BHI-01382
Rev. 0

Groundwater Monitoring and Sampling at the Environmental Restoration Disposal Facility, Calendar Year 1996 Through 1999

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Environmental Restoration

Submitted by: Bechtel Hanford, Inc.

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DISCLM-5.CHP (11/99)

BHI-01382
Rev. 0
OU: N/A
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title: Groundwater Monitoring and Sampling at the Environmental Restoration Disposal Facility, Calendar Year 1996 Through 1999

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Date Published

July 2000

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ACRONYMS

BHI	Bechtel Hanford, Inc.
CFR	*Code of Federal Regulations*
COC	contaminant of concern
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
GPP	groundwater protection plan
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 INTRODUCTION

The Environmental Restoration Disposal Facility (ERDF) began operations on July 1, 1996. The *Groundwater Protection Plan for the Environmental Restoration Disposal Facility* (ERDF GPP) (BHI 1996b) describes, in part, a baseline sampling suite to be obtained from the monitoring wells and the leachate collection system to determine the contaminants of concern (COCs) for long-term monitoring. A monitoring program for these selected analytes would then be instituted. The post-baseline monitoring program that fulfills this requirement is defined in the *Description of Work for Routine Groundwater Sampling at the Environmental Restoration Disposal Facility* (BHI 1996a).

1.1 PURPOSE AND OBJECTIVES

The purpose of this groundwater monitoring report is to fulfill the reporting requirements and evaluate the constituents in the groundwater to determine if impacts have occurred that could be attributed to ERDF operations.

The objectives of this report are as follows:

- Assess the groundwater analyses for encroaching contaminant plumes originating in the 200 West Area.
- Provide a statistical analysis of the groundwater results to evaluate whether ERDF is contributing to the plumes, and determine the changes in the COC concentrations and the associated plumes that originated in the 200 West Area.
- Assess the leachate testing results to determine if additional analytes should be added to the groundwater monitoring list.
- Determine whether the groundwater sampling frequency should be modified and the list of analytes amended to include additional COCs discovered in the leachate, if any.
- Assess groundwater levels in the monitoring wells to ensure that they will not go dry, or to determine if replacement or deepening may be needed.

2.0 BACKGROUND

The ERDF solid waste burial site is located in southeastern Washington State on the Hanford Site between the 200 East and 200 West Areas (Figure 2-1).

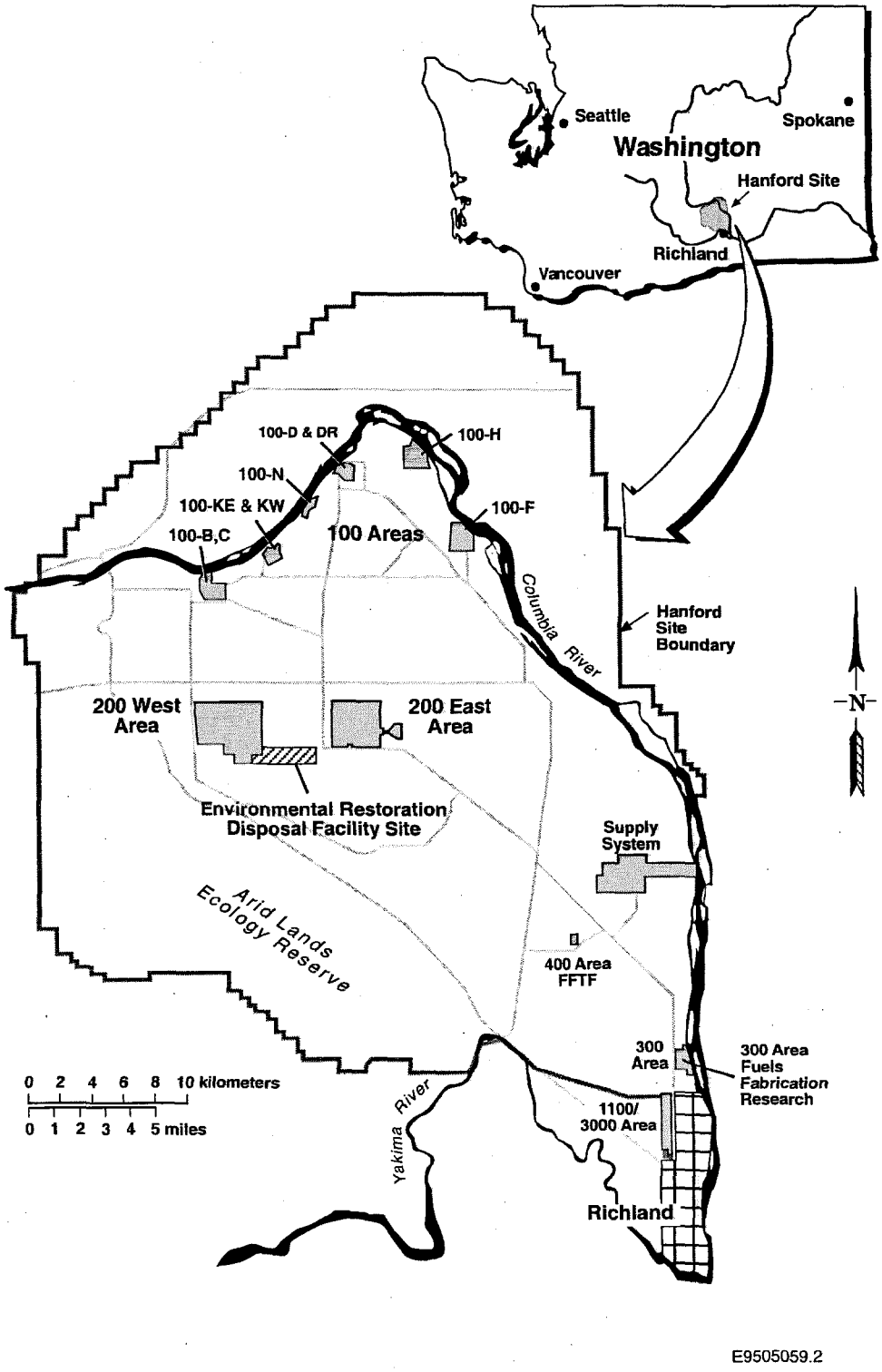
2.1 ENVIRONMENTAL RESTORATION DISPOSAL FACILITY

The ERDF Project site is authorized to expand to cover as much as 4.1 km^2 at completion and is operating the initial two cells consisting of 25.5 acres. Two additional cells have been built that cover an area of 24.0 acres. Wastes disposed therein contain elevated levels of radionuclides and hazardous constituents generated from 100 Area, 300 Area, and some 200 Area waste sites.

2.1.1 General Description

The ERDF landfill is authorized under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* and is designed to meet the *Resource Conservation and Recovery Act of 1976* minimum technology requirements. The site was selected over other possible sites in part because of the depth to groundwater and the location above existing groundwater plumes, the relatively flat topography, and the compatibility with stakeholder recommendations.

Figure 2-1. Location of the Environmental Restoration Disposal Facility.



3.0 GROUNDWATER MONITORING

The groundwater monitoring and sampling system is described in the ERDF GPP (BHI 1996b). The *Description of Work for Routine Groundwater Sampling at the Environmental Restoration Disposal Facility* (BHI 1996a) provides the guidelines for performing the sample collection(s), as well as the analytes that constitute the COCs (Table 3-1).

