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START

ENGINEERING CHANGE NOTICE

Page 1 of 2

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Proj. ECN N/A

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	M. J. Hartman, Geosciences, H6-06, 376-9924	[] Yes [X] No	17 April, 1996
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12. Description of Change

The attached document replaces rev. 0. It is the final report on the 1324-N/NA TOX assessment program.

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13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

This revision incorporates the results of phase 2 of the assessment program. Rev. 0 included only the results of phase 1.

14. Distribution (include name, MSIN, and no. of copies)

See attached distribution sheet.

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15. Design Verification Required	16. Cost Impact						17. Schedule Impact (days)	
	ENGINEERING			CONSTRUCTION				
[] Yes	Additional	[]	$	Additional	[]	$	Improvement	[]
[X] No	Savings	[]	$	Savings	[]	$	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
N/A		

20. Approvals

	Signature	Date		Signature	Date
OPERATIONS AND ENGINEERING			ARCHITECT-ENGINEER		
Cog. Eng. M. J. Hartman	Mary J Hartman	17 Apr 96	PE		
Cog. Mgr. D. G. Horton	D G Horton	4/17/96	QA		
QA W. R. Thackaberry	W R Thackaberry	4/17/96	Safety		
Safety			Design		
Environ. D. W. Fritz	MJH for DWF per cc mail	17 Apr 96	Environ.		
Other B. A. Williams	[signature]	4/18/96	Other		
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			Signature or a Control Number that tracks the Approval Signature		
			ADDITIONAL		

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RCRA Assessment Report: Total Organic Halogen at the 1325-N/NA Site

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Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

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Key Words: TOX, groundwater chemistry, chloroform, 1324-N, 1324-NA, 100-NR-1, 1143-N Paint Shop

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 a RCRA assessment program to investigate the elevated TOX. The TOX is due 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 1324-N/NA site will revert to indicator parameter monitoring.

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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 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.

The results of the first phase and a plan for the second phase of the TOX assessment program were reported in 1995, in Revision 0 of this document. This document (Revision 1) includes the results of both phases of the assessment program.

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 November 1995) were presented in quarterly reports (e.g., Hartman 1994b). 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 (phase 1) and gas chromatography/mass spectrometry (phase 2) 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 1993 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 exhibited 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.

Chloroform was the only volatile organic constituent detected in significant concentrations in the 1324-N/NA wells. 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. Assuming perfect recovery, if chloroform were the only halogenated organic compound present, 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). Normal variations in chloroform recovery probably account for the discrepancy (see Section 2.4).

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 reasons discussed in the following paragraphs.

2.1.2.1 1324-NA Percolation Pond. Records indicate that no organic waste was disposed 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. From late 1993 to 1995, TOX 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 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 since 1993. 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 in 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 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 since late 1993 (see Figures 5 and 6). 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 and 1994, sulfate, sodium, and specific conductance increased sharply in wells N-72, N-73, and N-77. Concentrations stabilized in 1995.

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, induced radial flow from a groundwater mound 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 at these wells (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 levels 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 1995). 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. None of the results for volatile organic constituents exceeded this limit.

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.

Matrix spike samples were prepared and analyzed in August and November 1995 to determine if the laboratory was recovering all the chloroform. Two samples were collected from well N-72. One sample was spiked with a known concentration of chloroform in a Hanford Site laboratory before being sent to the analytical laboratory along with the unspiked sample. The samples were analyzed for chloroform and TOX to determine if the analytical laboratory was recovering all of the chloroform. Results of the August data indicate that the TOX analysis recovered 60 percent of the chloroform, and the VOA analysis recovered 74 percent (Table 4). A recovery rate of between 75 percent and 125 percent is considered acceptable. The sample results were slightly below this range, but not unexpected, considering the low levels of chloroform present. The results do not alter the conclusions of this assessment program.

The TOX matrix spike sample from November 1995 was lost in the laboratory. The VOA matrix spike sample from November yielded only 6.3 ppb chloroform (sample was spiked with 100 ppb), while the unspiked sample from well N-72 had 56 ppb, much higher than recent trends in this well. TOX was not elevated in well N-72 in November, indicating that the high chloroform value was erroneous. It is possible that sample numbers were transposed. Because of this confusion, the results of the November matrix spikes must be rejected.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Groundwater chemistry varies considerably among the 1324-N/NA dowgradient wells. These inconsistencies may be caused by differences in hydrogeologic properties of the sediments.

TOX and chloroform concentrations are no longer elevated above background in 1324-N/NA wells. The high concentrations of TOX observed in 1992 and 1993 were caused by chloroform. The source of the chloroform may never be proven, but concentration-vs-time plots indicate that the 1324-N/NA site is probably not the source. A more likely source is chlorinated water from a paint spray booth disposed in a French drain in a nearby, upgradient paint shop. This spray booth is no longer used, so water cannot be tested to confirm or refute this hypothesis.

No evidence has been found that the 1324-N/NA Site has contributed dangerous waste constituents to the groundwater. Therefore, the site will return to indicator evaluation monitoring as allowed by 40 CFR 265.93(d)(6). The monitoring wells will be sampled semiannually and statistical comparisons of pH, conductivity, TOX, and TOC will be made between upgradient and downgradient wells.

Monitoring at 1324-N/NA will proceed according to the plan presented in Appendix C until a more complete plan is released. Monitoring is coordinated with other programs in the 100-N Area (e.g., CERCLA, Sitewide surveillance, ERA performance assessment).

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WHC, 1995, *Quality Assurance Project Plan for Groundwater Monitoring Activities Managed by Westinghouse Hanford Company*, WHC-SD-EN-QAPP-001, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

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

Phase 1 (8/93 through 5/95) (Hartman 1993a)	Phase 2 (6/95 through 12/95) (Hartman 1995)
pH	pH
specific conductance	specific conductance
total organic carbon	total organic carbon
total organic halogen	total organic halogen
turbidity	turbidity
temperature	temperature
Metals by the inductively coupled plasma method (filtered, unfiltered*)	Metals by the inductively couple plasma method (filtered)
Metals by atomic absorption* (filtered, unfiltered)	Anions by ion chromatography
Anions by ion chromatography	Alkalinity
Alkalinity	Volatile organics by gas chromatography/mass spectrometry (N-72 and N-77 only)
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
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			

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

Well	Date	TOX	Av. TOX	Chloroform	Av. TOX /Chloroform
	04-Nov-94	6.2	7.50	4.1	1.83
		6.9		4.1	
		8.4			
		8.5			
	01-Mar-95	10.1	7.28	4.30	1.69
		9.0			
		5.0 U			
		5.0 U			
	02-May-95	6.9 U	6.90	3.50	1.97
		6.9 U			
		6.9 U			
		6.9 U			
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
	24-Feb-95	16.9	16.90	8.50	1.99
	02-May-95	8.8 L	8.80	6.90	1.28
	28-Aug-95	10.0 L	10.00	6.0	1.67
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
	01-May-95	8.0 L	8.00	6.7	1.19

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
	10-Mar-95	15.2	15.20	5.0	3.04
	01-May-95	6.9 U	6.90	6.7	1.03
	15-Sep-95	7.0 L	7.00	8.3 Q	0.84
	13-Nov-95	6.9 U	6.90	7.3	0.95

*For dates where both chloroform and TOX exist. 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.
L = above method detection limit and below laboratory's contractual limit.

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.

Table 4. Matrix Spike Results, Well N-72.

Sample date	Constituent	Sample result (ppb)	Spiked Sample		Percent recovery
			Spiked conc. (ppb)	Result (ppb)	
8/28/95	TOX	10 L	67*	50	60
	Chloroform	6	100	81H	74
11/13/95	TOX	6.9 DU	sample lost		N/A
	Chloroform	59 F	100	6.3 F	N/A

D = sample was diluted
U = less than method detection limit
H = sample holding time exceeded
F = possibly erroneous. data evaluation in progress.
L = value above method detection limit and below contract required quantitation limit.
* Equivalent concentration of Cl in spiked concentration of chloroform.

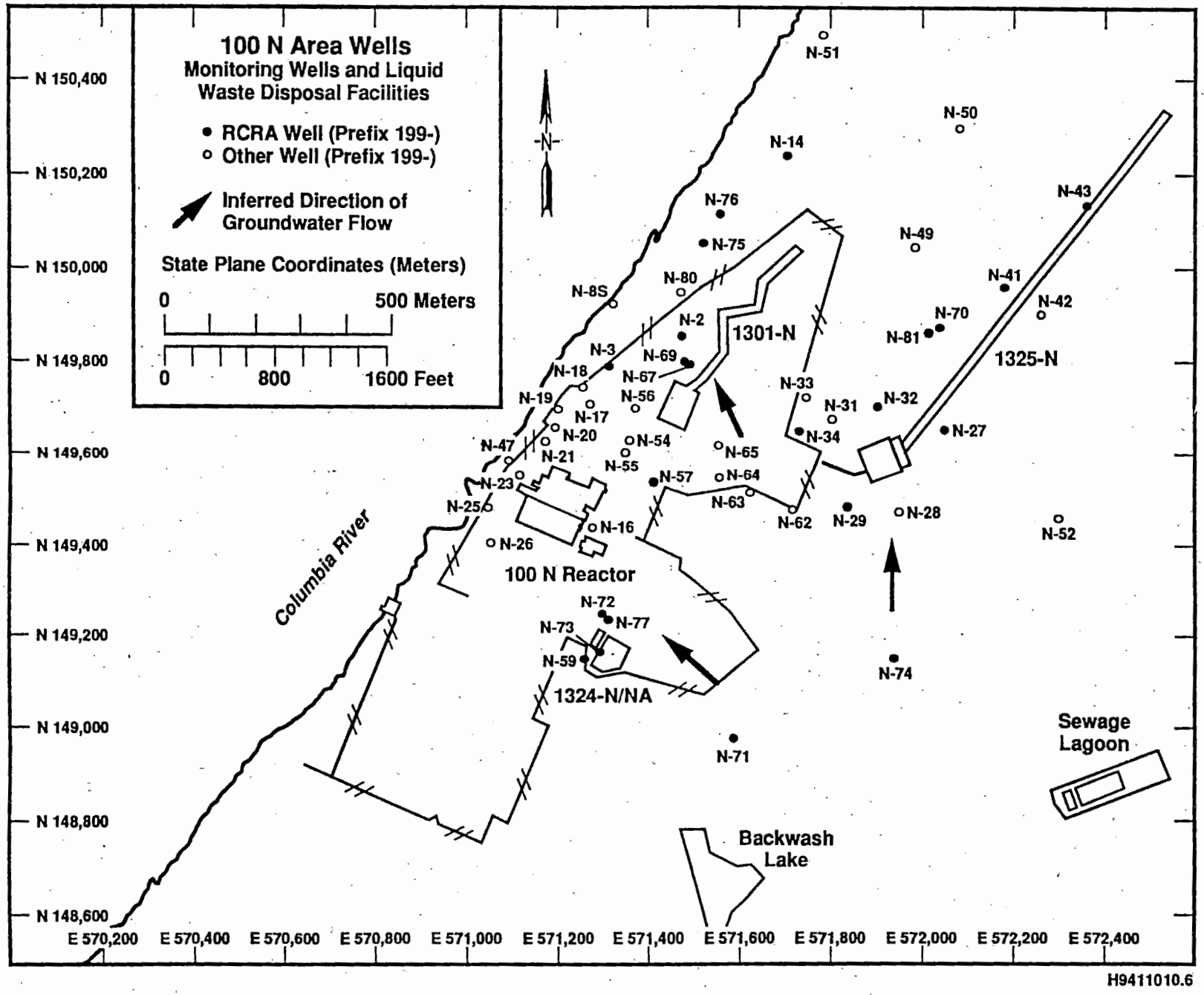


Figure 1. Locations of the 1324-N/NA Site and Groundwater Monitoring Wells.

