PNNL-11885
UC-630

Pacific Northwest
National Laboratory

Operated by Battelle for the
U.S. Department of Energy

Groundwater Quality Assessment Plan for the 1324-N/NA Site

Phase 1 (First Determination)

M. J. Hartman

May 1998

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

PNNL-11885

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401.

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161

Prepared by M. J. Hartman, Senior Research Scientist,
Field Hydrology and Chemistry Group

Mary J Hartman

PNNL-11885
UC-630

Groundwater Quality Assessment Plan for the 1324-N/NA Site

Phase 1 (First Determination)

M. J. Hartman

May 1998

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Richland, Washington 99352

Contents

Figures

Tables

1.0 Introduction

The 1324-N Surface Impoundment and 1324-NA Percolation Pond (1324-N/NA Site) are treatment/storage/disposal sites regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA). They are located in the 100-N Area of the Hanford Site (Figure 1.1), and were used to treat and dispose of corrosive waste from a water treatment plant.

Groundwater monitoring under an interim-status detection program compared indicator parameters from downgradient wells to background values established from an upgradient well. One of the indicator parameters, total organic carbon (TOC), exceeded its background value in one downgradient well, triggering an upgrade from a detection program to an assessment program. This plan presents the first phase of the assessment program.

Organic wastes were not documented to be present in the 1324-N/NA waste stream. The elevated TOC is believed to come from another source nearby. However, additional information is needed to confirm or refute this hypothesis.

1.1 Objective

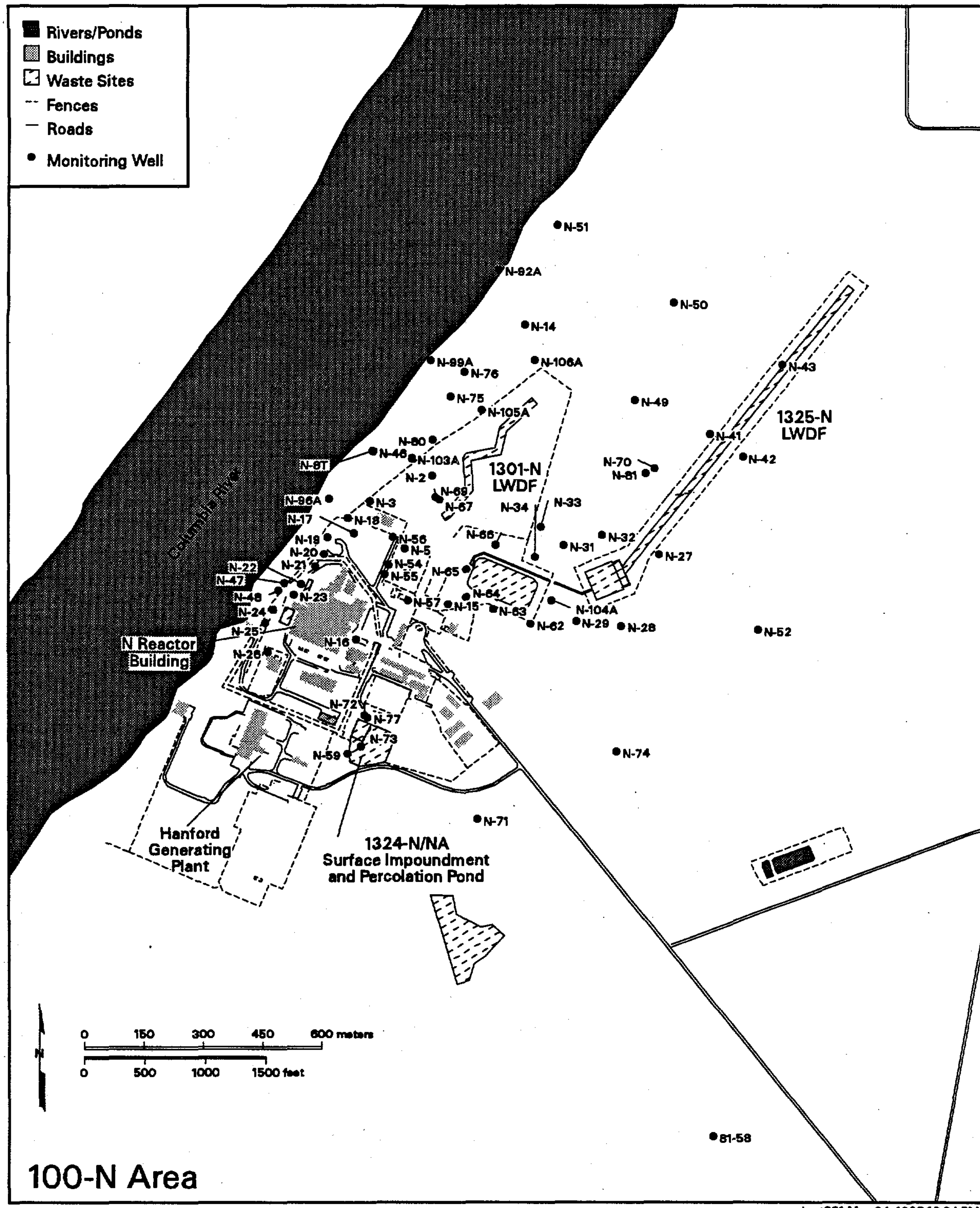
The RCRA regulations [40 CFR 265.94(d)(3)] state that an assessment program must determine:

(i) The rate and extent of migration of the hazardous waste or hazardous waste constituents in the ground water; and
(ii) The concentration of the hazardous waste or hazardous waste constituents in the ground water.