3.1 WELL MONITORING AND SAMPLING NETWORK

The well monitoring network for the existing facility consists of one upgradient well (699-36-70A, A9901) and three downgradient wells (699-35-66A, 699-36-67, and 699-37-68, A5139, B2733, B2732 respectively), as shown in Figure 3-1. Baseline sampling was conducted during the first quarter of 1996, prior to disposal of wastes. Initial post-baseline sampling for the COCs was performed in September 1996. Post-baseline sampling occurs during the first and third quarters of each calendar year.

3.2 LEACHATE MONITORING AND SAMPLING NETWORK

The leachate collection system is located beneath the existing disposal cells. Each cell contains a sump area for leachate collection. Leachate is removed from the sump(s) by pumping to ensure that the action leakage rate is not approached. The action leakage rate is predicated on the leachate not reaching or exceeding a 30-cm buildup in the sump(s) on either the primary or secondary liner. The levels are monitored by transducers located in the sump(s), which will trigger the corresponding pump(s) at levels significantly below the 30-cm action leakage rate. Leachate volume is measured to demonstrate that the liner systems are operating within design standards (below the action leakage rate).

3.2.1 Characterization Sampling

Samples are collected and analyzed after approximately 757,080 L (200,000 gal) have been pumped from the system. This sampling is intended to provide the Effluent Treatment Facility (ETF) with a consistent volume-based leachate characterization profile. The ETF requires leachate sampling at ERDF as part of its waste characterization process. The analyte list and corresponding analyses for the volume-based leachate samples are provided in Appendix B. The number of samples collected annually is directly related to the amount of leachate generated from precipitation as well as normal operating procedures (e.g., dust control).

3.2.2 Delisting Sampling

Leachate delisting analyses have been performed on samples since December 1998 to enable handling of the leachate as nonhazardous waste. Delisting sampling will continue until approximately November 2000, after which time data analyses will be used to determine the analytical profile and frequency of sampling.

3.2.3 Sampling Events

The initial pre-operational baseline sampling event occurred on March 1, 1996. The COCs for groundwater monitoring were initially defined for ERDF based on these results. From the beginning of operations on July 1, 1996, each well has been sampled during the first and third quarters (semi-annually) of each year of ERDF operation through 1999.

3.3 ANALYTICAL RESULTS

3.3.1 Leachate

Leachate analyses indicate that the liquid collected thus far contains no elevated levels of COCs. The data provided in Appendix B are volume-based characterization leachate analyses for calendar years 1996 and 1997. These data show that the leachate contains common laboratory residuals of some of the compounds used for analyses of volatile and semi-volatile organic compounds. The acetone, methylene chloride, toluene, and all the various phthalates are characteristically residues from laboratory analyses. The sporadic chloroform results are found only in analyses of the trip blanks and are a residual from chlorinating drinking water. The methyl chloride is probably a false-positive because it is in the lower detection range for the instrumentation.

The extensive leachate delisting analyses for both ETF characterization and delisting show values of equivalent COC concentrations. The delisting sampling results will be presented in a separate report upon conclusion of the first phase of the delisting evaluation.

3.3.2 Groundwater

Groundwater sampling for the COCs has been completed for each of the semi-annual events. Results are tabulated and included as Appendix A. Cells without numeric data in Appendix A indicate analyses that were not performed i.e, carbon-14 in September 1996 and carbon tetrachloride in March 1998. The field parameters of pH, specific conductance, and turbidity may not have been recorded in the database for the listed dates.

A number of contaminant plumes that originated from past activities in the 200 West Area are near, or beneath, the ERDF site. Of the 10 plumes referred to in the ERDF GPP, 7 are on the COC list for the monitoring wells: nitrate, carbon tetrachloride, gross beta, gross alpha, technetium-99, iodine-129, and uranium.

Of the remaining three plumes identified in the 200 West Area, chloroform and trichloroethylene are small localized plumes that occupy the same general area west of the ERDF site. In two sampled wells near the southeastern boundary of the 200 West Area, chloroform concentrations were below drinking water standards and trichloroethylene concentrations were above drinking water standards. These plumes may migrate beneath the ERDF site in the future. The tritium plume is extensive beneath ERDF and is moving to the east from the 200 West Area. Plume movement can be monitored via the upgradient well.

3.4 WATER TABLE VARIATIONS SINCE 1996

The groundwater table in and near the 200 West Area has been declining since discharges to the 200 West Area ponds and trenches systems were discontinued during the mid-1980's. The current hydrograph for the ERDF monitoring wells is presented in Figure 3-2. The hydrograph indicates an annual decline of approximately 0.4 m/yr, which is consistent with the regional hydrologic changes reported for the area (Swanson et al. 1999, Hartman et al. 2000). Each well has about 9 m of water remaining, or 20 years of use at the current decline rate.

A water table map of the ERDF area is shown in Figure 3-3. Based on this map, the groundwater moves from the northwest to the east and southeast across the site. The hydraulic gradient is about 0.001 m/m (BHI 1995). The downgradient wells appear to be in the same groundwater flowpath as the upgradient well.

Figure 3-1. ERDF Monitoring Well Location Map.

