61	U		ppb
			1,2-Dichloroethane	.45	U		ppb
			1,2-Dichloroethene	1.20	U		ppb
			1,4-Dichlorobenzene	.63	U		ppb
			1-Butanol	13.10	U		ppb
			4-Methyl-2-pentanone	.85	U		ppb
			Acetone	13.40	U		ppb
			Benzene	.65	U		ppb
			Carbon disulfide	.95	U		ppb
			Carbon tetrachloride	.87	U		ppb
			Chloroform	.40	U		ppb
			Ethyl cyanide	4.34	U		ppb
			Methyl ethyl ketone	4.25	U		ppb
			Methylene chloride	.61	U		ppb
			Tetrachloroethene	1.10	U		ppb
			Tetrahydrofuran	3.67	U		ppb
			Toluene	.73	U		ppb
			Trichloroethene	.77	U		ppb
			Vinyl chloride	.78	U		ppb
			Xylenes (total)	1.70	U		ppb

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APPENDIX C

GROUNDWATER QUALITY ASSESSMENT PLAN FOR THE 1324-N/NA SITE (PHASE II)

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APPENDIX C

GROUNDWATER QUALITY ASSESSMENT PLAN FOR THE 1324-N/NA SITE (PHASE II)

Hartman (1993) presented the first phase of the assessment program to investigate elevated total organic halogen (TOX) at the 1324-N/NA site. That document stated that, depending on the outcome of Phase I, additional phases of investigation might be needed. This appendix describes Phase II of the investigation.

C.1 ASSESSMENT MONITORING NETWORK

The monitoring network remains unchanged from Hartman (1993).

C.2 SAMPLING AND ANALYSIS

C.2.1 Constituent Lists

The constituent lists for wells N-72 and N-77, which have shown the highest TOX concentrations, will include volatile organic constituents analyzed by the gas chromatography/mass spectrometry method. This method analyzes for more constituents than gas chromatography, which was used in Phase I. The other wells will not be analyzed for specific organic constituents. Table C-1 shows the revised constituent lists.

C.2.2 Sampling and Analytical Methods

Sample collection, preservation, chain of custody, and analysis shall proceed according to WHC (1993) or its current revision.

C.2.3 Quality Control

The quality control program for Hanford Site RCRA groundwater monitoring is described in WHC (1993) or its current revision. A matrix spike will be collected for Phase II of the 1324-N/NA assessment program. The matrix spike will be an extra sample from well N-72 to which the laboratory adds a known quantity of chloroform. The sample will be analyzed for organic constituents, TOX, and TOC in the same manner as the field samples. If all the chloroform is recovered, the result will agree closely with the spiked amount plus the amount detected in the unspiked sample from well N-72.

C.2.4 Data Validation and Reporting

Data validation and reporting requirements are unchanged from Hartman (1993).

C.3 WATER LEVEL MONITORING

Water levels will be measured manually before wells are sampled, except in wells that are equipped with pressure transducers and data loggers.

C.4 SCHEDULE

Phase II will begin with the June 1995 sampling, and will proceed with quarterly sampling. After the data from the first sample event are received and validated, they will be interpreted along with results of the matrix spike and any other routine QC samples. If additional data are needed, quarterly sampling will continue. The results of the phase II assessment will be reported in 1996.

C.5 REFERENCES

Hartman, M. J., 1993, *Groundwater Quality Assessment Plan for the 1324-N/NA Site*, WHC-SD-EN-AP-005, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Quality Assurance Project Plan for RCRA Groundwater Monitoring Activities*, WHC-SD-EN-QAPP-001, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Table C-1. Constituent Lists for 1324-N/NA Assessment, Phase II.

Constituent	N-72 and N-77	N-59, N-71, and N-73
pH (field and lab)	X	X
specific conductance (field and lab)	X	X
total organic carbon	X	X
total organic halogen	X	X
turbidity	X	X
total dissolved solids	X	X
alkalinity	X	X
metals by the inductively coupled plasma method (filtered)	X	X
anions by ion chromatography	X	X
volatile organics by gas chromatography/mass spectrometry	X	(a)

(a) Organics will not be analyzed unless TOX increases in these wells.