If the results of the first such determination indicate that the contaminant did not originate at the regulated unit, a detection program may be reinstated [40 CFR 265.93(d)(6)]. The objective of phase 1 of the assessment for 1324-N/NA is to determine if it is the source of dangerous waste contamination in groundwater. If so, a second phase of assessment will be designed to determine the nature, rate of movement, and extent of contamination. If 1324-N/NA is not the source, the site will revert to detection monitoring.

1.2 Background

The 1324-N/NA Site was used to treat and dispose of effluent from a water demineralization plant and related facilities. The 1324-NA Percolation Pond is an unlined pond that was used to treat corrosive waste from August 1977 to May 1986 and to dispose of neutralized waste from May 1986 through August 1990. The adjacent 1324-N Surface Impoundment was used to neutralize waste from May 1986 to November 1988. It is a double-lined pond with a leachate collection system. No leaks were detected throughout its period of use (DOE 1998).



canhart001 May 04, 1998 12:04 PM

Figure 1.1. The 1324-N/NA Site Located in the 100-N Area

Waste treated in the 1324-N Surface Impoundment, and before 1986 in the 1324-NA Percolation Pond, had pH ranging from 1 to 14 (DOE 1998, Appendix B). The waste contained sulfuric acid and sodium hydroxide and was designated dangerous because of the characteristic of corrosivity. Discharge of corrosive waste to the percolation pond ceased in 1986, and discharges ceased entirely in 1990. No effluent of any kind has been discharged to the 1324-N Surface Impoundment since 1988.

The 1324-N Surface Impoundment and 1324-NA Percolation Pond are monitored together because of their proximity to one another and their similar waste histories. Groundwater monitoring began in December 1987. After the first year of monitoring, the indicator parameter specific conductance was elevated in all of the downgradient wells. A groundwater quality assessment program ensued, and eventually concluded that the elevated specific conductance was caused by primarily sulfate and sodium, which are nondangerous constituents (Hartman 1992). The monitoring program did not immediately revert to a detection program because total organic halides (TOX), another indicator parameter, was slightly elevated in two downgradient wells. A revised assessment program concluded that the TOX was caused by chloroform from another source upgradient (southeast) of the site (Hartman 1996b). A detection monitoring program was then reinstated (Hartman 1996a).

The 1324-N/NA Site is scheduled to be incorporated into the Hanford Site RCRA Permit modification D in December 1998. At that time, groundwater monitoring will be carried out in accordance with the conditions in the permit.

1.3 Hydrogeology

The following information is from Hartman and Dresel (1998).

Depth to the water table in the 100-N Area varies from less than 1 m near the Columbia River to ~21 m farther inland. The uppermost aquifer is contained in a unit of sands and gravels. A representative range of hydraulic conductivity is 6.1 to 37 m/d. The base of the uppermost aquifer is a clay-rich unit ~12 m beneath the water table. One well is completed in a thin sand unit within this clay. Deeper sandy units probably also act as confined aquifers, but no wells are completed in these units. Basalt lies at a depth of approximately 150 m below land surface. The hydrogeology of the 100-N Area is described in more detail by Hartman and Lindsey (1993).

When the major liquid waste disposal units in the 100-N Area were active, the water table in the entire area was elevated by up to 7 m. Discharge to all the facilities ceased by 1991, resulting in a sharp water table decline in the early 1990s and stabilization by 1994. The water table fluctuated up to 2.5 m beneath the 100-N Area RCRA sites in 1997 in response to changes in river stage.

Groundwater normally flows toward the northwest (toward the river) beneath the 1324-N and 1324-NA facilities. During 1996 and 1997, however, high river stage affected the gradient. For example, in June 1997, the gradient sloped toward the southeast beneath the 1324-N and 1324-NA facilities (Figure 1.2).