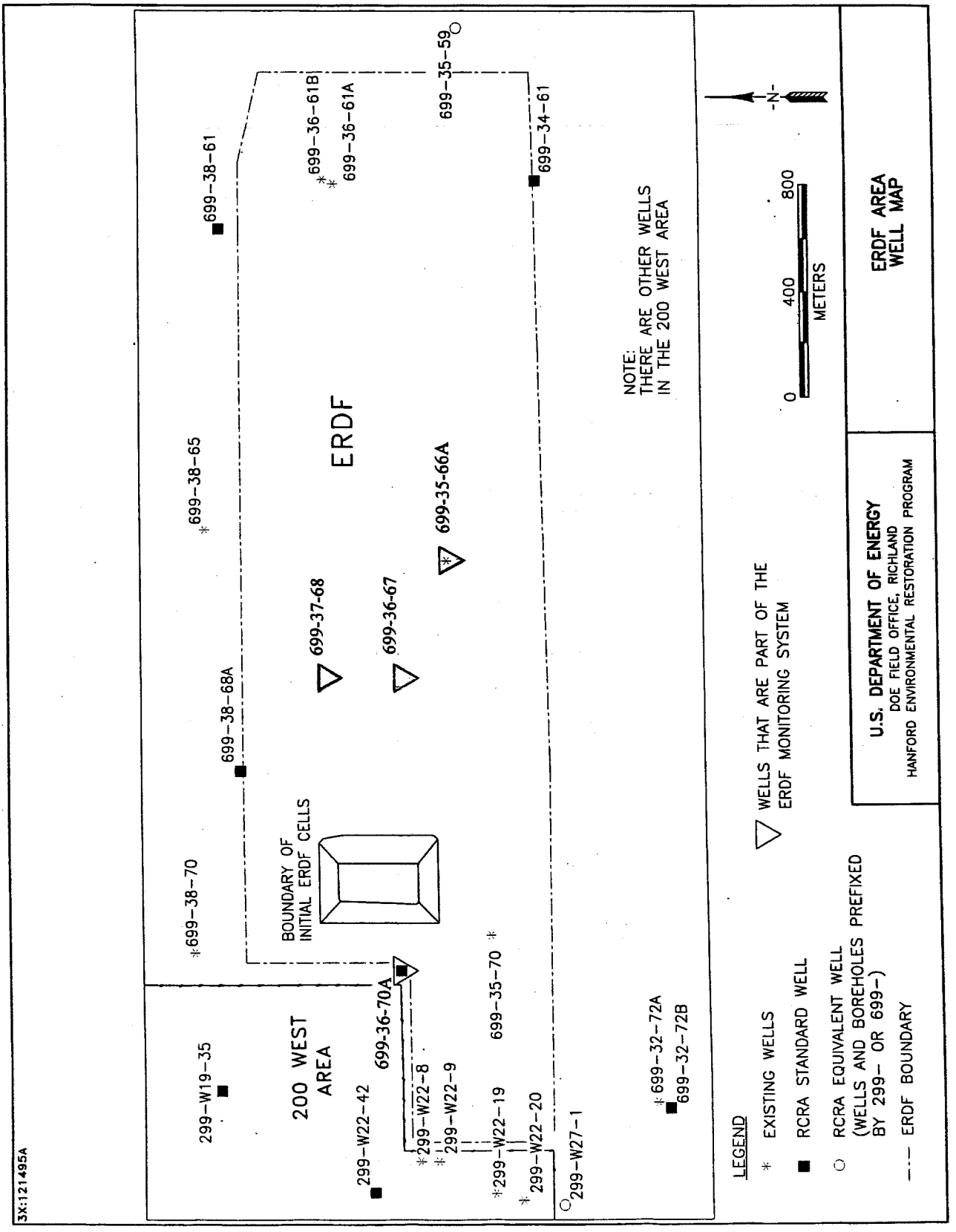


Figure 3-2. ERDF Groundwater Monitoring Wells Hydrograph.

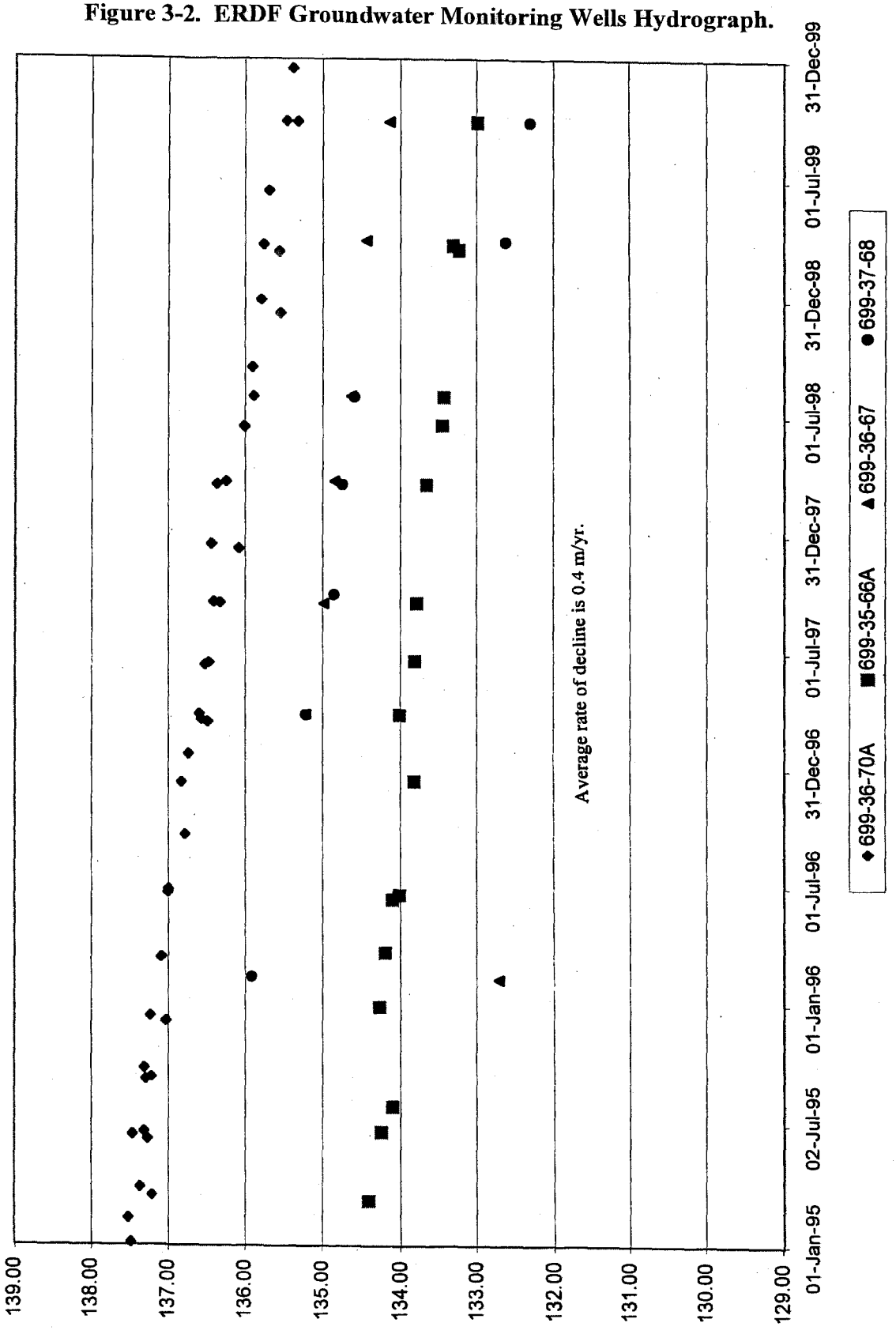


Figure 3-3. Water Table Map.