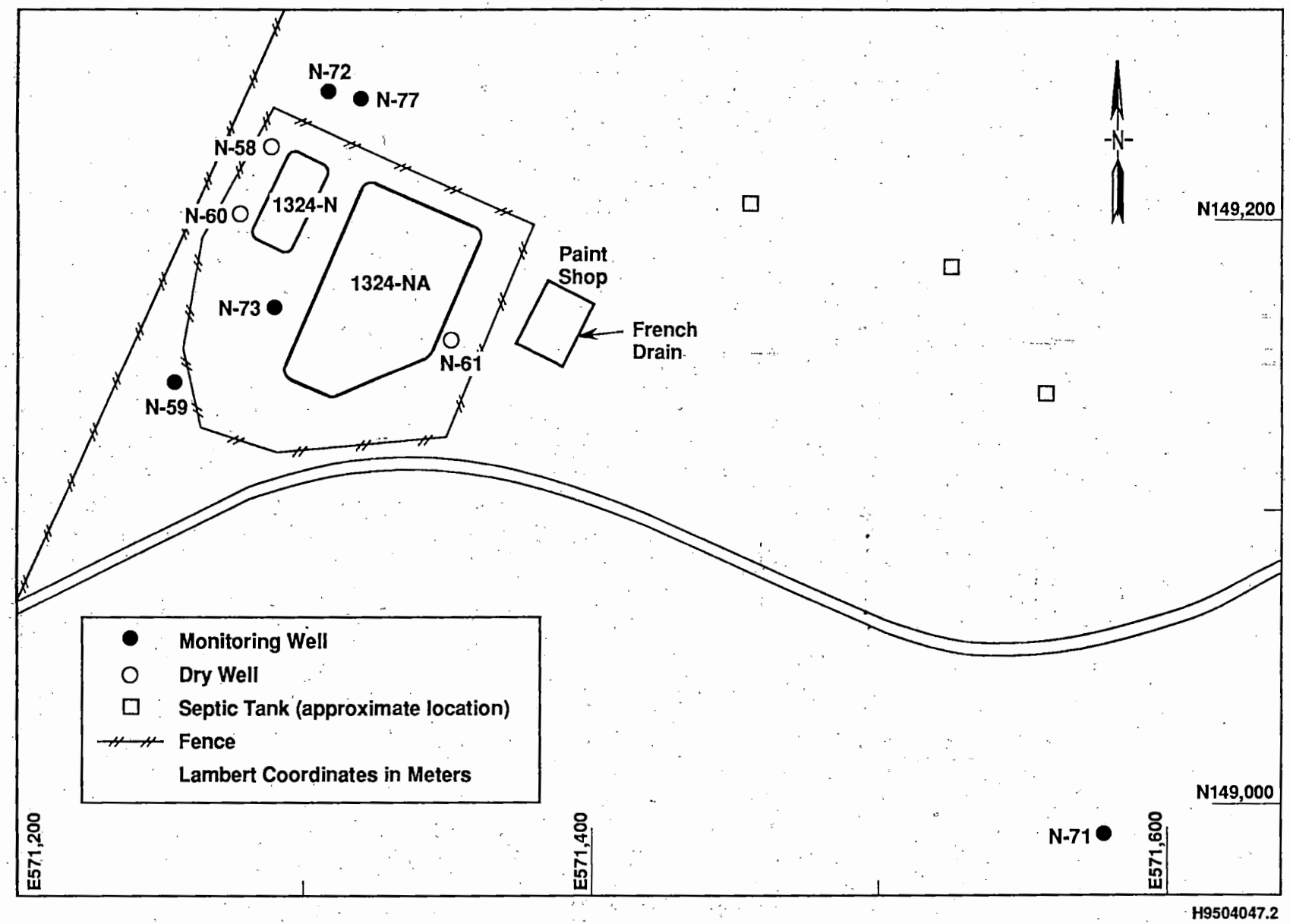
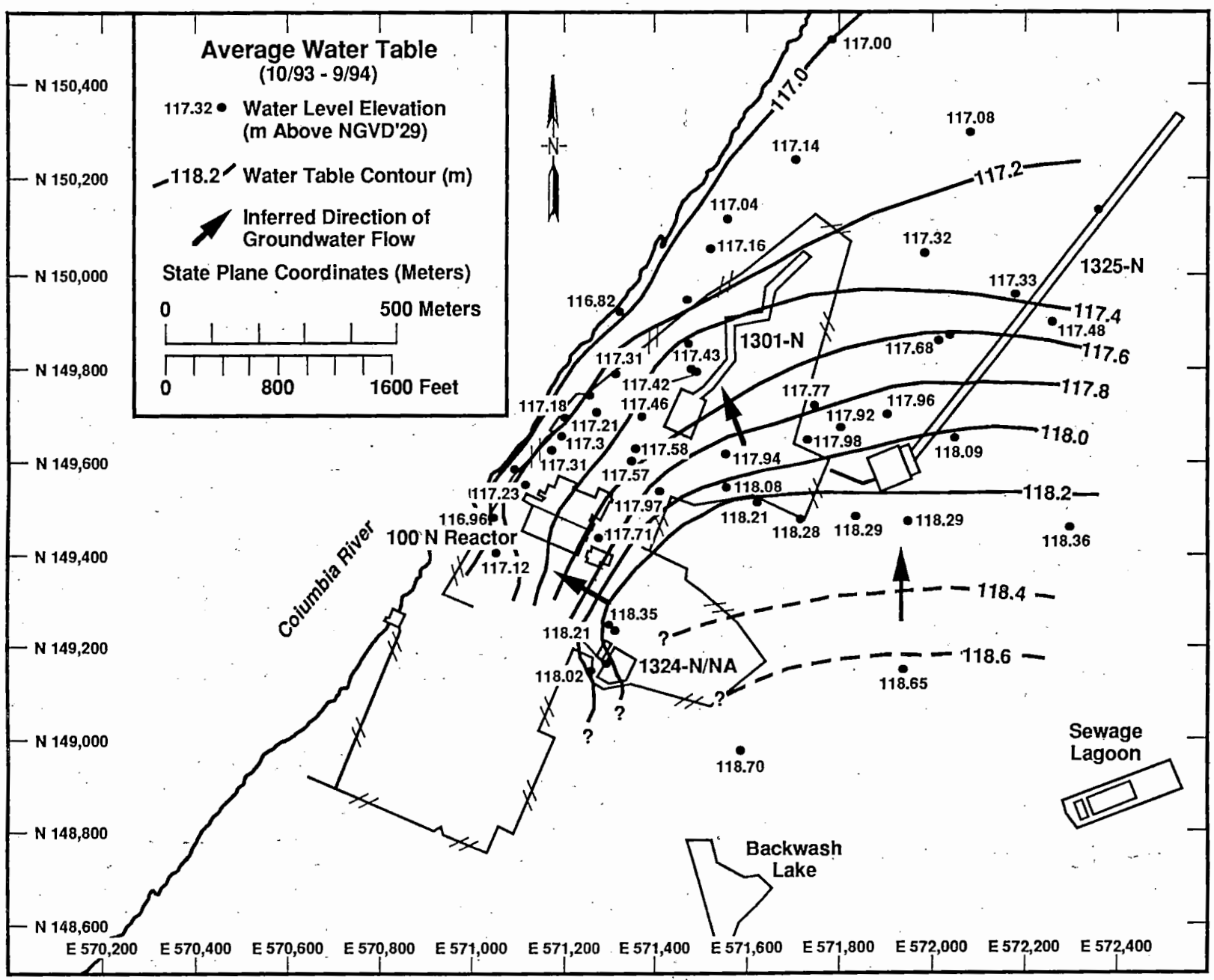


Figure 2. Locations of 1324-N/NA Monitoring Wells and Potential Waste Sources.



H9411010.23

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.