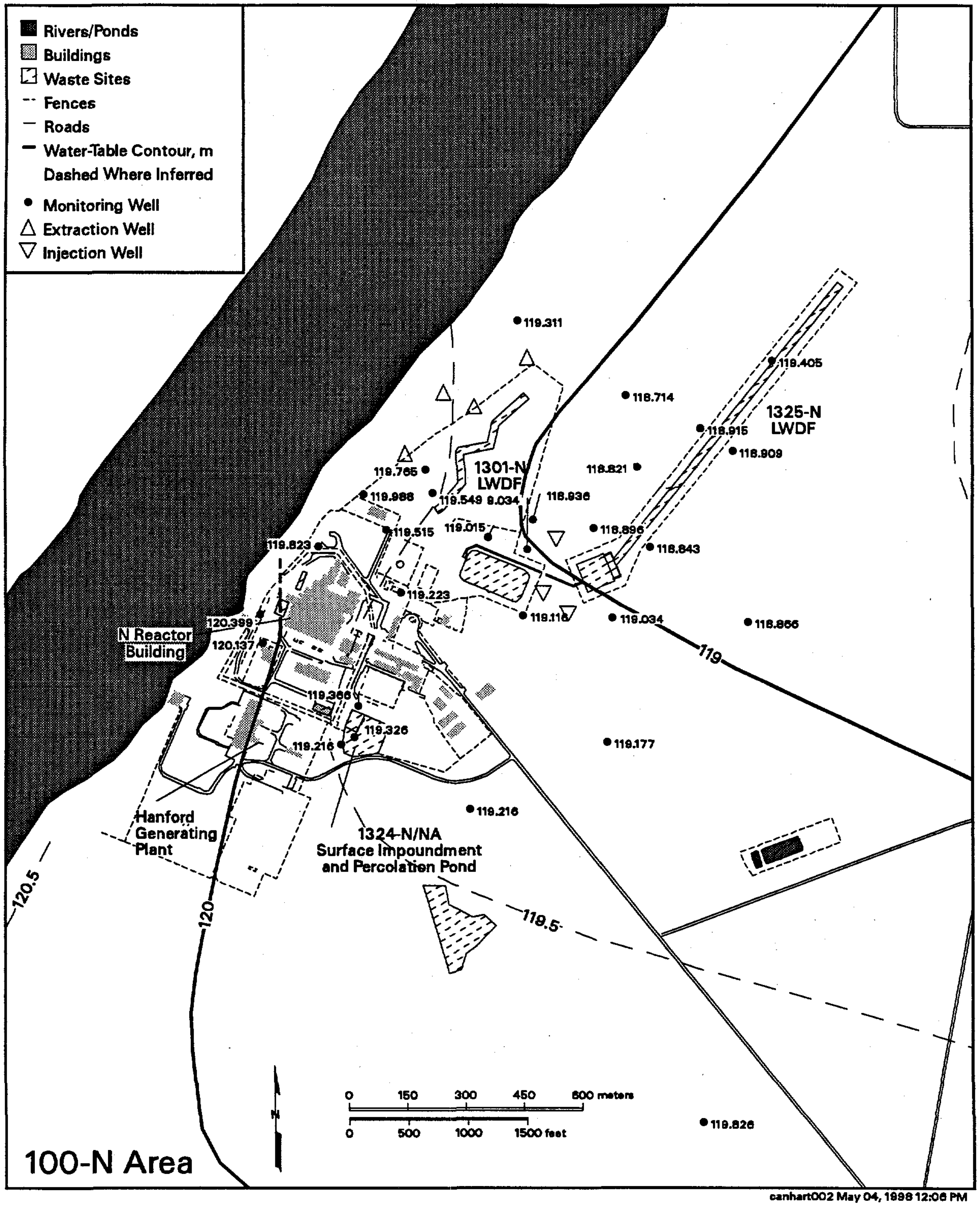


Figure 1.2. June 1997 Water Table

2.0 Evaluation of Existing Data

2.1 Groundwater Data

In March 1997, the average of quadruplicate TOC values from well 199-N-59 exceeded the critical mean value. At that time there appeared to be a high bias and poor precision in TOC data across the Hanford groundwater monitoring project. Verification sampling was postponed until after the problem could be corrected. Laboratory procedures were corrected in July 1997, and subsequent quality control samples indicated the high bias had been eliminated. When well 199-N-59 was sampled in September 1997, TOC again exceeded the critical mean value. The well was resampled for verification in January 1998, and sample sets were sent to two different laboratories, which both confirmed the exceedance. Figure 2.1 shows TOC versus time in three wells monitored for the 1324-N/NA Site. Data from the other downgradient wells follow trends similar to well 199-N-73.

Samples from the 1324-N/NA network have not been analyzed for individual organic constituents in recent years because they were not constituents of potential concern. In 1995-96, during the assessment of elevated TOX, the only organic constituent detected was chloroform. Chloroform and TOX declined to background levels, and TOX is no longer elevated.