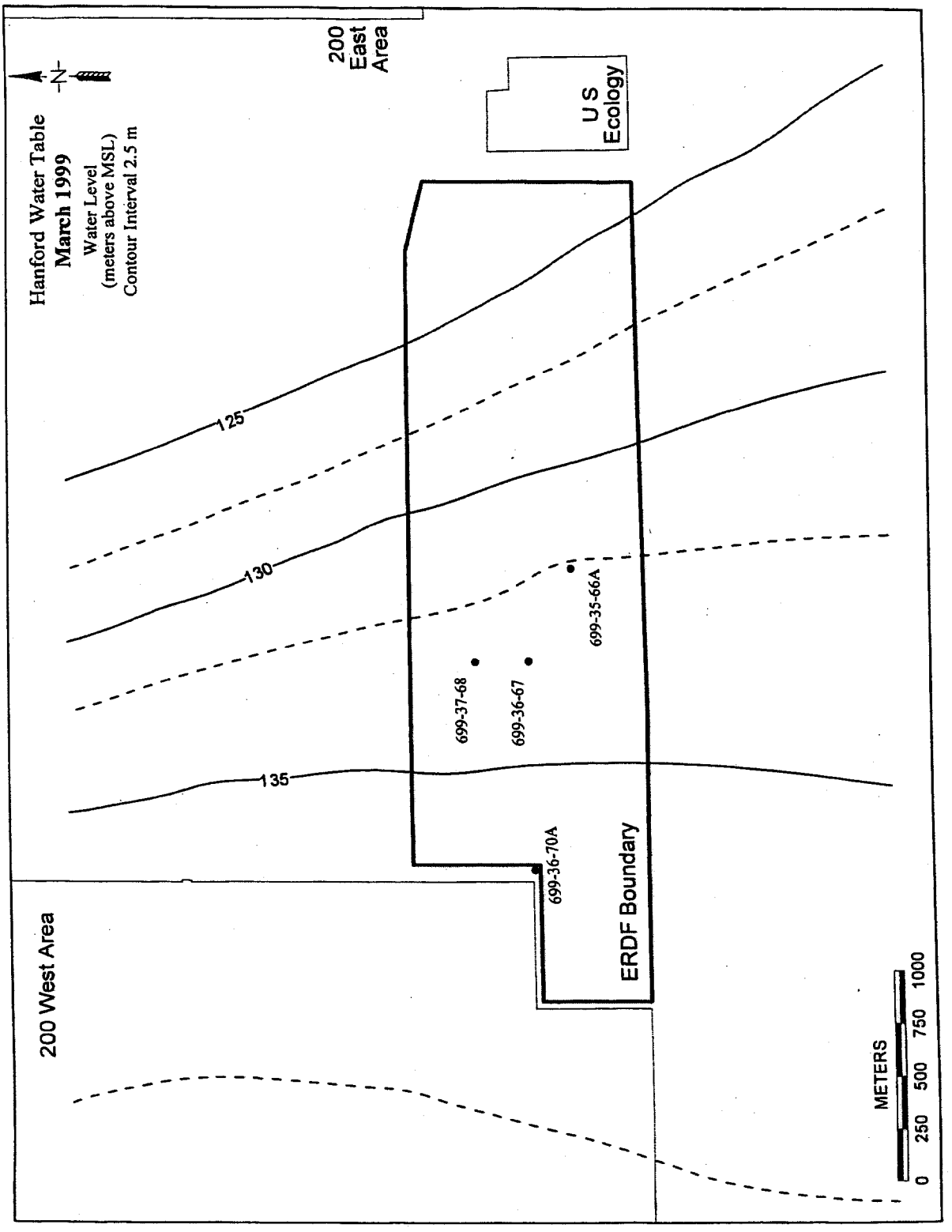


Table 3-1. List of Analytes by Analytical Method (from BHI 1996a).

Analyte	Method[a]	Practical Quantitation Limit[b]	Accuracy[c] (%)	Precision[c] (%)
Arsenic	7060	10	±25	±25
Barium	6010A	20	±25	±25
Chromium	6010A	70	±25	±25
Lead	6010A	40	±25	±25
Selenium	7740	750	±25	±25
Tin	6010A	30	±25	±25
Vanadium	6010A	80	±25	±25
Zinc	6010A	20	±25	±25
Carbon tetrachloride	8240A/8260	5	±25	±25
Alkalinity	310.1[d]	10,000	±20	±25
Chloride	300/modified[e]	10,000	±20	±25
Fluoride	300/modified[e]	100	±20	±25
Nitrite/nitrate	353.1	0.05	±20	±25
Sulfate	300/modified[e]	2,000	±20	±25
Total dissolved solids	160.1[d]	10,000	±20	NA
Total organic halides	9020	5	±20	NA
Carbon-14	[f]	[f]	[f]	[f]
Iodine-129	[g]	5 pCi/L	±20	±25
Technetium-99	Tc-01[h]	10 pCi/L	±20	±25
Radium	[g]	1 pCi/L	±20	±25
Total uranium	[g]	1 pCi/L	±20	±25
Gross alpha	900[i]	3 pCi/L	±20	±25
Gross beta	900[i]	4 pCi/L	±20	±25
pH[j]	[k]	NA	NA	NA
Specific conductance[j]	[k]	25 µmho/cm	±20	NA
Turbidity[j]	180.1[d]	0.05 NTU	±0.05 NTU	NA

[a] Method number indicated is from *Test Method for Evaluating Solid Wastes: Physical Chemical Methods* (SW-846) (EPA 1986) unless otherwise specified.
[b] Units are µg/L unless otherwise specified.
[c] Precision is expressed as a percent relative difference; accuracy is expressed as percent recovery.
[d] Method specified is from *Methods for Chemical Analysis of Water and Wastes* (Kopp and McKee 1983).
[e] Method specified is from *Determination of Inorganic Anions in Aqueous and Solid Samples by Ion Chromatography* (Lindahl 1984) and is a modification of EPA Method 300.0.
[f] Methods, contract-required quantitation limits, and maximum ranges for precision and accuracy shall be developed and approved by Bechtel Hanford, Inc.
[g] Industry standard method, laboratory specific, based on approval from Bechtel Hanford, Inc.
[h] Method specified is from *Environmental Measurements Laboratory Procedures Manual* (Volchok and dePlanque 1982).
[i] Method specified is from Prescribed *Procedures for Measurement of Radioactivity in Drinking Water* (Krieger and Whittaker 1980).
[j] Parameter collected in the field.
[k] Parameter shall be measured in the field in compliance with BHI-EE-01, *Environmental Investigations Procedures*, Procedure 4.1, "Groundwater Sampling."
NA = not applicable

4.0 STATISTICAL ANALYSIS OF THE ANALYTICAL RESULTS

To evaluate the post-baseline monitoring program at ERDF, a statistical method is used. Data taken from a well (699-36-70A) upgradient from ERDF and three wells (669-35-66A, 669-36-67, and 669-37-68) downgradient help determine if contamination has undergone a statistically significant increase in concentration. This method, detailed in *Hanford Site Groundwater Monitoring: Setting, Source and Methods* (PNNL 2000), uses an averaged replicate t-test method to compare the upgradient and downgradient data. The results from this analysis are designed to help determine effects of plume movement from the 200 West Area.

Each downgradient well was tested separately against the upgradient well to analyze concentration location-specific results. At well 699-35-66A, two analytes showed a significant increase in concentration, alkalinity and carbon-14. Zinc and total organic halide concentration increased at well 699-36-67. Also, well 699-37-68 data depicted statistical increases in zinc, alkalinity, and nitrogen in nitrite and nitrate. No other analyte concentrations reflected a statistically significant increase when compared to well 699-35-70A concentrations. The statistical data are included as Appendix C.

Measured leachate volumes are accounted for at ERDF. Analytical results of the leachate reveal no COCs. As there are no leachate-derived COCs, and no leachate released to the soil column, it is impossible to perform a meaningful statistical analysis between groundwater and ERDF-derived leachate. The most probable scenario for COC increases in downgradient wells is the result of plume migration from the 200 West Area.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were drawn:

- Sampling results indicate that leachate analyte concentrations do not contain elevated COCs.
- There are no indications that leachate has impacted groundwater.
- Groundwater plumes from the 200 West Area are moving to the east or southeast below the ERDF site.
- Elevated levels of COCs in downgradient wells can be attributed to plume migration from the 200 West Area as a result of groundwater movement.

The following recommendation is presented:

- The semi-annual groundwater sampling should be reevaluated based on the leachate monitoring results and the ability of the contaminants to reach groundwater in any meaningful time frame.

6.0 REFERENCES

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APPENDIX A

GROUNDWATER SAMPLING RESULTS, 1996-1999

Table A-1. Sample Date and Analytical Results for Well 699-35-66A.