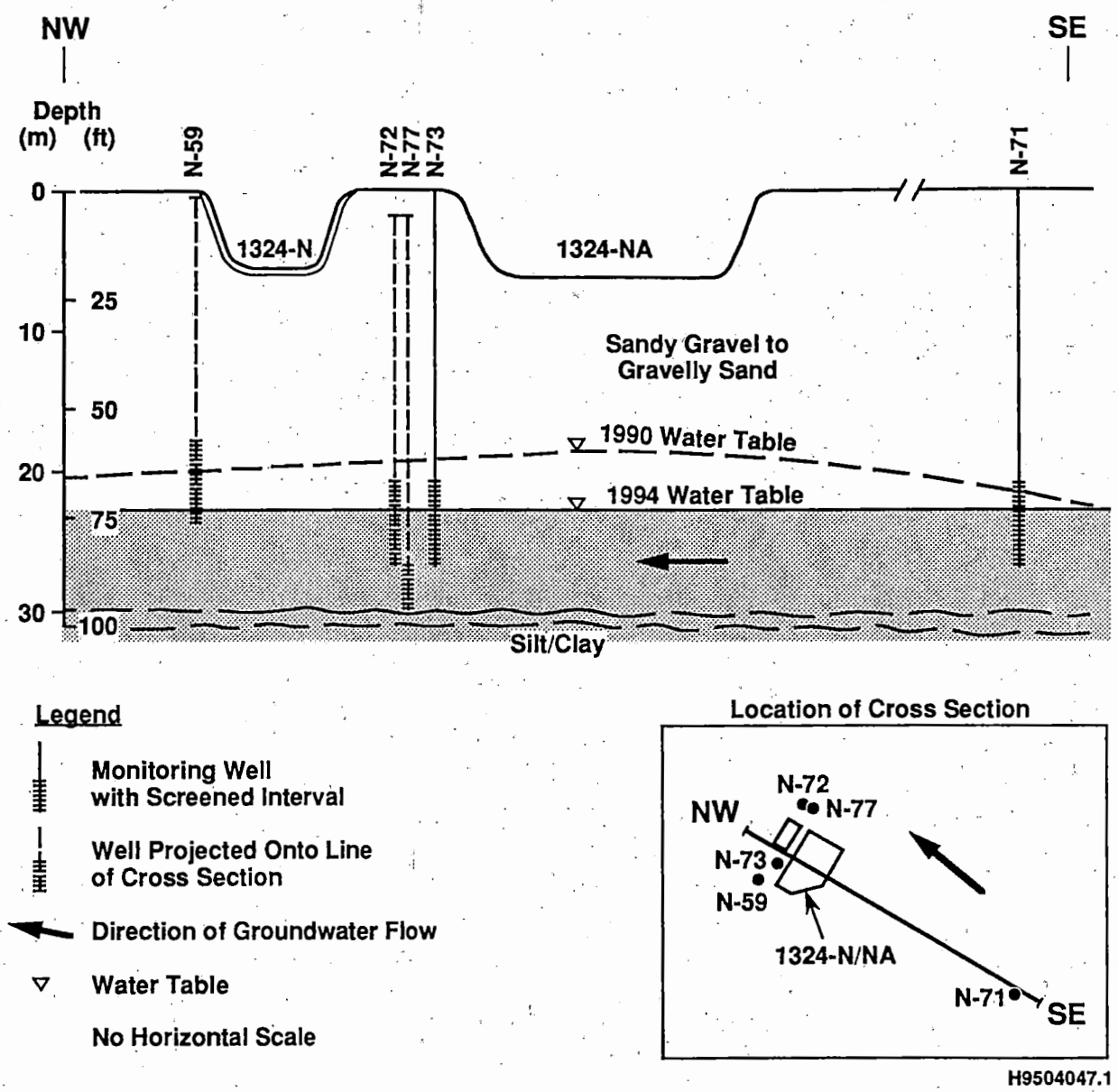


Figure 5. TOX vs Time in 1324-N/NA Wells.

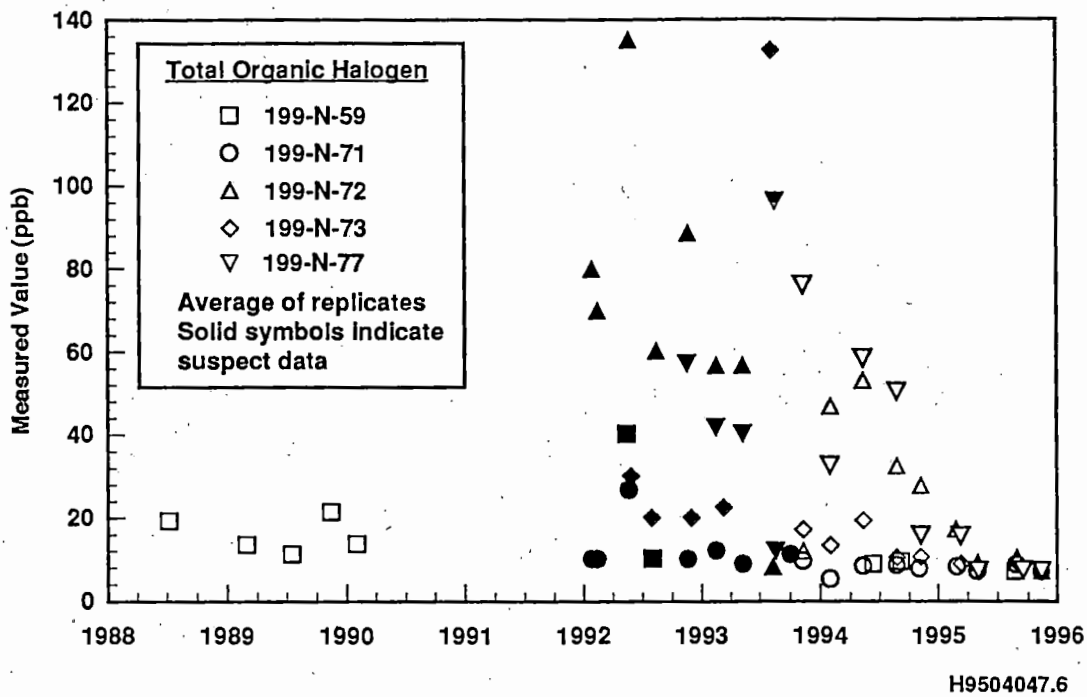


Figure 6. Chloroform vs Time in 1324-N/NA Wells.

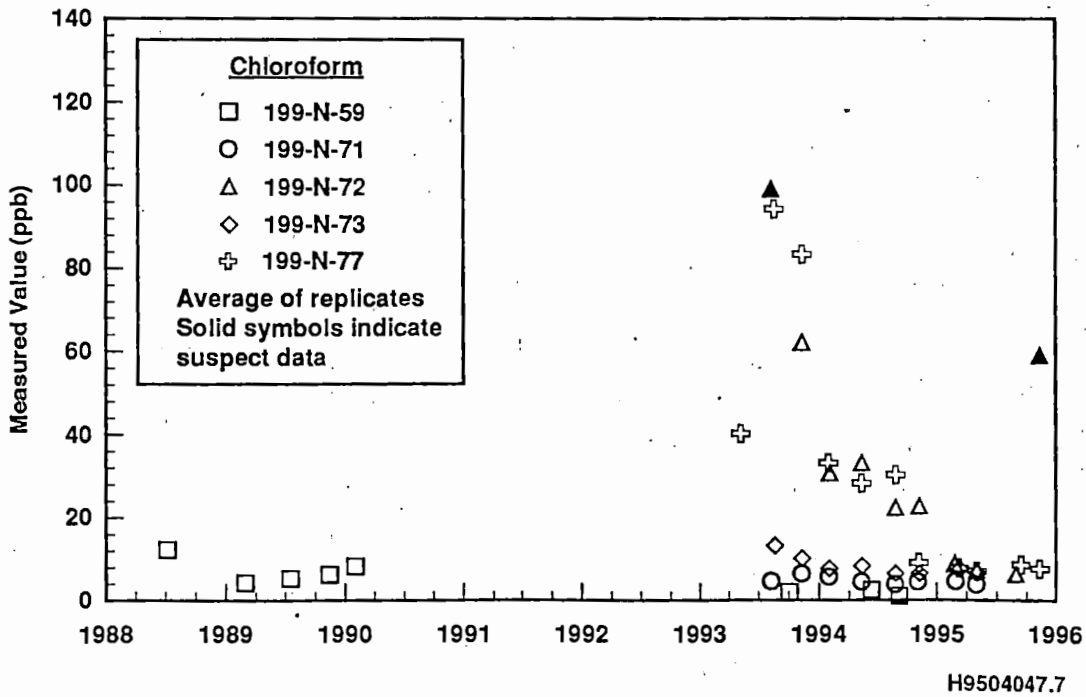


Figure 7. TOX vs Time in Former 1324-N/NA Monitoring Wells.

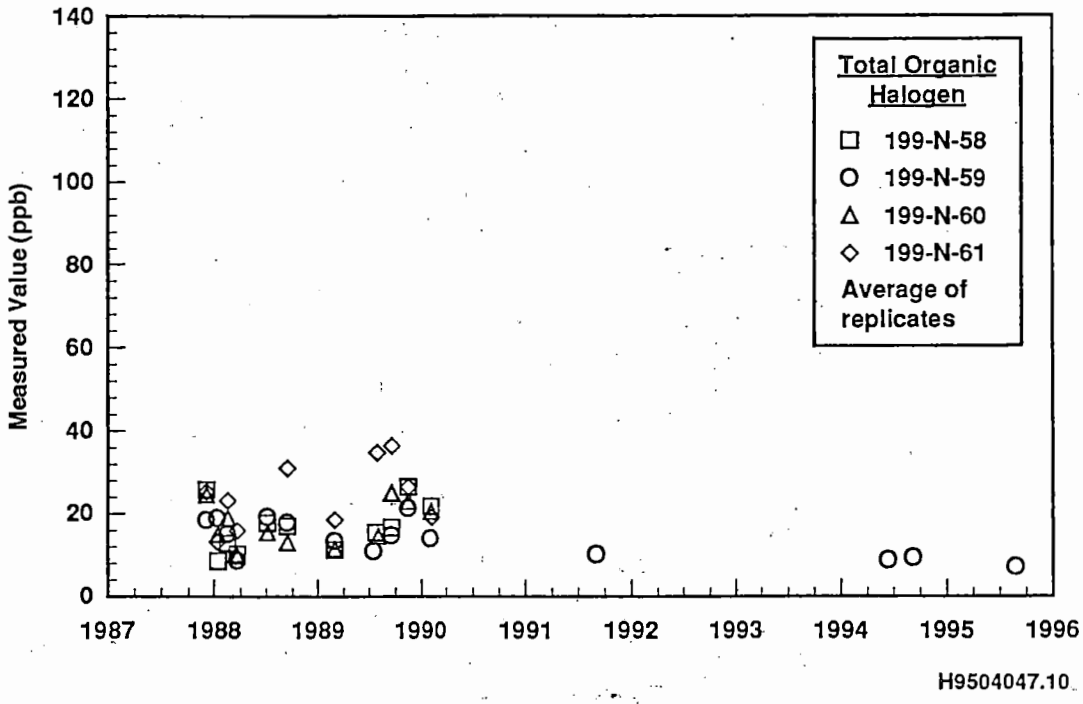


Figure 8. Sulfate vs Time in 1324-N/NA Wells.