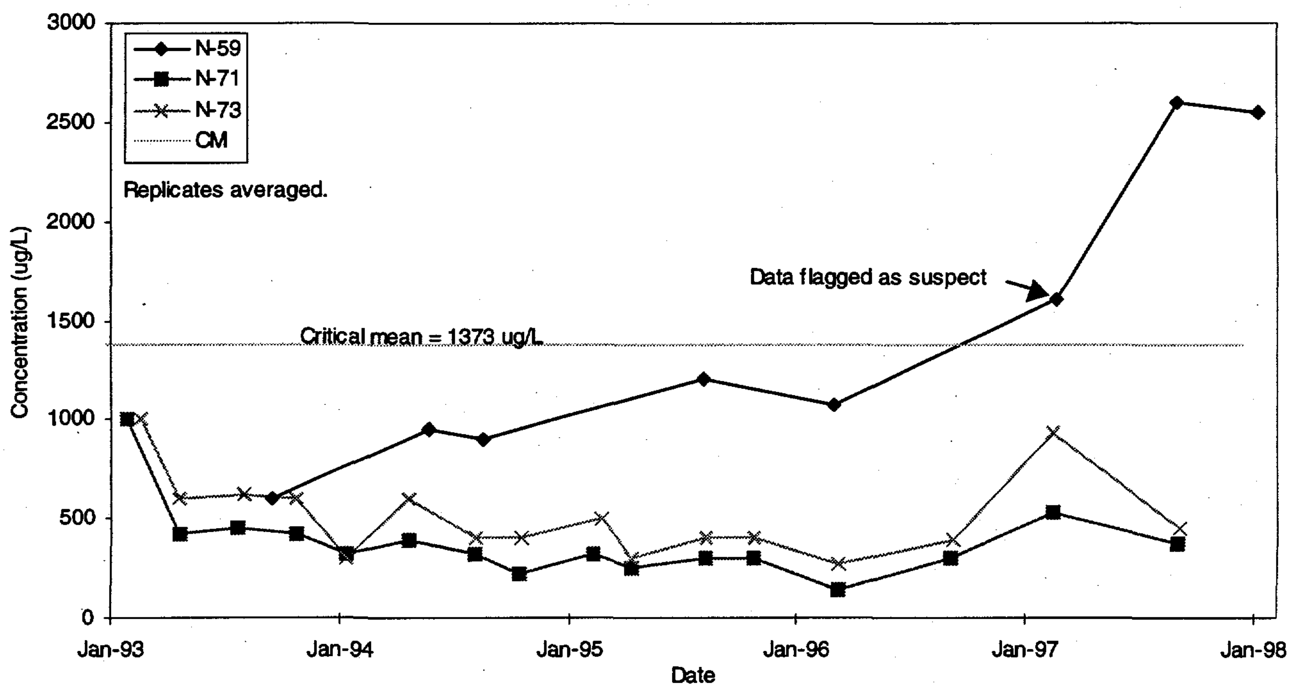


Figure 2.1. TOC Versus Time in Three Wells (N-59, N-71, and N-73) Monitored for the 1324-N/NA Site

As discussed in Section 1.3, groundwater flow directions beneath the 1324-N/NA Site are affected by the river stage. Water table maps for June 1996 and 1997 illustrate a potential for flow inward from the river toward the southeast beneath the site (see Figure 1.2). There are insufficient data to construct an average water table map for 1996 and 1997, but river stage remained higher than average for much of this period (Figure 2.2).

2.2 Sediment Data

Sediment samples were collected from the 1324-N Surface Impoundment and 1324-NA Percolation Pond in 1992 and early 1993, from the surface to as deep as 23 m (DOE 1998). The samples were analyzed for heavy metals, organics, cyanide, pH, and anions. No organic constituents were detected. The concentrations of other constituents were within the normal background range for the site. Thus, there are no contaminants of potential concern for the sites (DOE 1998).

2.3 Waste Sites

The Corrective Measures Study for the 100-NR-1 and 100-NR-2 Operable Units (DOE 1997) identified 22 sites where petroleum waste was/is present (Figure 2.3). Summary information on these sites, and a few non-petroleum sites with a potential for organic contamination, is listed in Table 2.1. Several of these waste sites are located near the 1324-N/NA Site, and could be upgradient under high river stage conditions.