Analyte	Units	Mar. 1996	Sep. 1996	Mar. 1997	Sep. 1997	Mar. 1998	Aug. 1998	Mar. 1999	Sep. 1999
Arsenic	µg/L	3	2.5	2.7	2.8	2.1	2.8	3.3	3.3
Barium	µg/L	46	42	47	40.9	43.7	39.8	40.5	40.2
Chromium	µg/L	15	9.8	12	13.4	16.6	13.5	13.9	14.8
Lead	µg/L	1	42.1	26	1.1	1.1	30.2	1.8	4
Selenium	µg/L	2.2	3.2	2.3	2.9	3.2	3.2	5.2	5.2
Tin	µg/L	35.3	33.5	24.7	5.6	4.9	28	2.7	2.1
Vanadium	µg/L	24.6	32.9	30.3	27.2	29	39.5	28.3	28.6
Zinc	µg/L	17.4	16.2	26.5	5.7	5.8	10.3	2.6	3.5
Carbon tetrachloride	µg/L	5	4	4	5	--	2	1	5
Alkalinity	mg/L	138	143	147	138	140	143	143	140
Chloride	mg/L	21.1	19	19.2	19.9	16.1	18.3	19.5	18.9
Fluoride	mg/L	0.34	0.34	0.34	0.39	0.304	0.342	0.5	0.5
Nitrogen in nitrite and nitrate	mg/L	4.58	4.19	4.19	4.19	4.62	4.18	4.53	4.5
Sulfate	mg/L	24.2	25.2	27	26.6	22.7	26	26.8	25.8
Total dissolved solids	mg/L	254	236	283	278	322	296	280	280
Total organic halides	µg/L	6.6	5	5	6.05	4.62	5.9	24	128
Carbon-14	pCi/L	22.3	--	21.6	10.7	19.4	18.5	25	14.1
Iodine-129	pCi/L	9.4	7.54	10.1	11.3	4.54	9.6	6.1	6.96
Technetium-99	pCi/L	25.5	20.3	20	17.3	23.2	29.4	0	34.3
Radium	pCi/L	0.141	.00497	0.0235	0.0723	0.078	0.0391	0.001	0.025
Uranium	µg/L	2.64	2.4	2.7	2.55	2.33	2.59	2.6	2.65
Gross alpha	pCi/L	1.45	1.69	1.69	0.39	1.32	0.431	2.7	2.64
Gross beta	pCi/L	10.9	13.2	11.2	12.7	10.5	17.1	25	25.8
pH	pH	--	--	7.82	7.86	7.86	7.95	--	7.95
Specific conductance	µS/cm	--	--	428	423	441	405	--	416
Turbidity	NTU	--	--	0.71	1.9	1.65	1.29	--	2.29

-- = Analyses not performed.
NTU = Nephelometric turbidity unit.

Table A-2. Sample Date and Analytical Results for Well 699-36-67.

Analyte	Units	Mar. 1996	Sep. 1996	Mar. 1997	Sep. 1997	Mar. 1998	Aug. 1998	Mar. 1999	Sep. 1999
Arsenic	µg/L	1.5	1.4	2.7	2.1	1.1	1	3.3	3.3
Barium	µg/L	77.9	65.6	100	66.1	68.4	58.2	63.2	54.1
Chromium	µg/L	5.1	4.4	5.8	4.2	4.6	4.2	5.6	2.5
Lead	µg/L	1	42.1	27.9	1.1	1.1	30.2	1.8	49.2
Selenium	µg/L	2.9	4.5	2.9	3.7	3.1	4.5	4.5	3.7
Tin	µg/L	35.3	33.5	24.7	5.6	4.9	28	2.7	2.1
Vanadium	µg/L	8.5	24.7	33.6	22.6	22.7	30.1	23.8	17.5
Zinc	µg/L	414	763	745	573	496	241	347	215
Carbon tetrachloride	µg/L	2	7	6	4	--	6	3	4
Alkalinity	mg/L	121	125	129	125	123	124	124	123
Chloride	mg/L	24.2	22.9	23.7	22.9	21.4	23.7	24.4	26.3
Fluoride	mg/L	0.4	0.37	0.36	0.348	0.363	0.355	0.5	0.5
Nitrogen in nitrite and nitrate	mg/L	20.8	20.6	22.6	18.9	20.1	24	20.8	20
Sulfate	mg/L	29.9	32.2	31.5	32.6	31.4	30.7	32	32.5
Total dissolved solids	mg/L	340	367	404	377	320	406	400	370
Total organic halides	µg/L	10.5	5	5	7.05	4.62	5.85	24	206
Carbon-14	pCi/L	6.76	--	11.1	3.27	7.16	8.63	9.9	-2.74
Iodine-129	pCi/L	9.42	11.9	7.81	9.73	13.2	12.2	1.2	9.24
Technetium-99	pCi/L	65	53.5	77.5	66.8	68.6	74.9	83	85.2
Radium	pCi/L	0.207	0.135	0.065	0.0353	0.103	0.0864	0.088	0.083
Uranium	µg/L	2.24	2.26	2.69	2.43	2.44	2.48	2.8	2.63
Gross alpha	pCi/L	2.12	0.109	1.31	0.791	0.659	2.3	3	0.535
Gross beta	pCi/L	22.4	26.9	21.6	20.7	25.4	27.4	67	57.2
pH	pH	--	--	7.68	7.86	7.8	8.31	7.72	7.69
Specific conductance	µS/cm	--	--	545	540	534	510	577	541
Turbidity	NTU	0.3	--	8.91	14.4	23.4	90.5	52.6	87.2

-- = Analyses not performed.
NTU = Nephelometric turbidity unit.

Table A-3. Sample Date and Analytical Results for Well 699-37-68.

Analyte	Units	Mar. 1996	Sep. 1996	Mar. 1997	Sep. 1997	Mar. 1998	Aug. 1998	Mar. 1999	Sep. 1999
Arsenic	µg/L	1.5	1.1	2.3	1.8	0.6	1	3.3	3.3
Barium	µg/L	92.8	76.3	117	73.9	79	71.1	73.2	69.8
Chromium	µg/L	30.4	10.9	42.8	7.2	4.1	4.2	3.1	3.1
Lead	µg/L	3.7	42.1	44	47.1	2.4	30.2	2.5	2.4
Selenium	µg/L	4	4.8	3.3	4.5	4.2	5.5	4.2	4.6
Tin	µg/L	35.3	33.5	24.7	33.2	4.9	28	2.7	2.1
Vanadium	µg/L	17.6	29	32.2	27	23	36	23.6	23.5
Zinc	µg/L	530	1,930	1,910	499	386	663	347	350
Carbon tetrachloride	µg/L	5	5	4	5	--	3	3	3
Alkalinity	mg/L	125	129	121	125	127	131	129	130
Chloride	mg/L	20.6	20.1	20.08	21	19.6	21	21.7	28.1
Fluoride	mg/L	0.36	0.33	0.3	0.331	0.33	0.34	0.5	0.5
Nitrogen in nitrite and nitrate	mg/L	36.5	33.7	34.1	35.4	34.3	34.5	31.8	33
Sulfate	mg/L	28.9	30.3	30.5	31.4	31.2	31.5	30.8	31.3
Total dissolved solids	mg/L	420	457	514	463	456	491	440	470
Total organic halides	µg/L	6.6	5	5	5	4.62	5	14.3	12
Carbon-14	pCi/L	3.72	--	3.81	5.43	-1.49	6.46	-6.5	-5.94
Iodine-129	pCi/L	3.69	2.22	2.82	3.03	1.62	2.78	2.9	1.87
Technetium-99	pCi/L	32	32.1	30	34.8	23.5	16.5	36	44.6
Radium	pCi/L	0.276	0.0248	0.07	0.0748	0.114	1.035	0.017	0.668
Uranium	µg/L	2.77	2.21	2.87	2.38	2.32	2.34	2.7	2.58
Gross alpha	pCi/L	1.73	1.15	0.837	2.5	0.683	2.45	1.5	1.55
Gross beta	pCi/L	16	17.6	13.5	15.9	14.5	19.1	27	27.1
pH	pH	--	--	7.64	7.74	7.71	7.77	--	--
Specific conductance	µS/cm	--	--	630	614	671	270	--	--
Turbidity	NTU	1.48	--	60.6	4.56	4.85	2.95	--	--

-- = Analyses not performed.
NTU = Nephelometric turbidity unit.

Table A-4. Sample Date and Analytical Result for Well 699-36-70A.