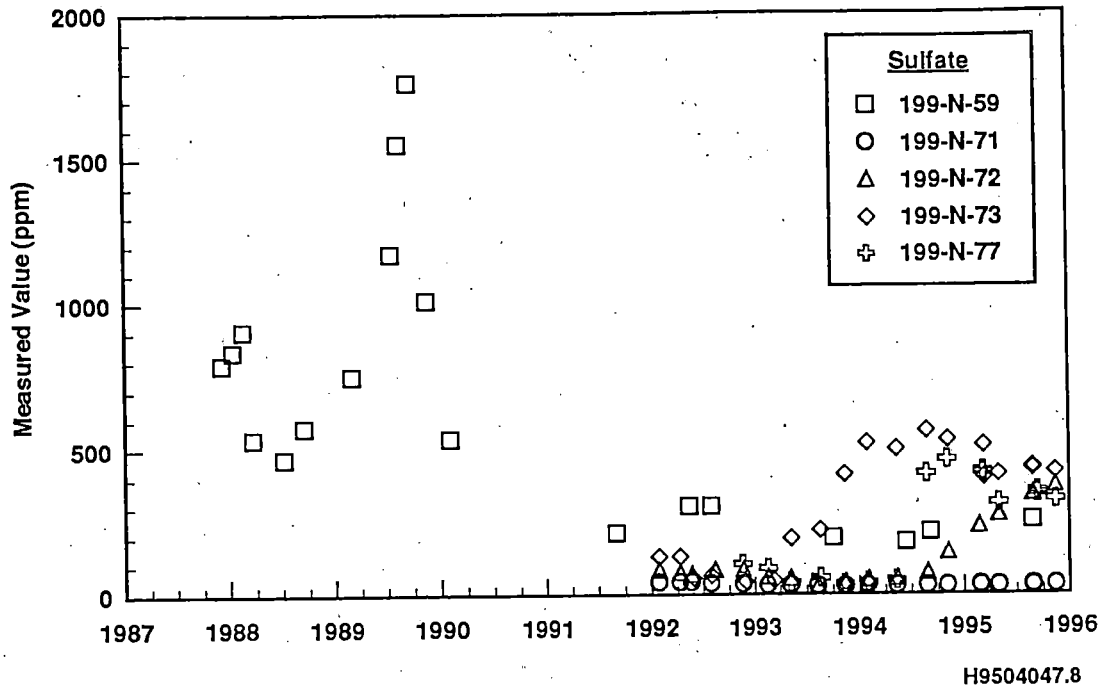
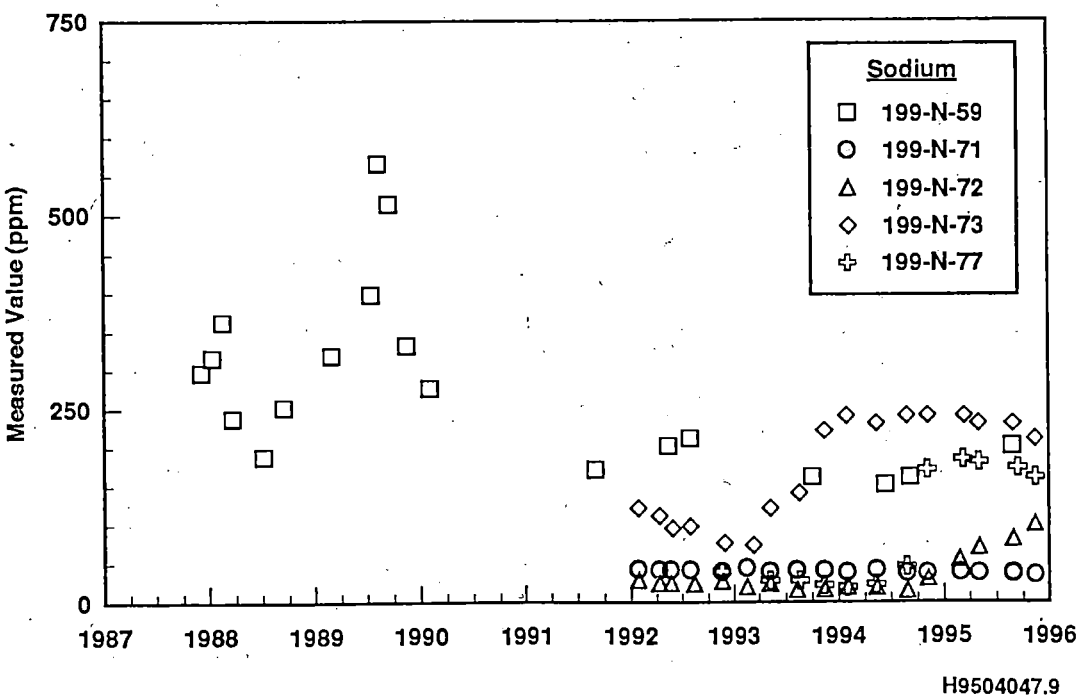


Figure 9. Sodium vs Time in 1324-N/NA Wells.



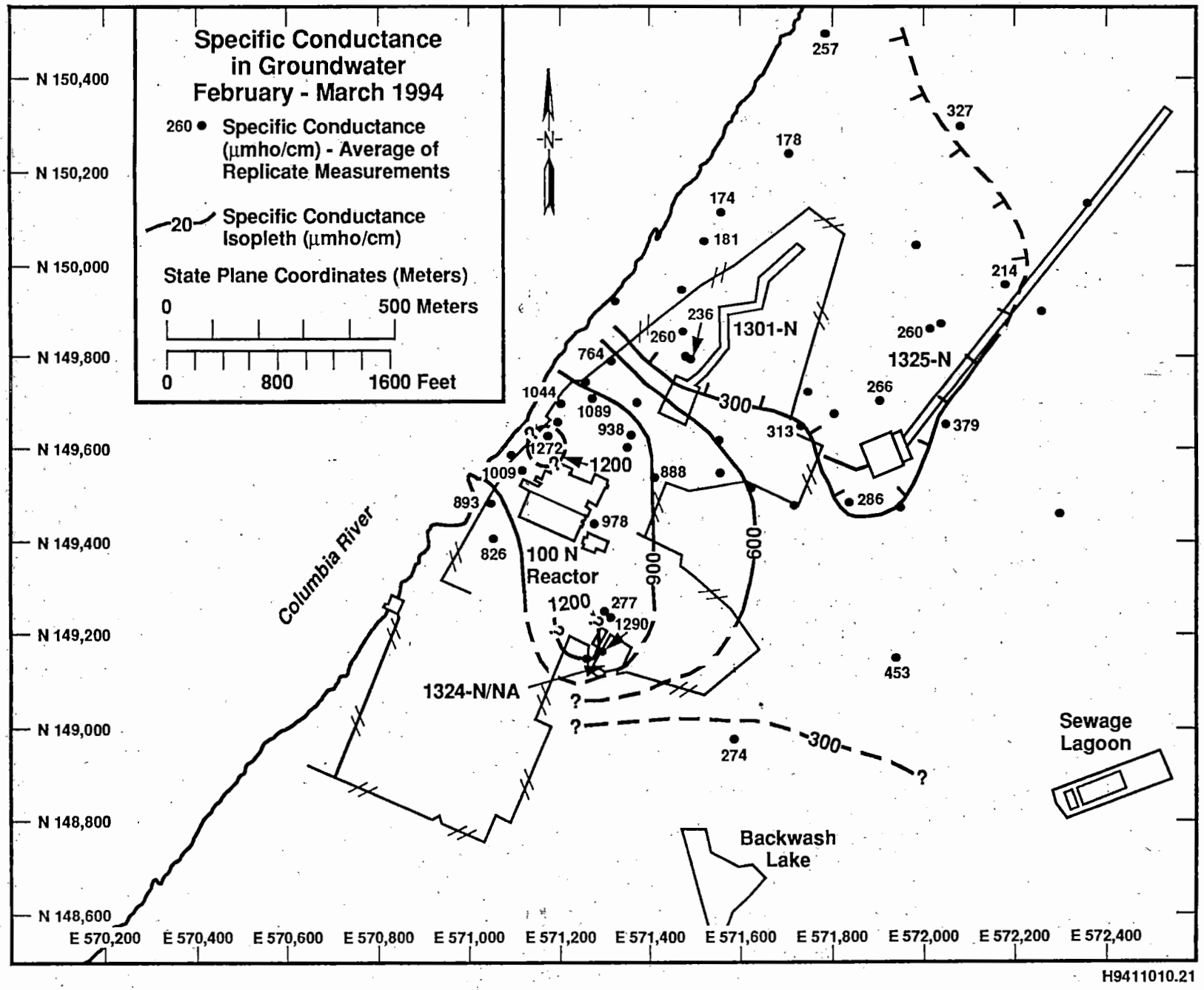


Figure 10. Conductivity in the Uppermost Aquifer, February/March 1994.