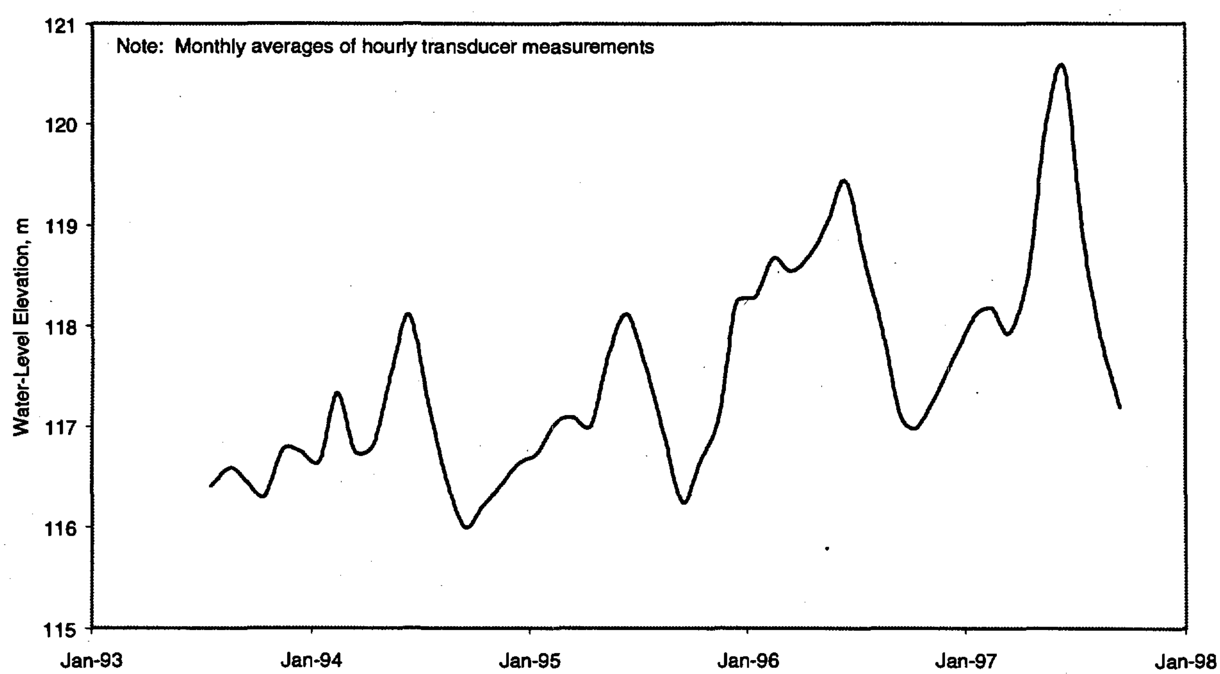


Figure 2.2. Columbia River Stage at the 100-N Area

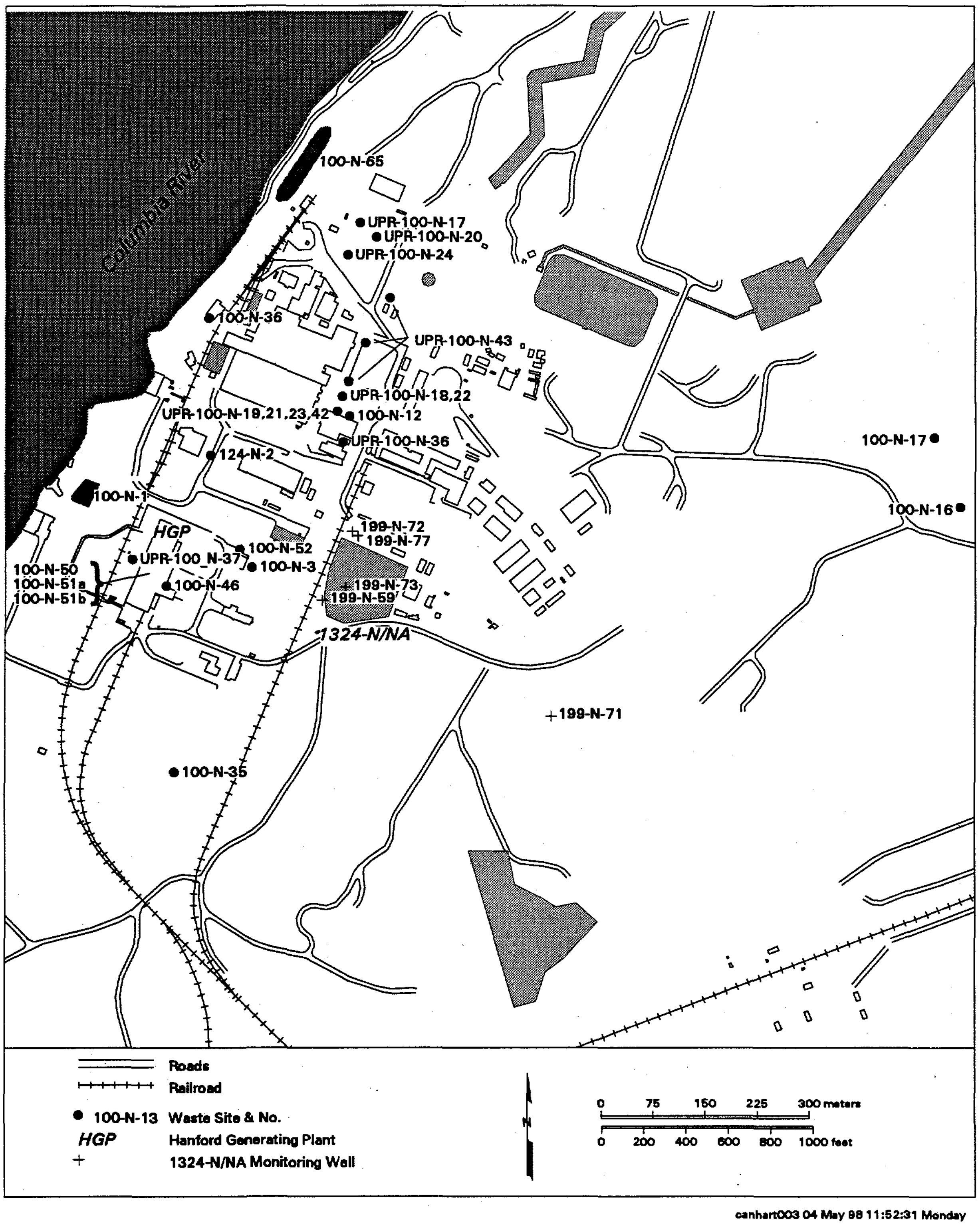


Figure 2.3. Location of Petroleum/Organic Waste Sites (modified from DOE 1997)

Table 2.1. Petroleum/Organic Waste Sites in 100-NR-1 Operable Unit (DOE/RL-95-111)