Analyte	Units	Mar. 1996	Sep. 1996	Mar. 1997	Sep. 1997	Mar. 1998	Aug. 1998	Mar. 1999	Sep. 1999
Arsenic	µg/L	3	2.6	2.7	2.7	2.6	1.2	3.3	3.3
Barium	µg/L	92.1	84.2	84.6	81.7	82.4	72.5	72.8	77
Chromium	µg/L	16.3	9.9	7.1	10.1	5.4	4.2	5.1	4.4
Lead	µg/L	1	42.1	26	1.1	1.1	30.2	1.8	2.9
Selenium	µg/L	3.8	4.1	2.9	4.6	4.4	6.1	7.6	7.3
Tin	µg/L	35.3	33.5	24.7	5.6	4.9	28	2.7	2.1
Vanadium	µg/L	25.7	33.3	31.4	26.7	26.8	40.3	25.2	26.9
Zinc	µg/L	17.2	25.3	17.7	8.6	2.2	7	0.8	0.8
Carbon tetrachloride	µg/L	4	7	7	11	--	5	7	3
Alkalinity	mg/L	113	117	113	119	120	124	123	122
Chloride	mg/L	24.2	21.7	20.4	22.4	20.9	21.4	23.3	23.2
Fluoride	mg/L	0.42	0.41	0.397	0.415	0.371	0.362	0.5	0.5
Nitrogen in nitrite and nitrate	mg/L	31.9	26.1	21.3	24.6	25.3	26.3	24.6	23.7
Sulfate	mg/L	30.7	33.2	32.2	34.9	34.8	35.4	37.3	34.6
Total dissolved solids	mg/L	384	411	5	401	327	422	390	410
Total organic halides	µg/L	5.6	5	5	4.62	4.62	6.7	34.5	12
Carbon-14	pCi/L	4.26	--	3.94	1.6	3.69	2.07	-6.1	-9.54
Iodine-129	pCi/L	18.7	13.7	11.8	16.2	15.2	15.2	3.8	1.87
Technetium-99	pCi/L	64.2	52.3	59.9	57	78.2	77.4	70.5	90.1
Radium	pCi/L	0.521	0.0482	0.0577	0.123	0.148	0.14	0.087	0.195
Uranium	µg/L	2.94	2.42	3.16	3.01	2.99	3.34	3.4	3.41
Gross alpha	pCi/L	2.28	1.57	1.26	1.2	2.17	2.89	1.3	1.31
Gross beta	pCi/L	20.4	25.7	23.2	21	20.2	25.1	25.1	38
pH	pH	7.8	7.66	7.67	7.76	7.64	7.95	7.71	7.82
Specific conductance	µS/cm	616	595	562	575	565	546	552	578
Turbidity	NTU	0.26	1.31	0.84	1.33	3.52	--	0.3	2.68

-- = Analyses not performed.
NTU = Nephelometric turbidity unit.

APPENDIX B

LEACHATE SAMPLING RESULTS THROUGH 1997

Table B-1. Volatile Organics Analysis. (2 Pages)

CAS No.	Component	Max	1996-101A	1996-102B	1997-200	1997-201	1997-210	1997-211	1997-220	1997-221	1997-230	1997-231	1997-240	1997-241	1997-250	1997-251	1997-260	1997-261	1997-270	1997-271
67-64-1	Acetone	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	12	ND	ND	ND	ND
71-43-2	Benzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-27-4	Bromodichloromethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-25-2	Bromoform; tribromomethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
56-23-5	Carbon tetrachloride	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-15-0	Carbon disulfide	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
108-90-7	Chlorobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-00-3	Chloroethane; ethyl chloride	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
67-66-3	Chloroform	4	ND	1	ND	ND	ND	ND	ND	4	ND	ND	ND	ND	ND	2	ND	ND	ND	ND
	Dibromochlorormethane;																			
124-48-1	Chlorodibromomethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1,2-Dichloroethane; ethylene																			
107-06-2	Dichloride	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-34-3	1,1-Dichloroethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1,1-Dichloroethylene; vinylidene																			
75-35-4	Chloride	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
540-59-0	1,2-Dichloroethylene (total)	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
78-87-5	1,2-Dichloropropane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10061-01-5	cis-1,3-Dichloropropene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10061-02-6	trans-1,3-Dichloropropene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
100-41-4	Ethylbenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
591-78-6	2-Hexanone	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4-Mehtyl-2-pentanone; methyl																			
108-10-1	Isobutyl ketone	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
74-83-9	Mehtyl bromide; bromomethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
74-87-3	Methyle chloride; chloromethane	1	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND
78-93-3	Methyl ethyl ketone; MEK	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Methylene chloride;																			
75-09-2	Dichloromethane	2	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	2	1	ND	ND	ND	ND
100-42-5	Styrene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-1. Volatile Organics Analysis. (2 Pages)

CAS No.	Component	Max	1996-101A	1996-102B	1997-200	1997-201	1997-210	1997-211	1997-220	1997-221	1997-230	1997-231	1997-240	1997-241	1997-250	1997-251	1997-260	1997-261	1997-270	1997-271
79-34-5	1,1,2,2-Tetrachloroethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Tetrachloroethylene;																			
	Perchloroethylene;																			
127-18-4	Tetrachloroethene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
108-88-3	Toluene	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	ND
	1,1,1-Trichloroethane;																			
71-55-6	Methychloroform	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
79-00-5	1,1,2-Trichloroethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
79-01-6	Trichloroethylene; trichloroethene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
75-01-4	Vinyl chloride	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1330-20-7	Xylene (total)	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected
Column header defines the year the sample was taken, followed by a number. Even numbers, or "A," indicate leachate analysis, and the odd numbers, or "B," indicate trip blanks for the same sampling event.
Units are µg/L for all VOAs.

Table B-2. Semi-Volatile Organics Analysis. (3 Pages)

CAS No.	Component	Max	1996 103	1996 104	1996 105	1997 200	1997 201	1997 210	1997 211	1997 220	1997 221	1997 230	1997 231	1997 240	1997 241	1997 250	1997 251	1997 260	1997 261	1997 270	1997 271
83-32-9	Acenaphthene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
208-96-8	Acenaphythylene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
120-12-7	Anthracene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
56-55-3	Benzo(a)anthracene benzanthracene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
50-32-8	Benzo(a)pyrene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
205-99-2	Benzo(b) flouranthene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
191-24-2	Benzo(ghi)perylene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
207-08-9	Benzo(k) flouranthene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Bis(2-chloro-1-methylethyl) ether; 2,2'-Di-																				
108-60-1	chlorodiisopropyl ether	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
111-91-1	Bis(2-chloroethoxy) methane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
111-44-4	Bis(2-chloroethyl)ether	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
117-81-7	Bis(2-ethylhexyl) phthalate	14	8	14	ND	ND	ND	ND	ND	1	ND	ND	ND	2	ND	6	ND	1	ND	6	6
101-55-3	4-Bromophenyl phenyl ether	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Butly benzyl phthalate; benzyl butyl																				
85-68-7	phthalate	8	ND	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-74-8	Carbazole	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
59-50-7	p-Chloro-m-cresol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
106-47-8	p-Chloroaniline	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91-58-7	2-Chloronaphthalene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95-57-8	2-Chlorophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7005-72-3	4-Chlorophenyl phenyl ether	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95-48-7	o-Cresol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
106-44-5	p-Cresol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
218-01-9	Crysene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
84-74-2	Di-n-butyl phthalate	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. Semi-Volatile Organics Analysis. (3 Pages)