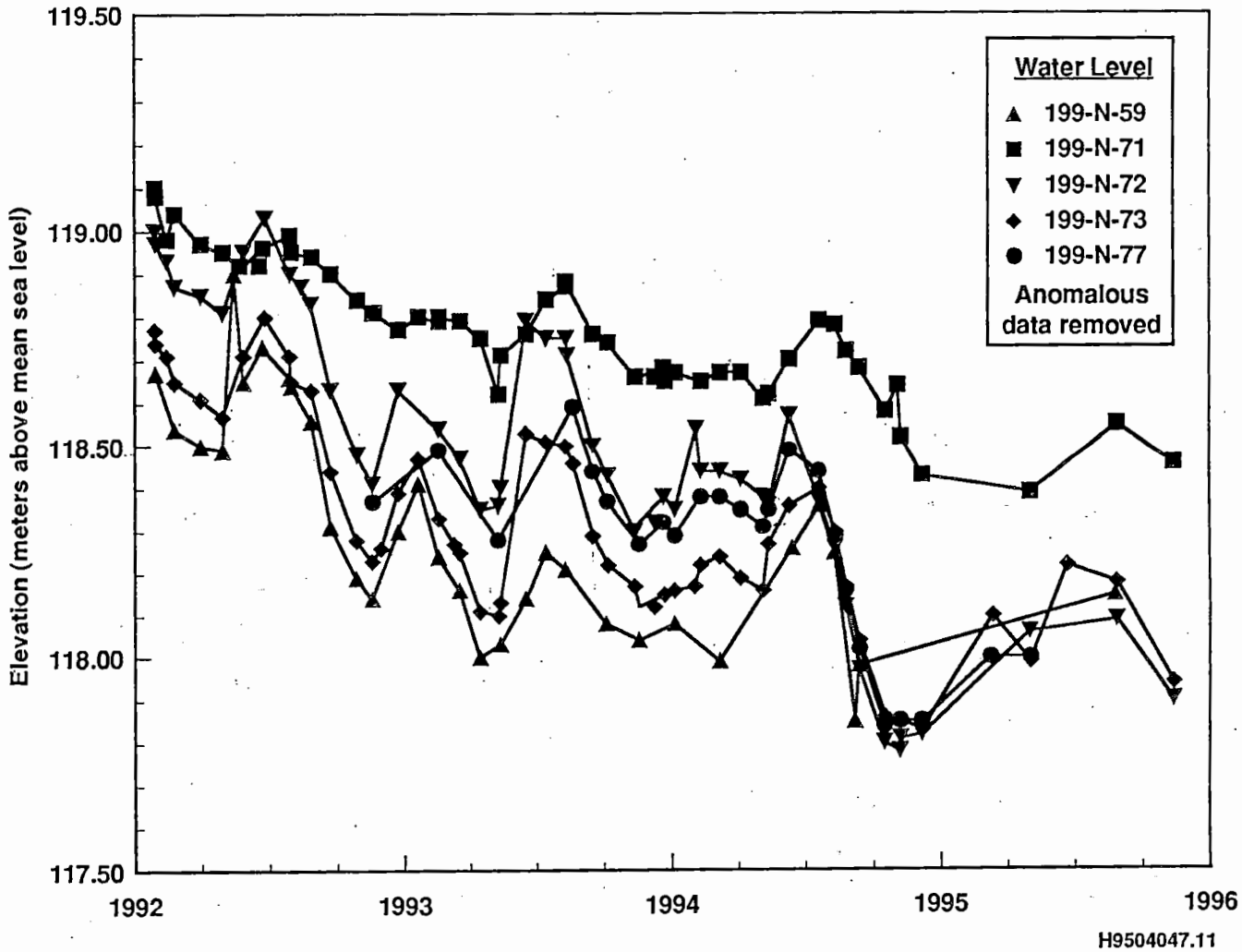


Figure 11. Water Levels in 1324-N/NA Wells.

APPENDIX A

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

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 199-N-71

WELL DESIGNATION :	199-N-71
CERCLA UNIT :	100 Aggregate Area Management Study
RCRA FACILITY :	1324-N/NA
HANFORD COORDINATES :	N 83,696.76 W 59,945.5 [100N-conversion]
100N	N 5,088.5 W 4,643.8 [11Dec91-100N]
LAMBERT COORDINATES :	N 488,845 E 2,235,165 [HANCONV]
	N 148,982.17m E 571,588.81m [ACOE-NAD83]
DATE DRILLED :	Oct91
DEPTH DRILLED (GS) :	87.0-ft
MEASURED DEPTH (GS) :	Not documented
DEPTH TO WATER (GS) :	68.1-ft, 25Oct91
	70.4-ft, 17Jun93
CASING DIAMETER :	4-in stainless steel, +1.0↔63.8-ft;
	6-in stainless steel, +3.01↔-0.5-ft
ELEV TOP CASING :	463.04-ft, [11Dec91-NGVD'29]
ELEV GROUND SURFACE :	460.06-ft, Brass cap [11Dec91-NGVD'29]
PERFORATED INTERVAL :	Not applicable
SCREENED INTERVAL :	63.8↔84.5-ft, 4-in #20-slot stainless steel;
COMMENTS :	FIELD INSPECTION, 23Aug93;
	4 and 6-in stainless steel casing.
	4-ft by 4-ft concrete pad, 4 posts, 1 removable.
	Capped and locked, brass cap in pad with well ID.
	Not in radiation zone.
	OTHER:
AVAILABLE LOGS :	Geologist
TV SCAN COMMENTS :	Not applicable
DATE EVALUATED :	Not applicable
EVAL RECOMMENDATION :	Not applicable
LISTED USE :	100N monthly w/l measurement, 27Nov91↔12Sep94;
CURRENT USER :	BHI ER characterization
	WHC ES&M w/l monitoring and RCRA sampling,
PUMP TYPE :	Hydrostar
MAINTENANCE :	

WELL CONSTRUCTION AND COMPLETION SUMMARY

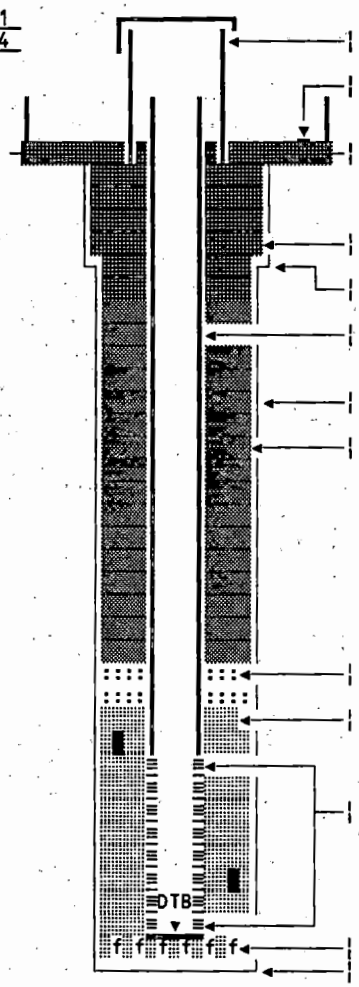
Drilling Method: Cable tool	Sample Drive barrel Method: Hard tool	WELL NUMBER: 199-N-71 A4714 TEMPORARY WELL NO:
Drilling Fluid Used: Raw water	Additives Used: None	Hanford 100N N 5,088.5 W 4,643.8
Driller's Name: J. Ockert	WA State Lic Nr: Not documented	Coordinates: N/S N 83,696.76 E/W W 59,945.50
Drilling Company: Kaiser Engineers	Company Location: Hanford	State NAD83 N 148,982.17m E 571,588.81m
Date Started: 07Aug91	Date Complete: 28Oct91	Coordinates: N 488,845 E 2,235,165
		Start Card #: Not documented T___ R___ S___
		Elevation Ground surface: 460.03-ft Brass cap

Depth to water: 68.1-ft 25Oct91
(Ground surface) 70.7-ft 12Sep94

GENERALIZED STRATIGRAPHY Geologist's Log
Sl=slightly

0↔3.5: Sl gravelly SILT
3.5↔10: Silty sandy GRAVEL
10↔20 Gravelly sandy SILT
20↔45: GRAVEL
45↔85: Sandy GRAVEL
85↔86.1: Gravelly SAND
86.1↔87: Sandy GRAVEL

DRILLING NOTE:
Drill shoe left in hole from 10-in casing. Slag from removing casing also noted falling in hole.
Magnetic anomalies logged @ 62 and 75-ft (GS).



- Elevation of reference point: [463.06-ft] (top of casing)
- Height of reference point above ground surface [3.0-ft]
- Depth of surface seal [+0.5↔18.0-ft]
  Type of surface seal, 4-ft by 4-ft concrete surface pad extending 3.0-ft into annulus
- Cement grout to 18.0-ft
- 13-in nominal hole, 0↔12.6-ft
- 4-in ID T304 stainless steel casing, +3.0↔63.8-ft
- 11-in nominal hole, 12.6↔87.0-ft
- Bentonite crumbles, 18.0↔55.8-ft
- Bentonite pellets, 55.8↔59.7-ft
- 10↔20-mesh silica sand, 59.7↔85.8-ft
- 4-in ID T304 stainless steel screen, 63.8↔84.5-ft, #20-slot
- Fill, 85.8↔87.0-ft
- Borehole drilled depth: [87.0-ft]

DTB=Depth to bottom, 85.1-ft, 23Aug93

Drawing By: RKL/1-N-71.ASB
Date : 21Dec94
Reference : WHC-SD-EN-DP-40

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 199-N-72

WELL DESIGNATION :	199-N-72
CERCLA UNIT :	100 Aggregate Area Management Study
RCRA FACILITY :	1324-N/NA
HANFORD COORDINATES :	N 84,577.20 W 60,884.34 [100N-conversion]
100N	N 5,532.5 W 5,851.1 [11Dec91-100N]
LAMBERT COORDINATES :	N 497,723 E 2,234,225 [HANCONV]
	N 149,249.65m E 571,302.17m [ACOE-NAD83]
DATE DRILLED :	Oct91
DEPTH DRILLED (GS) :	84.1-ft
MEASURED DEPTH (GS) :	84.4-ft, 12Aug93
DEPTH TO WATER (GS) :	65.1-ft, 25Oct91
	68.6-ft, 13Sep94
CASING DIAMETER :	4-in stainless steel, +1.0↔61.2-ft;
	6-in stainless steel, +3.40↔~0.5-ft
ELEV TOP CASING :	458.99-ft, [11Dec91-NGVD'29]
ELEV GROUND SURFACE :	455.59-ft, Brass cap [11Dec91-NGVD'29]
PERFORATED INTERVAL :	Not applicable
SCREENED INTERVAL :	61.2↔82.3-ft, 4-in #20-slot stainless steel;
COMMENTS :	FIELD INSPECTION, 12Aug93;
	4 and 6-in stainless steel casing.
	4-ft by 4-ft concrete pad, 4 posts, 1 removable.
	Capped and locked, brass cap in pad with well ID.
	Not in radiation zone.
	OTHER:
AVAILABLE LOGS :	Geologist
TV SCAN COMMENTS :	Not applicable
DATE EVALUATED :	Not applicable
EVAL RECOMMENDATION :	Not applicable
LISTED USE :	100N monthly w/l measurement, 27Nov91↔13Sep94;
CURRENT USER :	BHI ER characterization
	WHC ES&M w/l monitoring and RCRA sampling,
PUMP TYPE :	Hydrostar
MAINTENANCE :	