Site Name	Site History	Contaminants
100-N-1 HGP[a] settling pond	Received discharges from condenser pit, HGP floor drains, demineralizer backwash, roof and parking lot runoff.	TPH[b], radionuclides, chrome, lead, nickel, zinc, copper, calcium, morpholine, hydrazine, ammonia.
100-N-3 HGP maintenance garage septic system (French drain)	Received septic and garage wastes (oils, etc.)	Petroleum products
100-N-5 HGP bone yard	Open storage of metals, electrical equipment, and scrap iron	Potential for PCB, TPH, metals. Ion exchange resin beds and sandblast grit.
100-N-12 184-N Pipeline	Spill inside 184-N Building leaked to outside	TPH
100-N-16 burn pit	East of 1120-N. Used to burn municipal type waste	PCB[c], negative for VOC, TPH, and metals
100-N-17 burn pit	East of 1120-N building. Used to burn office waste.	Paints, solvents. VOC, TPH, and PCB not detected.
100-N-35 Hanford Substation	HGP/BPA switch yard	PCBs to 7 ppm
100-N-36 107-N oil stained pad	Air compressor lube oil leakage and spillage	TPH
100-N-46 HGP oil storage tank	75,708-L underground tank. Inactive.	Diesel fuel oil
100-N-50 Turbine oil filter unit in HGP	Turbine oil cleaning system in HGP basement. Large spills could go to 100-N-51b.	Turbine oil. No information available on filter disposal.
100-N-51a HGP Bldg. oil storage	Basement storage room in HGP building for oil, lubricants, petroleum. No outlet.	Oil, lubricants, small quantities of petroleum products.
100-N-51b HGP Bldg. floor drains and sumps	Floor drains and central sump in HGP basement. Received spills, leaks, and flood water. Discharged to 100-N-1.	Oil or maintenance spills and water.
100-N-52 Maintenance garage east of HGP	Garage for servicing vehicles. Floor drains and sink discharged to 100-N-3.	Used oil, solvents, paint, gasoline, pesticides
100-N-65 Diesel burn pit	Pit excavated adjacent to river to intercept and burn diesel oil spill (UPR-100-N-17)	TPH Diesel oil

Table 2.1. (contd)

Site Name	Site History	Contaminants
124-N-2 Septic system	East of 182-N building	Potential petroleum
UPR-100-N-17 166-N supply line leak	4-in. line in tank farm leaked to ground. Trench dug at river shoreline to intercept oil (100-N-65).	TPH Diesel oil
UPR-100-N-18 166-N supply line leak	4-in. diesel supply line between the 166-N and 184-N storage area	TPH Diesel oil
UPR-100-N-19 184-N fuel oil spill	Fuel oil day tank	TPH No. 6 fuel oil
UPR-100-N-20 166-N return line leak	Leak from tank farm 2-in. return line	TPH No. 2 diesel oil
UPR-100-N-21 184-N tank overflow	Diesel oil day tank	TPH No. 2 diesel oil
UPR-100-N-22 184-N leak no. 1	Supply pipeline located outside the 184-N	TPH No. 2 diesel oil
UPR-100-N-23 184-N leak no. 2	Supply line located near diesel day tank	TPH No. 2 diesel oil
UPR-100-N-24 166-N supply line leak	Leak caused by corrosion on transfer line	TPH No. 6 fuel oil
UPR-100-N-36 184-N annex	Located near diesel day tank, 184-N powerhouse	TPH Diesel fuel and motor oil
UPR-100-N-37 HGP transformer yard	Fenced area along northwest wall of HGP. Location of nine large transformers.	Potential for asbestos, PCB, and transformer oil.
UPR-100-N-42 184-N diesel oil spill	Located near diesel day tank, 184-N powerhouse	TPH
UPR-100-N-43 Pipelines	Oil supply pipeline from 116-N to 184-N	TPH Diesel oil

(a) HGP = Hanford Generating Plant
(b) TPH = Total Petroleum Hydrocarbons
(c) PCB = Polychlorinated biphenyl

2.4 Data Limitations

The following limitations have been identified and may need to be addressed in the assessment:

- Well 199-N-59 was installed when the 1324-NA Percolation Pond was in use and the water table was higher than it is now. Consequently, the well sometimes contains too little water to be sampled.

- Samples from 1324-N/NA wells, including 199-N-59, have not been analyzed for specific organic constituents in the past several years because they were not considered contaminants of concern for the site.

- There are no water-level or groundwater chemistry data between the 1324-N/NA Site and the river to the west (Hanford Generating Plant area). Therefore, water-table maps have not been constructed for this area, and groundwater contamination has not been identified.

3.0 Groundwater Quality Assessment Program: Phase 1

3.1 Summary of Approach

The objective of phase 1 of the assessment program is to make the first determination whether the 1324-N/NA Site has contributed dangerous waste constituents to groundwater. Data quality objectives were used as a basis to design the program; results are documented in Appendix A. The approach includes the following steps.

- Review waste site information for potential contaminant sources
- Review sediment data from the1324-N/NA Site and other potential sources, if available
- Sample 1324-N/NA wells and analyze for organic constituents of interest
- Measure water levels to determine how they may affect groundwater flow and contaminant concentration.