CAS No.	Component	Max	1996 103	1996 104	1996 105	1997 200	1997 201	1997 210	1997 211	1997 220	1997 221	1997 230	1997 231	1997 240	1997 241	1997 250	1997 251	1997 260	1997 261	1997 270	1997 271
117-84-0	Di-n-octyl phthalate	5	ND	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
53-70-3	Dibenz(a,h) anthracene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
132-64-9	Dibenzofuran	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
541-73-1	m-Dichlorobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95-50-1	o-Dichlorobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
106-46-7	p-Dichlorobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91-94-1	3,3'-Dichlorobenzidine	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
120-83-2	2,4-Dichlorophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
84-66-2	Diethyl phthalate	20	ND	ND	ND	ND	7	20	ND	ND	ND	ND	ND	ND	1	ND	10	ND	ND	ND	18
131-11-3	Dimethyl phthalate	11	ND	ND	ND	ND	6	ND	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
105-67-9	2,4-Dimethylphenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
534-52-1	4,6-Dinitro-o-cresol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
51-28-5	2,4-Dinitrophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
121-14-2	2,4-Dinitrotoluene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
606-20-2	2,6-Dinitrotoluene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
260-44-0	Fluoranthene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-73-7	Fluorene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B-2. Semi-Volatile Organics Analysis. (3 Pages)

CAS No.	Component	Max	1996-103	1996-104	1996-105	1997-200	1997-201	1997-210	1997-211	1997-220	1997-221	1997-230	1997-231	1997-240	1997-241	1997-250	1997-251	1997-260	1997-261	1997-270	1997-271
118-74-1	Hexa-chlorobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
87-68-3	Hexa-chlorobutadiene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
77-47-4	Hexachloro-cyclopentadiene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
67-72-1	Hexachloroethane	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
193-39-5	Indeno(1,2,3-cd) pyrene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
78-59-1	Isophorone	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91-57-6	2-Methylnaphthalene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	N-Nitrosodipropylamine; Di-n-																				
621-64-7	propylnitrosamine	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91-20-3	Naphthalene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
99-09-2	m-Nitroaniline	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-74-4	o-Nitroaniline	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
100-01-6	p-Nitroaniline	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
98-95-3	Nitrobenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-75-5	o-Nitrophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
100-02-7	p-Nitrophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
86-30-6	N-Nitro-sodiphenylamine	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
87-86-5	Pentachlorophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
85-01-8	Phenanthrene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
108-95-2	Phenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
129-00-0	Pyrene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
120-82-1	1,2,4-Trichlorbenzene	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95-95-4	2,4,5-Trichlorophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
88-06-2	2,4,6-Trichlorophenol	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected
Column header defines the year the sample was taken, followed by a number. Even numbers, or "A," indicate leachate analysis, and the odd numbers, or "B," indicate trip blanks for the sample sampling event.
Units are µg/L for all volatile organic analysis.

Table B-3. Metals. (2 Pages)

CAS No.	Constituent	Max	1996-106	1996-107	1996-108	1997-200	1997-201	1997-210	1997-211	1997-220	1997-221
7429-90-5	Aluminum	494	ND	ND	ND	61.3	ND	47.1	33.7	ND	ND
7440-36-0	Antimony	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-22-4	Arsenic	32.6	26.2	25.4	ND	18.8	ND	13.6	ND	17.2	ND
7440-39-3	Barium	63.3	42	38.8	1.4	47.4	2	63.3	0.9	39.3	1.1
7440-41-7	Beryllium	0.77	0.52	0.35	ND	0.42	ND	0.71	ND	0.33	ND
7440-43-9	Cadmium	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-70-2	Calcium	227,000	75,500	71,400	311	151,000	345	227,000	258	143,000	311
7440-47-3	Chromium	13.9	7.9	5.2	ND	4.2	ND	ND	ND	ND	ND
7440-48-4	Cobalt	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-50-8	Copper	24.7	24.7	18.3	6.6	23.3	10.5	10.2	ND	10.9	21.4
7439-89-6	Iron	798	157	104	38.8	102	43.3	61.6	18.9	57.1	26.8
7439-92-1	Lead	2.1	ND	ND	ND	ND	ND	ND	2	ND	1.2
7439-95-4	Magnesium	65,300	21,000	20,000	94.2	42,600	193	65,300	ND	43,000	ND
7439-96-5	Manganese	17.7	5.1	4	1.2	9	1	6.2	ND	4.4	ND
7440-02-0	Nickel	10.2	10.2	ND	ND	ND	ND	ND	ND	ND	ND
7440-09-7	Potassium	17,000	13,800	11,400	ND	13,900	ND	17,000	ND	14,000	ND
7782-49-2	Selenium	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-22-4	Silver	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-23-5	Sodium	249,000	207,000	197,000	642	249,000	687	247,000	465	248,000	491
7440-28-0	Thallium	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-62-2	Vanadium	52.9	52.9	44.4	4.2	39.9	7.4	27.9	ND	27.3	ND
7440-66-6	Zinc	171	47.5	51	171	18.2	15	19.5	10.9	28.1	29.6
7439-97-6	Mercury	0.16	0.16	0.16	ND	0.16	ND	ND	ND	ND	ND

Table B-3. Metals. (2 Pages)

CAS No.	Constituent	1997-230	1997-231	1997-240	1997-241	1997-250	1997-251	1997-260	1997-261	1997-270	1997-271
7429-90-5	Aluminum	213	ND	ND	ND	ND	ND	ND	61.3	ND	47.1
7440-36-0	Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-22-4	Arsenic	32.6	ND	22.5	ND	26.2	25.4	ND	18.8	ND	13.6
7440-39-3	Barium	53.6	1.5	29.4	ND	42	38.8	1.4	47.4	2	63.3
7440-41-7	Beryllium	0.62	ND	0.73	ND	0.52	0.35	ND	0.42	ND	0.71
7440-43-9	Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-70-2	Calcium	110,000	297	107,000	290	75,500	71,400	311	151,000	345	227,000
7440-47-3	Chromium	ND	ND	3.8	ND	7.9	5.2	ND	4.2	ND	ND
7440-48-4	Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-50-8	Copper	14	7.9	17.7	10.2	24.7	18.3	6.6	23.3	10.5	10.2
7439-89-6	Iron	353	47.9	56.9	11.1	157	104	38.8	102	43.3	61.6
7439-92-1	Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7439-95-4	Magnesium	33,500	ND	32,000	ND	21,000	20,000	94.2	42,600	193	65,300
7439-96-5	Manganese	11.6	1.5	4.6	ND	5.1	4	1.2	9	1	6.2
7440-02-0	Nickel	ND	ND	ND	ND	10.2	ND	ND	ND	ND	ND
7440-09-7	Potassium	10,600	ND	11,300	ND	13,800	11,400	ND	13,900	ND	17,000
7782-49-2	Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-22-4	Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-23-5	Sodium	179,000	495	226,000	485	207,000	197,000	642	249,000	687	247,000
7440-28-0	Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7440-62-2	Vanadium	34	ND	31.9	ND	52.9	44.4	4.2	39.9	7.4	27.9
7440-66-6	Zinc	13.2	15.9	26	14.7	47.5	51	171	18.2	15	19.5
7439-97-6	Mercury	ND	ND	ND	ND	0.16	0.16	ND	0.16	ND	ND

ND = not detected

Appendix B – Leachate Sampling Results Through 1997

Table B-4. Radionuclides.