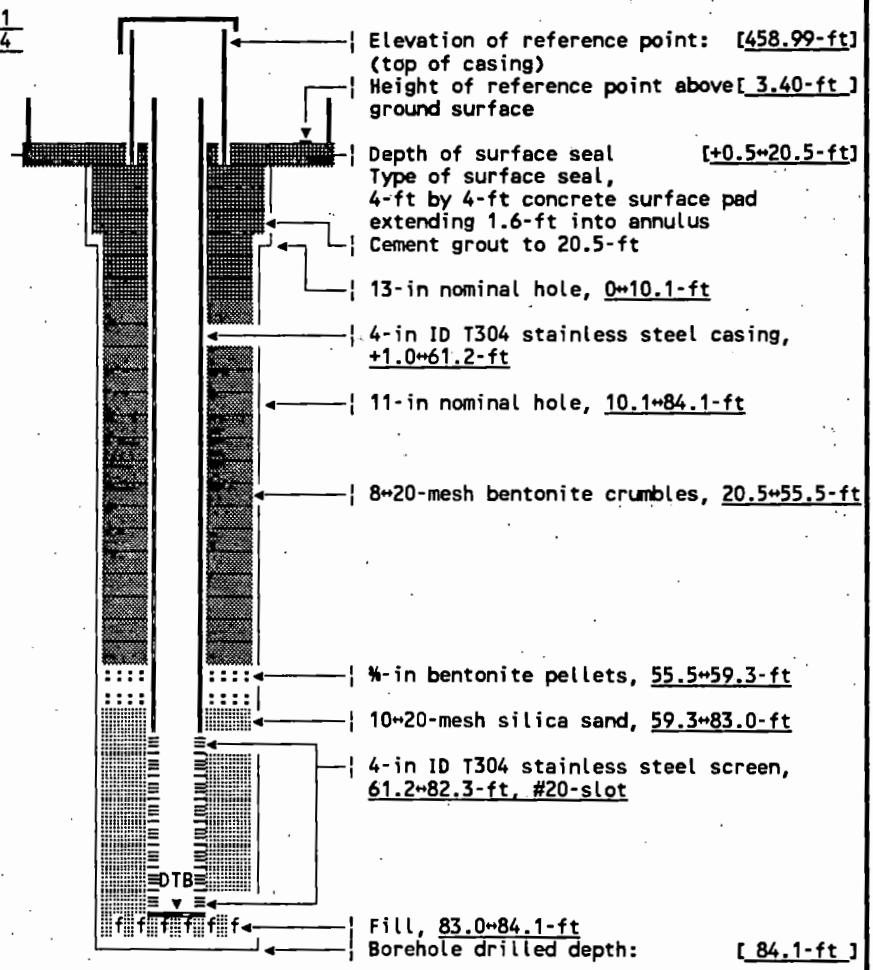
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Drive barrel Method: Hard tool	WELL NUMBER: 199-N-72 A4715 TEMPORARY WELL NO:
Drilling Fluid Used: Raw water	Additives Used: None	Hanford 100N N 5,532.5 W 5,851.1
Driller's Name: J. Ockert/G. Howel	WA State Lic Nr: Not documented	Coordinates: N/S N 84,577.20 E/W W 60,884.34
Drilling Company: Kaiser Engineers	Company Location: Hanford	State NAD83 N 149,249.65m E 571,302.17m
Date Started: 30Aug91	Date Complete: 30Oct91	Coordinates: N 497,723 E 2,234,225
		Start Card #: Not documented T___ R___ S___
		Elevation Ground surface: 455.59-ft Brass cap

Depth to water: 65.1-ft 25Oct91
(Ground surface)68.6-ft 13Sep94

GENERALIZED Geologist's STRATIGRAPHY Log
Sl=slightly

0↔5: Silty sandy GRAVEL
5↔35: Sandy GRAVEL
35↔55: GRAVEL
55↔65: Sandy GRAVEL
65↔82: GRAVEL
82↔82.4: Gravelly SAND
82.4↔84.1: Sandy GRAVEL



Elevation of reference point: [458.99-ft] (top of casing)
Height of reference point above ground surface [3.40-ft]
Depth of surface seal [+0.5↔20.5-ft]
Type of surface seal, 4-ft by 4-ft concrete surface pad extending 1.6-ft into annulus
Cement grout to 20.5-ft
13-in nominal hole, 0↔10.1-ft
4-in ID T304 stainless steel casing, +1.0↔61.2-ft
11-in nominal hole, 10.1↔84.1-ft
8↔20-mesh bentonite crumbles, 20.5↔55.5-ft
⅜-in bentonite pellets, 55.5↔59.3-ft
10↔20-mesh silica sand, 59.3↔83.0-ft
4-in ID T304 stainless steel screen, 61.2↔82.3-ft, #20-slot
Fill, 83.0↔84.1-ft
Borehole drilled depth: [84.1-ft]

DTB=Depth to bottom, 84.4-ft, 12Aug93

Drawing By: RKL/1-N-72.ASB
Date : 21Dec94
Reference : WHC-SD-EN-DP-40

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 199-N-73

WELL DESIGNATION :	199-N-73
CERCLA UNIT :	100 Aggregate Area Management Study
RCRA FACILITY :	1324-N/NA
HANFORD COORDINATES :	N 84,312.68 W 60,917.40 [100N-conversion]
100N	N 5,275.7 W 5,779.1 [11Dec91-100N]
LAMBERT COORDINATES :	N 489,458 E 2,234,191 [HANCONV]
	N 149,168.99m E 571,292.02m [ACOE-NAD83]
DATE DRILLED :	Oct91
DEPTH DRILLED (GS) :	89.1-ft
MEASURED DEPTH (GS) :	87.7-ft, 18Oct93
DEPTH TO WATER (GS) :	68.3-ft, 16Sep91
	72.7-ft, 13Sep94
CASING DIAMETER :	4-in stainless steel, +1.0↔65.4-ft;
	6-in stainless steel, +3.30↔~0.5-ft
ELEV TOP CASING :	463.28-ft, [11Dec91-NGVD'29]
ELEV GROUND SURFACE :	459.98-ft, Brass cap [11Dec91-NGVD'29]
PERFORATED INTERVAL :	Not applicable
SCREENED INTERVAL :	65.4↔86.1-ft, 4-in #20-slot stainless steel;
COMMENTS :	FIELD INSPECTION, 18Oct93;
	4 and 6-in stainless steel casing.
	4-ft by 4-ft concrete pad, 4 posts, 1 removable.
	Capped and locked, brass cap in pad with well ID.
	Not in radiation zone.
	OTHER:
AVAILABLE LOGS :	Geologist
TV SCAN COMMENTS :	Not applicable
DATE EVALUATED :	Not applicable
EVAL RECOMMENDATION :	Not applicable
LISTED USE :	100N monthly w/l measurement, 27Nov91↔13Sep94
CURRENT USER :	BHI ER characterization
	WHC ES&M w/l monitoring and RCRA sampling,
PUMP TYPE :	Hydrostar
MAINTENANCE :	

WELL CONSTRUCTION AND COMPLETION SUMMARY

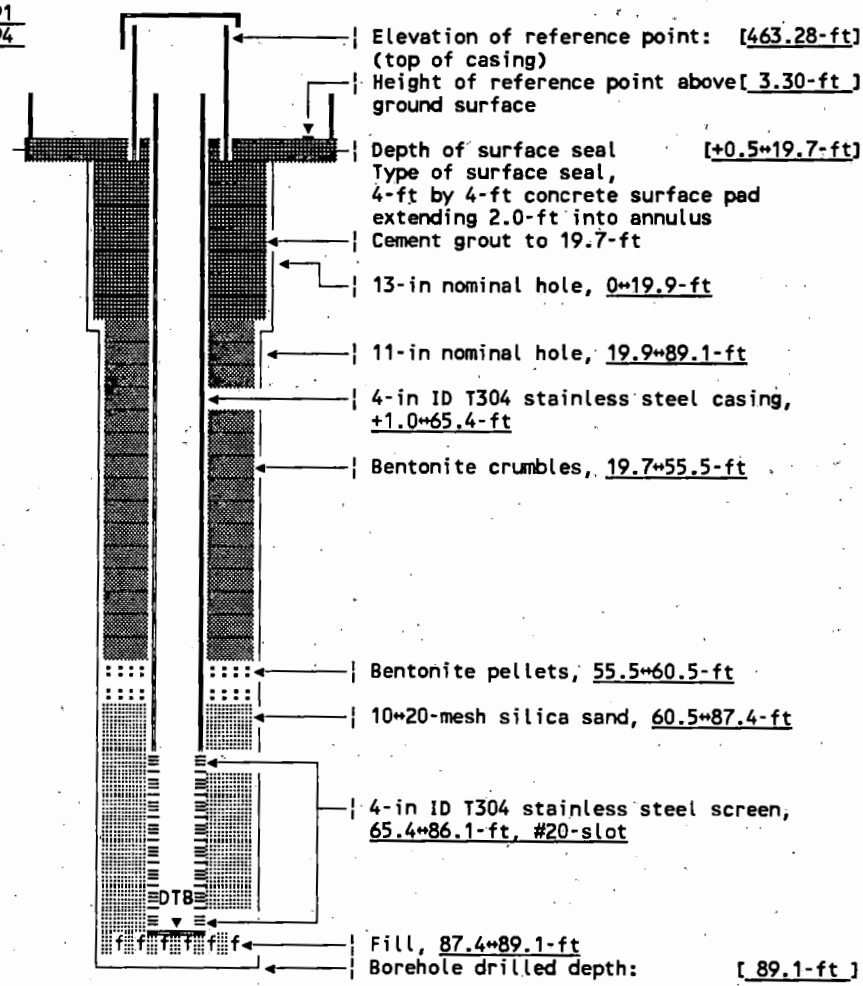
Drilling Method: Cable tool	Sample Method: Hard tool
Drilling Fluid Used: Raw water	Additives Used: None
Driller's Name: D. Kruger	WA State Lic Nr: Not documented
Drilling Company: Kaiser Engineers	Company Location: Hanford
Date Started: 26Aug91	Date Complete: 31Oct91

WELL NUMBER: 199-N-73 A4716 TEMPORARY WELL NO:
Hanford 100N N 5,275.7 W 5,779.1
Coordinates: N/S N 84,312.68 E/W W 60,917.40
State NAD83 N 149,168.99m E 571,292.02m
Coordinates: N 489,458 E 2,234,191
Start Card #: Not documented T___ R___ S___
Elevation Ground surface: 459.98-ft Brass cap

Depth to water: 68.3-ft 16Sep91
(Ground surface) 72.7-ft 13Sep94

GENERALIZED STRATIGRAPHY Log
Geologist's
Sl=slightly

0↔50: GRAVEL
50↔72.1: Sandy GRAVEL
72.1↔73.6: Gravelly SAND
73.6↔89.1: Sandy GRAVEL



DTB=Depth to bottom,
87.7-ft, 18Oct93

Drawing By: RKL/1-N-73.ASB
Date : 21Dec94
Reference : WHC-SD-EN-DP-40

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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 Phases I and II of the assessment of total organic halogen at the 1324-N/NA Site. Table B-1 includes organic constituents for samples collected between August 1993 and November 1995. Table B-1 includes results of duplicate samples. Tables B-2 through B-4 contain other quality control data. These data have been reported in quarterly RCRA groundwater monitoring reports.