The output of phase 1 will be a decision: Is 1324-N/NA the source of dangerous waste constituents in groundwater? If yes, a plan for phase 2 assessment will be prepared. If not, a detection program will be instated.

3.2 Assessment Monitoring Network

TOC is elevated in only one well: 199-N-59. The assessment monitoring network will therefore remain the same as the detection network (see Figure 1.1): upgradient well 199-N-71, shallow downgradient wells 199-N-59, 199-N-72, and 199-N-73, and deeper downgradient well 199-N-77 (completed at the base of Ringold unit E aquifer). As-built diagrams of the wells are included in Hartman (1996a). The shallow wells monitor the top 1 to 4 m of the uppermost aquifer. Well 199-N-77 monitors the base of the aquifer, ~4 m deeper than the shallow wells.

3.3 Constituents and Sampling Frequency

Wells will be sampled quarterly during the period of assessment for the constituents listed in Table 3.1. Well 199-N-59 will be sampled quarterly for organic constituents. Other wells will be sampled for specific organic constituents only once, unless sampling results indicate contamination is present.

When the water table is relatively low, well 199-N-59 contains too little water to sample. The water table has been higher than average during 1997 and early 1998, and the well is expected to be sampleable at least through spring and early summer 1998. Sampling under this plan will begin in June 1998, when

Table 3.1. Wells, Constituents, and Sampling Frequency for Phase 1 Assessment

June 1998 – All Wells	September 1998 – Well 199-N-59	September 1998 – Wells 199-N-71, 199-N-72, 199-N-73, and 199-N-77
Specific conductance	Specific conductance	Specific conductance
pH	pH	pH
TOC	TOC	TOC
TOX	TOX	TOX
Volatile organics (GC/MS)	Volatile organics (GC/MS)	
Semivolatile organics (GC/MS)	Semivolatile organics (GC/MS)	
Total petroleum hydrocarbons (diesel and gas ranges)	Total petroleum hydrocarbons (diesel and gas ranges)	
Oil and grease	Oil and grease	

well 199-N-59 is likely to contain enough water to sample. The next sampling will be in September 1998. If well 199-N-59 does not contain enough water to sample, the remaining wells will be sampled and 199-N-59 will be sampled (if necessary) when the water table rises again.

Results of sample analyses from the first two quarters will be evaluated to determine if quarterly sampling should continue or if detection should be reinstated.

3.4 Potential Sources

Based on records of discharges to the 1324-N/NA Site, it is unlikely that these units are the source of the contaminants causing the elevated TOC (DOE 1998). Sediment data identified no contaminants of concern; no organic constituents were detected in the sediments.

Other potential sources of organic contaminants will be investigated through operable unit documents (e.g., DOE 1997) and any available sediment analyses. Potential sources of petroleum contamination are shown in Figure 2.3.

3.5 Water-Level Monitoring

Water levels will be measured monthly in most of the useable 100-N Area wells during the phase 1 assessment period. The data will be entered into the HEIS database and will be used to construct water table maps from which groundwater flow directions will be inferred.

4.0 Sampling and Analysis

Sampling procedures, analytical methods, and quality assurance and quality control requirements are described in *The Hanford Ground-Water Monitoring Project Quality Assurance Project Plan* (PNNL 1997). Analytical methods conform to the U.S. Environmental Protection Agency's published methods.

A field transfer blank will be collected while sampling well 199-N-59 in June and/or September to check for the unlikely possibility of field contamination. This sample will be analyzed for volatile and semivolatile organic constituents. An equipment blank is not required because the wells have dedicated sampling equipment.

5.0 Future Monitoring

If results of the first phase of assessment monitoring indicate that the 1324-N/NA Site has not contributed dangerous waste constituents to groundwater, a detection program will be instated. Groundwater monitoring requirements will be specified in the Hanford Site RCRA Permit modification D, scheduled for implementation in December 1998. Until those requirements are implemented, monitoring will revert to the existing plan (Hartman 1996a).

If results of the first phase of assessment monitoring indicate that 1324-N/NA is probably the source of organic contamination, and if the contaminant causing the elevated TOC is a dangerous constituent, a second phase of assessment monitoring will be required. After the site is incorporated into the Hanford Site RCRA Permit, the second phase will be a final-status "compliance" program rather than the interim-status "assessment." In a compliance plan, concentration limits will be established for the constituents of interest. Future groundwater results will be statistically compared to the concentration limits to determine if corrective action is warranted.

6.0 References

DOE 1997. *Corrective Measures Study for the 100-NR-1 and 100-NR-2 Operable Units*, DOE/RL-95-111, Rev. 0., U.S. Department of Energy, Richland, Washington.

DOE 1998. *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measure Study/Closure Plan,* DOE/RL-96-39, Rev. 0, U.S. Department of Energy, Richland, Washington.