Radionuclide	B0JFJ4	1996-100	1997-200	1997-210	1997-220	1997-230	1997-240	1997-250	1997-260
Gross Alpha	1.22	12.8	3.46	7.79	11.6	8.51	8.44	10.3	11.8
Gross Beta	ND	26.7	24.2	20.3	18.5	15.6	15.4	15.6	18.3
Be-7		ND	ND	ND	ND	ND	ND	ND	ND
Co-60		ND	ND	ND	ND	ND	ND	ND	ND
Cs-134		ND	ND	ND	ND	ND	ND	ND	ND
Cs-137		ND	ND	ND	ND	ND	ND	ND	ND
Eu-154		ND	ND	ND	ND	ND	ND	ND	ND
Eu-155		ND	ND	ND	ND	ND	ND	ND	ND
K-40		ND	ND	ND	ND	ND	ND	ND	ND
Ru-106		ND	ND	ND	ND	ND	ND	ND	ND
Sb-125		ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected

APPENDIX C

GROUNDWATER STATISTICAL ANALYSES

Table C-1. Statistical Analysis Between Wells 699-36-70A and 699-35-66A. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-35-66A		-70A	-66A			
Arsenic	2.68	2.81	0.663	8	8	0.220	1.895	
Barium	80.91	42.51	6.593	8	8	-6.178	1.895	
Chromium	7.81	13.63	4.141	8	8	1.489	1.895	
Lead	13.18	13.41	16.831	8	8	0.015	1.895	
Selenium	5.10	3.43	1.705	8	8	-1.042	1.895	
Tin	17.10	17.10	14.591	8	8	0.000	1.895	
Vanadium	29.54	30.05	5.203	8	8	0.104	1.895	
Zinc	9.95	11.00	9.152	8	8	0.122	1.895	
Carbon tetrachloride	6.29	3.71	2.628	7	7	-1.046	1.943	
Alkalinity	118.88	141.50	4.257	8	8	5.637	1.895	Increase
Chloride	22.19	19.00	1.313	8	8	-2.575	1.895	
Fluoride	0.42	0.38	0.052	8	8	-0.808	1.895	
Nitrogen in nitrite and nitrate	25.48	4.37	3.035	8	8	-7.374	1.895	
Sulfate	34.14	25.54	2.045	8	8	-4.460	1.895	
Total dissolved solids	343.75	278.63	139.951	8	8	-0.494	1.895	
Total organic halides	9.76	23.15	10.295	8	8	1.380	1.895	
Carbon-14	-0.01	18.80	5.513	7	7	3.648	1.943	Increase
Iodine-129	12.06	8.19	6.045	8	8	-0.678	1.895	
Technetium-99	68.70	24.29	12.709	8	7	-3.707	1.895	
Radium	0.26	0.05	0.287	8	8	-0.773	1.895	
Uranium	3.08	2.56	0.328	8	8	-1.701	1.895	

Table C-1. Statistical Analysis Between Wells 699-36-70A and 699-35-66A. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-35-66A		-70A	-66A			
Gross alpha	1.75	1.54	0.624	8	8	-0.354	1.895	
Gross beta	20.39	15.80	7.609	8	8	-0.639	1.895	
pH	7.75	7.85	NA	8	6	NA	NA	
Specific conductance	573.63	418.67	NA	8	6	NA	NA	
Turbidity	1.46	1.36	NA	7	6	NA	NA	

NA = not applicable

Table C-2. Statistical Analysis Between Wells 699-36-70A and 699-36-67. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-36-67		-70A	-67			
Arsenic	2.68	2.05	0.663	8	8	-1.000	1.895	
Barium	80.91	69.19	6.593	8	8	-1.886	1.895	
Chromium	7.81	4.55	4.141	8	8	-0.836	1.895	
Lead	13.18	19.30	16.831	8	8	0.386	1.895	
Selenium	5.10	3.73	1.705	8	8	-0.855	1.895	
Tin	17.10	17.10	14.591	8	8	0.000	1.895	
Vanadium	29.54	22.94	5.203	8	8	-1.345	1.895	
Zinc	9.95	474.25	9.152	8	8	53.811	1.895	Increase
Carbon tetrachloride	6.29	4.57	2.628	7	7	-0.697	1.943	
Alkalinity	118.88	124.25	4.257	8	8	1.339	1.895	

Table C-2. Statistical Analysis Between Wells 699-36-70A and 699-36-67. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-36-67		-70A	-67			
Chloride	22.19	23.69	1.313	8	8	1.212	1.895	
Fluoride	0.42	0.40	0.052	8	8	-0.453	1.895	
Nitrogen in nitrite and nitrate	25.48	20.98	3.035	8	8	-1.572	1.895	
Sulfate	34.14	31.60	2.045	8	8	-1.316	1.895	
Total dissolved solids	343.75	373.00	139.951	8	8	0.222	1.895	
Total organic halides	9.76	33.50	10.295	8	8	2.447	1.895	Increase
Carbon-14	-0.01	6.30	5.513	7	7	1.223	1.943	
Iodine-129	12.06	9.34	6.045	8	8	-0.477	1.895	
Technetium-99	68.70	71.81	12.709	8	8	0.260	1.895	
Radium	0.26	0.10	0.287	8	8	-0.601	1.895	
Uranium	3.08	2.50	0.328	8	8	-1.899	1.895	
Gross alpha	1.75	1.35	0.624	8	8	-0.670	1.895	
Gross beta	20.39	33.58	7.609	8	8	1.839	1.895	
pH	7.75	7.84	NA	8	6	NA	NA	
Specific conductance	573.63	541.17	NA	8	6	NA	NA	
Turbidity	1.46	39.62	1.221	7	7	NA	NA	

NA = not applicable

Table C-3. Statistical Analysis Between Wells 699-36-70A and 699-37-68. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-37-68		-70A	-68			
Arsenic	2.68	1.86	0.663	8	8	-1.300	1.895	
Barium	80.91	81.64	6.593	8	8	0.117	1.895	
Chromium	7.81	13.23	4.141	8	8	1.386	1.895	
Lead	13.18	21.80	16.831	8	8	0.544	1.895	
Selenium	5.10	4.39	1.705	8	8	-0.443	1.895	
Tin	17.10	20.55	14.591	8	8	0.251	1.895	
Vanadium	29.54	26.49	5.203	8	8	-0.622	1.895	
Zinc	9.95	826.88	9.152	8	8	94.679	1.895	Increase
Carbon tetrachloride	6.29	4.00	2.628	7	7	-0.930	1.943	
Alkalinity	118.88	127.13	4.257	8	8	2.055	1.895	Increase
Chloride	22.19	21.52	1.313	8	8	-0.537	1.895	
Fluoride	0.42	0.37	0.052	8	8	-0.972	1.895	
Nitrogen in nitrite and nitrate	25.48	34.16	3.035	8	8	3.036	1.895	Increase
Sulfate	34.14	30.74	2.045	8	8	-1.763	1.895	
Total dissolved solids	343.75	463.88	139.951	8	8	0.910	1.895	
Total organic halides	9.76	7.19	10.295	8	8	-0.264	1.895	
Carbon-14	-0.01	0.78	5.513	7	7	0.154	1.943	
Iodine-129	12.06	2.62	6.045	8	8	-1.657	1.895	
Technetium-99	68.70	31.19	12.709	8	8	-3.131	1.895	
Radium	0.26	0.08	0.287	8	8	-0.675	1.895	

Table C-3. Statistical Analysis Between Wells 699-36-70A and 699-37-68. (2 Pages)

Analyte	Average of Analyte		Standard Deviation for Well 699-36-70A	Number of Data Points		Average Replicate t Test (A)	Bonferroni Critical Value (B)	Is (A) > (B)?
	Well 699-36-70A	Well 699-37-68		-70A	-68			
Uranium	3.08	2.52	0.328	8	8	-1.819	1.895	
Gross alpha	1.75	1.55	0.624	8	8	-0.336	1.895	
Gross beta	24.84	18.84	5.766	8	8	-1.104	1.895	
pH	7.75	7.72	NA	8	4	NA	NA	
Specific conductance	573.63	546.25	NA	8	4	NA	NA	
Turbidity	1.46	14.89	NA	7	5	NA	NA	

NA = not applicable

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