Concentration units in the following tables are ppb unless otherwise noted. 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	
199-N-59	10/04/93	B090L3	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	1.70	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	6/13/94	B0C0H1	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	2.30	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
		B0C0H2	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	2.00	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	9/07/94	B0C9B5	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	.76	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-59	9/07/94	B0C9B5	Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	8/25/95	B0GC14	Total organic carbon	1200.00	
			Total organic halogen	6.90	U
199-N-71	8/10/93	B090L8	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	4.30	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	L
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	11/12/93	B09LC3	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	6.20	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	BL
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	2/01/94	B09TT9	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	UX
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	5.30	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	UX
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-71	5/12/94	B0BWN1	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	4.20	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	8/26/94	B0C9C2	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	3.50	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	11/04/94	B0D714	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	UH
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	4.10	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	3/01/95	B0DYF3	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	U
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	4.30	
			Ethylbenzene	.05	U
			Methylene chloride	.09	UQ
			Tetrachloroethene	.22	U
			Toluene	.02	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-71	3/01/95	BODYF3	Total organic carbon	300.00	L
			Total organic halogen	10.10	
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
		BODYF4	Total organic carbon	300.00	L
			Total organic halogen	9.00	
		BODYF5	Total organic carbon	400.00	L
			Total organic halogen	5.00	U
		BODYF6	Total organic carbon	300.00	L
			Total organic halogen	5.00	U
	5/02/95	BOFCB1	1,1,1-Trichloroethane	.06	U
			1,1,2-Trichloroethane	.07	U
			1,1-Dichloroethane	.05	U
			1,2-Dichloroethane	.05	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.06	U
			Carbon tetrachloride	.04	U
			Chloroform	3.50	
			Ethylbenzene	.03	U
			Methylene chloride	.08	U
			Tetrachloroethene	.04	U
			Toluene	.05	U
			Total organic carbon	200.00	L
			Total organic halogen	6.90	U
			Trichloroethene	.08	U
			Vinyl chloride	.25	U
			Xylenes (total)	.09	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.05	U
		BOFCB2	Total organic carbon	300.00	L
			Total organic halogen	6.90	U
		BOFCB3	Total organic carbon	200.00	L
			Total organic halogen	6.90	U
		BOFCB4	Total organic carbon	300.00	L
			Total organic halogen	6.90	U
	8/28/95	BOGBT9	Total organic carbon	300.00	L
			Total organic halogen	9.00	L
		BOGC22	Total organic carbon	300.00	L
			Total organic halogen	8.00	L
	11/13/95	BOGWL3	Total organic carbon	300.00	L
			Total organic halogen	6.90	U
199-N-72	8/11/93	BO90M3	1,1,1-Trichloroethane	.07	UY
			1,1,2-Trichloroethane	.04	UHY
			1,1-Dichloroethane	.34	UY
			1,2-Dichloroethane	.14	UY
			1,4-Dichlorobenzene	.11	UY
			Benzene	.11	UY
			Carbon tetrachloride	.12	UY
			Chloroform	99.00	Y
			Ethylbenzene	.05	UY
			Methylene chloride	1.10	LBY
			Tetrachloroethene	.05	UY
			Toluene	.06	UY
			Trichloroethene	.32	LY
			Vinyl chloride	.27	UY
			Xylenes (total)	.20	UY
			cis-1,2-Dichloroethylene	.13	UY
			trans-1,2-Dichloroethylene	.15	UY

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-72	11/12/93	B09LC8	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	62.00	D
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	2/03/94	B09FH3	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	UY
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	32.00	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	UXY
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
		B09TV4	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	UY
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	29.00	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	UXY
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	5/12/94	B0BWN6	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	33.00	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-72	5/12/94	B0BWN6	Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	8/26/94	B0C9C7	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	22.00	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	11/07/94	B0D719	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	UH
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	23.00	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
		B0D720	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	UH
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	22.00	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	2/24/95	B0DWY9	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	U
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-72	2/24/95	B0DWY9	Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	8.50	
			Ethylbenzene	.05	U
			Methylene chloride	.09	UQ
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Total organic carbon	300.00	L
			Total organic halogen	16.90	
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	5/02/95	B0FCB6	1,1,1-Trichloroethane	.06	U
			1,1,2-Trichloroethane	.07	U
			1,1-Dichloroethane	.05	U
			1,2-Dichloroethane	.05	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.06	U
			Carbon tetrachloride	.04	U
			Chloroform	6.90	
			Ethylbenzene	.03	U
			Methylene chloride	.08	U
			Tetrachloroethene	.04	U
			Toluene	.05	U
			Total organic carbon	400.00	L
			Total organic halogen	8.80	L
			Trichloroethene	.08	U
			Vinyl chloride	.25	U
			Xylenes (total)	.09	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.05	U
	8/28/95	B0GBZ6	1,1,1-Trichloroethane	.28	UH
			1,1,2-Trichloroethane	.19	UH
			1,1-Dichloroethane	.22	UH
			1,2-Dichloroethane	.24	UH
			1,2-Dichloroethene	.26	UH
			1,4-Dichlorobenzene	1.30	LH
			1-Butanol	84.00	UH
			4-Methyl-2-pentanone	.65	UH
			Acetone	4.70	UH
			Benzene	.14	UH
			Carbon disulfide	.65	UH
			Carbon tetrachloride	.22	UH
			Chloroform	6.00	H
			Ethyl cyanide	2.70	UH
			Methyl ethyl ketone	3.90	UH
			Methylene chloride	.62	UH
			Tetrachloroethene	.24	UH
			Tetrahydrofuran	.45	UH
			Toluene	.13	UH
			Total organic carbon	400.00	L
			Total organic halogen	10.00	L
			Trichloroethene	.24	UH
			Vinyl chloride	.33	UH
			Xylenes (total)	.57	UH

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-72	11/13/95	B0GWH8	Total organic carbon	440.00	L
			Total organic halogen	6.90	DU
		B0GWL5	1,1,1-Trichloroethane	.28	U
			1,1,2-Trichloroethane	.19	U
			1,1-Dichloroethane	.22	U
			1,2-Dichloroethane	.24	U
			1,4-Dichlorobenzene	.20	U
			1-Butanol	84.00	U
			4-Methyl-2-pentanone	.65	U
			Acetone	4.70	U
			Benzene	.14	U
			Carbon disulfide	.65	U
			Carbon tetrachloride	.22	U
			Chloroform	59.00	F
			Ethyl cyanide	2.70	U
			Methyl ethyl ketone	3.90	U
			Methylene chloride	.62	U
			Tetrachloroethene	.24	U
			Tetrahydrofuran	.45	U
			Toluene	.13	U
			Trichloroethene	.24	U
			Vinyl chloride	.33	U
			Xylenes (total)	.57	U
			cis-1,2-Dichloroethylene	.17	U
			trans-1,2-Dichloroethylene	.14	U
199-N-73	8/20/93	B090M8	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	13.00	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	11/12/93	B09LD0	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	10.00	
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-73	2/01/94	B09TW1	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	UX
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.49	L
			Chloroform	7.60	
			Ethylbenzene	.09	BL
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	UX
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	5/12/94	B0BWN8	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	8.10	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	8/26/94	B0C9C9	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	6.30	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	11/07/94	B0D723	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	UH
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	6.30	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-73	11/07/94	B0D723	Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	3/13/95	B0DYF8	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	U
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	7.40	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Total organic halogen	8.80	
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	5/03/95	B0FCB8	1,1,1-Trichloroethane	.06	U
			1,1,2-Trichloroethane	.07	U
			1,1-Dichloroethane	.05	U
			1,2-Dichloroethane	.05	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.06	U
			Carbon tetrachloride	1.10	
			Chloroform	6.50	
			Ethylbenzene	.03	U
			Methylene chloride	.08	U
			Tetrachloroethene	.04	U
			Toluene	.05	U
			Total organic carbon	300.00	L
			Total organic halogen	8.00	L
			Trichloroethene	.08	U
			Vinyl chloride	.25	U
			Xylenes (total)	.09	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.05	U
	8/28/95	B0GC30	Total organic carbon	400.00	L
			Total organic halogen	9.00	L
	11/13/95	B0GWL6	Total organic carbon	400.00	L
			Total organic halogen	6.90	U
199-N-77	8/20/93	B090N3	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	94.00	D
			Ethylbenzene	.05	U
			Methylene chloride	.10	LB
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-77	8/20/93	B090N3	Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	11/12/93	B09LD2	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	83.00	D
			Ethylbenzene	.05	U
			Methylene chloride	.06	U
			Tetrachloroethene	.05	U
			Toluene	.06	U
			Trichloroethene	.07	U
			Vinyl chloride	.27	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	2/01/94	B09TW3	1,1,1-Trichloroethane	.07	U
			1,1,2-Trichloroethane	.04	UH
			1,1-Dichloroethane	.34	U
			1,2-Dichloroethane	.14	UX
			1,4-Dichlorobenzene	.11	U
			Benzene	.11	U
			Carbon tetrachloride	.12	U
			Chloroform	33.00	
			Ethylbenzene	.05	BL
			Methylene chloride	.06	U
			Tetrachloroethene	.06	L
			Toluene	.07	L
			Trichloroethene	.07	U
		B09TW3	Vinyl chloride	.27	UX
			Xylenes (total)	.23	L
			cis-1,2-Dichloroethylene	.13	U
			trans-1,2-Dichloroethylene	.15	U
	5/12/94	B0BWP0	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	28.00	
			Ethylbenzene	.04	U
			Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	8/26/94	B0C9D1	1,1,1-Trichloroethane	.22	U
			1,1,2-Trichloroethane	.06	UH
			1,1-Dichloroethane	.08	U
			1,2-Dichloroethane	.06	U
			1,4-Dichlorobenzene	.11	U
			Benzene	.24	U
			Carbon tetrachloride	.32	U
			Chloroform	30.00	
			Ethylbenzene	.04	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-77	8/26/94	B0C9D1	Methylene chloride	.08	U
			Tetrachloroethene	.08	U
			Toluene	.08	U
			Trichloroethene	.04	U
			Vinyl chloride	.15	U
			Xylenes (total)	.20	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.07	U
	11/07/94	B0D725	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	UH
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	8.80	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	3/10/95	B0DYH9	1,1,1-Trichloroethane	.04	U
			1,1,2-Trichloroethane	.08	U
			1,1-Dichloroethane	.06	U
			1,2-Dichloroethane	.03	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.01	U
			Carbon tetrachloride	.08	U
			Chloroform	7.60	
			Ethylbenzene	.05	U
			Methylene chloride	.09	U
			Tetrachloroethene	.22	U
			Toluene	.02	U
			Total organic carbon	400.00	L
			Total organic halogen	15.20	
			Trichloroethene	.11	U
			Vinyl chloride	.13	U
			Xylenes (total)	.04	U
			cis-1,2-Dichloroethylene	.11	U
			trans-1,2-Dichloroethylene	.07	U
	5/03/95	B0FCC0	1,1,1-Trichloroethane	.06	U
			1,1,2-Trichloroethane	.07	U
			1,1-Dichloroethane	.05	U
			1,2-Dichloroethane	.05	U
			1,4-Dichlorobenzene	.06	U
			Benzene	.06	U
			Carbon tetrachloride	6.50	F
			Chloroform	6.70	
			Ethylbenzene	.03	U
			Methylene chloride	.08	U
			Tetrachloroethene	.04	U
			Toluene	.05	U
			Total organic carbon	200.00	L
			Total organic halogen	6.90	U
			Trichloroethene	.08	U
			Vinyl chloride	.25	U
			Xylenes (total)	.09	U
			cis-1,2-Dichloroethylene	.05	U
			trans-1,2-Dichloroethylene	.05	U