Hartman, M. J. 1992. *Results of Ground Water Quality Assessment Monitoring at the 1301-N Liquid Waste Disposal Facility and 1324-N/NA Facilities*, WHC-SD-EN-EV-003, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hartman, M. J. 1996a. *Groundwater Monitoring Plan for the 1301-N, 1325-N, and 1324-N/NA Sites*, WHC-SD-EN-AP-038, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Hartman, M. J. 1996b. *RCRA Assessment Report: Total Organic Halogen at the 1324-N/NA Site*, WHC-SD-EN-EV-031, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hartman, M. J., and K. A. Lindsey. 1993. *Hydrogeology of the 100-N Area, Hanford Site, Washington*, WHC-SD-EN-EV-027, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Hartman, M. J., and P. E. Dresel (editors). 1998. *Hanford Site Groundwater Monitoring for Fiscal Year 1997*, PNNL-11793, Pacific Northwest National Laboratory, Richland, Washington.

PNNL. 1997. *The Hanford Ground-Water Monitoring Project Quality Assurance Project Plan*, QA Plan ETD-012, Pacific Northwest National Laboratory, Richland, Washington.

Appendix

Data Quality Objectives

Appendix

Data Quality Objectives

This appendix presents the results of the Data Quality Objectives (DQO) process as applied to development of a sampling and analysis plan (described in Section 3.0 of this plan) for the1324-N/NA groundwater quality assessment program. The following sections are based on the seven-step process originally devised for use at remedial action sites (EPA 1993).

Step 1. State the Problem.

Total Organic Carbon (TOC) in a downgradient well exceeded the critical mean value, indicating that the facility may be negatively affecting groundwater quality. Thus a groundwater quality assessment program is required to investigate the problem.

Step 2. Identify the Decisions.

The decision to be made under Phase 1 assessment is: has contamination from the 1324-N/NA facility entered groundwater? If yes, the assessment will proceed to phase 2: define the concentration and extent of contamination and the rate of migration. The following discussion is limited to the decision for Phase 1.

Step 3. Identify Inputs to the Decision.

a) Historical and new groundwater data to determine which constituents contribute to the elevated TOC.

b) Documentation of effluent discharged to the facility during its use

c) Sediment data from ponds

d) Information on other sites nearby that could be source of organics

e) Water-level elevations

Step 4. Define the Boundaries of the Decision.

The areal boundary is the immediate vicinity of 1324-N/NA and its monitoring network. The elevated TOC is observed in only one well. Boundaries may expand if other potential sources of the contaminant are suspected. The vertical boundary is the uppermost aquifer as monitored by network. We will attempt to determine whether 1324-NA was the source of contamination after receiving and evaluating the first two quarters of data (temporal boundary).

Step 5. Develop Decision Rules.

If the specific groundwater contaminants beneath 1324-N/NA are consistent with other waste sources in 100-N Area or the Hanford Generating Plant, then 1324-NA will be assumed NOT to be the source and the site will return to detection monitoring. If contaminants are not consistent with other waste sources or if no specific contaminants can be identified, additional assessment will be required to determine whether undocumented discharges to 1324-N/NA may have been the source, and if so, the concentration, extent, and rate of contaminant migration.

Step 6. Specify Acceptable Decision Errors.

a) Identifying organic constituents: Gas chromatograph/mass spectroscopy (GC/MS) method detects a broader range of constituents than the GC method, and thus is preferable for this assessment. Constituents should be detectable by this method, given the levels of TOC observed. If none are detected, we can try the GC method, which has lower detection limits but a narrower range of constituents.

b) Frequency of sampling: assessment requires quarterly determinations; more frequent sampling would not help make the determination.

c) Frequency of water-level measurements: We need to estimate the water table configuration before and during the times of sampling. The water table beneath 1324-N/NA and the Hanford Generating Plant does not respond rapidly to river-stage changes so monthly measurements are judged to be adequate.

d) Quadruplicate samples for indicator parameters are no longer required during assessment. If TOC increases at another downgradient well, we will resample for TOC and organics as soon as possible.

e) Special quality control samples may be added to assess the possibility of field contamination.

Step 7. Optimization.

a) Limit "long list" analyses to the well with the elevated TOC, plus one run for all network wells (unless some of the other wells show hits).

b) Schedule N-59 when the water table is likely to be high, so it isn't dry (spring). If it is dry, sample the other wells to see if there are any trends in TOC. Try sampling well N-59 again when able.

c) Coordinate sampling with other programs if possible.

d) QC: collect field blank sample and analyze for TOC and volatile organics.

Reference

EPA. 1993. *Data Quality Objectives Process for Superfund Interim Final Guidance.* EPA/540-R-93-071, U.S. Environmental Protection Agency, Washington, D.C.

Distribution

No. of Copies

OFFSITE

2 DOE/Office of Scientific and Technical Information

ONSITE

3 **DOE Richland Operations Office**

M. J. Furman	HO-12
D. E. Olson	HO-12
K. M. Thompson	HO-12

ERC

J. V. Borghese	HO-19

No. of Copies

3 **Ecology**

S. M. Alexander	B5-18
S. Leja	B5-18
W. W. Soper	B5-18

18 **Pacific Northwest National Laboratory**

E. P. Dresel	K6-96
M. J. Hartman (5)	K6-96
S. P. Luttrell	K6-96
R. M. Smith	K6-96
D. L. Stewart	K6-96
C. J. Thompson	K6-96
B. A. Williams	K6-81
Information Release (7)	K1-11