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

Well	Sample Date	Sample Number	Constituent Name	Result	
199-N-77	9/15/95	B0GC08	1,1,1-Trichloroethane	.28	U
			1,1,2-Trichloroethane	.19	U
			1,1-Dichloroethane	.22	U
			1,2-Dichloroethane	.24	U
			1,2-Dichloroethene	.26	U
			1,4-Dichlorobenzene	.20	U
			1-Butanol	84.00	U
			4-Methyl-2-pentanone	.65	U
			Acetone	4.70	U
			Benzene	.14	U
			Carbon disulfide	.65	U
			Carbon tetrachloride	.22	U
			Chloroform	8.30	
			Ethyl cyanide	2.70	U
			Methyl ethyl ketone	3.90	U
			Methylene chloride	.62	U
			Tetrachloroethene	.24	U
			Tetrahydrofuran	.45	U
			Toluene	.13	U
			Total organic carbon	300.00	L
			Total organic halogen	7.00	L
			Trichloroethene	.24	U
			Vinyl chloride	.33	U
			Xylenes (total)	.57	U
	11/13/95	B0GWL1	Total organic carbon	400.00	L
			Total organic halogen	6.90	U
		B0GWL8	1,1,1-Trichloroethane	.28	U
			1,1,2-Trichloroethane	.19	U
			1,1-Dichloroethane	.22	U
			1,2-Dichloroethane	.24	U
			1,4-Dichlorobenzene	.20	U
			1-Butanol	84.00	U
			4-Methyl-2-pentanone	.65	U
			Acetone	4.70	U
			Benzene	.14	U
			Carbon disulfide	.65	U
			Carbon tetrachloride	.22	U
			Chloroform	7.30	
			Ethyl cyanide	2.70	U
			Methyl ethyl ketone	3.90	U
			Methylene chloride	.62	U
			Tetrachloroethene	.24	U
			Tetrahydrofuran	.45	U
			Toluene	.13	U
			Trichloroethene	.24	U
			Vinyl chloride	.33	U
			Xylenes (total)	.57	U
			cis-1,2-Dichloroethylene	.17	U
			trans-1,2-Dichloroethylene	.14	U

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

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

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

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

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

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

Table B-4. 1324-N/NA Matrix Spike Sample.

Collect Date	Sample Number	Constituent Name	Result
8/28/95	B0GC21	1,1,1-Trichloroethane	.28 UH
		1,1,2-Trichloroethane	.19 UH
		1,1-Dichloroethane	.22 UH
		1,2-Dichloroethane	.24 UH
		1,2-Dichloroethene	.26 UH
		1,4-Dichlorobenzene	.20 UH
		1-Butanol	84.00 UH
		4-Methyl-2-pentanone	.65 UH
		Acetone	4.70 UH
		Benzene	.14 UH
		Carbon disulfide	.65 UH
		Carbon tetrachloride	.22 UH
		Chloroform	81.00 H
		Ethyl cyanide	2.70 UH
		Methyl ethyl ketone	3.90 UH
		Methylene chloride	.62 UH
		Tetrachloroethene	.24 UH
		Tetrahydrofuran	.45 UH
		Toluene	.13 UH
		Total organic halogen	50.00
		Trichloroethene	.24 UH
		Vinyl chloride	.33 UH
		Xylenes (total)	.57 UH
11/13/95	B0GWJ0	1,1,1-Trichloroethane	.3 U
		1,1,2-Trichloroethane	.2 U
		1,1-Dichloroethane	.2 U
		1,2-Dichloroethane	.2 U
		1,4-Dichlorobenzene	.2 U
		1-Butanol	84.0 U
		4-Methyl-2-pentanone	.7 U
		Acetone	4.7 U
		Benzene	.1 U
		Carbon disulfide	.7 U
		Carbon tetrachloride	.2 U
		Chloroform	6.3 F
		Ethyl cyanide	2.7 U
		Methyl ethyl ketone	3.9 U
		Methylene chloride	.6 U
		Tetrachloroethene	.2 U
		Tetrahydrofuran	.5 U
		Toluene	.1 U
		Trichloroethene	.2 U
		Vinyl chloride	.3 U
		Xylenes (total)	.6 U
		cis-1,2-Dichloroethylene	.2 U
		trans-1,2-Dichloroethyl	.1 U

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APPENDIX C

GROUNDWATER MONITORING PLAN FOR THE 1324-N/NA SITE

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APPENDIX C

GROUNDWATER MONITORING PLAN FOR THE 1324-N/NA SITE

This appendix describes the essential elements of a detection-level groundwater monitoring program for the 1324-N/NA site. A more detailed groundwater monitoring plan will replace this appendix later in 1996.

Resource Conservation and Recovery Act of 1976 (RCRA) groundwater monitoring in the 100-N Area has been coordinated with other groundwater programs (e.g., *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), performance assessment, sitewide surveillance), as described in Borghese et al. (1996). Borghese et al. (1996) includes well lists and constituent lists for the 1324-N/NA RCRA program. However, it does not provide additional detail such as quality assurance/quality control (QA/QC) requirements, sampling protocols, and statistical methods. Therefore, a RCRA monitoring plan is still required.

C.1 MONITORING NETWORK

One upgradient well (N-71) and two downgradient wells (N-72 and N-73) will be monitored for the site. The RCRA regulations (40 *Code of Federal Regulations* (CFR) 265.91) require at least three downgradient wells. However, there is technical justification for using only two wells. The 1324-N/NA facility is small and can be adequately monitored by two downgradient wells. The Monitoring Efficiency Model (Jackson et al. 1991) indicates the network is 100 percent efficient with only wells N-72 and N-73 as downgradient wells. Well N-59, a downgradient well that has been monitored in the past, is nearly dry and can only be sampled when the local water table is at a seasonal high.

C.2 SAMPLING AND ANALYSIS

C.2.1 Constituent Lists

Groundwater samples from the 1324-N/NA network will be sampled for the constituents listed in Table C-1. The list includes indicator parameters and turbidity (semiannually), and metals, anions, and alkalinity (annually). This list includes all parameters required under 40 CFR 265.92 except phenols. The samples will not be analyzed for phenols because they were not discharged to the 1324-N/NA site and have never been detected in groundwater at the site.

C.2.2 Sampling and Analytical Methods

Sample collection, preservation, chain of custody, analysis, and quality control shall proceed according to the most current revision of WHC (1995).

C.2.3 Statistical Analysis

Statistical methods for detection monitoring are described in the groundwater monitoring plan for the 1301-N and 1325-N sites (Hartman 1993).

C.2.4 Data Validation and Reporting

Data reporting requirements for the analytical laboratory are specified in WHC (1995). Data validation and verification are described in WHC (1995) and WHC-CM-7-8, Section 2.6. Water level and chemistry data are stored in the Hanford Environmental Information System, a publicly available electronic database.

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 REFERENCES

Borghese, J. V., M. J. Hartman, S. P. Lutrell, C. J. Perkins, J. P. Zoric, and S. C. Tindall, 1996, *100-N Pilot Project: Proposed Consolidated Groundwater Monitoring Program*, BHI-00725, Draft A, Bechtel Hanford, Inc., Richland, Washington.

Hartman, M. J., 1993, *Groundwater Monitoring Plan for the 1301-N and 1325-N Facilities*, WHC-SD-EN-AP-038, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Jackson, R. L., C. M. Einbereger, R. B. Mercer, and C. R. Wilson, 1991, Efficiency-Based Groundwater Monitoring Network Design for Hazardous Waste Sites, WHC-SA-1157-FP, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, *Quality Assurance Project Plan for Groundwater Monitoring Activities Managed by Westinghouse Hanford Company*, WHC-SD-EN-QAPP-001, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-8, *Environmental Engineering and Geotechnology Procedures*, Westinghouse Hanford Company, Richland, Washington.

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

Constituent	Semiannually	Annually
pH (field)*	X	
specific conductance (field)*	X	
total organic carbon*	X	
total organic halogen*	X	
turbidity	X	
alkalinity		X
metals by the inductively coupled plasma method (filtered)		X
anions by ion chromatography		X

*quadruplicate samples.

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